

Ref. Enquiry No.: **PE/PG/RTC/E-6450/2020**

Dated: 03.06.2020

**TENDER ENQUIRY THROUGH E-PROCUREMENT
(CONDITIONAL ENQUIRY)**

**SUBJECT: TENDER ENQUIRY FOR FRAMEWORK AGREEMENT (RATE CONTRACT) OF HT XLPE POWER CABLES
AS PER TECHNICAL SPECIFICATION NO. PE-RC-998-507-E001, REV 00
OUR REF: TENDER ENQUIRY NO: **PE/PG/RTC/E-6450/2020, DTD-03.06.2020****

DUE DATE – 15.06.2020, BY 10.00AM

Dear Sir/ Ma'am,

We are pleased to invite your offer for subject package in two parts strictly as per Clause-2.0 of “Instructions to Bidders” of **GCC Rev 07**. Please upload your best quotation/ offer on <https://bhel.abcpocure.com> for the requirement strictly as per schedule of price format before above mentioned due date & time. The details of the tender enquiry are as mentioned below:

Sl. No	Description for which (Framework Agreement) Rate Contract is desired	Tentative Quantity	Delivery required
1	HT XLPE POWER CABLES - Refer Technical specification no PE-RC-998-507-E001, REV 00 for detailed description.	As per BOQ cum price schedule in Annexure-I) cumulative for the Prospective Projects as per Annexure-IV	Within Four (04) months from date of CAT-1 approval of Primary drawing/documents, subjected to drawing/document submission/re-submission schedule as stipulated, in case of any delay in submission/re-submission of Primary drawing/documents, then same shall be reduced from the given delivery period. Delay in BHEL's comments/approval beyond 18 days shall also be considered for delay analysis. Please refer clause no 4 of Technical Specification no-PE-RC-998-507-E001.

Your best quotation/offer for the above requirement, in line with our terms and conditions, should be submitted online via e-procurement system. It shall be the responsibility of the bidder to ensure that the Tender is submitted on or before the due date by 10.am. Part-I bids shall be opened at 11.00 am on due date through e-procurement Portal.

Detailed Tender documents can be downloaded from the following websites: -

a) www.eprocure.gov.in b) <https://bhel.abcpocure.com> c) www.bhel.com d) www.bhelpem.com

Tender submission through e-procurement portal- Bidders may go through the Sellers' manual & Help documents provided on E-Procurement Portal website (<https://bhel.abcpocure.com>).

E-procurement service Provider details:

M/s E-Procurement Technologies Limited, Ahmedabad

B705. Wall Street II, Opp. Orient Club, Near Gujrat college, Ellis Bridge, Ahmedabad, PIN 380 006.

Please get in touch with our service provider at the earliest for required support. The contact details of the service provider are given at: <https://bhel.abcpocure.com/EPROC/contactus>

Note: -

1. Please note that Part Supplies offered for tender BOQ shall disqualify the bidder's offer.
2. Documents and Credential as per Technical & Financial PQR, Techno Commercial Bids and Price Bids should be uploaded on the e-procurement portal.
3. Bidders to ensure that Third party/customer issued certificates being submitted as proof of PQR qualification should have verifiable details of document/certificate issuing authority such as name & designation of Issuing Authority and its organisation contact number and email id etc. In case the same found not available, Purchaser has right to reject such document from evaluation.
4. "This item/Package/System falls under the list of items defined in Para 3 of Ministry of Finance guideline datedt.20-09-2016 (procurement of items related to public safety, health, critical security operations and equipment's, etc.) & hence criteria of prior experience/turnover shall be same for all the bidders including start up/MSME".

Please refer GCC Rev-07 which is available on www.bhelpem.com. You are requested to kindly download the same.

TERMS AND CONDITIONS

MR SUMEET SAHAY
DY MANAGER/CMM
BHEL/PS-PEM
POWER PROJECT ENGINEERING INSTITUTE,
PLOT NO. 25, SECTOR - 16A, NOIDA (UP)
(OFF) 0120-4213532, 09999498202

Regd. Office:
BHEL House
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New Delhi-110049

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1. This tender is being issued by BHEL PEM for Framework Agreement (Rate Contract) of HT XLP Power cables required at various BHEL project sites on behalf of various BHEL units. All bidders to note the following –
 - a) As and when requirement arises, the concerned unit of BHEL will place order directly on the supplier against the Framework Agreement (Rate Contract).
 - b) The drawings/ documents submission & approval, submission of BG, submission of invoices, processing and release of payment after supply of material shall be dealt as per Framework Agreement (Rate Contract) contract terms and shall be directly done with BHEL unit which has placed purchase order noted at sl.no. (a) above.
2. Bidders to note that their bid shall be conditional, subject to qualify PQR (technical and financial) & registration in PEM for subject package & NTPC Approval before price bid opening/RA.
3. **Framework Agreement (Rate contract), on PVC basis, will be done for 2 years from placement of Framework Agreement (Rate contract) PO with a provision for further extension after review on mutual consent.**
4. **Framework Agreement (Rate contract) will be done with 2 vendors in ratio of 70:30 value wise at L1 FOR site price (Ex-works + freight) for this package. Splitting of Framework Agreement (Rate contract) between 2 vendors may be changed during project ordering process if any vendor in Framework Agreement (Rate Contract) is not approved by customer (i.e. BHEL may place order on any of the vendor in Framework Agreement (Rate Contract) up to total applicable Framework Agreement (Rate Contract) value in case of non-availability of customer approval for other vendor in Framework Agreement (Rate Contract)). However, order for a project shall not be split.**
5. **Framework Agreement (Rate Contract) will be finalized on total lump sum basis.**
6. L1 Rates (Ex works + Freight) shall be counter offered to all bidders who participated in Price Bid Opening/RA for 30% value and in case acceptance of counter offer received from more than one vendor then **acceptance shall be considered as per FINAL Price Bid Opening / Reverse Auction Ranking (as applicable)**. If none accepts L1 rates, Framework Agreement (Rate Contract) shall be done with L1 vendor for 100% value.
7. PVC shall be applicable for the subject package. **Base date for initial prices for this tender shall be first May 2020.** All bidders shall be asked to quote as per the Price Variation Formulae for Cables uploaded on BHEL PEM website on the link <https://www.bhelpem.com/Documents/GCC/Price%20Variation%20Formulae%20for%20Cables.pdf>.

Also refer Annexure A. The price variation shall be limited to + 20% of total ex-works actually supplied (cable size wise) and negative price variation shall be unlimited.

8. As per cl. no. 3 (b) of make in India Circular ref: No. P-45021/2/2017-PP (BE-II) dtd 29/05/19 issued by Ministry of Commerce and Industry, Govt. of India, If L1 bid is not from a local supplier, 50% of the order quantity shall be awarded to L 1. Thereafter, the lowest bidder among the local suppliers, will be invited to match the L1 price for the remaining 50% quantity subject to the local supplier's quoted price falling within the margin of purchase preference (20%), and contract for that quantity shall be awarded to such local supplier subject to matching the L 1 price. In case such lowest eligible local supplier fails to match the L 1 price or accepts less than the offered quantity, the next higher local supplier within the margin of purchase preference shall be invited to match the L 1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on local suppliers, then such balance quantity may also be ordered on the L 1 bidder.

In such case further counter-offering for 70:30 as mentioned at point no. 4 & 6 shall not be applicable. However, if L1 bid is from local supplier or local supplier is not in the range of margin of purchase preference then further counter-offering for 70:30 shall be applicable as mentioned at point no. 4 & 6.

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9. As per circular ref: No. P-45021/2/2017-PP (BE-II) dtd 28/05/18, the Margin of Purchase Preference shall be 20%.
10. For HT XLPE Power Cable package, the package is divisible in nature and the Local content shall be minimum 100%.
11. For this procurement, Public Procurement (preference to make in India), order 2017, Dt:- 15.06.17, 28.05.18 & 29.05.19 and subsequent orders issued by the respective nodal ministry shall be applicable even if issued after issue of this NIT but before finalization of contract/PO/WO against this NIT. In the event of any nodal ministry prescribing higher or lower percentage of purchase preference and / or local content in respect of this procurement, same shall be applicable. Vendors are requested to go through the above mentioned orders and confirm the following: -

The local supplier at the time of tender, bidding or solicitation shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) that the item offered meets the minimum local content as per above mentioned orders and shall give details of the location(s) at which the local value addition is made.

12. Bidders to note the following: -

- i. Tender Evaluation - Evaluation will be done on overall L1 (Total Cost to BHEL excluding GST) basis with necessary loading as applicable i.e. Evaluation will be on Ex Works + Freight basis for this tender.
 - In case of PBO, the loading (technical/commercial), if any, shall be added by BHEL for evaluation.
 - In case of RA, the loading (technical/commercial), if any, shall be added by bidder while submitting the bid in reverse auction portal.
 - Ordering shall be done after de-loading the commercial/ technical loading from bidder's final price.
- ii. In the course of evaluation, if more than one bidder happens to occupy L-1 status, effective L-1 will be decided by soliciting discounts from the respective L-1 bidders. In case more than one bidder happens to occupy the L-1 status even after soliciting discounts, the L-1 bidder shall be decided by a toss / draw of lots, in the presence of the respective L-1 bidder(s) or their representative(s). Ranking will be done accordingly. BHEL's decision in such situations shall be final and binding.
- iii. **Bidder to give single % of freight charges considering anywhere in India in the freight column. Bidders have to give same % of freight for each line item.**
- iv. Bidders to mention applicable GST rate on (total Ex. works + freight) in the specified cells of price schedule on price form at e-procurement portal. However, may please note that GST shall not be considered in evaluation.
- v. Though evaluation is on Ex Works + Freight, but there is % allocation weightage against BOQ quantity of each item which shall be used for arriving at price break up. Bidders need to give only their total ex works price for given BOQ at the specific cells that has been kept opened in the price schedule available in the e-procurement portal (Grand Total ex works price). Price mentioned anywhere else in BOQ or price uploaded anywhere else in the e-procurement portal shall not be taken in cognizance.
- vi. Rest of the prices shall be derived by BHEL in line with allocation fixed for each item. There is formula applied in price schedule form available in e-procurement portal. As soon as bidder fills the cells for Total Ex works, freight percentage and GST percentage, rest values for e.g. unit ex works – item wise, total ex works – item wise, FOR site price – item wise will filled automatically.
- vii. For better clarity to the bidders where value is to be filled is kept open in price form at e-procurement portal and for other columns it will be locked which shall be derived by BHEL as per allocation fixed against each item.
- viii. HSN Code has been mentioned in Price Schedule.

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- ix. Incomplete offer shall be summarily rejected.
- x. **PRE-QUALIFICATION REQUIREMENT: -**
Bidders is requested to fill up the details in "TECHNICAL AND FINANCIAL PRE-QUALIFYING REQUIREMENT" as per the conditions mentioned in the PQR (technical and financial) and also to submit the credentials. Bids of only those bidders shall be evaluated who meet the Technical & Financial pre-qualifying requirements (if applicable). **Bidders to ensure that Third party/customer issued certificates being submitted as proof of PQR qualification should have verifiable details of document/certificate issuing authority such as name & designation of Issuing Authority and its organisation contact number and email Id etc. In case the same found not available, Purchaser has right to reject such document from evaluation.**
"This item/Package/System falls under the list of items defined in Para 3 of Ministry of Finance guideline datedt.20-09-2016 (procurement of items related to public safety, health, critical security operations and equipment's, etc.) & hence criteria of prior experience/turnover shall be same for all the bidders including start up/MSME".
- xi. Bidders to note that their bid shall be conditional subject to qualify PQR (technical & financial) by registered vendors & non-registered vendors have to qualify PQR (technical & financial) & get registered with PEM for the package & **NTPC Approval before price bid opening/RA.**
For registration in PEM "Bidders needs to apply & get registered for subject package with PEM before P-2 (price bid opening) & hence you need to apply online for registration on PEM web portal & have to enclose acknowledgement with this effect with the bid documents else your bid may not be considered for evaluation"
- xii. This enquiry is subject to Conditions/ limits if any imposed in PMD / Vendor registration.
- xiii. Refer Annexure I for tentative quantity of HT XLPE Power Cables, required for prospective projects. Project list is indicative only, BHEL may ask for delivery anywhere in India for any of the project added in the prospective project/ existing projects during RC period. No minimum quantity is guaranteed by BHEL.
- xiv. Quantity variation shall be +30%. Bidders to note that the quantities indicated in the tender are tentative quantities. No minimum quantity is guaranteed by BHEL
- xv. CIF allocation is not applicable for this tender. Bidder to quote accordingly.
- xvi. Tenderers must enclose the Quality Plan in the prescribed format, for approval. Equipment will be dispatched only after Purchaser's / Owner's inspection of the hold points specified in the approved Quality Plan and issue of Material Dispatch Clearance Certificate (MDCC).
- xvii. In case of joint bidding, bidders to furnish scope matrix which should be clearly defined between them along with the offer for the complete scope.
- xviii. **Integrity pact is applicable for this tender**
IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Contractors are handled in a fair, transparent and corruption free manner. Following Independent External Monitors (IEMs) have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL.

Sl No.	IEM	Phone & Email
1.	Shri Arun Chandra Verma, IPS (Retd.)	acverma1@gmail.com
2.	Shri Virendra Bahadur Singh, IPS (Retd.)	ybsinghips@gmail.com

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

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

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

OTHER TERMS AND CONDITIONS

1. Procurement of the subject package shall be done through e-procurement
2. Offers should be uploaded in two parts online at <https://bhel.abcpocure.com> in as follows:
 - a) Part-I Bid: - Documents and Credential as per Technical & Financial PQR and Techno-Commercial offer (along with un-priced copy of un-priced bid and un-priced schedule of Technical-Commercial Deviation, Annexure I & II)
 - b) Part II Bid: - Price Bid and Priced schedule of Technical-Commercial Deviation
3. Terms and conditions: -
 - a) Part I bid will be opened on date & time mentioned in the NIT or subsequent corrigenda/amendments, if any.
 - b) **Techno-commercial offer of only those bidders shall be evaluated who will meet the Technical & Financial pre-qualifying requirement of the tender.**
All the above Tender Documents shall automatically become a part of the Order/Contract after its finalisation.
4. Vendors shall quote in accordance with the requirements mentioned in the tender documents. In case of deviations (Technical/ Commercial), the same shall be highlighted separately giving Clause references along with the Cost of withdrawal of Deviations in e-procurement portal, along with reasons for taking such deviations.
Bidder to note all the points mentioned in "Notes" of cost of withdrawal sheet in e-procurement portal.
5. **Please note the following:**
 - a. **Compliance to price form available at e-procurement portal.**
 - b. **SCC enclosed for compliance.**
GCC enclosed for compliance. GCC Rev-07 is available on www.bhelpem.com. You are requested to kindly download the same. Bidders are requested for furnishing compliance of these documents.
6. Tenders shall be submitted strictly in accordance with the requirements of the above tender documents.
7. Standard pre-printed terms & conditions of the tenderers shall not be considered valid.
8. Validity of offer shall be as per cl.no.7(instruction to bidders) of GCC Rev 07.
9. Unsolicited fresh/revised Price Bids shall not be entertained.
10. Purchaser shall be under no obligation to accept the lowest or any other tender and shall be entitled to accept or reject any/all tender(s) in part or full without assigning any reason whatsoever.
11. Late tenders will be rejected.
12. Definition of Terms is also enclosed. These definitions will apply to all the tender documents including this Enquiry Letter.
13. Tenders and all correspondence thereof, shall be addressed to the undersigned by name & designation and sent at the following address:

Mr. I P SINGH, DGM, CMM
M/s Bharat Heavy Electricals Ltd.,
Project Engineering Management,
Power Project Engineering Institute,
HRD & ESI Complex,
Plot No 25, Sector-16 A, Noida-201301

Mr. SUMEET SAHAY, DY MGR, CMM
M/s Bharat Heavy Electricals Ltd.,
Project Engineering Management,
Power Project Engineering Institute,
HRD & ESI Complex,
Plot No 25, Sector-16 A, Noida-201301

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Kind Attn: I P SINGH/ CMM E-MAIL: indra.pal.singh@bhel.in Ph. No. 0120-4218749 ,09818989654	Kind Attn: SUMEET SAHAY/ CMM E-MAIL: sumeetsahay@bhel.in Ph. No. 0120-4213532 ,09999498202
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14. Delivery:

Within Four (04) months from date of CAT-1 approval of Primary drawing/documents, subjected to drawing/document submission/re-submission schedule as stipulated, in case of any delay in submission/re-submission of Primary drawing/documents, then same shall be reduced from the given delivery period. Delay in BHEL's comments/approval beyond 18 days shall also be considered for delay analysis.

SI No	Drawings/Document Description	Primary/ Secondary	Drawings / Document Number	Drg Sch for Vendors
1	Technical Data sheet for HT XLPE Power Cables	Primary	Shall be informed later	R-0 within 14 days from PO & subsequent revisions within 10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18 days from receipt.
2	Cross section drawings for HT XLPE Power Cables	Primary		
3	Manufacturing Quality Plan for HT XLPE Power Cables	Primary		
4	Type Test Reports – HT XLPE Power Cables (previously conducted within 10 years)	Primary		
5	Type Test Reports – HT XLPE Power Cables (Conducted for this contract)	Secondary		Within 1 week after conduction of type test & subsequent revisions within 1 week of comments received from BHEL

** Please refer clause no 4 of Technical Specification no-PE-RC-998-507-E001.

Note:

1. The above list of drawings and documents is indicative.
2. After receiving LOI, the vendor shall submit drawings/documents in requisite number of copies as per NIT.

* Standard Quality Plan as enclosed in the technical specification is to be appended with cover sheet bearing document number and description as stated above. The signed and stamped copy of the same shall be submitted to BHEL without making any changes in the contents of the document.

15. All other terms and conditions shall be as per GCC Rev 07 and Special Conditions of (Framework Agreement) Rate Contract as per attached Annexure-IV. In the event of any contradiction in the terms and conditions mentioned, the order of preference shall be as mentioned in clause no 36 of GCTC of GCC (Rev.07).
16. All the above Tender Documents shall automatically become a part of the Order/Contract after its finalization.
17. All corrigenda, addenda, amendments, time extensions, clarifications etc. to the tender will be hosted on BHEL websites only (www.bhelpem.com, www.bhel.com & <https://bhel.abcpocure.com> under subject tender reference. Bidders are requested to visit our websites from time to time to keep themselves updated. **Bidders may go through the Sellers' manual & Help documents provided on E-Procurement Portal website & obtain required Digital Signature Certificate for participating in the subject Tender.**
18. Bidders to submit their offers strictly in line with the form available at e-procurement portal.
19. Inspection shall be done by BHEL/ END CUSTOMER/Third party Agency (finalized by BHEL).

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20. Foreign & indigenous bidders participating through open/limited tender will necessarily have to but class III DSCs issued by the certifying authorities in India. Basic procedure/ checklist is uploaded on www.bhel.com.
21. Non- registered bidder to submit the credentials required for Registration in BHEL PEM: -
"Online Registration Portal is operational in BHEL. Non-registered Vendors, who wish to apply for registration with BHEL-PEM, have to apply through Online Registration Portal available at www.bhelpem.com - vendor section - Online Supplier Registration. All credentials and/or documents duly signed and stamped related to registration has to be uploaded on the website and submit the application for registration. One set of hard copy of the filled-up SRF downloaded from Online Registration Portal duly signed and stamped has to be submitted."
22. Purchaser reserves the right to split up the scope of the tender enquiry and place the orders for different scope/ items with different bidders and also increase or decrease the quantity.
23. In case of RA, revised RA guidelines AA:SSP:RA:03 issued on 26.09.2016 (uploaded on http://www.bhel.com/vender_registration/pdf/Guidelines%20for%20Reverse%20Auction-2016.pdf) shall be applicable.
24. BHEL reserves the right to go for Reverse Auction (RA) (Guidelines as available on www.bhel.com) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. Bidders to give their acceptance with the offer 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.
- Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'Process compliance form' (to the designated service provider) as well as 'Online sealed bid' in the Reverse Auction. Non-submission of 'Process compliance form' or 'Online sealed bid' by the agreed bidder(s) will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).
- The bidders have to necessarily submit online sealed bid less than or equal to their envelope sealed price bid already submitted to BHEL along with the offer. The envelope sealed price bid of successful L1 bidder in RA, if conducted, shall also be opened after RA and the order will be placed on lower of the two bids (RA closing price & envelope sealed price) thus obtained. The bidder having submitted this offer specifically agrees to this condition and undertakes to execute the contract on thus awarded rates.
- If it is found that L1 bidder has quoted higher in online sealed bid in comparison to envelope sealed bid for any item(s), the bidder will be issued a warning letter to this effect. However, if the same bidder again defaults on this count in any subsequent tender in the unit, it will be considered as fraud and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).
- As a reminder to the bidders, system will flash following message (in RED Color) during the course of 'online sealed bid':
- "Bidders to submit online sealed bid less than or equal to their envelope sealed bid already submitted to BHEL"**
- Detailed guidelines of reverse auction 2016 are available in "information section" of www.bhelpem.com, same are applicable for subject tender.

IMPORTANT INSTRUCTION TO BIDDERS IN CASE OF REVERSE AUCTION

"The Bidders has to quote the Single Price (i.e. Total Cost to BHEL) in Reverse Auction. Price are to be inclusive of Packing & Forwarding charges, all the routine & type tests as per tender scope, Freight as applicable, including loading (if any) but excluding GST. De-loading (if any) shall be done in line with NIT terms.

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In case of RA, if bidder fail to submit the price break up within prescribed time limit then the prices submitted by bidder in his hard bid shall be reduced proportionately for ordering purpose.

25. Successful bidder in RA to note that ordering shall be done on lower of the two bids (RA closing price & Conventional Price Bid). After successful completion of reverse auction L1 bidder have to submit break up in line with taxes & duties, freight quoted in their Conventional Price Bid.
26. If any bidder has mentioned the term Not Applicable / Not required / Not Quoted in bidding form. The bidder needs to substantiate the same. If the same item will be required in future for the system same will be supplied free of cost.
27. L1 bidder will have to submit Bank Guarantee for each POs (irrespective of value) which will be placed under the (Framework Agreement) Rate Contract finalised through this tender considering RC as original contract as per format mentioned in in GCC Rev 07.

Thanking you,
Yours faithfully,
For and on behalf of BHEL

(Signature of official with Name & Designation)

Enclosure:

1. Enquiry Terms & Conditions.
2. Price Schedule - Annexure-I to NIT (to be filled in e-procurement portal only)
3. Cost of withdrawal sheet -Annexure-II to NIT (to be filled in e-procurement portal only)
4. Technical Specifications.
5. Technical PQR
6. Financial PQR
7. SCC – Annexure-III to NIT.
8. Prospective Project List – Annexure-IV to NIT
9. Format for CA/Cost Auditor-certification regarding local content – Annexure- V to NIT
10. Bank Guarantee Format – Annexure-VI to NIT.
11. Integrity Pact (IP) – Annexure-VII to NIT
12. Annexure A – PVC Formulae

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 ANNEXURE I TO NIT REF NO- PE/PG/RTC/E-6450/2020, DTD-03.06.2020 PRICE SCHEDULE FOR HT XLPE POWER CABLES FRAMEWORK AGREEMENT (RATE CONTRACT)													
NAME OF VENDOR - (Please fill vendor's name)													
SL. NO.	ITEM CODE	ITEM DESCRIPTION	UOM	QUANTITY	HSN CODE	UNIT EX- WORKS PRICE (DULY PACKED) OF TOTAL EX-WORKS PRICE (INR)	UNIT EX- WORKS PRICE (DULY PACKED) (INR)	FORMULA FOR TOTAL EX- WORKS PRICE (DULY PACKED) (INR)	TOTAL EX- WORKS PRICE (DULY PACKED) (INR)	FREIGHT CHARGES WITHOUT GST @ % OF TOTAL EX WORKS (INR)	APPLICABLE GST RATE % ON (TOTAL EX WORKS + FREIGHT) (INR)	TOTAL FOR SITE PRICE (INR)	REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	507-27153-A	19/33 KV 1C-630 AL Armoured	Metres	45,000	8544	0.12815 * X /45000	Derived	0.12815 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
2	507-27152-A	19/33 KV 1C-500 AL Armoured	Metres	50,000	8544	0.11877 * X /50000	Derived	0.11877 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
3	507-27154-A	19/33 KV 1C-240 AL Armoured	Metres	30,000	8544	0.03979 * X /30000	Derived	0.03979 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
4	507-27025-A	11 kV 1C-630 AL Armoured	Metres	20,000	8544	0.03842 * X /20000	Derived	0.03842 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
5	507-27021-A	11 kV 1C-500 AL Armoured	Metres	15,000	8544	0.02395 * X /15000	Derived	0.02395 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
6	507-27013-A	11 kV 1C-300 AL Armoured	Metres	5,000	8544	0.00516 * X /5000	Derived	0.00516 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
7	507-27033-A	11 kV 3C-185 AL Armoured	Metres	25,000	8544	0.06467 * X /25000	Derived	0.06467 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
8	507-27029-A	11 kV 3C-150 AL Armoured	Metres	10,000	8544	0.02287 * X /10000	Derived	0.02287 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
9	507-27109-A	6.6 kV 1C-500 AL Armoured	Metres	5,000	8544	0.00712 * X /5000	Derived	0.00712 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
10	507-27125-A	6.6 kV 3C-240 AL Armoured	Metres	5,000	8544	0.01407 * X /5000	Derived	0.01407 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
11	507-27121-A	6.6 kV 3C-185 AL Armoured	Metres	5,000	8544	0.01179 * X /5000	Derived	0.01179 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
12	507-27117-A	6.6 kV 3C-150 AL Armoured	Metres	80,000	8544	0.16039 * X /80000	Derived	0.16039 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
13	507-27049-A	3.3 kV 1C-185 AL Armoured	Metres	20,000	8544	0.01382 * X /20000	Derived	0.01382 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
14	507-27077-A	3.3 kV 3C-185 AL Armoured	Metres	5,000	8544	0.00985 * X /5000	Derived	0.00985 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	

ANNEXURE I TO NIT REF NO- PE/PG/RTC/E-6450/2020, DTD-03.06.2020													
PRICE SCHEDULE FOR HT XLPE POWER CABLES													
FRAMEWORK AGREEMENT (RATE CONTRACT)													
NAME OF VENDOR - (Please fill vendor's name)													
SL. NO.	ITEM CODE	ITEM DESCRIPTION	UOM	QUANTIT Y	HSN CODE	UNIT EX- WORKS PRICE (DULY PACKED) OF TOTAL EX-WORKS PRICE (INR)	UNIT EX- WORKS PRICE (DULY PACKED) (INR)	FORMULA FOR TOTAL EX- WORKS PRICE (DULY PACKED) (INR)	TOTAL EX- WORKS PRICE (DULY PACKED) (INR)	FREIGHT CHARGES WITHOUT GST @ % OF TOTAL EX WORKS (INR)	APPLICABLE GST RATE % ON (TOTAL EX WORKS + FREIGHT) (INR)	TOTAL FOR SITE PRICE (INR)	REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	507-27073-A	3.3 kV 3C-150 AL Armoured	Metres	35,000	8544	0.05753 * X /35000	Derived	0.05753 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
16	507-27026-A	11 kV 1C-630 AL Unarmoured	Metres	5,000	8544	0.00853 * X /5000	Derived	0.00853 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
17	507-27022-A	11 kV 1C-500 AL Unarmoured	Metres	15,000	8544	0.02007 * X /15000	Derived	0.02007 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
18	507-27034-A	11 kV 3C-185 AL Unarmoured	Metres	5,000	8544	0.01231 * X /5000	Derived	0.01231 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
19	507-27030-A	11 kV 3C-150 AL Unarmoured	Metres	10,000	8544	0.02152 * X /10000	Derived	0.02152 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
20	507-27114-A	6.6 kV 1C-630 AL Unarmoured	Metres	55,000	8544	0.0903 * X /55000	Derived	0.0903 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
21	507-27122-A	6.6 kV 3C-185 AL Unarmoured	Metres	5,000	8544	0.01086 * X /5000	Derived	0.01086 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
22	507-27118-A	6.6 kV 3C-150 AL Unarmoured	Metres	30,000	8544	0.05444 * X /30000	Derived	0.05444 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
23	507-27078-A	3.3 kV 3C-185 AL Unarmoured	Metres	5,000	8544	0.00873 * X /5000	Derived	0.00873 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
24	507-27074-A	3.3 kV 3C-150 AL Unarmoured	Metres	40,000	8544	0.05689 * X /40000	Derived	0.05689 * X	Derived	% TO BE QUOTED	% TO BE QUOTED	Derived	
25	GRAND TOTAL (1 TO 24)								X= TO BE QUOTED (IN FIGURES)	Derived = Rs Y	Derived	Derived	
									X= TO BE QUOTED (IN WORDS)				
NOTE:-													

 ANNEXURE I TO NIT REF NO- PE/PG/RTC/E-6450/2020, DTD-03.06.2020 PRICE SCHEDULE FOR HT XLPE POWER CABLES FRAMEWORK AGREEMENT (RATE CONTRACT)													
NAME OF VENDOR - (Please fill vendor's name)													
SL. NO.	ITEM CODE	ITEM DESCRIPTION	UOM	QUANTIT Y	HSN CODE	UNIT EX- WORKS PRICE (DULY PACKED) OF TOTAL EX-WORKS PRICE (INR)	UNIT EX- WORKS PRICE (DULY PACKED) (INR)	FORMULA FOR TOTAL EX- WORKS PRICE (DULY PACKED) (INR)	TOTAL EX- WORKS PRICE (DULY PACKED) (INR)	FREIGHT CHARGES WITHOUT GST @ % OF TOTAL EX WORKS (INR)	APPLICABLE GST RATE % ON (TOTAL EX WORKS + FREIGHT) (INR)	TOTAL FOR SITE PRICE (INR)	REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Bidder to note that evaluation shall be on Total Ex works price + Freight. Bidder to quote grand total Ex works value of the complete package (Sl. No 25 Column 10.i.e Rs X) only as per the BOQ above. The item wise break up of Ex works prices (unit as well as total) for all the items in the BOQ shall be derived as per the formulae indicated above by BHEL. Bidder also need to indicate Freight and GST rate in percentage in the respective column. Freight percentage to be quoted in percentage of Ex works value considering delivery anywhere in India.													
2. The standard drum length shall be 500/600/750/1000 meters as per project requirement. Tolerance on individual drum length shall be ±5%.													
3. Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0% except where the total ordered quantity is one single drum length of 500/600/750m, in which case it shall be -5% to 0%. Cables consumed for testing and inspection shall be to bidder's account.													
4. For each individual cable size, one short length of not less than 200m may be accepted only in the final drum length to complete the supply (except where the total ordered quantity is one single drum length of 500/600/750m). The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).													
5. In case of the quantities cleared by BHEL for manufacturing are manufactured and offered for inspection by successful bidder in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implications.													
6. Unit price of cables quoted by bidder shall be inclusive of type test charges. No separate charges shall be payable for type tests.													
7 Value is to be filled only where "to be quoted" is mentioned and for other columns where "derived" is mentioned same shall be derived by BHEL as per % allocation fixed against each item													
8. Price mentioned anywhere else in BOQ shall not be taken in cognizance.													
9. For any clarification please refer Technical Specification No-PE-RC-998-507-E001													
10. In case of Reverse Auction, vendor has to quote their Ex Works price+ Freight , that is price quoted above at Sl No-25, column 10 i.e. (Rs X) + Freight Value, Rs Y													
11. Quantity variation shall be +30%.													

ANNEXURE-II: DEVIATION SHEET (COST OF WITHDRAWL)										
PACKAGE:- HT XLPE POWER CABLE- RATE CONTRACT										
TENDER ENQUIRY REF NO-PE/PG/RTC/E-6450/2020. DTD-03.06.2020										
NAME OF VENDOR:-										
SL NO	VOLUME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASONS FOR QUOTING DEVIATION	
TECHNICAL DEVIATIONS										
COMMERCIAL DEVIATIONS										
PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE										
NOTES:										
1. Cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.										
2. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.										
3. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.										
4. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable. In the absence of same, such deviation(s) shall not be considered and offer shall be considered in total compliance to NIT.										
5. Bidder shall furnish price copy of above format along with price bid.										
6. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.										
7. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.										
8. For deviations w.r.t. Credit Period, Liquidated damages, Firm prices if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VII, will apply. For any other deviation mentioned in unpriced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.										
9. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be considered.										
10. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.										
11. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.										
12. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.										
13. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.										



BHEL / PEM / CMM
SPECIAL CONDITIONS OF (FRAMEWORK AGREEMENT) RATE CONTRACT

ANNEXURE III TO NIT REF NO - PE/PG/RTC/E-6450/2020, DTD-03.06.2020
SPECIAL CONDITION OF (FRAMEWORK AGREEMENT) RATE CONTRACT FOR HT XLPE POWER CABLES

1. BHEL/PEM on behalf of various BHEL units intends to enter into (Framework Agreement) Rate Contract for supply of the tendered items for a period of two years. The (Framework Agreement) Rate Contract shall come into force from the date of issue of Purchase order for Rate Contract. Validity for ordering shall be two years from the purchase order for (Framework Agreement) Rate Contract.
2. For this specific tender, Purchaser word referred in GCC Rev 07 shall mean BHEL units which will place project specific purchase order to seller on the basis of framework agreement (rate contract) finalized with this tender.
3. Seller to use GSTIN number (wherever required) of Purchaser i.e. BHEL unit who will issue project specific purchase order. GSTIN number mentioned in GCC Rev 07 shall be applicable for all project specific purchase orders issued by BHEL PEM.
4. Clause no 7 of GCTC, GCC Rev 07 is applicable for project specific purchase orders issued by BHEL PEM. For other BHEL Unit who will issue project specific purchase order, their respective DMS for drgs/docs submission will be applicable.
5. Details of consignee and project site information for dispatch of material shall be intimated at the time of placement of PO for specific project after finalization of (Framework Agreement) Rate Contract
6. Transit Insurance is in BHEL scope
7. The items will be required against respective projects. Exact quantities and Project information shall be intimated while placing order for a specific project based on the (Framework Agreement) Rate Contract.
8. The prices shall be on PVC basis during the period of two years with a provision for further extension after review on mutual consent.
9. Inspection of materials shall be carried out by BHEL/CQA and or by Customer or by an authorized agency at manufacture's works before dispatch, if required. Dispatch of material to be done, only after receipt of BHEL/Customer MDCC. It is responsibility of vendor to for obtain Material Dispatch Clearance Certificate (MDCC) from BHEL or Customer as required before dispatch of material.

Vendor shall give inspection call on BHEL-CQS web site to applicable inspection agency with a copy of inspection call to BHEL for arranging Customer participation (if applicable) in inspection / Joint inspection on the proposed date with an advance notice of 15 working days. Inspection charges shall be paid by BHEL.

Items have to be manufactured as per specification and supplied strictly in accordance with the approved BHEL / Customer's Drawings & Quality Plan. The items/ test certificate of items, which for any reason are not acceptable to BHEL / Customer, shall be required to be retested. No extra charge shall be payable on those account by BHEL.

10. Other terms and conditions shall be as per Standard Technical specification no, GCC Rev 07 & Enquiry letter.
11. This enquiry is subject to Conditions/ limits if any imposed in PMD/ Vendor registration.
12. Tentative quantity is given in enquiry.
13. Bidders to submit offer for (Framework Agreement) Rate Contract of said items ONLINE via e-Procurement System only. Bidder to upload tender documents complete in all respects duly signed & stamped on each and every page by the authorized signatory of the bidder as a token of acceptance of all the terms and conditions of tender.



BHEL / PEM / CMM
SPECIAL CONDITIONS OF (FRAMEWORK AGREEMENT) RATE CONTRACT

14. The Bidder along with its associate/ collaborators/ sub-contractors/ sub-vendor/ consultants/ service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL web site <http://www.bhel.com> and shall immediately bring to the notice of BHEL Management about any fraud as soon as it comes to their notice.
15. All bidders to quote as per the Price Variation Formulae for Cables uploaded on BHEL PEM website on the link given below. <https://www.bhelpem.com/Documents/GCC/Price%20Variation%20Formulae%20for%20Cables.pdf>

ANNEX-IV TO NIT REF NO- PE/PG/RTC/E-6450/2020, DTD-03.06.2020
TENTATIVE PROJECT LIST
FRAMEWORK AGREEMENT (RATE CONTRACT) - HT XLPE POWER CABLES

Sl.No	Name of Project	
1	3X660 MW Nabinagar FGD Project	
2	2X250 MW Bhilai FGD Project	
3	3X200 MW+4X500 MW Korba FGD Project	
4	3X200 MW+3X500 MW Ramagundam FGD Project	
5	4X250 MW Nabinagar FGD Project	
6	3X800 MW Patratu	
7	2X660 MW Khurja TG	
8	3X210MW + 3X500MW Kahalgaon FGD Project	

	ANNEXURE – A TO NIT REF NO- PE/PG/RTC/E-6450/2020, DTD-03.06.2020	PRICE VARIATION FORMULAE
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**HT XLPE POWE CABLE
FRAMEWORK AGREEMENT - RATE CONTRACT**

1. All bidders to quote as per the Price Variation Formulae for Cables uploaded on BHEL PEM website on the link given below.
<https://www.bhelpem.com/Documents/GCC/Price%20Variation%20Formulae%20for%20Cables.pdf>
2. Prices shall be variable as per following PVC formulae given below (basis IEEMA). The price variation shall be limited to + 20% of total ex-works actually supplied (cable size wise) and negative price variation shall be unlimited. Rates for working out price variation shall be as per rates published by IEEMA for the factors given in PVC Annexure II.
3. Base date for prices (as per IEEMA):

Initial Price (As per IEEMA) for Al₀, Cu₀, CCo, PVCCo & Fe₀:

Base date shall be May 2020

Final Price (As per IEEMA) for Al, Cu, Cc, PVCC & Fe:

The first working day of month, one month prior to the date on which cable is notified as being ready for inspection i.e. TPIA inspection call raise date on web portal.

4. Variation factor value for ALF, CuF, CCFAL, CCFCu, XLFAL, XLFCu, FeF & FeW as applicable shall be as per Technical Specification
5. PVC shall be payable within contractual delivery period (including any extension thereto)

IEEMA TABLE FOR PRICE VARIATION CLAUSE FOR VARIOUS TYPE OF CABLE

Aluminium Conductor Cable

SI No	Cable Type	AIF (Single core unarmoured & Multi core armoured)	AIF (Single core armoured)	CCFAL	XLFAL (Single core)	XLFCu (Multi core)	FeF	FeW	IEEMA Formula
1	HT XLPE Power Cable	ALP	H1	H2	XL3	XL4	H3	H5	$P = P_0 + AIF(AL - Al_0) + XLFAL(CC - CCo) + CCFAL(PVC - PVCCo) + FeF(Fe - Fe_0)$



Ref: PW/PE/CMM-PVC Cables Packages (Rev-02)

Dated:19/02/2019

Note: Applicable for cable tenders released on or after 14/01/2019.

Price Variation Formulae for cables -Annexure-I

1. Prices shall be variable as per price variation formulae given below (basis IEEMA).
The price variation shall be limited to + 20% of total ex-works price actually supplied (cable size wise) and -ve price variation shall be unlimited. Rates for working out price variation shall be as per rates published by IEEMA for the factors given in Annexure-II

2. Base date for prices:

Initial Price (As per IEEMA) for-Alo, Cuo, CCo, PVCCo & Feo:

Base Date shall be- 1st working day of the previous month to the date of issue of tender enquiry.

Final Price (as per IEEMA) for- Al, Cu, Cc, PVCC & Fe:

1st working day of month, one month prior to the date on which cable is notified as being ready for inspection i.e TPIA inspection call raise date on web portal.

3. Variation factor value for ALF, CuF, CCFAL, CCFCu, XLFAL, XLFCu, FeF & FeW as applicable shall be as per Technical Specification.

4. PVC shall be payable within contractual delivery period (including any extension thereto).

IEEMA table for Price variation cause for various type of cable

1. Aluminium conductor cable

S.No	Cable Type	AIF (Single core unarmoured & Multi core armoured)	AIF (Single core armoured)	CCFAI	XLFAL (Single core)	XLFAL (Multi core)	FeF	FeW	IEEMA Formula
1.	HT XLPE Power cable	ALP	H1	H2	XL3	XL4	H3	H5	$P = P_o + AIF(AL - Alo) + XLFAL(CC - CCo) + CCFAI(PVCC - PVCCo) + FeF(Fe - Feo)$
2.	LT XLPE Power Cable	ALP	P1	L2	XL1	XL1	P3	P3 (Additional)	$P = P_o + AIF(AL - Alo) + XLFAL(CC - CCo) + CCFAI(PVCC - PVCCo) + FeF(Fe - Feo)$
3.	LT PVC Power Cable	ALP	P1	P2	-	-	P3	P3 (Additional)	$P = P_o + AIF(AL - Alo) + CCFAI(PVCC - PVCCo) + FeF(Fe - Feo)$
4.	LT HRPVC Power Cable	ALP	P1	P2	-	-	P3	P3 (Additional)	$P = P_o + AIF(AL - Alo) + CCFAI(PVCC - PVCCo) + FeF(Fe - Feo)$

2. Copper conductor cable

S no.	Cable type	CuF	AIF (single core armoured)	CCFCu	XLFCU (Single core)	XLFCU (Multi core)	FeF	FeW	IEEMA Formula
1	HT XLPE Power cable	CUP	H4	H2	XL3	XL4	H3	H5	$P = P_o + CuF(Cu - Cuo) + XLFCU(CC - CCo) + CCFCu(PVCC - PVCCo) + FeF(Fe - Feo) + AIF(AL - Alo)$
2	LT XLPE Power Cable	CUP	P4	L2	XL1	XL1	P3	P3 (Additional)	$P = P_o + CuF(Cu - Cuo) + XLFCU(CC - CCo) + CCFCu(PVCC - PVCCo) + FeF(Fe - Feo) + AIF(AL - Alo)$

S no.	Cable type	CuF	AIF (single core armoured)	CCFCu	XLFCU (Single core)	XLFCU (Multi core)	FeF	FeW	IEEMA Formula
3	LT PVC Power Cable	CUP	P4	P2	--	--	P3	P3 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$
4	LT HRPVC Power Cable	CUP	P4	P2	--	--	P3	P3 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$
5	LT XLPE Control Cable	CUC	--	P5	--	XL2	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)$
6	LT PVC Control Cable	CUC	--	P5	--	--	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)$
7	LT HRPVC Control Cable	CUC	--	P5	--	--	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu(PVCC-PVCCo) + FeF(Fe-Feo)$
8	LT XLPE Fire Survival Power Cable	CUP	P4	L2	XL1	XL1	P3	P3 (Addit ional)	$P=Po+CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$
9	LT XLPE Fire Survival Control	CUC	--	P5	--	XL2	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)$
10	LT EPR Fire Survival Power Cable	CUP	P4	L2	--	--	P3	P3 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$
11	LT EPR Fire Survival Control cable	CUC	--	P5	--	--	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)$
12	Screened control Cable (Overall screen)	Cu POS	--	--	--	--	Fe POS	Fe POS	$P=Po+CuF(Cu-Cuo) + FeF(Fe-Feo)$
13	Screened control Cable (Individual	Cu PIS	--	--	--	--	Fe PIS	Fe PIS	$P=Po+CuF(Cu-Cuo) + FeF(Fe-Feo)$

IEEMA Table for Price Variation Clause for various types of Cables**Notes:-**

- (i) Cu POS, Cu PIS, Fe POS & Fe PIS tables shall be as per IEEMA circular No. IEEMA (PVC) /Instrumentation Cable/2014 effective from dtd 01.07.2014.
- (ii) All other tables shall be as per IEEMA circular No. 35//DIV/CAB/05/ dated 24.04.2018.

Terms used in PVC formulae:

P = Price payable as adjusted in accordance with above appropriate formula (In Rs./Km).
 Po= Price quoted/confined (in Rs./km).

1. ALUMINIUM

ALF Variation factor for aluminium.
 Al =Price of aluminium.
 Alo = Price of aluminium.

2 COPPER

CuF =Variation factor for copper.
 Cu = Price of CC copper rods.
 Cuo = Price of CC copper rods.

3.PVCc COMPOUND/POLYMER

PVCc = Price of PVC compound.
 PVCco= Price of PVC compound.
 CCFAL= Variation factor for PVC compound/Polymer for aluminium conductor cable.
 CCFCu =Variation factor for PVC compound/Polymer for copper conductor cable.

4. XLPE COMPOUND

Cc = Price of XLPE compound.
 Cco= Price of XLPE compound.
 XLFAL= Variation factor for XLPE compound for aluminium conductor cable.
 XLFCu =Variation factor for XLPE compound for copper conductor cable.

5.STEEL

Fe= Price of steel strips/steel wire.
 Feo= Price of steel strips/steel wire.
 FeF =Variation factor for steel.
 FeW=Variation factor for round wire steel armouring.



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IEEMA (PVC)/Instrumentation Cable/2014

Effective from: 1st July 2014

Material Price Variation Clause For Instrumentation Cables

The Price quoted/confirmed is based on the input cost of raw materials/components as on the date of quotation, and the same is deemed to be related to the prices of raw materials as specified in the price variation clause given below. In case of any variation in these prices, the price payable shall be subject to adjustment up or down in accordance with the formulae provided in this document.

Terms used in price variation formulae:

P Price payable as adjusted in accordance with above appropriate formula (in Rs/Km)

P₀ Price quoted/confirmed (in Rs/Km)

COPPER

CuF Variation factor for copper

Cu Price of CC copper rods. This price is as applicable on first working day of the month, one month prior to the date of delivery.

Cu₀ Price of CC copper rods. This price is as applicable on first working day of the month, one month prior to the date of tendering.

STEEL

FeF Variation factor for steel

Fe Price of Steel Strips/steel wire. This price is as applicable on the first working day of the month, one month prior to the date of delivery.

Fe₀ Price of steel strips/steel wire. This price is as applicable on first working day of the month, one month prior to the date of tendering.

The above prices and indices are as published by IEEMA vide Circular reference IEEMA(PVC)/CABLE/--/prevailing as on 1st working day of the month i.e. one month prior to the date of tendering.

The date of delivery is the date on which the cable is notified as being ready for inspection/dispatch (in the absence of such notification, the date of manufacturer's dispatch note is to be considered as the date of delivery) or the contracted delivery date (including any agreed extension thereto), whichever is earlier.

Page 1 of 2

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Indian Electrical & Electronics Manufacturers' Association

IEEMA (PVC)/Instrumentation Cable/2014

Effective from: 1st July 2014

Notes

- (a) All prices of raw materials are exclusive of modvatable excise/CV duty amount and exclusive of any other central, state or local taxes, octroi, etc.
- (b) All Prices are as on first working day of the month.
- (c) The details of prices are as under:
 1. Price of CC copper rods (in Rs/MT) is ex-works price as quoted by the primary producer.
 2. Price of galvanized steel strip / steel wire (in Rs/MT) is ex-works price as quoted by the manufacturer for Round steel Wire and Flat steel strip (the relevant price of steel strip or steel wire is to be selected depending upon the type of armouring of the cable).

Price variation formula for 'Instrumentation Cables'

$$P = P_o + CuF (Cu - Cu_o) + FeF (Fe - Fe_o)$$

1. For Pair Instrumentation Over all Screen Cables

Tables References:

Cu POS Copper Factor
Fe POS Steel Factor

2. For Pair Instrumentation Individual and Over all Screen Cables

Tables References:

Cu PIS Copper Factor
Fe PIS Steel Factor

3. For Triad Instrumentation Over all Screen Cables

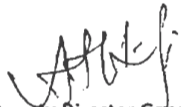
Tables References:

Cu TOS Copper Factor
Fe TOS Steel Factor

4. For Triad Instrumentation Individual & Overall Screen Cables

Tables References:

Cu TIS Copper Factor
Fe TIS Steel Factor


Deputy Director General
Page 2 of 2

Copper Factors for Instrumentation Cables - CuF

Cu POS

Pair Instrumentation Over all Screen Cables					
No. of Pairs Cable size in sq.mm	0.5 sq.mm	0.75 sq.mm	1.0 sq.mm	1.5 sq.mm	2.5 sq.mm
1	0.0142	0.0185	0.0233	0.0326	0.0500
2	0.0258	0.0345	0.0440	0.0625	0.0978
3	0.0353	0.0484	0.0626	0.0904	0.1433
4	0.0448	0.0623	0.0811	0.1183	0.1888
5	0.0578	0.0800	0.1022	0.1467	0.2356
6	0.0662	0.0926	0.1210	0.1768	0.2829
7	0.0756	0.1067	0.1378	0.2000	0.3245
8	0.0852	0.1204	0.1582	0.2327	0.3741
9	0.0933	0.1334	0.1734	0.2534	0.4134
10	0.1046	0.1485	0.1959	0.2893	0.4665
11	0.1111	0.1600	0.2089	0.3067	0.5023
12	0.1236	0.1764	0.2333	0.3452	0.5580
13	0.1289	0.1867	0.2445	0.3600	0.5912
14	0.1378	0.2000	0.2623	0.3867	0.6356
15	0.1467	0.2134	0.2800	0.4134	0.6801
16	0.1618	0.2322	0.3080	0.4573	0.7409
17	0.1645	0.2400	0.3156	0.4667	0.7690
18	0.1734	0.2534	0.3334	0.4934	0.8134
19	0.1822	0.2667	0.3512	0.5201	0.8579
20	0.1911	0.2800	0.3689	0.5467	0.9023
21	0.2000	0.2934	0.3867	0.5734	0.9468
22	0.2089	0.3067	0.4045	0.6001	0.9912
23	0.2178	0.3200	0.4223	0.6267	1.0357
24	0.2381	0.3437	0.4575	0.6813	1.1068
25	0.2356	0.3467	0.4578	0.6801	1.1246
26	0.2445	0.3600	0.4756	0.7068	1.1690
27	0.2534	0.3734	0.4934	0.7334	1.2135
28	0.2623	0.3867	0.5112	0.7601	1.2579
29	0.2711	0.4001	0.5290	0.7868	1.3024
30	0.2800	0.4134	0.5467	0.8134	1.3468
31	0.2889	0.4267	0.5645	0.8401	1.3913
32	0.2978	0.4401	0.5823	0.8668	1.4357
33	0.3067	0.4534	0.6001	0.8934	1.4802
34	0.3156	0.4667	0.6179	0.9201	1.5246
35	0.3245	0.4801	0.6356	0.9468	1.5691
36	0.3334	0.4934	0.6534	0.9735	1.6135
37	0.3423	0.5067	0.6712	1.0001	1.6580
38	0.3512	0.5201	0.6890	1.0268	1.7024
39	0.3600	0.5334	0.7068	1.0535	1.7469
40	0.3689	0.5467	0.7245	1.0801	1.7913
41	0.3778	0.5601	0.7423	1.1068	1.8358
42	0.3867	0.5734	0.7601	1.1335	1.8802
43	0.3956	0.5867	0.7779	1.1601	1.9247
44	0.4045	0.6001	0.7957	1.1868	1.9691
45	0.4134	0.6134	0.8134	1.2135	2.0136
46	0.4223	0.6267	0.8312	1.2402	2.0580
47	0.4312	0.6401	0.8490	1.2668	2.1025
48	0.4710	0.6759	0.9010	1.3410	2.2009

Copper Factors for Instrumentation Cables - CuF

Cu PIS

Pair Instrumentation Individual and Over all Screen Cables					
No. of Pairs Cable size in sq.mm	0.5 sq.mm	0.75 sq.mm	1.0 sq.mm	1.5 sq.mm	2.5 sq.mm
1	0.0133	0.0178	0.0222	0.0311	0.0489
2	0.0349	0.0437	0.0531	0.0717	0.1069
3	0.0490	0.0621	0.0763	0.1041	0.1570
4	0.0630	0.0806	0.0994	0.1389	0.2071
5	0.0800	0.1022	0.1245	0.1689	0.2578
6	0.0937	0.1200	0.1484	0.2042	0.3103
7	0.1067	0.1378	0.1689	0.2311	0.3556
8	0.1218	0.1569	0.1948	0.2692	0.4107
9	0.1334	0.1734	0.2134	0.2934	0.4534
10	0.1503	0.1943	0.2417	0.3349	0.5122
11	0.1600	0.2089	0.2578	0.3556	0.5512
12	0.1785	0.2313	0.2882	0.4001	0.6128
13	0.1867	0.2445	0.3023	0.4178	0.6490
14	0.2000	0.2623	0.3245	0.4489	0.6979
15	0.2134	0.2800	0.3467	0.4801	0.7468
16	0.2350	0.3053	0.3812	0.5305	0.8141
17	0.2400	0.3156	0.3912	0.5423	0.8446
18	0.2534	0.3334	0.4134	0.5734	0.8934
19	0.2667	0.3512	0.4356	0.6045	0.9423
20	0.2800	0.3689	0.4578	0.6356	0.9912
21	0.2934	0.3867	0.4801	0.6668	1.0401
22	0.3067	0.4045	0.5023	0.6979	1.0890
23	0.3200	0.4223	0.5245	0.7290	1.1379
24	0.3479	0.4535	0.5673	0.7911	1.2165
25	0.3467	0.4578	0.5690	0.7912	1.2357
26	0.3600	0.4756	0.5912	0.8223	1.2846
27	0.3734	0.4934	0.6134	0.8534	1.3335
28	0.3867	0.5112	0.6356	0.8846	1.3824
29	0.4001	0.5290	0.6579	0.9157	1.4313
30	0.4134	0.5467	0.6801	0.9468	1.4802
31	0.4267	0.5645	0.7023	0.9779	1.5291
32	0.4401	0.5823	0.7245	1.0090	1.5780
33	0.4534	0.6001	0.7468	1.0401	1.6269
34	0.4667	0.6179	0.7690	1.0712	1.6758
35	0.4801	0.6356	0.7912	1.1024	1.7247
36	0.4934	0.6534	0.8134	1.1335	1.7736
37	0.5067	0.6712	0.8357	1.1646	1.8225
38	0.5201	0.6890	0.8579	1.1957	1.8713
39	0.5334	0.7068	0.8801	1.2268	1.9202
40	0.5467	0.7245	0.9023	1.2579	1.9691
41	0.5601	0.7423	0.9246	1.2891	2.0180
42	0.5734	0.7601	0.9468	1.3202	2.0669
43	0.5867	0.7779	0.9690	1.3513	2.1158
44	0.6001	0.7957	0.9912	1.3824	2.1647
45	0.6134	0.8134	1.0135	1.4135	2.2136
46	0.6267	0.8312	1.0357	1.4446	2.2625
47	0.6401	0.8490	1.0579	1.4757	2.3114
48	0.6887	0.8936	1.1186	1.5587	2.4186

Steel Factors for Instrumentation Cables - FeF					
Fe POS					
Pair Instrumentation Over all Screen Cables					
No. of Pairs Cable size in sq.mm	0.5 sq.mm	0.75 sq.mm	1.0 sq.mm	1.5 sq.mm	2.5 sq.mm
1	0.1490	0.1565	0.1635	0.1735	0.1930
2	0.2190	0.2335	0.2470	0.2665	0.2595
3	0.2360	0.2545	0.2690	0.2900	0.2680
4	0.2390	0.2580	0.2715	0.2945	0.2830
5	0.2630	0.2820	0.2420	0.2805	0.3155
6	0.2840	0.3160	0.2805	0.2995	0.3430
7	0.2840	0.2595	0.2805	0.2995	0.3430
8	0.3235	0.2930	0.3030	0.3315	0.3780
9	0.2805	0.3180	0.3290	0.3590	0.4205
10	0.2970	0.3215	0.3455	0.3755	0.4385
11	0.3005	0.3255	0.3490	0.3805	0.4435
12	0.3055	0.3440	0.3680	0.3880	0.4520
13	0.3265	0.3530	0.3780	0.4105	0.4785
14	0.3265	0.3530	0.3780	0.4105	0.4785
15	0.3490	0.3765	0.4015	0.4365	0.5195
16	0.3490	0.3765	0.4015	0.4365	0.5195
17	0.3590	0.4005	0.4140	0.4635	0.5470
18	0.3590	0.4005	0.4265	0.4635	0.5470
19	0.3590	0.4005	0.4265	0.4635	0.5470
20	0.3830	0.4240	0.4535	0.4920	0.5760
21	0.3830	0.4240	0.4535	0.4920	0.5760
22	0.4065	0.4520	0.4785	0.5310	0.6190
23	0.4065	0.4520	0.4810	0.5310	0.6190
24	0.4305	0.4770	0.5070	0.5595	0.6475
25	0.4305	0.4770	0.5070	0.5595	0.6475
26	0.4305	0.4770	0.5070	0.5595	0.6475
27	0.4355	0.4820	0.5245	0.5660	0.6700
28	0.4570	0.5045	0.5345	0.5895	0.6950
29	0.4570	0.5045	0.5345	0.5895	0.6950
30	0.4570	0.5045	0.5345	0.5895	0.6950
31	0.4795	0.5285	0.5595	0.6150	0.7225
32	0.4820	0.5285	0.5595	0.6150	0.7225
33	0.4820	0.5285	0.5595	0.6150	0.7225
34	0.4920	0.5520	0.5835	0.6410	0.7500
35	0.4920	0.5520	0.5835	0.6410	0.7500
36	0.4920	0.5520	0.5835	0.6410	0.7500
37	0.4920	0.5520	0.5835	0.6410	0.7500
38	0.5145	0.5760	0.6225	0.6550	0.7805
39	0.5145	0.5760	0.6225	0.6550	0.7805
40	0.5145	0.5760	0.6225	0.6550	0.7805
41	0.5395	0.6025	0.6475	0.6975	0.8230
42	0.5395	0.6025	0.6475	0.6975	0.8230
43	0.5395	0.6025	0.6475	0.6975	0.8230
44	0.5635	0.6265	0.6735	0.7250	0.8540
45	0.5635	0.6265	0.6760	0.7250	0.8540
46	0.5635	0.6265	0.6760	0.7250	0.8540
47	0.5635	0.6265	0.6760	0.7250	0.8540
48	0.5635	0.6265	0.6760	0.7375	0.8665

Steel Factors for Instrumentation Cables - FeF

Fe PIS

Pair Instrumentation Individual and Over all Screen Cables

No. of Pairs Cable size in sq.mm	0.5 sq.mm	0.75 sq.mm	1.0 sq.mm	1.5 sq.mm	2.5 sq.mm
1	0.1880	0.1980	0.2070	0.2220	0.2410
2	0.2315	0.2460	0.2595	0.2815	0.2755
3	0.2505	0.2690	0.2820	0.2495	0.2830
4	0.2645	0.2830	0.2420	0.2805	0.3155
5	0.2895	0.2730	0.2805	0.3005	0.3430
6	0.2755	0.2980	0.3005	0.3280	0.3730
7	0.2755	0.2980	0.3005	0.3280	0.3730
8	0.2980	0.3215	0.3455	0.3740	0.4230
9	0.3230	0.3490	0.3730	0.4040	0.4685
10	0.3405	0.3655	0.3765	0.4215	0.4885
11	0.3430	0.3690	0.3815	0.4265	0.4945
12	0.3490	0.3765	0.4015	0.4470	0.5160
13	0.3715	0.3990	0.4255	0.4720	0.5420
14	0.3715	0.3990	0.4255	0.4720	0.5420
15	0.3955	0.4240	0.4510	0.5020	0.5720
16	0.3955	0.4240	0.4510	0.5020	0.5720
17	0.4190	0.4495	0.4795	0.5295	0.6150
18	0.4190	0.4495	0.4795	0.5295	0.6150
19	0.4190	0.4495	0.4795	0.5295	0.6150
20	0.4445	0.4770	0.5060	0.5570	0.6450
21	0.4445	0.4895	0.5060	0.5695	0.6450
22	0.4695	0.5045	0.5345	0.5870	0.6885
23	0.4695	0.5045	0.5345	0.5870	0.6885
24	0.4970	0.5310	0.5620	0.6285	0.7210
25	0.4970	0.5310	0.5620	0.6285	0.7210
26	0.4970	0.5310	0.5620	0.6285	0.7210
27	0.5035	0.5495	0.5810	0.6360	0.7410
28	0.5135	0.5610	0.6050	0.6610	0.7690
29	0.5135	0.5610	0.6050	0.6610	0.7690
30	0.5260	0.5610	0.6050	0.6610	0.7690
31	0.5495	0.5845	0.6300	0.6885	0.7990
32	0.5495	0.5845	0.6300	0.6885	0.7990
33	0.5495	0.5845	0.6300	0.6885	0.7990
34	0.5735	0.6225	0.6585	0.7285	0.8405
35	0.5735	0.6225	0.6585	0.7285	0.8405
36	0.5735	0.6225	0.6585	0.7285	0.8405
37	0.5735	0.6225	0.6585	0.7285	0.8405
38	0.5990	0.6485	0.6850	0.7575	0.8740
39	0.5990	0.6485	0.6850	0.7575	0.8740
40	0.5990	0.6485	0.6850	0.7575	0.8740
41	0.6250	0.6775	0.7135	0.7880	0.9180
42	0.6250	0.6775	0.7135	0.7880	0.9180
43	0.6250	0.6775	0.7135	0.7880	0.9180
44	0.6485	0.7050	0.7410	0.8165	0.9495
45	0.6485	0.7050	0.7410	0.8165	0.9495
46	0.6485	0.7050	0.7410	0.8165	0.9495
47	0.6485	0.7050	0.7410	0.8165	0.9495
48	0.6485	0.7050	0.7535	0.8290	0.9620



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Cir. No. 35/DIV/CAB/05/

24th April 2018

To Members of the Cable Division, Utilities, Railways & Listed purchasing organizations

Sub: Correction in PV formulae of LT XLPE Power Cable and addition of factors for HT XLPE Power Cables

We have recently published revised Price Variation Clause for LT&HT XLPE Power Cables and made it effective from 1st November 2017 vide Cir. No.111/DIV/CAB/05 dated 5th December 2017

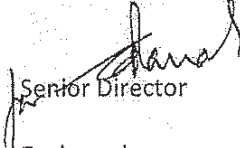
While replying to a query of a buyer it is observed that the polymer factor for LT XLPE Power Cables (both aluminium and copper) was incorrectly represented by Table P2.

We have now corrected the anomaly by correcting the PV formulae of LT XLPE Aluminium and Copper Insulated Cables (Sl. No. D & E) by representing Polymer factor by Table L2.

We have also worked out factors for XLPE, Copper and Steel for 3 core HT XLPE Power Cables for 500 and 630 sq.mm.

We now enclose complete PV clause of Cable by including all the PV formulae of different types of power cable (Sl. No. A to I), polymer factor Table L2 and updated XL4, H2 and H5 Table of factors for your perusal & record.

We request to replace PV clause of Cable already circulated vide Cir. 111/DIV/CAB/05 dated 5th December 2017 with the enclosed PV clause in your records for future use.


 Senior Director
 Encl: as above

prasad partners in implementation



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IEEMA (PVC)/CABLE(R-1)/2017**Effective from: 1st November 2017****Material Price Variation Clause For PVC And XLPE Insulated Cables**

The Price quoted/confirmed is based on the input cost of raw materials/components as on the date of quotation, and the same is deemed to be related to the prices of raw materials as specified in the price variation clause given below. In case of any variation in these prices, the price payable shall be subject to adjustment up or down in accordance with the formulae provided in this document.

Terms used in price variation formulae:

P Price payable as adjusted in accordance with above appropriate formula (in Rs/Km)

Po Price quoted/confirmed (in Rs/Km)

ALUMINIUM

AIF Variation factor for aluminium

AI Price of Aluminium. This price is as applicable of first working day of the month, one month prior to the date of delivery.

Alo Price of aluminium. This price is as applicable on first working day of the month, one month prior to the date of tendering.

COPPER

CuF Variation factor for copper

Cu Price of CC copper rods. This price is as applicable on first working day of the month, one month prior to the date of delivery.

Cuo Price of CC copper rods. This price is as applicable on first working day of the month, one month prior to the date of tendering.

PVC COMPOUND

PVCc price of PVC compound. This price is as applicable on first working day of the month, one month prior to the date of delivery.

PVCco Price of PVC compound. This price is as applicable on first working day of the month, one month prior to the date of tendering.

CCFAI Variation factor for PVC compound/Polymer for aluminum conductor cable.

CCFCu Variation factor for PVC compound/Polymer for copper conductor cable.

proud partners in implementation



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IEEMA (PVC)/CABLE(R-1)/2017
XLPE COMPOUND

Effective from: 1st November 217

Cc price of XLPE compound. This price is as applicable on first working day of the month, one month prior to the date of delivery.

Cco Price of XLPE compound. This price is as applicable on first working day of the month, one month prior to the date of tendering.

XLFAL Variation factor for XLPE compound for aluminum conductor cable.

XLFCU Variation factor for XLPE compound for Copper conductor cable.

STEEL

FeF Variation factor for steel

FeW Variation factor for round wire steel armouring

Fe Price of Steel Strips/steel wire. This price is as applicable on the first working day of the month, one month prior to the date of delivery.

Feo Price of steel strips/steel wire. This price is as applicable on first working day of the month, one month prior to the date of tendering.

The above prices and indices are as published by IEEMA vide Circular reference IEEMA (PVC)/CABLE R(1)/--/-- prevailing as on 1st working day of the month i.e. one month prior to the date of tendering.

The date of delivery is the date on which the cable is notified as being ready for inspection/dispatch (in the absence of such notification, the date of manufacturer's dispatch note is to be considered as the date of delivery) or the contracted delivery date (including any agreed extension thereto), whichever is earlier.

Notes

- (a) All prices of raw materials are exclusive of GST amount.
- (b) All prices excluding Aluminium & Copper are as on first working day of the month.
- (c) The details of prices are as under:

1. Price of Aluminium is LME average Cash SELLER Settlement price of Primary Aluminium in US\$ per MT as published by London Metal Bulletin (LME) including Premium for Aluminium Ingot in US\$ per MT is converted in Indian Rs./MT.
2. Price of PVC Compound (in Rs/MT) is the ex-works price, as quoted by the manufacturer.
3. Price of XLPE Compound (in Rs/MT) is the ex-works price, as quoted by the manufacturer
4. Price of CC copper rods (in Rs/MT) is ex-works price as quoted by the primary producer.
5. Price of galvanized steel strip / steel wire (in Rs/MT) is ex-works price as quoted by the manufacturer for Round steel Wire and Flat steel strip (the relevant price of steel strip or steel wire is to be selected depending upon the type of armouring of the cable).

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Price variation formulae for 'Power Cables'

A. Aluminum conductor PVC insulated 1.1 kV power cables

$$P = P_o + AIF (AL - ALo) + CCFAI (PVCc - PVCco) + FeF (Fe - Feo)$$

For unarmoured multicore cables (without steel armour); FeF = 0

Table References:

ALP	Aluminium conductor in single core unarmoured & multicore cables
P1	Aluminium conductor aluminium armour in single core armoured cables
P2	PVC compound
P3	Steel armour

B. Copper conductor PVC insulated 1.1 kV power cables

$$P = P_o + CuF (Cu - Cuo) + CCFCu (PVCc - PVCco) + FeF (Fe - Feo) + AIF (Al - ALo)$$

For steel armoured cables; AIF = 0 For aluminium armoured cables; FeF = 0

For unarmoured cables; FeF, AIF = 0

Tables References:

CUP	Copper conductor
P2	PVC compound
P3	Steel armour
P4	Aluminium armour

C. Copper conductor PVC insulated 1.1 kV control cables

$$P = P_o + CuF (Cu - Cuo) + CCFCu (PVCc - PVCco) + FeF (Fe - Feo)$$

For unarmoured cables; FeF = 0

Tables References:

CUC	Copper conductor
P5	PVC compound
P6	Steel armour

D. Aluminum conductor XLPE insulated 1.1 kV power cables

$$P = P_o + AIF (AL - ALo) + XLFAL (CC - Cco) + CCFAI (PVCc - PVCco) + FeF (Fe - Feo)$$

For unarmoured multicore cables (without steel armour); FeF = 0

Table References:

ALP	Aluminium conductor in single core unarmoured & multicore cables
P1	Aluminium conductor aluminium armour in single core armoured cables
L2	Polymer (CCFAI)
P3	Steel armour
XL1	XLPE Compound (XLFAL)

E. Copper conductor XLPE insulated 1.1 kV power cables

$$P = P_o + CuF (Cu - Cuo) + XLFCU (CC - Cco) + CCFCu (PVCc - PVCco) + FeF (Fe - Feo) + AIF (Al - ALo)$$

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For steel armoured cables; AIF = 0 For aluminium armoured cables; FeF = 0

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For unarmoured cables; FeF, AIF = 0

Tables References:

CUP	Copper conductor
L2	Polymer (CCFCu)
P3	Steel armour
P4	Aluminium armour
XL1	XLPE Compound (XLFCu)

F. Copper conductor XLPE insulated 1.1 kV control cables

$$P = P_o + CuF (Cu - Cu_o) + XLFCU (CC-Cco) + CCFCu (PVCc-PVCco) + FeF (Fe-Fe_o)$$

For unarmoured cables; FeF = 0

Tables References:

CUC	Copper conductor
P5	PVC compound
P6	Steel armour
XL2	XLPE Compound

G. For Aluminium conductor XLPE insulated 3.3 to 33 kV power cables

$$P = P_o + AIF (Al - Al_o) + XLFAL (CC-Cco) + CCFAI (PVCc - PVCco) + FeF (Fe - Fe_o)$$

For unarmoured multicore cables (without steel armour); FeF = 0

Table References:

ALP	Aluminium conductor in single core unarmoured & multicore cables
H1	Aluminium conductor + aluminium armour in single core armoured cables
H2	Polymer
H3/H5	Steel armour (Flat/Round)
XL3/XL4	XLPE Compound (Single core /Multicore)

H. Copper conductor XLPE Insulated 3.3 to 33 kV power cables

$$P = P_o + CuF (Cu - Cu_o) + XLFCU (CC-Cco) + CCFCu (PVCc - PVCco) + FeF (Fe - Fe_o) + AIF (Al - Al_o)$$

For steel armoured cables; AIF = 0 For aluminium armoured cables; FeF = 0

For unarmoured cables; FeF, AIF = 0

Table References:

CUP	Copper conductor
H2	Polymer
H3/H5	Steel armour (Flat/Round)
H4	Aluminium armour
XL3/XL4	XLPE Compound (Single core /Multicore)

I. Copper conductor XLPE insulated 1.0 and 1.5 kV Solar PV DC cables

$$P = P_o + CuF (Cu - Cu_o)$$

Table CUscd Copper Conductor

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TABLE ALP

VARIATION FACTOR FOR ALUMINIUM (AIF)
POWER CABLES WITH ALUMINIUM CONDUCTOR
(EXCLUDING SINGLE CORE ARMoured CABLES)

Nominal Cross Sectional Area (in Sq. mm.)	1 core	2 core	3 core	3.5 core	4 core
2.5	0.007	0.014	0.021	-	0.028
4	0.011	0.023	0.034	-	0.046
6	0.017	0.034	0.052	-	0.069
10	0.029	0.053	0.087	-	0.116
16	0.046	0.091	0.137	-	0.183
25/16	0.073	0.146	0.219	0.262	0.292
35/16	0.101	0.202	0.302	0.345	0.404
50/25	0.137	0.273	0.410	0.478	0.547
70/35	0.197	0.395	0.593	0.687	0.791
95/50	0.274	0.548	0.821	0.949	1.095
120/70	0.346	0.691	1.035	1.221	1.382
150/70	0.425	0.853	1.279	1.464	1.706
185/95	0.533	1.070	1.605	1.861	2.140
225/120	0.655	1.310	1.965	2.287	2.620
240/120	0.703	1.400	2.099	2.421	2.799
300/150	0.879	1.757	2.635	3.033	3.514
400/185	1.126	2.249	3.374	3.873	4.498
500	1.418	2.838	4.256	-	5.675
630	1.828	3.663	5.494	-	7.326
800	2.340	4.679	7.018	-	9.357
1000	2.951	5.890	8.834	-	11.779

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TABLE CUP

VARIATION FACTOR FOR COPPER CONDUCTOR (CUF)
POWER CABLES WITH COPPER CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm.)	1 core	2 core	3 core	3.5 core	4 core
2.5	0.023	0.046	0.069	-	0.092
4	0.036	0.076	0.112	-	0.151
6	0.056	0.112	0.171	-	0.227
10	0.095	0.174	0.286	-	0.382
16	0.151	0.299	0.451	-	0.602
25/16	0.240	0.480	0.720	0.862	0.960
35/16	0.332	0.664	0.993	1.135	1.329
50/25	0.451	0.898	1.348	1.572	1.799
70/35	0.648	1.299	1.950	2.260	2.602
95/50	0.901	1.802	2.700	3.121	3.601
120/70	1.138	2.273	3.407	4.016	4.545
150/70	1.398	2.806	4.207	4.815	5.611
185/95	1.753	3.519	5.279	6.121	7.038
225/120	2.154	4.309	6.463	7.522	8.617
240/120	2.312	4.605	6.904	7.963	9.206
300/150	2.891	5.779	8.667	9.976	11.558
400/185	3.703	7.397	11.097	12.738	14.794
500	4.664	9.334	13.998	-	18.665
630	6.012	12.048	18.070	-	24.095
800	7.696	15.389	23.082	-	30.775
1000	9.706	19.372	29.055	-	38.741

TABLE CU_{sd}c

VARIATION FACTOR FOR COPPER CONDUCTOR (CUF)
1.0 & 1.5KV Solar PV DC Cables with Copper Conductor

Cable Size in sq.mm.	Copper content in MT/km
2.5	0.023
4	0.038
6	0.058
10	0.090

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TABLE CUC

**VARIATION FACTOR FOR COPPER CONDUCTOR (CUF)
CONTROL CABLES WITH COPPER CONDUCTOR**

No of Cores	Core size 1.5 sq mm	Core size 2.5 sq mm
2	0.026	0.047
3	0.039	0.070
4	0.052	0.094
5	0.065	0.117
6	0.078	0.141
7	0.091	0.164
8	0.110	0.182
9	0.117	0.205
10	0.130	0.235
12	0.157	0.282
14	0.183	0.329
16	0.209	0.376
18	0.246	0.410
19	0.248	0.446
20	0.260	0.456
24	0.313	0.563
27	0.352	0.634
30	0.391	0.704
37	0.483	0.869
44	0.573	1.033
52	0.678	1.221
61	0.796	1.432

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TABLE P1

VARIATION FACTOR FOR ALUMINIUM (AIF)
ALUMINIUM ARMoured SINGLE CORE PVC INSULATED 1.1 KV CABLES

Nominal cross sectional area (in Sq.mm)	Aluminium factor for Aluminium armoured cable with aluminium conductor
4	0.0685
6	0.0795
10	0.1017
16	0.1303
25	0.1693
35	0.2090
50	0.2597
70	0.3360
95	0.4567
120	0.5443
150	0.6427
185	0.7743
240	0.9737
300	1.2582
400	1.5502
500	1.8958
630	2.3650
800	2.9306
1000	3.7666

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TABLE P2

VARIATION FACTOR FOR PVC COMPOUND (CCFAI/CCFCu)
PVC INSULATED 1.1 KV POWER CABLES WITH COPPER/ALUMINIUM CONDUCTOR

Nominal cross Sectional Area (in Sq. mm)	1 core	2 core		3 core		3.5 core		4 core	
	Unarm	Unarm	arm	Unarm	arm	Unarm	arm	Unarm	arm
2.5	0.079	0.125	0.139	0.141	0.157	-	-	0.161	0.179
4	0.094	0.140	0.156	0.164	0.182	-	-	0.188	0.209
6	0.101	0.154	0.171	0.179	0.199	-	-	0.198	0.220
10	0.114	0.194	0.216	0.214	0.238	-	-	0.249	0.277
16	0.142	0.234	0.246	0.279	0.290	-	-	0.328	0.345
25	0.171	0.288	0.303	0.364	0.383	0.422	0.444	0.443	0.466
35	0.189	0.321	0.338	0.403	0.429	0.489	0.515	0.498	0.524
50	0.211	0.411	0.433	0.508	0.535	0.613	0.645	0.647	0.681
70	0.241	-	-	0.613	0.645	0.707	0.744	-	-
95	0.284	-	-	0.795	0.811	0.908	0.927	-	-
120	0.339	-	-	0.866	0.884	1.024	1.045	-	-
150	0.388	-	-	1.070	1.092	1.289	1.315	-	-
185	0.450	-	-	1.310	1.337	1.499	1.530	-	-
225	0.521	-	-	1.586	1.618	1.840	1.878	-	-
240	0.534	-	-	1.649	1.683	1.990	2.031	-	-
300	0.653	-	-	2.007	2.048	2.361	2.409	-	-
400	0.770	-	-	2.437	2.487	2.616	2.669	-	-
500	0.936	-	-	3.117	3.181	3.687	3.762	-	-
630	1.175	-	-	-	-	-	-	-	-
800	1.433	-	-	-	-	-	-	-	-
1000	1.642	-	-	-	-	-	-	-	-

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TABLE P3

VARIATION FACTOR FOR STEEL (FeF)
PVC INSULATED 1.1 KV POWER CABLES WITH COPPER/ALUMINIUM CONDUCTOR

Nominal Cross sectional Area (in Sq. mm)	2 core	Shape	3 core	Shape	3 ½ core	Shape	4 core	Shape
4	0.305	W	0.335	W	-	-	0.363	W
6	0.348	W	0.363	W	-	-	0.407	W
10	0.392	W	0.407	W	-	-	0.293	F
16	0.235	F	0.293	F	-	-	0.323	F
25	0.293	F	0.352	F	0.382	F	0.382	F
35	0.323	F	0.382	F	0.411	F	0.440	F
50	0.382	F	0.440	F	0.469	F	0.499	F
70	0.411	F	0.499	F	-	F	0.587	F
95	0.499	F	0.587	F	0.616	F	0.645	F
120	0.528	F	0.616	F	0.675	F	0.731	F
150	0.587	F	0.675	F	0.731	F	0.790	F
185	0.645	F	0.761	F	0.820	F	0.879	F
240	0.731	F	0.879	F	0.937	F	0.996	F
300	0.820	F	0.966	F	1.055	F	1.113	F
400	0.937	F	1.083	F	1.172	F	1.231	F
500	1.055	F	1.231	F	1.348	F	1.406	F
630	1.172	F	-	-	-	-	-	-

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TABLE P3 (Additional)

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VARIATION FACTOR FOR ROUND WIRE 'W' STEEL (FeF)
PVC INSULATED 1.1 KV POWER CABLES WITH COPPER/ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area (in sq. mm)	2 Core	3 Core	3.5 Core	4 Core
1.5	0.247	0.259		0.288
2.5	0.273	0.289		0.329
4	0.305	0.335		0.363
6	0.348	0.363		0.407
10	0.392	0.407		0.533
16	0.439	0.523	0.014	0.573
25	0.526	0.625	0.664	0.685
35	0.591	0.685	0.729	0.761
50	0.661	0.790	0.864	1.108
70	0.745	1.122	1.200	1.256
95	1.085	1.286	1.376	1.443
120	1.147	1.386	1.479	1.562
150	1.267	1.526	1.684	2.173
185	1.403	2.090	2.315	2.421
240	1.994	2.397	2.641	2.722
300	2.180	2.642	3.670	3.842
400	2.987	3.728	4.126	4.292
500	3.517	4.226	5.958	6.301
630	4.774	6.018	6.737	7.141

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TABLE P4

VARIATION FACTOR FOR ALUMINIUM (AIF)
PVC INSULATED 1.1 KV POWER CABLES WITH COPPER CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm)	Aluminium Factor for Aluminium armoured cable with copper conductor
4	0.058
6	0.063
10	0.073
16	0.084
25	0.096
35	0.108
50	0.123
70	0.139
95	0.183
120	0.198
150	0.218
185	0.241
240	0.271
300	0.379
400	0.424
500	0.478
630	0.537
800	0.591
1000	0.816

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TABLE P5

VARIATION FACTOR FOR PVC COMPOUND (CCFCu)
PVC INSULATED CONTROL CABLES WITH COPPER CONDUCTOR

No of cores	Core size 1.5 sq mm		Core size 2.5 sq mm	
	Unarm	Arm	Unarm	Arm
2	0.118	0.121	0.125	0.139
3	0.121	0.131	0.141	0.157
4	0.137	0.152	0.161	0.179
5	0.157	0.174	0.187	0.206
6	0.179	0.199	0.234	0.260
7	0.179	0.199	0.234	0.260
8	0.193	0.215	0.292	0.325
9	0.216	0.241	0.300	0.335
10	0.236	0.262	0.303	0.337
12	0.249	0.277	0.334	0.371
14	0.311	0.327	0.389	0.409
16	0.344	0.362	0.435	0.458
18	0.352	0.371	0.474	0.500
19	0.375	0.395	0.476	0.501
20	0.391	0.412	0.519	0.546
24	0.457	0.481	0.584	0.615
27	0.491	0.517	0.631	0.664
30	0.529	0.557	0.706	0.743
37	0.615	0.647	0.835	0.879
44	0.739	0.778	1.019	1.026
52	0.845	0.889	1.100	1.158
61	0.952	1.002	1.246	1.312

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TABLE P6

VARIATION FACTOR FOR STEEL (FeF)
PVC INSULATED CONTROL CABLES WITH COPPER CONDUCTOR

No of cores	Core size 1.5 sq mm	Shape of armour	Core size 2.5 sq mm	Shape of armour
2	0.243	W	0.277	W
3	0.257	W	0.289	W
4	0.277	W	0.314	W
5	0.303	W	0.342	W
6	0.329	W	0.379	W
7	0.329	W	0.379	W
8	0.341	W	0.456	W
9	0.383	W	0.275	F
10	0.408	W	0.325	F
12	0.289	F	0.342	F
14	0.306	F	0.360	F
16	0.317	F	0.372	F
18	0.332	F	0.350	F
19	0.343	F	0.397	F
20	0.368	F	0.400	F
24	0.398	F	0.475	F
27	0.414	F	0.478	F
30	0.425	F	0.503	F
37	0.461	F	0.548	F
44	0.507	F	0.601	F
52	0.556	F	0.641	F
61	0.585	F	0.685	F

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TABLE P6 (Additional)

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VARIATION FACTOR FOR ROUND WIRE 'W' STEEL (FeF)
PVC INSULATED CONTROL CABLES WITH COPPER CONDUCTOR

No. of Cores	Core size 1.5 sq mm	Core size 2.5 sq mm
2	0.243	0.273
3	0.257	0.289
4	0.277	0.314
5	0.303	0.342
6	0.329	0.379
7	0.329	0.379
8	0.341	0.456
9	0.383	0.508
10	0.408	0.535
12	0.510	0.572
14	0.546	0.625
16	0.581	0.660
19	0.608	0.696
24	0.714	0.819
25	0.679	0.798
27	0.732	0.837
28	0.696	0.815
30	0.758	0.881
33	0.747	0.883
37	0.820	1.217
44	0.926	1.355
48	1.122	1.308
50	1.122	1.308
52	1.149	1.361
56	1.202	1.388
61	1.299	1.520

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TABLE L2

VARIATION FACTOR FOR POLYMER (CCFAI / CCFCu)
XLPE INSULATED 1.1 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm)	1 core	2 core		3 core		3.5 core		4 core	
	Unarm	Unarm	Arm	Unarm	Arm	Unarm	Arm	Unarm	Arm
2.5	0.055	0.163	0.175	0.166	0.177	-	-	0.177	0.188
4	0.075	0.201	0.204	0.205	0.213	-	-	0.218	0.213
6	0.085	0.213	0.234	0.205	0.230	-	-	0.242	0.232
10	0.082	0.252	0.280	0.217	0.251	-	-	0.285	0.298
16	0.089	0.278	0.341	0.289	0.246	-	-	0.300	0.279
25	0.101	0.307	0.278	0.276	0.247	0.295	0.264	0.331	0.290
35	0.109	0.330	0.319	0.305	0.270	0.328	0.292	0.368	0.319
50	0.124	0.482	0.685	0.348	0.311	0.372	0.335	0.422	0.394
70	0.146	0.354	0.335	0.469	0.397	0.489	0.420	0.528	0.464
95	0.163	0.436	0.389	0.504	0.441	0.544	0.471	0.591	0.523
120	0.176	0.475	0.421	0.556	0.498	0.599	0.538	0.722	0.656
150	0.217	0.510	0.490	0.690	0.611	0.717	0.633	0.840	0.762
185	0.236	0.631	0.608	0.836	0.738	0.854	0.756	1.007	0.899
240	0.273	0.750	0.726	1.002	0.842	1.079	0.952	1.238	1.119
300	0.303	0.919	0.887	1.161	1.012	1.170	1.031	1.457	1.414
400	0.372	1.093	1.040	1.376	1.283	1.545	1.379	1.778	1.626
500	0.413	1.342	-	1.568	1.400	1.806	1.456	-	-
630	0.469	1.546	-	-	-	-	-	-	-
800	0.569	-	-	-	-	-	-	-	-
1000	0.667	-	-	-	-	-	-	-	-

IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 217

TABLE XL1
VARIATION FACTOR FOR XLPE COMPOUND (XLFAL/XLFUCU)
XLPE INSULATED 1.1 KV POWER CABLES WITH COPPER/ALUMINIUM CONDUCTOR

Nominal cross Sectional Area (in Sq. mm)	1 core		2 core		3 core		3.5 core		4 core	
	Unarm	Arm	Unarm	Arm	Unarm	arm	Unarm	Arm	Unarm	arm
2.5	0.007	0.010	0.014	0.014	0.021	0.021			0.028	0.028
4	0.009	0.012	0.018	0.018	0.027	0.027			0.036	0.036
6	0.010	0.015	0.022	0.022	0.033	0.033			0.043	0.043
10	0.013	0.018	0.025	0.025	0.039	0.039			0.053	0.053
16	0.016	0.023	0.034	0.034	0.049	0.049			0.065	0.065
25	0.021	0.030	0.048	0.048	0.070	0.070	0.084	0.084	0.093	0.093
35	0.025	0.035	0.059	0.059	0.084	0.084	0.099	0.099	0.112	0.112
50	0.033	0.044	0.075	0.075	0.108	0.108	0.130	0.130	0.144	0.144
70	0.042	0.054	0.095	0.095	0.137	0.137	0.160	0.160	0.179	0.179
95	0.048	0.062	0.110	0.110	0.160	0.160	0.190	0.190	0.211	0.211
120	0.060	0.076	0.138	0.138	0.200	0.200	0.239	0.239	0.266	0.266
150	0.078	0.095	0.180	0.180	0.259	0.259	0.296	0.296	0.344	0.344
185	0.097	0.116	0.224	0.224	0.324	0.324	0.369	0.369	0.430	0.430
240	0.116	0.137	0.266	0.266	0.388	0.388	0.446	0.446	0.518	0.518
300	0.138	0.164	0.325	0.325	0.467	0.467	0.540	0.540	0.620	0.620
400	0.175	0.214	0.357	0.357	0.536	0.536	0.619	0.619	0.714	0.714
500	0.217	0.260	0.440	0.440	0.660	0.660	0.769	0.769	0.880	0.880
630	0.265	0.318	0.542	0.542	0.814	0.814	0.941	0.941	1.085	1.085
800	0.323	0.389								
1000	0.375	0.444								

IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 217

TABLE XL2
VARIATION FACTOR FOR XLPE COMPOUND (XLFCU)
XLPE INSULATED CONTROL CABLES WITH COPPER CONDUCTOR

No of cores	Core size 1.5 sq mm		Core size 2.5 sq mm	
	Unarm	Arm	Unarm	Arm
2	0.010	0.010	0.012	0.012
3	0.016	0.016	0.018	0.018
4	0.021	0.021	0.025	0.025
5	0.026	0.026	0.031	0.031
6	0.031	0.031	0.037	0.037
7	0.036	0.036	0.043	0.043
8	0.036	0.036	0.043	0.043
9	0.042	0.042	0.049	0.049
10	0.052	0.052	0.061	0.061
12	0.062	0.062	0.074	0.074
14	0.073	0.073	0.086	0.086
16	0.083	0.083	0.098	0.098
18	0.094	0.094	0.110	0.110
19	0.099	0.099	0.116	0.116
20	0.104	0.104	0.123	0.123
24	0.125	0.125	0.147	0.147
27	0.140	0.140	0.165	0.165
30	0.156	0.156	0.184	0.184
37	0.192	0.192	0.227	0.227
44	0.229	0.229	0.270	0.270
52	0.270	0.270	0.319	0.319
61	0.317	0.317	0.374	0.374

IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 217

TABLE XL3

VARIATION FACTOR FOR XLPE(XLFAL/XLFUC)

SINGLE CORE ARMoured /UNARMoured XLPE INSULATED 3.3 to 33 KV POWER CABLES WITH
CU / AL CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm.)	XLPE Factor for Armoured/ Unarmoured Cable with AL /CU Conductor					
	3.3 KV	6.6 KV (E)	11 KV (E)/ 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
25	0.110	0.131	0.170	0.279		
35	0.122	0.137	0.175	0.284	0.317	0.522
50	0.135	0.151	0.191	0.307	0.341	0.563
70	0.155	0.172	0.215	0.342	0.379	0.615
95	0.174	0.193	0.241	0.377	0.417	0.670
120	0.192	0.212	0.262	0.407	0.449	0.713
150	0.209	0.229	0.283	0.437	0.481	0.757
185	0.228	0.250	0.308	0.471	0.518	0.809
240	0.255	0.279	0.343	0.519	0.569	0.883
300	0.280	0.322	0.372	0.560	0.613	0.943
400	0.326	0.392	0.420	0.625	0.683	1.041
500	0.388	0.461	0.469	0.694	0.757	1.142
630	0.467	0.520	0.529	0.777	0.845	1.265
800	0.567	0.593	0.602	0.874	0.949	1.407
1000	0.656	0.665	0.660	0.955	1.036	1.525

Note : XLPE factors include Semicons for Conductor & Insulation screen

TABLE - XL4

VARIATION FACTOR FOR XLPE (CCF1A/ / CCF1Cu)

3 CORE XLPE INSULATED 3.3 to 33 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm)	3.3 KV ARM	6.6 KV (E) ARM	6.6 KV (UE) / 11 KV (E) ARM	11 KV (UE) ARM	22 KV (E) ARM	33 KV (E) ARM
25	0.315	0.394	0.511	0.838		
35	0.339	0.427	0.545	0.880	0.982	1.638
50	0.378	0.474	0.600	0.957	1.065	1.751
70	0.435	0.541	0.679	1.067	1.183	1.916
95	0.489	0.604	0.755	1.171	1.295	2.071
120	0.537	0.661	0.822	1.265	1.396	2.210
150	0.585	0.719	0.890	1.359	1.497	2.350
185	0.642	0.784	0.968	1.468	1.614	2.513
240	0.717	0.873	1.074	1.615	1.773	2.732
300	0.781	1.006	1.167	1.744	1.928	2.919
400	0.886	1.227	1.314	1.948	2.130	3.229
500	0.956	1.421	1.446	2.148	2.381	3.538
630	1.129	1.582	1.609	2.382	2.630	3.940

Note : XLPE factors include Semicons for Conductor & Insulation screen

TABLE H1
VARIATION FACTOR FOR ALUMINIUM (AIF)
ALUMINIUM ARMoured SINGLE CORE XLPE INSULATED 3.3 TO 33 KV CABLES

Nominal Cross Sectional Area (in Sq. mm.)	Aluminium Factor for Aluminium Armoured Cable with Aluminium Conductor					
	3.3 KV	6.6 KV (E)	11 KV (E)/ 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
35	0.251	0.284	0.301	0.344	0.358	0.473
50	0.312	0.336	0.352	0.397	0.408	0.672
70	0.385	0.409	0.423	0.469	0.501	0.723
95	0.476	0.500	0.518	0.637	0.656	0.856
120	0.561	0.586	0.601	0.726	0.744	0.949
150	0.653	0.678	0.696	0.823	0.842	1.050
185	0.773	0.797	0.893	0.949	0.965	1.183
240	0.997	1.063	1.083	1.139	1.154	1.387
300	1.209	1.271	1.283	1.333	1.307	1.753
400	1.438	1.556	1.565	1.620	1.636	2.046
500	1.873	1.901	1.910	2.110	2.128	2.484
630	2.337	2.361	2.369	2.580	2.595	2.978
800	3.007	3.071	3.080	3.145	3.163	3.588
1000	3.737	3.741	3.749	3.804	3.822	4.565

TABLE H2
VARIATION FACTOR FOR POLYMER (CCFAI / CCFCu)
3 CORE XLPE INSULATED 3.3 to 33 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm)	3.3 KV ARM	6.6 KV (E) ARM	6.6 KV (UE) / 11 KV (E) ARM	11 KV (UE) ARM	22 KV (E) ARM	33 KV (E) ARM
35	0.374	0.990	1.142	1.604	1.782	-
50	0.445	1.119	1.260	1.834	2.046	2.864
70	0.547	1.290	1.396	2.011	2.284	3.219
95	0.594	1.440	1.647	2.269	2.428	3.367
120	0.732	1.692	1.877	2.498	2.715	3.646
150	0.812	1.906	2.061	2.767	2.931	3.927
185	0.960	2.086	2.406	3.028	3.180	4.166
240	1.130	2.484	2.744	3.398	3.580	4.589
300	1.219	2.912	3.161	3.840	4.016	5.029
400	1.313	3.530	3.664	4.353	4.666	5.736
500	1.652	3.925	3.971	4.621	4.878	5.913
630	1.949	4.487	4.982	5.225	5.477	6.696

Fillers added in PVC consumption

IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 217

TABLE H3
VARIATION FACTOR FOR STEEL (FeF)
XLPE INSULATED 3.3 TO 33 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area Sq. mm.	3.3 KV	6.6 KV (E)	11 KV (E) / 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
25	0.551	0.604	0.656	0.814		
35	0.645	0.645	0.731	0.879	0.937	-
50	0.675	0.703	0.761	0.937	0.966	1.181
70	0.761	0.761	0.849	0.996	1.055	1.289
95	0.820	0.849	0.907	1.083	1.113	1.348
120	0.879	0.907	0.966	1.142	1.172	1.406
150	0.966	0.966	1.055	1.201	1.259	1.494
185	1.025	1.055	1.113	1.259	1.318	1.553
240	1.142	1.142	1.231	1.377	1.406	1.641
300	1.231	1.259	1.318	1.465	1.524	1.758
400	1.348	1.406	1.435	1.582	1.641	1.876

IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 217

TABLE H4
VARIATION FACTOR FOR ALUMINIUM (AIF)
XLPE INSULATED SINGLE CORE 3.3 TO 33 KV POWER CABLES WITH COPPER CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm.)	Aluminium Factor for Aluminium Armoured Cable with Copper Conductor					
	3.3 KV	6.6 KV (E)	11 KV (E)/ 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
35	0.153	0.187	0.204	0.247	0.258	0.372
50	0.179	0.203	0.220	0.262	0.275	0.425
70	0.196	0.219	0.233	0.278	0.311	0.444
95	0.213	0.237	0.254	0.373	0.392	0.470
120	0.228	0.253	0.268	0.393	0.410	0.488
150	0.243	0.269	0.287	0.414	0.432	0.504
185	0.261	0.285	0.381	0.437	0.455	0.526
240	0.324	0.389	0.410	0.465	0.480	0.556
300	0.365	0.428	0.440	0.490	0.510	0.737
400	0.432	0.471	0.480	0.536	0.552	0.783
500	0.489	0.517	0.526	0.726	0.744	0.844
630	0.544	0.568	0.572	0.787	0.801	0.902
800	0.706	0.787	0.797	0.862	0.880	0.982
1000	0.824	0.865	0.867	0.923	0.940	1.324

TABLE - H5
VARIATION FACTOR FOR STEEL (FeW)
XLPE INSULATED 3.3KV TO 33 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area in Sq. mm	3.3/3.3 KV	3.3/6.6 KV	11 KV (E) / 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
25	1.258	1.457	1.612	2.509	1.503	--
35	1.361	1.569	1.853	2.644	2.797	2.517
50	1.682	1.687	2.321	2.800	2.921	4.569
70	2.033	1.979	2.503	3.219	3.347	4.809
95	2.202	2.507	2.718	4.019	4.200	5.437
120	2.371	2.675	2.882	4.241	4.416	6.713
150	2.870	2.847	3.265	4.447	4.621	6.976
185	3.121	3.309	4.148	4.726	5.289	7.356
240	3.758	4.227	4.442	5.442	6.651	7.718
300	4.099	5.024	5.182	6.894	7.084	8.187
400	5.750	6.572	6.658	7.433	7.657	8.760
500	6.716	6.777	6.861	7.588	7.797	8.830
630	7.492	7.465	7.477	8.209	8.386	9.413

ANNEXURE V TO NIT REF NO-PE/PG/RTC/E-6450/2020, DTD-03.06.2020

Letter head of CA/ Statutory auditor / Cost auditor (>Rs. 10 Cr value)

Ref:

Date:

To,

Bharat Heavy Electricals Limited

PEM, PPEI Building, Plot No 25,

Sector -16A, Noida (U.P)-201301

Subject: - Certification regarding local content

Reference: Tender Enquiry No-.....

Name of Package:

Dear Sir,

We hereby certify that items of(package name).....for.....(Project Name/Rate Contract).....offered by M/s(bidder's name)..... having its registered works at has local content of%.

Further, M/s(bidder's name)..... meets the requirement of minimum local content in line with clause no..... of NIT no..... dated..... and the Public Procurement (Preference to Make in India), Order 2017 dated-15.06.2017, 28.05.2018 & 29.05.2019.

Thanking You.

For (CA/Cost Firm Name with FRN & Seal)

Chartered/Cost Accountants

(name of Member)

(Membership no.)

(UDIN no.)

BANK GUARANTEE FOR PERFORMANCE SECURITY

Bank Guarantee No: _____

Date: _____

To,

NAME

& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of the Bharat Heavy Electricals Limited 1 (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at1 through its Unit at..... (name of the Unit) having awarded to (Name of the Vendor / Contractor / Supplier) having its registered office at2 hereinafter referred to as the 'Vendor/Contractor/Supplier', which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref No.....dated3 valued at Rs 4 (Rupees)/ FC (in words) for..... 5 (hereinafter called the 'Contract') and the Vendor/Contractor/Seller having agreed to provide a Contract Performance Guarantee, equivalent to % (.... Percent) of the said value of the Contract to the Employer for the faithful performance of the Contract,

we, , (hereinafter referred to as the Bank), having registered/Head office at and inter alia a branch at being the Guarantor under this Guarantee, hereby, irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer a maximum amount Rs 6 (Rupees) without any demur, immediately on first demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand.

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

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

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

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

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

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

This Guarantee shall remain in force up to and including..... 7 and shall be extended from time to time for such period as may be desired by Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Vendor/Contractor/Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the8 we shall be discharged from all liabilities under this guarantee thereafter.

We, BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a. The liability of the Bank under this Guarantee shall not exceed6
- b. This Guarantee shall be valid up to7
- c. Unless the Bank is served a written claim or demand on or before..... 8 all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

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

Dated.....

For and on behalf of

Place of Issue.....

(Name of the Bank)

1 NAME AND ADDRESS OF EMPLOYER i.e. Bharat Heavy Electricals Limited

2 NAME AND ADDRESS OF THE VENDOR / CONTRACTOR / SUPPLIER.

3 DETAILS ABOUT THE NOTICE OF AWARD/ CONTRACT REFERENCE

4 CONTRACT VALUE

5 PROJECT/SUPPLY DETAILS

6 BG AMOUNT IN FIGURES AND WORDS

7 VALIDITY DATE

8 DATE OF EXPIRY OF CLAIM PERIOD

Note:

1. Units are advised that expiry of claim period may be kept 3-6 months after validity date. It may be ensured that the same is in line with the agreement/ contract entered with the vendor.
2. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier/Bank issuing the guarantee.
3. In line with the GCC, SCC and contractual terms, Unit may carry out minor modifications in the Standard BG Formats. If required, such modifications may be carried out after taking up appropriately with the Unit/Region's Law Deptt.
4. In Case of Bank Guarantees submitted by Foreign Vendors-
 - a) From Nationalized Public Sector 1 Private Sector/ Foreign Banks (BG issued by Branches in India) can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/ city or at nearest branch where the Unit (New Delhi for POs issued from PEM Noida/ PO issuing agency) is located i.e. Demand can be presented at the Branch located in the town/ city or at nearest branch where the Unit is located.
 - b) From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks** only will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank's (BHEL's Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ Counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b 2 In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at sl.no. b.1 will required to be followed.
 - b 3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). The BG Format provided to them should clearly specify the same.

or & On behalf of Guarantee issuing bank

(Office Seal)

Name:

E-mail ID:

Contact number:

BHEL-IP

AA:SSP:IP:R02 dtd 10.07.2018

Annexure-1

INTEGRITY PACT

Between

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

and

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

Preamble

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

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

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

Section 1- Commitments of the Principal

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

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

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

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

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

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

- 2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.
- 2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.
- 2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
- 2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- 2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
- 2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.
- 2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and will await their decision in the matter.

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

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

Section 4 - Compensation for Damages

- 4.1 If the Principal has disqualified the Bidder from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent Earnest Money Deposit/ Bid Security.
- 4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to



demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee, whichever is higher.

Section 5 - Previous Transgression

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

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

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

6.1 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors. In case of sub-contracting, the Principal contractor shall be responsible for the adoption of IP by his sub-contractors and shall continue to remain responsible for any default by his sub-contractors.

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

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

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

Section 8 - Independent External Monitor(s)

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

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

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

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

- 8.5 The role of IEMs is advisory, would not be legally binding and it is restricted to resolving issues raised by an intending bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.
- 8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process, the matter should be examined by the full panel of IEMs jointly as far as possible, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.
- 8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to CMD, BHEL, at the earliest. They may also send their report directly to the CVO and the Commission, in case of suspicion of serious irregularities requiring legal/ administrative action. IEMs will tender their advice on the complaints within 10 days as far as possible.
- 8.8 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.
- 8.9 IEM should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the organization should be looked into by the CVO of the concerned organisation.
- 8.10 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code/ Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.
- 8.11 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.
- 8.12 The word 'Monitor' would include both singular and plural.

Section 9 - Pact Duration

- 9.1 This Pact shall be operative from the date IP is signed by both the parties till the final completion of contract for successful bidder and for all other bidders 6 months after the contract has been awarded. Issues like warranty / guarantee etc. should be outside the purview of IEMs.
- 9.2 If any claim is made/ lodged during currency of IP, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

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



AA:SSP:IP:R02 dtd 10.07.2018

- सुमीत साहय SUMIT SAHAY
 Dy. Manager (CAM)
 भारत हेवी इलेक्ट्रिक्स लि. Bharat Heavy Electricals Ltd.
 प्लॉट नं. १३, इंदिरा गांधी नगर, दिल्ली-११००५५
 भारत भारत-प्रोजेक्ट्स एंड इंजीनियरिंग प्रबंधन
 कंसल्टिंग प्रा. लि. भारत-प्रोजेक्ट्स एंड इंजीनियरिंग प्रबंधन
 प्लॉट नं. १३, इंदिरा गांधी नगर, दिल्ली-११००५५
 Power Sector-Project Engineering-Management
 कंसल्टिंग प्रा. लि. भारत-प्रोजेक्ट्स एंड इंजीनियरिंग प्रबंधन
 प्लॉट नं. १३, इंदिरा गांधी नगर, दिल्ली-११००५५
 For & On Behalf of the Principal

(Office Seal)

(Office Seal)

Date-----

(Name & Address) 1. B-Singh
BHEC PEM Noida

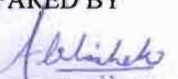
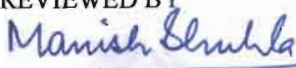
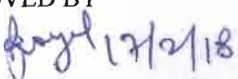
(Name & Address) _____

	PRE-QUALIFICATION REQUIREMENTS FOR HT XLPE POWER CABLES	PE-PQ-999-507-E011
		REVISION NO. 03 DATE 17/02/2018
		SHEET NO. 1 OF 1

ITEMS : HT XLPE Power Cable	
SCOPE : Supply : YES; Erection & Commissioning : NO;	
1.0	Vendor should be a manufacturer of HT power cables.
2.0	Availability of test reports on HT XLPE FRLS power cables to establish in-house capability to carry out all routine, type & acceptance tests as per relevant IS/ International Standards (except UV radiation & hydrolytic stability test which can be conducted at Govt. Lab/ Govt. approved Independent lab).
3.0	Capacity of manufacturing 40 km of HT XLPE power cables per month.
4.0	Manufactured and supplied at least One (1) Km. FRLS Cables.
5.0	Manufactured and supplied HT XLPE power cable sizes of minimum 240 sq. mm for 3/3.5 core and minimum 630 sq. mm for single core cable.
6.0	Manufactured & supplied at least 50 km of 11kV/6.6kV/3.3kV grade XLPE power cables in one or more orders and at least 15 km in one single order.
7.0	Minimum two (2) nos. purchase orders for HT XLPE Power cables shall be submitted which should not be more than five (5) years old from the date of application for registration or date of techno- commercial bid opening (as applicable) for establishing continuity in business.

Notes (General points):

1. Consideration of offer shall be subject to customer's approval of bidders, if applicable.
2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.
3. Any other project specific requirement shall be as per Annexure-I and bidder shall submit relevant supporting documents.
4. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.
5. After satisfactory fulfillment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

PREPARED BY  ABHISHEK, MANAGER (CONVENOR)	REVIEWED BY  MANISH SHUKLA, DGM 17/02/18 (APPROVER)	APPROVED BY  RAJNISH GOYAL, AGM (DH)
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BHEL PEM-ELECTRICAL
PRE-QUALIFYING REQUIREMENTS FOR HT XLPE POWER CABLE
ANNEXURE –I
PROJECT SPECIFIC CRITERIA AGAINST ENQUIRY
PROJECT: RATE CONTRACT-NTPC PROJECTS

The bidder should have manufactured and supplied following cables prior to the date of 08.09.18.

- (a) At least 50kms of XLPE insulated power cables of 6.35/11 KV or higher voltage grade, executed in one or more orders.
- (b) At least one (1) Km of flame retardant low smoke cables of any voltage level.

Note: In case of any conflict of project specific PQR with main PQR, vendor to furnish document meeting the stringent requirement between the main PQR and project specific PQR.

[Dealing Engineer]

[Controlling Officer]

[Section Head]

[DH-Electrical]



PRE - QUALIFYING REQUIREMENTS

ENQUIRY NO:

PROJECT :

RATE CONTRACT

PACKAGE:

HT XLPE CABLES

CRITERIA FOR EVALUATION - FINANCIAL :

Average annual financial turnover during the last Three Financial Years should not be less than Amount (in Rs.)
Rs.8,50,00,000.00
Rupees EIGHT CRORE FIFTY LAKH(S) Only

Notes:-

a) The bidder has to submit financial accounts (audited, if applicable comprising of Audit report, Balance Sheet, Profit & Loss A/c Statement and Notes/Schedules pertaining to Turnover/Sales/Revenue), for last three years (or from the date of incorporation, whichever is less) as on tender due date to review the above criteria. In case the incorporation of vendor is less than 3 years, average annual financial turnover shall be calculated based on available information as below:-

i) If the accounts are available for ≤ 1 Financial Year, the Average Annual Turnover shall be calculated based on available information divided by 1 (One).

ii) If the accounts are available for >1 but ≤ 2 Financial Years, the Average Annual Turnover shall be calculated based on available information divided by 2 (Two).

iii) If the accounts are available for >2 but ≤ 3 Financial Years, the Average Annual Turnover shall be calculated based on available information divided by 3 (Three).

b) Foreign bidder is to submit a latest report from reputed third party business rating agency like Dun & Bradstreet, Credit reform etc. in addition to the documents mentioned at point (a) above for review of above criteria.

c) Other Income shall not be considered for arriving at Annual Turnover/Sales. For evaluation purpose, Turnover figure excluding taxes shall be considered.

d) For evaluation of foreign bidder, exchange rate (TT selling rate of SBI) as on scheduled date of tender opening (Part-I bid in case of two part bid) shall be considered.

VOLUME II

TECHNICAL SPECIFICATION

FOR

HT XLPE POWER CABLES

SPECIFICATION NO: *PE-RC-998-507-E001*

REVISION: 0

RATE CONTRACT-NTPC PROJECTS



BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, UP (INDIA) – 201301



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
HT XLPE POWER CABLES**

SPECIFICATION NO. PE-RC-998-507-E001

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DATE: 19.03.2020

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2.	COMPLIANCE CERTIFICATE	01
3.	SECTION – I	
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	b) DATA SHEET-A	04
	c) DATA SHEET-C (GUARANTEED TECHNICAL PARTICULARS)	04
4.	SECTION – II	
	a) GENERAL TECHNICAL SPECIFICATION	01
	b) QUALITY PLAN (ALONGWITH ANNEXURE A to QP)	20
	c) ANNEXURE-B (QUALITY ASSURANCE & INSPECTION)	04
	d) ANNEXURE-C TO SECTION-II (DRUM DRAWING, TYPICAL)	02
	TOTAL NO. OF SHEETS=	41
	(INCLUDING COVER/ SEPARATOR SHEETS)	

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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

BIDDER'S STAMP & SIGNATURE



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SECTION –I

SPECIFIC TECHNICAL REQUIREMENTS



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1.0 SCOPE OF ENQUIRY

- 1.1 Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of HT XLPE Power Cables conforming to this specification.
- 1.2 General technical requirements of the HT XLPE Power cables are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I.
- 1.3 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail in case of any conflict between the stipulations of Section-I, Data Sheet - A & Section-II.
- 1.4 The documents shall be in English Language and MKS system of units.

2.0 BILL OF QUANTITIES:

- 2.1 Quantity requirements shall be as per 'BOQ-cum-price schedule' as part of NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

- 3.1 BHEL Standard Quality Plan (PE-QP-999-507-E001) shall be read as "QP. NO. 0000-999-QOE-S-042, REV-0". The quality plan no. 0000-999-QOE-S-042 R0 shall be read in conjunction with Annexure B (Quality Assurance & Inspection). However, Type testing and packing on cables shall be conducted as per attached BHEL QP (PE-QP-999-507-E001) along with Annexure-A.

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

- 4.1 Following documents/drawings shall be submitted after placement of order for BHEL & customer's approval: -

Sl. No.	Drawings/Document Description	Drawings / Document Number	Document Type	First Submission	Resubmission
1.	Technical Data sheet for HT XLPE Power Cables	Shall be informed later	Primary	Within 14 days of award of contract.	Within 10 days of comments
2.	Cross section drawings for HT XLPE Power Cables		Primary	Within 14 days of award of contract.	Within 10 days of comments
3.	Manufacturing Quality Plan for HT XLPE Power Cables		Primary	Within 14 days of award of contract.	Within 10 days of comments
4.	Type Test Reports – HT XLPE Power Cables (previously conducted within 10 years)		Primary	Within 14 days of award of contract.	Within 10 days of comments
5.	Type Test Reports – HT XLPE Power Cables (Conducted for this contract)		Secondary	Within 1 week from conducting Type Test	Within 1 week of comments

Note:

1. The above list of drawings and documents is indicative.
2. After receiving LOI, the vendor shall submit drawings/documents in requisite number of copies as per NIT.

* Standard Quality Plan as enclosed in the technical specification is to be appended with cover sheet bearing document number and description as stated above. The signed and stamped copy of the same shall be submitted to BHEL without making any changes in the contents of the document.



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DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR HT
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1.0	Type of Cable	Flame Retardant-Low Smoke (FRLS)
2.0	Standard applicable in general (Latest amendment to be referred if any)	IS:7098 (Part-2), IS:8130, IS:5831, IS:10810, IS:3975, ASTMD:2843, ASTMD:2863, IEC-754-1, IEC:60332 (Part-1), IEC:60332-3-23, IEEE:60383
3.0	Voltage Grade	19/33kV (E), 11/11kV(UE), 6.6/6.6kV (UE) & 3.3/3.3kV(UE)
4.0	Number of cores, cross sectional area of conductors and quantities	As per BOQ cum price schedule (part of NIT)
5.0	CONDUCTOR	
(a)	Material	Aluminium
	Grade and Class	Multi-Stranded, H2, Class 2
(b)	Standard Applicable	IS: 8130
(c)	Shape	Compacted Circular
(d)	Min. number and diameter of strands	As per Class-2 of IS: 8130
(e)	Conductor screen	
(i)	Material	Extruded Cross-linked Semi-conducting compound
(ii)	Minimum thickness	0.3 mm
6.0	INSULATION	
(a)	Material	Cross-Linked Polyethylene(XLPE)
(b)	Standard Applicable	IS: 7098 (Part-2)
(c)	Continuous withstand temperature	90°C
(d)	Short-circuit withstand temperature	250°C
(e)	Nominal Thickness of Insulation	As per Table – 4 of IS 7098 Part-2
7.0	INSULATION SCREEN	For both SINGLE CORE & MULTI CORE cables
(a)	Non-metallic	
(i)	Material	Extruded Cross-linked Semi-conducting compound
(ii)	Type of Semiconducting compound	Bonded
(iii)	Minimum thickness	0.3 mm
(b)	Metallic	
(i)	Material	Copper
(ii)	Type	Tape
(iii)	Size	Nominal thickness 0.1mm or more with tolerance (±) 10% (Suitable to meet 600A for 2 secs for each core)
(iv)	Minimum Overlap	20%
(c)	Earth fault current withstand capacity	600A, 2 sec (For multi-core cables, screen of each core shall be rated individually for the above value). Armour shall constitute metallic part of screening capable of carrying earth fault current of 600A for 2 sec.(for 11kV and below grade cable) and 25KA for 1 sec. (for 33kV cable) for single core armoured cable. For single core Unarmoured cable copper tape shall be applicable for carrying 600A for 2 secs.
8.0	EXTRUSION (Insulation and Screens)	
(a)	Process	Triple Extrusion



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		(Extruded semi-conducting compound conductor screen and insulation screen shall be applied along with XLPE insulation in a single operation by triple extrusion process).
(b)	Method of Curing	For 19/33kV- Dry curing/gas curing & 11 kV, 6.6kV & 3.3 kV - Dry curing/gas curing/steam curing
9.0	CORE IDENTIFICATION	Colour coding as per IS:7098(Part-2)
10.0	INNER SHEATH	(Not applicable for Single Core Cable)
(a)	Material	PVC Type ST-2
(b)	Standard Applicable	IS: 7098 (Part-2) & IS: 5831
(c)	Colour	Black
(d)	Whether FR-LSH	NO
(e)	Inner sheath applicable for single core cable	NO
(f)	Fillers	Acceptable
(g)	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)
(h)	Method of application	
(1)	Multi-core cables:	
(i)	With fillers	[√]Pressure extruded [√]Vacuum extruded
(ii)	Without fillers	Pressure extruded
(i)	Thickness of inner sheath	As per Table-5 of IS: 7098 (Part-2)
11.0	ARMOUR	Applicable, as per BOQ cum price schedule (part of NIT)
a)	Material	
(i)	Multicore cables	Galvanised Steel Strip Armour (Armour dimensions as per Sl. No.(ii) of table – 6 of IS 7098 Part-II.
(ii)	Single core cables	Aluminium Round Wire H4 grade to IS: 8130
b)	Minimum coverage	90%
c)	Gap between armour wires	Shall not exceed one armour wire space (No core-over/over-riding)
d)	Breaking load of joint	95% of normal armour
e)	Armour joint surface	To be applied with Zinc rich paint
12.0	OUTERSHEATH	
(a)	Material	PVC Type ST2 as per IS: 5831
(b)	Colour	Black
(c)	Whether FR-LSH	Yes
(d)	Method of application	Extruded
(e)	Thickness of outer sheath	As per Table-7 of IS: 7098 (Part-2)
(f)	Marking	(A) Following shall be marked @ 5m (by embossing): 'FR-LSH', Manufacturer's name and trade mark, Year of manufacture, cable code, Type of cable and Voltage grade, cross section area of conductor and number of cores, Screen fault current 600A for 2 sec (As applicable), "BHEL-PEM/BHEL-ISG", "NTPC"



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		(B) Progressive sequential marking of length of the cable in metres @ 1m (by embossing/ printing) Further customer specific marking requirement (if any) shall be informed later.
13.0	FR-LSH CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per IS 7098-2 /ASTMD 2863)
(b)	Temperature index	Min. 250°C(As per IS 7098-2 /ASTMD 2863)
(c)	Acid gas generation	Max. 20% by weight (As per IS 7098-2 /IEC-60754-1)
(d)	Smoke density rating	Max. 60% (As per IS 7098-2 /ASTM D 2843)
(e)	Flammability Test	
(i)	Flammability test for single cable	YES As per: IEC-60332 Part-1
(ii)	Flammability test for bunched cables	YES As per IEC-60332 Part-3, CAT-B
Note- FRLS Characteristics Test shall be done as per IS 10810 part 58 if required by customer.		
14.0	TOLERANCE ON OUTER DIAMETER	(±)2 mm. over the declared value
15.0	CABLE DRUMS	
(a)	Type of Drum	[✓] Wooden as per IS 10418 [✓] Steel as per relevant IS
(b)	Standard drum length	1000M (±) 5% for Single core cables 750M (±) 5% for Multi-core cables
(c)	Painting	Entire surface to be painted
(d)	Outermost Layer	To be covered with waterproof polyethylene
(e)	Construction details	Clause no 4.2 of Section-II of this technical specification
(f)	Particular information on Drum	Each drum shall carry manufacturer's name, owner's name, address and contract no., item no. & type, size & length of cable and net gross weight stencilled on both sides of drum. A tag containing same information shall be attached to the leading end of the cable. An arrow & suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled. Further customer specific marking requirement (if any) shall be informed later.
(g)	Cable packing	Please refer Clause no 4.2 of Section-II of this technical specification. It may be noted that the outer most cable layer shall be covered with water proof cover polythene followed by complete drum covering with wooden plank of suitable thickness across flanges. (Pls refer typical drawing of cable drum packing, attached in section -II)

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DATASHEET C

**GUARANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)**

S.No.	Particulars	Unit	Description
1.0	GENERAL		
1.1	Name of Manufacturer	-	
1.2	Place of Manufacture	-	
2.0	STANDARDS APPLICABLE		
2.1	IS: 7098 Part-2 For general specification of XLPE Cables	YES	
2.2	IS: 8130 For conductor material	YES	
2.3	IS: 5831 For material of innersheath & outersheath	YES	
2.4	IS: 3975 / IS: 8130 For armour of 3 core/ single core cables	YES	
2.5	IS: 10810 For method of tests	YES	
2.6	ASTMD-2863 For oxygen index test	YES	
2.7	SS:424-14-75 & IEC-60332-3 & IEC-60332-1 & IEEE: 60383 For flammability test	YES	
2.8	IEC-60754-1 For acid gas generation test	YES	
2.9	ASTMD-2843 For smoke generation test	YES	
2.10	Current rating of cables conforms to	-	
2.11	Short circuit rating conforms to	-	
2.12	Formula for calculating short circuit current for different durations	-	
3.0	INSTALLATION CONDITIONS AT SITE		
3.1	Ambient air temperature	deg. C	
3.2	Ground temperature	deg. C	
3.3	Depth of laying of cables buried in ground	cm	
3.4	Thermal resistivity of soil	deg. C cm/W	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

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4.0	INSTALLATION CONDITIONS FOR CURRENT RATING SPECIFIED AT CLAUSE 7.3		
5.0	CHARACTERISTICS OF FR-LSH SHEATH		
5.1	Oxygen index	-	
5.2	Temperature index	-	
5.3	Acid gas generation	-	
5.4	Smoke density rating	-	
6.0	CABLE DRUMS		
6.1	Type & construction	-	
6.2	Standard drum length	-	
6.3	Tolerance on drum length	-	
7.0	INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE		
7.1	No. of cores x size	-	
7.2	Voltage grade (Uo/U)	kV	
7.3	Base current ratings (*) based on Clause No. 3.0		
a)	In air	Amp	
b)	In ground	Amp	
c)	ducts	Amp	
7.4	Short circuit rating	kA, sec	
7.5	Properties		
a)	D.C. resistance of conductor at 20 deg. C	ohm/km	
b)	A.C. resistance of conductor at 90 deg. C	ohm/km	
c)	Reactance of cable at normal frequency	ohm/km	
d)	Electrostatic capacitance of cable at normal frequency	mF/km	
7.6	CONDUCTOR		
a)	Material type & grade	-	
b)	No & dia of wires in each core before stranding	no x mm	
c)	Shape	-	

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NAME	SIGNATURE	DATE			

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7.7	CONDUCTOR SCREEN		
a)	Material	-	
b)	Minimum thickness	mm	
7.8	XLPE INSULATION		
a)	Nominal thickness of insulation	mm	
b)	Method of curing	-	
7.9	INSULATION SCREEN		
a)	Type of screen	-	
b)	Material and thickness (minimum and nominal)	mm	
i)	Metallic	-	
	No. of tapes and Minimum overlapping	-	
ii)	Non-metallic	-	
iii)	Earth fault current withstand capacity (calculation to be furnished)	kA, sec.	
7.10	PVC ST2 INNERSHEATH		
a)	Material	-	
b)	Thickness (min.)	mm.	
c)	Method of application	-	
1)	Multi-core cables		
i)	With fillers	-	
ii)	With out fillers	Pressure Extruded	
2)	Single core cables		
d)	Type & Shape of fillers (if used)	-	
e)	Colour	-	
7.11	ARMOUR		
a)	Material	-	
b)	Size/ dimensions	-	
c)	Minimum no. of wires/ formed wires	-	
d)	Tolerance on formed wire dimension	-	
e)	Maximum resistivity of GS formed wire	-	
f)	Maximum resistivity of Al round wire	-	
g)	Earth fault current withstand capacity (calculation to be furnished)	kA, sec.	
7.12	PVC/POLYETHYLENE ST2 FR-LSH OUTERSHEATH		
a)	Nominal thickness of outer sheath	mm.	

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NAME	SIGNATURE	DATE			

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7.13	DIAMETERS		
a)	Diameter of insulated conductor	mm.	
b)	Cable diameter under armour	mm.	
c)	Cable diameter over armour	mm.	
d)	Overall diameter of cable	mm.	
7.14	Tolerance on overall diameter	(±) mm	
7.15	Minimum bending radius	x O.D.	
7.16	Safe pulling force	kg.	
7.17	Weight of cable	kg./km	
a)	Weight of conductor	MT./km	
b)	Weight of XLPE insulation	MT./km	
c)	Weight of PVC (Inner Sheath & Fillers)	kg./km	
d)	Maximum resistivity of GS formed wire	kg./km	
e)	Weight of PVC/Polyethylene (Outer Sheath & Fillers)	kg./km	
7.18	Dimension of drum	mm.	
7.19	Shipping weight	kg	
7.20	Cable marking on outer sheath	-	
7.21	End sealing provided	Yes/No	
7.22	Over the cables polyethylene sheet wrapped .	Yes/No	

(*) For single core cables, the continuous current rating shall be furnished separately for armour earthed at one end and at both ends.

:

NAME OF VENDOR			SEAL	REV.	
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DOCUMENT TITLE

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SECTION – II

GENERAL TECHNICAL SPECIFICATION



DOCUMENT TITLE

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1.0 TECHNICAL REQUIREMENTS

- 1.1 Technical requirements for HT XLPE POWER CABLES shall be as indicated in this section, in addition to those specified in Section I & Datasheet-A.

2.0 CODES & STANDARDS

- 2.1 The design, material, construction, manufacture, inspection, testing and performance of HT XLPE POWER CABLES shall conform to the latest revision of relevant standards and codes of practices mentioned in Data Sheet - A.
- 2.2 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 QUALITY ASSURANCE REQUIREMENTS

- 3.1 Bidder shall confirm compliance with the Standard Quality Plan as attached with the specification without any deviations. At contract stage, the successful bidder shall submit the same QP for BHEL/ ultimate customer's approval. In case bidder has reference QP agreed with ultimate customer, same can be submitted for specific project after award of contract for BHEL/ultimate customer's approval. There shall be no commercial implication to BHEL on account of minor changes in QP during contract stage.
- 3.2 All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved Quality Plan.
- 3.3 Type testing requirements, routine / acceptance testing and special testing requirements shall be as per Annexure – A to QP. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price (except UV Radiation & Hydraulic Stability test).
- 3.4 The charges of UV Radiation test & Hydrolytic Stability test (if applicable) shall be reimbursed extra at actual against original money receipt of Govt. Lab. (CPRI/ ERDA etc.).
- 3.5 Cost of cables consumed for testing shall be to bidder's account.

4.0 Packing

- 4.1 Cables shall be supplied in non-returnable drums. Material of cable drums shall be as specified in Datasheet-A.
- 4.2 In case of wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper naphthenates / zinc naphthenates (refer IS: 401) and anti-termite. The surface of the drum and the outer most cable layer shall be covered with water proof cover polythene followed by complete drum covering by wooden plank. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Dimensions of wooden drums shall be as per IS 10418. All ferrous parts shall be treated with suitable rust protective finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum.
- 4.3 In case of Steel drums, New or practically new cable drums made of steel and painted with epoxy resin paint are to be used. Cable ends are carefully protected before packing. Over the cables polyethylene sheet shall be wrapped and then sealed properly. For Typical details of Steel drums, Annexure-B to Section-II, may be referred by the bidder. Bidder may modify, to choose appropriate dimensions of steel drums to suite various sizes/weight/ lengths of HT XLPE POWER CABLES. BIS certification mark shall be stamped on each cable drum.



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SHEET -

QUALITY PLAN

 Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)		STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S- 042 REV-00 DATE : 12-04-12 Page 2 of 12 VALID UP TO: 11-04-15 Reference Document			REVIEWED BY INDERJIT SINGH VIKRAMJITLWAR RAJEEV GARG Acceptance Norms		Record Format M C N		2	
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M C N								
1	2	3	4	5	6	7	8	9	10	11			

1.05	PVC Compound for Inner sheath	1. Make	MA	Verify	As per manufacturer norms	--	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	Supplier TC	V	V	--
		2. Type/ Grade	MA	Verify	--do--	--	NTPC ADS	NTPC ADS	--do--	V	V	--
1.06	Semi Conducting Compound	1. Make	MA	Verify	100%	100%	NTPC Approved sources	NTPC Approved sources	--do--	P	V	V
		2. Resistivity	MA	--do--	100%	100%	NTPC ADS	NTPC ADS	--do--	P	V	V
		3. Shelf Life / Storage condition	MA	Verify	100%	100%	Compound manuf. recommendation	Compound manuf. recommendations	--do--	P	V	V
1.07	Copper tape (Electrolytic High Conductivity Copper Foils)	1. Make	MA	Verify	100%	100%	NTPC Approved sources	NTPC Approved sources	--do--	✓	P	V
		2. Dimension	MA	Measu	As per cable mmfr std.	--	NTPC ADS	NTPC ADS	--do--	P	--	--
		3. Resistivity	MA	Verify	100%	----	IS 613	IS 613	Supplier TC	V	V	V
		4. Chem. & Phy. properties	MA	Elec & Mech.	As per cable mmfr std.	--	As per cable mmfr std.	As per cable mmfr std.	--do--	V	V	-
1.08	Polyester Tape (As applicable)	1. Make	MA	Verify	100%	100%	Manufacturer approved vendor	Manufacturer approved vendor	--do--	P	V	V
		2. Dimension	Phy.	Meas	As per cable mmfr std.	--	Manuf. Data sheet	Manuf. Data sheet	--do--	P	-	-
		3. T.S & Elongation	Phy.	Phy.	--do--	--	--do--	--do--	--do--	V	--	--

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Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency	Remarks	
1	2	3	4	5	M	C/N	7	8	9	10	11	

1.09	Steel wire / Formed Wire (As applicable)	1. Make	MA	Verify	As per cable mnfr std.	100%	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	QCR	V	V	BIS licensees only
		2. Dimension	MA	Meas	1 sample from each size / lot	--	NTPC APPROVED DATA SHEET & IS 3975	NTPC APPROVED DATA SHEET & IS 3975	QCR	P	--	
		3. All acceptance tests as per IS 3975	MA	Verify	As per IS 3975	--	IS 3975	IS 3975	Supplier RTC	V	V	
1.10	PVC compound for Sheath	1. Make	MA	Verify	As per manufacturer norms	100%	MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	QCR	V	V	
		2. Type / Grade	MA	Verify	100%	100%	NTPC ADS	NTPC ADS	QCR	V	V	
		3. All acceptance test as per manufacturer norms	MA	Verify	As per manufacturer norms	As per manufacturer norms	Compound Mnfr standard	IS 5831	QCR	V	V	Refer note 1
		4. Thermal Stability	MA	Chem	One sample / Batch	--	IS 5831	IS 5831	QCR	P	--	
		5. Oxygen Index	MA	Chem	--do--	--	NTPC ADS/ IS 10810 Part 58	NTPC ADS	--do--	P	--	
1.11	Filler Material (As applicable)	1. Type	MA	Verify	As per manuf. Std.	---	NTPC ADS	NTPC ADS	QCR	P	--	
1.12	Wooden Drum	1. Dimension	MI	Meas	Manuf. Std.	--	IS 10418	IS10418	--do--	P	--	
		2. Anti termite treatment	MI	Chem	Cable manuf. std	--	CABLE MANUF. STD.	CABLE MANUF. STD.	COC	V	V	COC from drum manuf.
1.13	Steel Drum	1. Dimension	MI	Meas	--do--	--	--do--	--do--	QCR	P	--	
		2. Surface finish	MI	Meas	--do--	--	--do--	--do--	--do--	P	--	
B	Process & Stage Inspection											
2.01	Wire Drawing	1. Surface finish	MA	Visual	One sample/Settin g of each size	--	SHOULD BE SMOOTH & FREE FROM SCRATCHES	SHOULD BE SMOOTH & FREE FROM SCRATCHES	QCR	P	--	
		2. Wire Diameter	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--	P	--	

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Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	D*	M	N
1	2	3	4	5	6	7	8	9		10	11

Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		CR	Mech	One sample/Setting of each size	One sample / Setting of each size	IS 8130	QCR	P	V	V	Refer Sl. No.3.03(iii)
					M	C/N										
2.02	Bunching / stranding	3. Tensile test									IS 8130					
		4. Wrapping test	CR	Mech	--do--	--do--					--do--	--do--	P	V	V	--do--
		5. Annealing Test	CR	Mech	--do--	--do--					--do--	--do--	P	V	V	--do--
		1. No. of wires	MA	Meas	--do--	--					NTPC ADS	--do--	P	--	--	
		2. Dia of wire	MA	Meas	--do--	--					--do--	--do--	P	--	--	
		3. Dimension of Conductor	MA	Meas	--do--	--					--do--	--do--	P	--	--	
		4. Direction of lay	MA	Visual	--do--	--					--do--	--do--	P	--	--	
2.03	Insulation extrusion (Conductor screen, XLPE Insulation & Insulation screen)	5. Records of strand breakage / welding during conductor stranding	MA	Verify	--do--	--					IS 8130	--do--	P	--	--	
		6. Surface finish	MA	Visual	--do--	--					--do--	--do--	P	--	--	
		7. DC Resistance	CR	Meas	--do--	--					IS 8130/NTPC ADS	--do--	P	--	--	
		1. Surface finish	MA	Visual	One sample / Setting of each size	--					Extrusion should be by triple extrusion technique Method of curing for cables shall be "dry curing / gas curing/ steam curing" up to 11KV & " dry curing/ gas curing " for 19/33 KV Insulation extrusion area should be preferably clean & dust free. Extrusion Should be smooth. No porosity is permitted	QCR-	P	--	--	
		2. Thickness	CR	Meas	--do--	--					NTPC ADS	QCR	P	--	--	
		3. Eccentricity & Ovality	CR	Meas	--do--	--					Eccentricity of core shall not exceed 10% and Ovality not to exceed 2% Ovality not to exceed 2%	--do--	P	--	--	
		3. Hot Set	CR	Mech	One sample/Setting of each size	--					IS 7098- Part II	--do--	P	--	--	Sample is to be taken from both top & bottom end

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

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Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	D*	M	C	N	Remarks
1	2	3	4	5	6	7	8	9		10		11	

2.04	Copper Taping	1. Thickness	CR	Mech	One sample/Settin g of each size	--	NTPC ADS	NTPC ADS	QCR	P	--	--	
		2. No. of tape	CR	Meas	--do--	--	--do--	--do--	--do--	P	--	--	
		3. Tape application overlap	CR	Meas	--do--	--	--do--	--do--	--do--	P	--	--	
		4. Core identification tape	CR	Visual	--do--	--	--do--	--do--	--do--	P	--	--	
2.05	Laying up	1. Core sequence	MA	Visual	--do--	--	IS 7098- Part II	IS 7098- Part II	--do--	P	--	--	
		2. Direction of lay	MA	Visual	--do--	--	--do--	--do--	--do--	P	--	--	
		3. Lay Length	MA	Meas	--do--	--	Manuf. Std	Manuf. Std	--do--	P	--	--	
		4. Dia over laid up core	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--	P	--	--	
2.06	Inner Sheath	1 Colour	MA	Visual	--do--	--	--do--	--do--	--do--	P	--	--	
		2.Thickness	MA	Meas	One sample/Settin g of each size	--	NTPC ADS	NTPC ADS	--do--	P	--	--	
		3 Dia over inner sheath	MI	Meas	--do--	--	--do--	--do--	--do--	P	--	--	
		1.Dimension	MA	Meas	--do--	--	--do--	--do--	--do--	P	--	--	
2.07	Armouring (As Applicable)	2.No. of wires / strip	MA	Meas.	--do--	--	--do--	--do--	--do--	P	--	--	
		3. Direction of lay	MA	Visual	--do--	--	IS 7098- Part II	IS 7098- Part II	--do--	P	--	--	
		4.Coverage & Quality of armouring	MA	Meas.	100%	--	Min area of coverage of armouring shall be 90%. The gap between amour wires / formed wires shall not exceed one amour wire/ formed wire space & there shall be no cross over/ over riding of amour wire / formed wire. Zn rich paint shall be applied on amour joint surface of G.S. Wire /formed wire. The breaking load of amour wire joint shall not be less than 95% of that amour wire / formed wire. (As per NTPC specification)	QCR	QCR	P	--	--	
		5 Dia over armouring	MA	Meas.	One sample/Settin g of each size	--	NTPC ADS	NTPC ADS	--do--	P	--	--	
2.08	Outer Sheath	1. Surface finish	MA	Visual	100%	--	Pimple, Fish Eye, Burnt particles, Blow Hole not permitted. Repairing on outer sheath not permitted. (As per NTPC specification)	--do--	--do--	P	--	--	
							PVC FRLS compound shall be preferably loaded in to						

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Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check			Acceptance Norms	Record Format	Remarks		
1	2	3	4	5	M	C/N	6	7	8	9	10	11

C	Finished Cables	extruder by suction method.										
		2. Colour of sheath	MA	Visual	One sample/Setting of each size	--	NTPC ADS	NTPC ADS	QCR			
		3. Dia over outer sheath	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--			
		4. Thickness of outer sheath	CR	Meas	--do--	-	--do--	--do--	--do--			
		5. Embossing quality	MA	Visual	100%	-	Following shall be embossed or printed on outer sheath at every 5 meter length of cable: (1) Batch number or Drum number (2) IS 7098-II (3) Cable size (4) Voltage grade (5) word "FRLS" (marking shall be legible & indelible).	--do--	--do--			
		6. Sequential marking	MA	Visual	Full length	--	Sequential marking of length of cable in meters at every one meter is to be embossed or printed. Embossing or printing shall be progressive, automatic, in line & marking shall be legible & indelible	--do--	--do--			

Type Test clearance from NTPC Engineering to be verified at the time of final inspection.															
3.01		Routine Tests	1.High Voltage test at room temperature	CR	Elect	100%	100%	NTPC ADS / IS 7098- Part II	NTPC ADS	Test certificate	✓	P	W	W	Refer note 2
3.02			2.Conductor Resistance	CR	Elect	100%	100%	NTPC ADS / IS 7098- Part II	NTPC ADS	--do--	✓	P	W	W	Refer note 2
			3. Partial Discharge Test	CR	Elect.	100%	100%	NTPC ADS / IS 7098- Part II	NTPC ADS	--do--	✓	P	W	W	For Screened cable only/ Refer note 2
3.03		Acceptance Tests													
3.03 (i)		Construction of finished Cable	1. OD of Cable	MA	Meas.	Each type & size of cables as per sampling plan of IS 7098- Part II		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
			2. Laying of core	CR	Visual	--do--		NTPC ADS / IS 7098- Part II	NTPC ADS / IS 7098- Part II	--do--	✓	P	W	W	
			3. Core Identification	CR	Visual	--do--		--do--	--do--	--do--	✓	P	W	W	

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Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	D*	Agency	Remarks
1	2	3	4	5	6	7	8	9		10	11

3.03 (ii)	Armour wires/ Formed wires.	4. Colour of outer sheath	MA	Visual	Each type & size of cables as per sampling plan of IS 7098- Part II	NTPC ADS	NTPC ADS	QCR	✓	P	W	W	
		5. Inner sheath thickness	CR	Meas	- do -	-do--	-do--	--do--	✓	P	W	W	
		6. Inner sheath colour	MA	Visual	- do -	- do -	- do -	--do--	✓	P	W	W	
		7. Copper tape / Wire dimension with overlap (As applicable)	CR	Phy	--do--	NTPC ADS/ Min overlap 20%	NTPC ADS/ Min. overlap 20%	--do--	✓	P	W	W	
		1. Dimensions	CR	Meas	Each type & size of cables as per sampling plan of IS 7098- Part II	NTPC ADS/ IS7098-II	NTPC ADS	Test Certificate	✓	P	W	W	Test as applicable for Galvanized wires/ strips / Al wires
		2. No. of wires/ formed wire	CR	Mech	-- do --	--do--	--do--	--do--	✓	P	W	W	
		3. Tensile test	CR	Mech	--do--	IS 3975	IS 3975	--do--	✓	P	W	W	
		4. Elongation test	CR	Mech	--do--	--do--	--do--	--do--	✓	P	W	W	
		5. Torsion test (for round wires only)	CR	Mech	--do--	--do--	--do--	--do--	✓	P	W	W	
		6. Wrapping test	CR	Mech	--do--	--do--	--do--	--do--	✓	P	W	W	
3.03 (iii)	Conductor	7. Resistance test	CR	Mech	--do--	--do--	--do--	--do--	✓	P	W	W	
		8. Mass of Zinc coating	CR	Meas	--do--	--do--	--do--	--do--	✓	P	W	W	
		9. Uniformity of Zinc Coating	CR	Chem.	--do--	--do--	--do--	--do--	✓	P	W	W	
		10. Adhesion test	CR	Mech	--do--	--do--	--do--	--do--	✓	P	W	W	
		11. Freedom from defects	CR	Visual	--do--	--do--	--do--	--do--	✓	P	W	W	
		1. Resistance Test	CR	Elect	--do--	--do--	--do--	--do--	✓	P	W	W	Test report of manufacturer to be reviewed as per SI. No. 2.01 for Tensile test & wrapping test
		2. Tensile test	CR	Mech	Each type & size of cables as per sampling plan of IS 7098-Part-II	IS 8130	IS 8130	Test Certificate	✓	P	W	W	

		Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)		STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S- 042 REV-00 DATE : 12-04-12 Page 8 of 12 VALID UP TO: 11-04-15		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY Approved by D.A.K. Garg		8
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency			Remarks
1	2	3	4	5	M	C/N	7	8	9	D*	M	C	N
1			4	5	6						10		11

		3. Wrapping test	CR	Mech	--do--	--do--	NTPC ADS & IS 7098-Part II	--do--	--do--	✓	P	P	W	--do--
3.03 (iv)	XLPE Insulation & PVC Sheath	1. Thickness of insulation & sheath	CR	Meas.	--do--	--do--	NTPC ADS	--do--	--do--	✓	P	W	W	
		2. Tensile strength & elongation at break of insulation & outer sheath (before ageing)	CR	Mech	--do--	--do--	IS 7098-Part II	IS 7098-Part II		✓	P	W	W	Refer Note 3 Also
		3. Tensile strength & elongation at break of insulation & outer sheath (after Ageing)	CR	Mech	Refer Note 3		IS 7098-Part II	IS 7098-Part II	Test Certificate	✓	P	W	W	Refer Note 3
		4. Insulation resistance (Volume resistivity method)	CR	Elect	Each type & size of cables as per sampling plan of IS 7098-Part II		--do--	--do--	--do--	✓	P	W	W	
		5. Partial Discharge test	CR	Elect.	--do--		--do--	--do--	--do--	✓	P	W	W	For Screened cable only
		6. High voltage test at room temperature	CR	Elect	Each type & size of cables as per sampling plan of IS 7098-Part II		--do--	--do--	--do--	✓	P	W	W	
		7. Thermal stability on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes		--do--	--do--	--do--	✓	P	W	W	

 Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)		STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S- 042 REV-00 DATE : 12-04-12 Page 9 of 12 VALID UP TO: 11-04-15 Reference Document		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG	APPROVED BY  RAJEEV GARG		9
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document	Acceptance Norms	Record Format	D*	Remarks
1	2	3	4	5	6	7	8	9	10	11

		8. Hot Set Test for inculation	CR	Mech	Each type & size of cables as per sampling plan of IS 7098-Part II	IS 7098-Part II	IS 7098-Part II	QCR	✓	P	W	W	For XLPE insulation only
		9 Smoke density test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes	NTPC ADS & ASTM D2843	NTPC ADS	--do--	✓	P	W	W	
		10. Acid gas generation test on outer sheath	CR	Chem	--do--	NTPC ADS & IEC 60754-1	NTPC ADS	--do--	✓	P	W	W	
		11. Oxygen Index	CR	Chem	--do--	NTPC ADS/ IS 10810 Part 58	--do--	--do--	✓	P	W	W	
		12 Flammability test on completed cable	CR	Chem	One sample irrespective of size per voltage grade	NTPC ADS & IEC 60332 Part-3 (Category-B)	--do--	--do--	✓	P	W	W	
		13 Surface finish & length measurement.	CR	Visual & Meas	One length of each size	A) Following shall be embossed or printed on outer sheath at every 5 meter length of cable: (1).Batch number or Drum number (2) IS 7098-II (3) Cable size (4) Voltage grade (5) word "FRLS" (marking shall be legible & indelible). B) Sequential marking of length of cable in meters at every one meter is to be embossed or printed. Embossing or printing shall be progressive, automatic, in line & marking shall be legible & indelible	Test Certificate	✓	P	W	W	Pimple, Fish Eye, Burnt particles, Blow Hole etc. not permitted. Repairing on outer sheath not permitted.	
		14. Sequence of cores armour coverage, gap between two consecutive armour/formed wire	CR	Visual & Meas	One length of each size	Min. area of coverage of armouring shall be 90%. The gap between armour wires / formed wires shall not exceed one armour wire/ formed wire space & there shall be no cross over/ over riding of armour wire / formed wire. Zn rich paint shall be applied on armour joint surface of G.S. Wire /formed wire	--do--	--do--	✓	P	W	W	
		15. Measurement of Eccentricity & Ovality	CR	Meas.	--do--	Eccentricity of core shall not exceed 10% and Ovality not to exceed 2%	--do--	--do--	✓	P	W	W	

 Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)		STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)		Q.P. NO. 0000-999- QOE- S- 042 REV-00 DATE : 12-04-12 Page 10 of 12 VALID UP TO: 11-04-15		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY 31/04/12 Approved Dt. 31/04/12		10
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M C/N	Reference Document	Acceptance Norms	Record Format	D* M C N	Remarks
1	2	3	4	5	6	7	8	9	10	11

4	Packing	1. Sealing	MA	Visual	100%	100%	(1) IS 7098-Part II (2) The surface of the drum and the outer most cable layer shall be covered with water proof cover; (3) Both the ends of cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by "U" nails.	QCR	✓	P	--	--
4.01	Identification	NTPC Sealing	MA	Visual	100%	100%	Sealing shall be visible	QCR	✓	P	V	V

Notes:												
1)		If the compound manufacturer is carrying out Ageing test , test report of compound manufacturer is to be reviewed. If the compound manufacturer is not carrying out ageing test, then cable manufacturer will carry out ageing test & the test report will be reviewed by NTPC (quantum of ageing test sample shall be one sample /batch)										
2)		(a) In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre/ Regional Offices :- Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection. NTPC will also witness routine tests on cables on 10% sample basis on 1.9 KV/ 3.3 KV and 3.3KV/ 3.3 KV cables , other HT cables will be witnessed on 100% basis. 2(b) In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre/ Regional Offices, :- Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection. NTPC will also witness routine tests on cables for the first order on 100% basis.										
3)		Refer table on page 11& 12 of 12 for Sampling & Acceptance criteria.										

		Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)		STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-042 REV-00 DATE : 12-04-12 Page 11 of 12 VALID UP TO: 11-04-15 Reference Document		REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG		APPROVED BY  Approved Dt...		11	
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check	Reference Document		Acceptance Norms	Record Format	D*	Remarks		
1	2	3	4	5	6	7		8	9	10	11		

LEGEND: NTPC ADS: NTPC approved data sheet, QCR: quality control records of cable manufacturer, CABLE MANUF STD- cable manufacturer's internal plant standard, MI: minor, MA: major, CR: critical, COC- certificate of conformance

Sampling & Acceptance Criteria				
Criteria	Manufacturer experience prerequisite	Condition	Testing procedure	Remarks
Samples as per relevant IS from every size/ type of cable in the offered lot shall be tested for Tensile Strength & Elongation (before ageing). The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 1.5% tolerance (final values should be more than the minimum values indicated in relevant standard) of the Type Test report	In case of Manufacturers/ Supplier who have supplied cables in the past through Corporate Centre / Regional offices	In case of sizes/ type which meet the criteria	1 Sample per size/ type out of sizes which have met the criteria, will be put on accelerated ageing test (refer IRS specification no. IRS: S-63/2007 Rev 3.0). The samples shall be aged in air oven at temperature of 130°C +/- 2°C for 5 hours. 1 Sample of XLPE insulation per type of cables offered which have met the criteria, will be put on ageing test as per IS 7098 –II . After wards the samples shall be tested for Tensile Strength & Elongation. Acceptance norms shall be as per relevant IS. This test shall be witnessed by NTPC.	In case the samples do not meet the requirement in accelerated ageing test then 1 sample of that size/ type will be put on ageing test as per IS.
		In case of size /type which do not meet the criteria	Particular size/ type will be put on ageing test as per IS. This test shall be witnessed by NTPC.	----

		Item:- HT POWER FRLS CABLE (3.3 KV TO 33 KV)		STANDARD QUALITY PLAN (CONFORMING TO CODE:IS 7098 Part-II AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S- 042 REV-00 DATE : 12-04-12 Page 12 of 12 VALID UP TO: 11-04-15 Reference Document		REVIEWED BY INDERJIT SINGH gnr VIKRAM TALWAR RAJEEV GARG		APPROVED BY A.K. Garg Approved Dt. 12/04/12		12
Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M	C/N	7	8	9	10	11		
1	2	3	4	5	6								

		In case of Manufacturers/ Supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre / Regional offices	In case of size /type which meet the criteria	1 Sample per sizes/ type out of all sizes which have met the criteria, will be put on aging test and witnessed by NTPC as per relevant IS	---
			In case of size/type which do not meet the criteria	Particular size / type will be put on ageing test as per IS. This test shall be witnessed by NTPC	---

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN				SPEC. NO :			DATE:	
			CUSTOMER :				QP NO.: PE-QP-999-507-E001				
			PROJECT:				PO NO.:				
			ITEM: HT XLPE POWER CABLE		SYSTEM: CABLE		SECTION: II			SHEET 01 OF 02	

SI. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	* D	**			
					M	C/N					M	C	N	

1.0	Final Inspection (EXTERNAL)	6. Type Tests (Refer Note-H)	CR	Physical & Electrical Tests	Sample #	Sample #	-do-	-do-	-do-	✓	P	W	W	
2.0	Packing	End Sealing Identification/ Polythene Packing	MA	Visual	100%	100%	Annroved Data Sheet	Annroved Data Sheet	-do-	✓	P	W		I

NOTES:

- Joints in conductors & armour shall be as permitted by IS:8130 & IS:7098-I respectively.
- No repair of core insulation permitted.
- Cable ends shall be sealed.
- Record of raw material, process & all stages shall be certified by Vendors QC and are liable to audit check by purchaser.
- Fillers/dummy cores etc. Shall be as per BHEL specification.
- Wherever extent of check for stage is mentioned as 'sample' & not defined in QP, the same shall be as per vendors sampling plan agreed by purchaser.
- Vendor shall furnish compliance certificate to the inspection agency confirming the packing as per IS/ BHEL specification.
- For lists of type tests refer annexure to QAP.
- Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e. raw material batch/ lot no. should be traceable to the final cable drum number or batch no.
- Cable manufacturer to maintain all quality records identified as per all QP stages enumerated below whether it is identified for BHEL verification or witness or not.
- BHEL reserves the right to perform repeat test, if required.
- Photographs of cable to be despatched shall be sent to BHEL purchase group for review prior to issue of mdcc.

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		VIKAS KUMAR SINGH	Checked by:		KUNAL GANDHI			Reviewed by:			
Reviewed by:		MANISH SHUKLA	Reviewed by:		RITESH KUMAR JAISWAL			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN				SPEC. NO :			DATE:		
			CUSTOMER :				QP NO.: PE-QP-999-507-E001					
			PROJECT:				PO NO.:					
			ITEM: HT XLPE POWER CABLE		SYSTEM: CABLE		SECTION: II			SHEET 02 OF 02		
Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLAS S	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD		AGENCY	REMARKS
1	2	3	4	5	6		7	8	9	*	**	
					M	C/N				D	M	C N

LEGENDS:
 *RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
 ** **M:** SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C:** CUSTOMER,
P: PERFORM, **W:** WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI:** MINOR, **CR:** CRITICAL
D: DOCUMENTATION

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		VIKAS KUMAR SINGH	Checked by:		KUNAL GANDHI			Reviewed by:			
Reviewed by:		MANISH SHUKLA	Reviewed by:		RITESH KUMAR JAISWAL			Approved by:			

	ANNEXURE-A TO QAP	CUSTOMER: NTPC LIMITED	PROJECT TITLE: RATE CONTRACT	SPECIFICATION NUMBER: PE-RC-998-507-E001
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : 0000-999-QOE-S-042, R0	SPECIFICATION TITLE: TECH. SPEC. FOR HT XLPE POWER CABLES
		SYSTEM	ITEM: HT XLPE POWER CABLES	DOC. NO.

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

- Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.
- Sampling:
 - Type test to be conducted on 1 drum for every 10 drums or less of each type and size of cable/ lot.
 - Electrical tests to be conducted on one drum of every size & voltage grade of cables.
 - FRLS test & Flammability Test to be conducted on every size & voltage grade of cables. Sampling quantity as per appendix –D of IS 7098-2, D2.2.

B. Acceptance Test Conduction:

- Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.
- Sampling:
 - Acceptance tests shall be as per 1 drum for every 10 drums or less of each type and size of cable/ lot.
 - FRLS test & Flammability Test to be conducted on every size & voltage grade of cables. Sampling quantity as per appendix –D of IS 7098-2, D2.2.

C. Routine Test Conduction:

- Tests for which "R" is indicated in the 'Test Conduction Required As' column below shall be conducted as Routine tests.
- Sampling: Routine tests shall be conducted on 100% cable drums.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	Tests for Conductor				
I.	Annealing test	For copper conductor only T,	A	IS 10810 Pt 1	<u>Internal in process Test Report to be furnished for acceptance test</u>
II.	Tensile test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	T, A	IS 10810 Pt 2	
III.	Wrapping test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	T, A	IS 10810 Pt 3	
IV.	Resistance test	For Al/Cu	T, A, R	IS 10810 Pt 5	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE-A TO QAP	CUSTOMER: NTPC LIMITED	PROJECT TITLE: RATE CONTRACT	SPECIFICATION NUMBER: PE-RC-998-507-E001
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : 0000-999-QOE-S-042, R0	SPECIFICATION TITLE: TECH. SPEC. FOR HT XLPE POWER CABLES
		SYSTEM	ITEM: HT XLPE POWER CABLES	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T,A	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only T,	A	IS 10810 Pt 38	
V.	Winding test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	T, A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 41	
IX.	Wrapping Test	For Aluminium wires only	T, A	IS 10810 Pt 3	
3.0	Physical Tests for XLPE Insulation & PVC sheath				
I.	Test for thickness & Eccentricity	Applicable for XLPE insulation, HRPVC inner sheath & For HRPVC inner/outer sheath only	T, A	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for XLPE insulation & For HRPVC inner/outer sheath only			
(a) B	efore ageing		T, A	IS 10810 Pt 7	
(b) Aft	er ageing		T, A	IS 10810 Pt 7	
III.	Ageing in air oven	Applicable for XLPE insulation & For HRPVC inner/outer sheath only	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For HRPVC inner/outer sheath only	T	IS 10810 Pt 10	
V.	Hot deformation test	For HRPVC inner/outer sheath only	T	IS 10810 Pt 15	
VI.	Heat shock test	For HRPVC inner/outer sheath only	T	IS 10810 Pt 14	
VII.	Shrinkage test	For XLPE insulation & For HRPVC inner/outer sheath only	T	IS 10810 Pt 12	
VIII.	Thermal stability test	For HRPVC inner/outer sheath only	T	IS 10810 Pt 60	
IX.	Hot set test	For XLPE insulation only	T, A	IS 10810 Pt 30	
X.	Water ab sorption (gravimetric) test	For XLPE insulation only	T	IS 10810 Pt 33	
XI.	Degree of cross-linking	For XLPE insulation only	T	IS 7098-II	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE-A TO QAP	CUSTOMER: NTPC LIMITED	PROJECT TITLE: RATE CONTRACT	SPECIFICATION NUMBER: PE-RC-998-507-E001
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : 0000-999-QOE-S-042, R0	SPECIFICATION TITLE: TECH. SPEC. FOR HT XLPE POWER CABLES
		SYSTEM	ITEM: HT XLPE POWER CABLES	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
4.0	<u>Tests On Extruded Semi-conducting Screen</u>				
I.	Test for Strippability	Applicable for Semi-conducting Strippable screen	T	IS 7098-II	<u>Not applicable since it is bonded type</u>
II.	Volume Resistivity	Applicable for Semi-conducting Strippable screen	T	IS 7098-II	
III.	Test for cross linking		A	IS 7098-II	
5.0	<u>Improved Fire performance (FR-LSH) Tests</u>				
I.	Oxygen index test	<i>For inner/outer sheath only</i>	T, A	IS 10810 Pt 58 / ASTM D 2863	<i>Sample shall be as per IS 7098, Part 2</i>
II.	Smoke density test	<i>For inner/outer sheath only</i>	T, A	ASTM D 2843	
III.	Acid gas generation test	<i>For inner/outer sheath only</i>	T, A	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	<i>For inner/outer sheath only</i>	T, A	IS 10810 Pt 64 / ASTM D 2863	
6.0	<u>Flammability Tests</u>				
I.	Flammability test for bunched cables	For complete cable	T, A	IEC-60332 (Part-3)	
II.	Flammability test for single cable	For complete cable	T, A	IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	A	IEEE: 60383	
7.0	<u>Electrical Tests</u>				
I.	High Voltage Test	For complete cable	T, A, R	IS 10810 Pt 45	
II.	Insulation Resistance Test (Volume resistivity method)	For complete cable	T, A	IS 10810 Pt 43	
III.	Partial discharge test (shall be carried out on full drum length)		T, A, R	IS 10810 Pt 46	
IV.	Bending Test followed by Partial Discharge test		T	IS 10810 Pt 50	
V.	Dielectric Power Factor Test (i) As a function of voltage (ii) As a function of temperature		T	IS 10810 Pt 48	
VI.	Heat Cycle Test		T	IS 10810 Pt 49	
VII.	Impulse Withstand Test		T	IS 10810 Pt 47	
VIII.	Thermal ageing test	For complete cable	T	IS 7098-II	
IX.	<i>Flammability Test</i>	<i>For HRPVC sheathed cable</i>	<i>T</i>	<i>IS 10810 Pt 53</i>	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC																																											
	<table> <tr> <th data-bbox="396 825 464 850">S. No</th><th data-bbox="521 825 651 884">Type Test Conductor</th><th data-bbox="976 825 1084 850">Remarks</th></tr> <tr> <td data-bbox="396 898 418 924">1.</td><td data-bbox="521 898 898 982">Resistance test For Armour Wires / Formed Wires</td><td data-bbox="976 898 1084 924"></td></tr> <tr> <td data-bbox="396 1014 418 1039">2.</td><td data-bbox="521 1014 841 1039">Measurement of Dimensions</td><td data-bbox="976 1014 1084 1039"></td></tr> <tr> <td data-bbox="396 1073 418 1098">3.</td><td data-bbox="521 1073 662 1098">Tensile Test</td><td data-bbox="976 1073 1084 1098"></td></tr> <tr> <td data-bbox="396 1131 418 1157">4.</td><td data-bbox="521 1131 698 1157">Elongation test</td><td data-bbox="976 1131 1084 1157"></td></tr> <tr> <td data-bbox="396 1190 418 1215">5.</td><td data-bbox="521 1190 656 1215">Torsion test</td><td data-bbox="976 1190 1206 1215">For round wires only</td></tr> <tr> <td data-bbox="396 1249 418 1274">6.</td><td data-bbox="521 1249 686 1274">Wrapping test</td><td data-bbox="976 1249 1084 1274"></td></tr> <tr> <td data-bbox="396 1308 418 1333">7.</td><td data-bbox="521 1308 703 1333">Resistance test</td><td data-bbox="976 1308 1084 1333"></td></tr> <tr> <td data-bbox="396 1367 448 1392">8(a)</td><td data-bbox="521 1367 954 1425">Mass & uniformity of Zinc Coating tests</td><td data-bbox="976 1367 1333 1392">For GS wires/formed wires only.</td></tr> <tr> <td data-bbox="396 1455 448 1480">8(b)</td><td data-bbox="521 1455 911 1539">Adhesion test For XLPE insulation & PVC Sheath</td><td data-bbox="976 1455 1333 1480">For GS wires/formed wires only</td></tr> <tr> <td data-bbox="396 1572 418 1598">9.</td><td data-bbox="521 1572 719 1598">Test for thickness</td><td data-bbox="976 1572 1084 1598"></td></tr> <tr> <td data-bbox="396 1631 435 1656">10.</td><td data-bbox="521 1631 954 1690">Tensile strength and elongation test before ageing and after ageing</td><td data-bbox="976 1631 1084 1656"></td></tr> <tr> <td data-bbox="396 1719 435 1745">11.</td><td data-bbox="521 1719 724 1745">Ageing in air oven</td><td data-bbox="976 1719 1084 1745"></td></tr> <tr> <td data-bbox="396 1778 435 1803">12.</td><td data-bbox="521 1778 719 1803">Loss of mass test</td><td data-bbox="976 1778 1279 1803">For PVC outer sheath only.</td></tr> </table>		S. No	Type Test Conductor	Remarks	1.	Resistance test For Armour Wires / Formed Wires		2.	Measurement of Dimensions		3.	Tensile Test		4.	Elongation test		5.	Torsion test	For round wires only	6.	Wrapping test		7.	Resistance test		8(a)	Mass & uniformity of Zinc Coating tests	For GS wires/formed wires only.	8(b)	Adhesion test For XLPE insulation & PVC Sheath	For GS wires/formed wires only	9.	Test for thickness		10.	Tensile strength and elongation test before ageing and after ageing		11.	Ageing in air oven		12.	Loss of mass test	For PVC outer sheath only.
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
5.02.00	S. No	Type Test	Remarks	
	13.	Hot deformation test	For PVC outer sheath only.	
	14.	Heat shock test	For PVC outer sheath only	
	15.	Shrinkage test		
	16.	Thermal stability test	For PVC outer sheath only	
	17.	Hot set test	For XLPE insulation only	
	18.	Water absorption test	For XLPE insulation only	
	19.	Oxygen index test	For PVC outer sheath only	
	20.	Smoke density test	For PVC outer sheath only	
	21.	Acid gas generation test	For PVC outer sheath only	
	22	Flammability test as per IEC-332	For completed cable only	
	Part-3 (Category -B)			
	The following type tests shall be carried out on each type (voltage grade) & size of the cable:			
	S. No.	Type Test For all cables		
	1.	Insulation resistance test (Volume Resistivity method)		
	2.	High voltage test		
	For cables of 19/33kV, 11/11KV & 6.6/6.6KV Grade only.			
	3.	Partial discharge test		
	4.	Bending test		
	5.	Dielectric power factor test		
		a) As a function of voltage		
		b) As a function of temperature		
6.	Heating cycle test			
7.	Impulse withstand test			
Indicative list of tests/ checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of H.T. Cables enclosed.				



QUALITY ASSURANCE

CLAUSE NO.

MV (3.3 kV / 6.6. kV / 11 kV / 33 kV) Cables

Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Lay length & Sequence	Armour coverage, cross over, looseness, gap between two	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability on outer (If applicable) Screening Metallic (Cu)	Anti termite coating on wooden drums	Construconal requirements feature as per NTPC	Routine & Acceptance Test as per relevant standard & NTPC	FRLS Test
Aluminium (IS-8130)	Y	Y	Y	Y	Y	Y									
Semiconducting Compound	Y		Y												
XLPE Compound (IS-7098 Part-II)	Y	Y	Y		Y				Y	Y					
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58) ,IEC-60754 Part-1)	Y	Y	Y						Y	Y					Y
Triple Extrusion & curing /Manufacturing of Core		Y	Y		Y	Y	Y								
Copper Tape	Y	Y	Y		Y										
Polyster tape	Y	Y													
Core Laying		Y					Y								
Armour wire/strip	Y	Y	Y												
Copper tapping	Y	Y									Y				
Inner sheath	Y	Y													
Armouring		Y						Y							
Outer Sheathing		Y							Y						
Power Cable (Finished)								Y	Y	Y			Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y										Y	Y		

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought out items will be subject to NTPC approval.

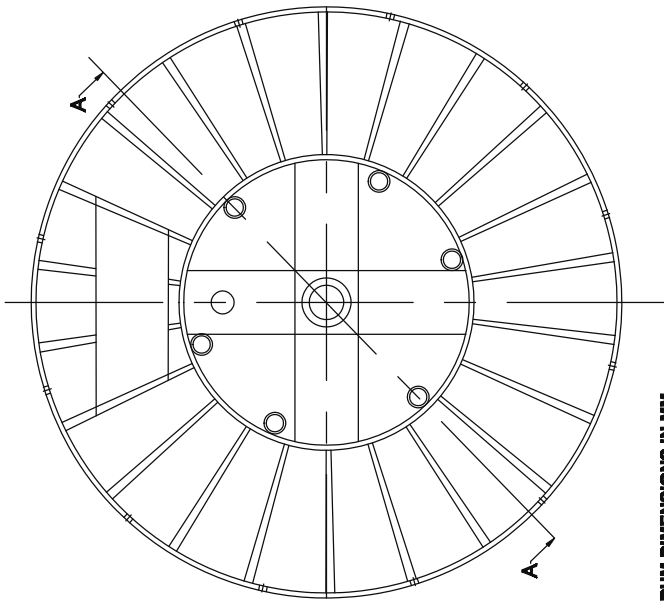
Clause No.	QUALITY ASSURANCE 																				
ROUTINE TESTS	Following routine tests shall be carried out on each drum of finished cables for all types & sizes. <table> <tr><td>1)</td><td>Conductor Resistance test</td></tr> <tr><td>2)</td><td>High voltage test</td></tr> <tr><td>3)</td><td>Partial discharge test (for Screened cables only)</td></tr> </table>	1)	Conductor Resistance test	2)	High voltage test	3)	Partial discharge test (for Screened cables only)														
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ACCEPTANCE TESTS	Following Acceptance tests shall be carried out on each size of each type (voltage rating) of cables, in the offered lot.																				
A) For Conductor (as per sampling plan mentioned in IS: 7098 Part II) <table> <tr><td>1)</td><td>Annealing test (Copper)</td></tr> <tr><td>2)</td><td>Tensile Test (Aluminum)</td></tr> <tr><td>3)</td><td>Wrapping Test (Aluminum)</td></tr> <tr><td>4)</td><td>Resistance test</td></tr> </table>		1)	Annealing test (Copper)	2)	Tensile Test (Aluminum)	3)	Wrapping Test (Aluminum)	4)	Resistance test												
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B) For copper tape / Wires (as per sampling plan mentioned in IS: 7098 Part II) <table> <tr><td>1)</td><td>Measurement of Dimensions</td></tr> <tr><td>2)</td><td>Conductivity check</td></tr> </table>		1)	Measurement of Dimensions	2)	Conductivity check																
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B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 7098 Part II) <table> <tr><td>1.</td><td>Measurement of Dimensions</td></tr> <tr><td>2.</td><td>Tensile Tests</td></tr> <tr><td>3.</td><td>Elongation Test</td></tr> <tr><td>4.</td><td>Torsion Test For Round wires only</td></tr> <tr><td>5.</td><td>Wrapping Test</td></tr> <tr><td>6.</td><td>Resistance Test</td></tr> <tr><td>7.</td><td>Mass of Zinc coating test For G S wires / Formed wires only</td></tr> <tr><td>8.</td><td>Uniformity of Zinc coating For G S wires / Formed wires only</td></tr> <tr><td>9.</td><td>Adhesion test For G S wires / Formed wires only</td></tr> <tr><td>10.</td><td>Freedom from surface defects</td></tr> </table>		1.	Measurement of Dimensions	2.	Tensile Tests	3.	Elongation Test	4.	Torsion Test For Round wires only	5.	Wrapping Test	6.	Resistance Test	7.	Mass of Zinc coating test For G S wires / Formed wires only	8.	Uniformity of Zinc coating For G S wires / Formed wires only	9.	Adhesion test For G S wires / Formed wires only	10.	Freedom from surface defects
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c) For XLPE insulation & PVC Sheath (as per sampling plan mentioned in IS: 7098 Part II) <table> <tr><td>1)</td><td>Test for thickness</td></tr> <tr><td>2)</td><td>Tensile strength & Elongation before ageing (for tests after ageing see "D")</td></tr> <tr><td>3)</td><td>Hot set test (For XLPE insulation)</td></tr> </table>		1)	Test for thickness	2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")	3)	Hot set test (For XLPE insulation)														
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QUALITY ASSURANCE				
D) Ageing test:				
	Criteria	Condition	Test Requirements	Remarks
PVC outer sheath :	Samples as per relevant IS, from each size of each type (voltage rating) of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). Tensile & elongation testing shall preferably be done with a computerized machine. The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	For PVC: The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°C+/- 2°C for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test then all sizes (which had met the criteria) will be put on ageing test as per IS.
XLPE Insulation	Samples as per relevant IS, from each size of each type (voltage rating) of cables in the offered lot, will be put on ageing test as per	Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
E) Following tests will be carried out on completed cables as per IS on each size of each type				
	1)	Insulation resistance test (Volume resistivity method)		
	2)	High voltage test		
	3)	Partial discharge test (for Screened cables only)		
F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)				
	1)	Thermal stability test on outer sheath		
	2)	Oxygen index test on outer sheath		
	3)	Smoke density rating test on outer sheath		
	4)	Acid gas generation test on outer sheath		
	5)	Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable		

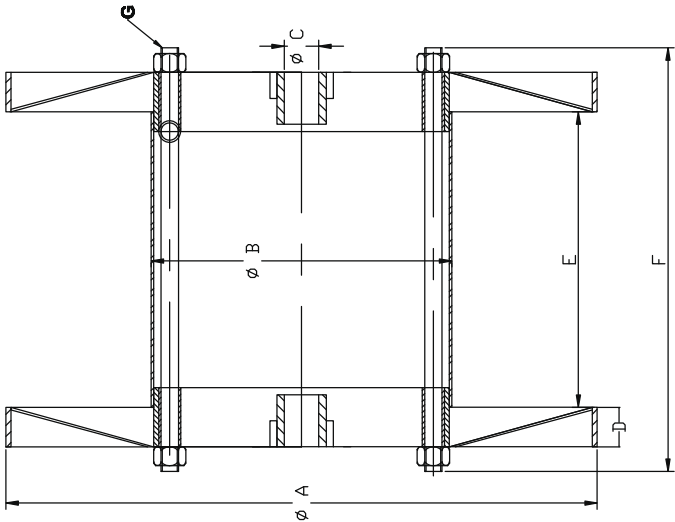
CLAUSE NO. QUALITY ASSURANCE 					
G) Following tests shall be carried on one length of each size of each type of offered lot:	<table> <tr> <td data-bbox="269 1312 355 1837">1)</td><td data-bbox="269 197 355 1312">Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, marking of drum no. / Batch number of outer sheath extrusion</td></tr> <tr> <td data-bbox="355 1312 391 1837">2)</td><td data-bbox="355 197 391 1312">Measurement of Eccentricity & Ovality</td></tr> </table>	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, marking of drum no. / Batch number of outer sheath extrusion	2)	Measurement of Eccentricity & Ovality
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2)	Measurement of Eccentricity & Ovality				

STEEL DRUM DRAWING (TYPICAL)

ANNEXURE-C TO SECTION-II



APPROXIMATE DRUM DIMENSIONS IN MM
ALL DIMENSIONS AND VALUES ARE
TYPICAL AND ARE DEPENDENT ON
CABLE WEIGHT.



A	FLANGE	2200
B	BARREL	1200
C	CENTRAL HOLE	100
D	FLANGE	50
E	TRAVERSE	1400
F	GROSS WIDTH	1600
G	STUD SIZE	16 MM.

- Dwg. not to scale.
- ALL DIMENSIONS ARE IN MM.

TYPICAL DRAWING OF CABLE DRUM PACKING

