

3X660 MW NORTH KARAPURA TPS

TECHNICAL SPECIFICATION FOR

LT PVC POWER CABLES

SPECIFICATION NO: PE-TS-405-507-E005
REVISION: 0



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301



TECHNICAL SPECIFICATION FOR
1.1 KV PVC POWER CABLES

SPECIFICATION NO. PE-TS- 405-507-E005

VOLUME II B

SECTION -

REVISION 0

DATE: 05.04.2016

SHEET

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IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION IN TOTO, & THAT THERE ARE NO TECHNICAL DEVIATIONS.

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF 'INSTRUCTIONS TO BIDDERS')



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INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. In line with clause no. 4.1 of Section-D, Volume-II-B of the specification, Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a. Unpriced BOQ-Cum-Price Schedule (Annexure-A) along with Annexure-I (“Quoted” words against items”) with bidder’s signature and company stamp.
 - b. A copy of this sheet (“Instructions to Bidders for Preparing Technical Offer”)
 - c. A copy of previous sheet (“List of Contents”), with bidder’s signature and company stamp.
 - d. A copy of quality plan including Annexure to QAP sheet, with bidder’s signature and company stamp.
2. **No technical submittal such as copies of type test certificates, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.**
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
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 cable description/ quantities from those given in Annexure-A [BOQ-Cum-Price schedule] of the specification shall not be considered (i.e., technical description & quantities as per specification shall prevail).

BIDDER’S STAMP & SIGNATURE



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PREAMBLE

1 The Tender documents contain three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 **VOLUME - I** CONDITIONS OF CONTRACT

This consists of four parts as below:

Volume – IA This part contains Instructions to bidders for making bids to BHEL.

Volume – IB This part contains General Commercial Conditions of the Tender & includes provision that vender shall be responsible for the quality of item supplied by their sub-vendors.

Volume – IC This part contains Special Conditions of Contract.

Volume – ID This part contains Commercial Conditions for Erection & Commissioning site work, as applicable.

1.2 **VOLUME – II** TECHNICAL SPECIFICATIONS

Technical requirements are stipulated in Volume – II, which comprises of:-

Volume – IIA General Technical Conditions.

Volume – IIB Technical Specification including Drawings, if any.

1.3 **VOLUME – IIB**

This volume is sub-divided in to following sections:-

Section – A: This section outlines the Intent of Specification.

Section – B: This section provides “Projection Information”.

Section – C: This section indicates Technical Requirements specific to Contract, not covered in Section – D.

Section – D: This section comprises of Technical Specifications of equipment complete with Data Sheets A and C.

Data Sheet-A: Specific data and other requirements pertaining to the equipments.

Data sheet–C: Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)

1.4 **VOLUME – III** TECHNICAL SCHEDULES (If Applicable)

This volume contains Technical Schedule and Data Sheets–B, which are to be duly filled by bidder and the same shall be furnished with the technical bid.

2.0 This requirements mentioned in Section – C / Data Sheet – A of Section – D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section – D.



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SECTION – 'A'
SCOPE OF ENQUIRY



TECHNICAL SPECIFICATION FOR
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SCOPE OF ENQUIRY

- 1.0 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to site of LT PVC POWER CABLES as mentioned in different sections of this specification for 3 X 660 MW NORTH KARANPURA TPS.
- 2.0 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall confirm in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation up to bidder's guarantee.
- 3.0 The general terms and conditions, instructions to bidders and other attachment referred to elsewhere be hereby made part of the Technical Specification.
- 4.0 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 Bidders shall confirm total compliance to the specification without any deviations from the technical/ quality assurance requirements stipulated.
- 6.0 The documents shall be in English language and MKS system of units.



TECHNICAL SPECIFICATION FOR
1.1 kV PVC POWER CABLES

DOC. NO. PE-TS-405-507-E005


VOLUME II B


SECTION B


REVISION 0

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SECTION – 'B'
PROJECT INFORMATION

| CLAUSE NO. | PROJECT INFORMATION | | |  | | | | | | | | | |
|---|---|---|---------------------------------------|---|--------|---|-----|---------|---|----|--|--|--|
| <p>1.00.00</p> <p>1.01.00</p> <p>1.02.00</p> <p>1.03.00</p> <p>1.04.00</p> <p>1.04.01</p> | <p>BACKGROUND</p> <p>North Karanpura Super Thermal Power Project (3x660 MW), a pit head coal based thermal power project, is located in Hazaribagh and Chatra districts of Jharkhand State. Basic inputs i.e. coal, water and land have already been tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand.</p> <p>The capacity of the project is 1980 MW comprising of three (3) units of 660 MW each.</p> <p>Location and Approach</p> <p>The power project is proposed to be located near Tandwa town in Chatra districts in the state of Jharkhand on Hazaribagh-Chatra State highway at a distance of about 50 kms from Hazaribagh city. The nearest commercial airport is Ranchi at a distance of 150 kms from project site. The nearest railhead Khalari Railway Station on Ranchi-Garhwa section of Eastern Railways is about 40 kms from project site.</p> <p>Major rail/road distances from the project site are as under:</p> <table border="1" data-bbox="395 813 1190 958"> <thead> <tr> <th><u>City</u></th> <th></th> <th><u>Distance Approx. (kms)</u></th> </tr> </thead> <tbody> <tr> <td>Ranchi</td> <td>:</td> <td>150</td> </tr> <tr> <td>Khalari</td> <td>:</td> <td>40</td> </tr> </tbody> </table> <p>The site is located near Tandwa town having latitude and longitude of about 23⁰ 50' N to 23⁰ 52' N and 84⁰ 59' E to 85⁰ 2' E respectively. The Vicinity Plan of the project is placed at Annexure-I.</p> <p>Further to the information given in this sub-section, Bidders are also advised to visit the project site and collect data on local site conditions.</p> <p>Land</p> <p>About 2245 acres of land is being acquired for the project. About 1500 acres of land is under possession/legal possession and out of 1500 acres, about 890 acres of land is to be used for plant, ash dyke and initial enabling township. No additional land is envisaged to be acquired in plant area. About 15 acres of land is envisaged to be acquired in Hazaribagh city for Township.</p> <p>Commissioner, Chatra vide dated 25.05.1999 and 14.06.2000 has given in-principle clearance for NKSTPP.</p> <p>Water</p> <p>Make up water available for this project would be about 22 cusec and will be arranged by constructing a dam/reservoir across river Garhi.</p> <p>Fuel (Coal)</p> <p>Coal Requirement, Availability and Linkage</p> <p>Coal requirement for the project is estimated as 10.6 Million Tonne/Annum (MTPA), considering a GCV of 3800 kcal/kg. Ministry of Coal vide letter dated 21.10.99 accorded in-principle coal linkage of 10.00 MTPA subject to ratification by Standing Linkage Committee-Long Term (SLC (LT)), of MOC. SLC (LT) in its meeting held on 15.12.2000 firmed up the coal linkage of 10.24 MTPA for the project. Subsequently, the coal linkage was withdrawn by SLC (LT) in its meeting held on 22/23.10.08.</p> | <u>City</u> | | <u>Distance Approx. (kms)</u> | Ranchi | : | 150 | Khalari | : | 40 | | | |
| <u>City</u> | | <u>Distance Approx. (kms)</u> | | | | | | | | | | | |
| Ranchi | : | 150 | | | | | | | | | | | |
| Khalari | : | 40 | | | | | | | | | | | |
| <p>NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p> | <p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2</p> | <p>SUB-SECTION-IB PROJECT INFORMATION</p> | <p>PAGE 1 OF 10</p> | | | | | | | | | | |

| CLAUSE NO. | PROJECT INFORMATION | | |  |
|--|--|---|-------------------------|---|
| 1.04.02 | <p>Cabinet Committee on Investment (GOI) in its meeting on 20.02.13 decided in-principle to restore the original coal linkage granted to NKSTPP (i.e. from Magadh Coal Block) with the stipulation that the coal supply will commence during the 13th Five Year Plan. MOC vide letter dated 09.05.2013 restored the coal linkage with the stipulation that the coal supply will commence during the 13th five year plan.</p> <p>Coal Transportation</p> <p>Coal from Magadh block of North Karanpura Coalfields is proposed to be transported to the project site through conveyor belt system. One external coal handling plant and one internal coal handling plant are envisaged.</p> | | | |
| 1.05.00 | <p>Meteorological Data</p> <p>Important meteorological data from nearest observatory at Hazaribag is placed at Annexure-II.</p> | | | |
| 1.06.00 | <p>Plant Water Scheme</p> <p>The Plant water scheme is described below.</p> | | | |
| 1.06.01 | <p>Condenser Cooling System</p> <p>It is proposed to adopt Air Cooled Condenser for the project.</p> | | | |
| 1.06.02 | <p>Equipment Cooling Water (ECW) System (Unit Auxiliaries)</p> <p>All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by auxiliary cooling water system. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.</p> | | | |
| 1.06.03 | <p>Ash Water System</p> <p>It is proposed to have HCSD (High concentration Slurry Disposal) system for combined fly ash and bottom ash. No recirculation of ash water from ash disposal area is envisaged.</p> | | | |
| 1.06.04 | <p>Other Miscellaneous Water Systems</p> <p>(a) Raw water shall be used for meeting the Fly ash and bottom ash system requirement etc.</p> <p>(b) The service water shall be taken from clarified water tank of Pretreatment plant. Service water (wash water) collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use.</p> <p>(c) The drinking water requirement of the plant shall be provided from water treatment plant.</p> | | | |
| <p>NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p> | <p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2</p> | <p>SUB-SECTION-IB PROJECT INFORMATION</p> | <p>PAGE 2 OF 10</p> | |

| CLAUSE NO. | PROJECT INFORMATION | | |  |
|---|---|--|--------------------------------|---|
| 1.07.00 | <p>(d) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water and makeup to the hydrogen generation plant shall be provided from Demineralising plant.</p> <p>(e) The quality of Raw water is enclosed with this sub-section as Annexure-III.</p> <p>Criteria for Earthquake Resistant Design of Structures and Equipment</p> <p>All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in the Part - B of this section.</p> | | | |
| 1.08.00 | <p>Criteria for Wind Resistant Design of Structures and Equipment</p> <p>All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part B of this section.</p> | | | |
| <p>NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p> | <p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2</p> | <p>SUB-SECTION-IB PROJECT INFORMATION</p> | <p>PAGE 3 OF 10</p> | |

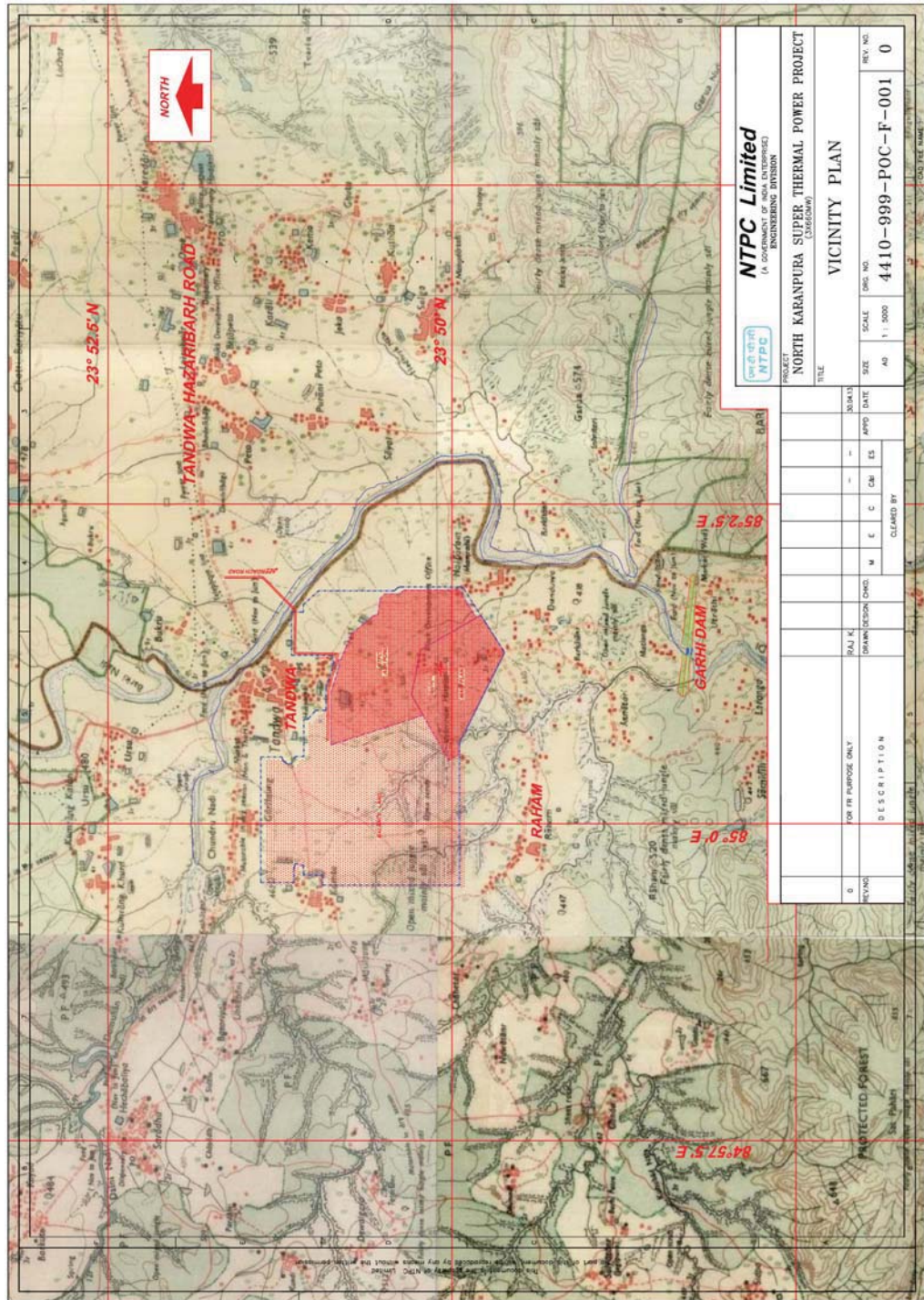
CLAUSE NO.

PROJECT INFORMATION



Annexure-I

VICINITY PLAN




| | | | |
|---|-------------|--|----------|
| | | NTPC Limited <small>(A GOVERNMENT OF INDIA ENTERPRISE)</small> ENGINEERING DIVISION | |
| PROJECT: NORTH KARANPURA SUPER THERMAL POWER PROJECT (Continued) | | | |
| TITLE: VICINITY PLAN | | | |
| REV. NO. | DATE | SCALE | REV. NO. |
| 0 | | 1 : 5000 | 0 |
| DESCRIPTION | APPROVED BY | DATE | REV. NO. |
| | | | 0 |


NORTH KARANPURA STPP
 (3 X 660 MW)
 EPC PACKAGE

TECHNICAL SPECIFICATION
 SECTION – VI, PART-A
 BID DOC. NO.:CS-4410-001-2

SUB-SECTION-IB
 PROJECT INFORMATION

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| CLAUSE NO. | PROJECT INFORMATION | | |  | | | | | | | | | | | | | | | | |
|--|--|--|---|---|----|----------------------|--------|---|-------------|------------------------------|----|------------------|--|-------------------------------|---|--------------------|----|---------------|---|-------|
| 1.00.00 | General Requirements | | | | | | | | | | | | | | | | | | | |
| 1.01.00 | For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% shall be considered. The equipment shall operate in a highly polluted environment. However, for equipment in air conditioned areas, design ambient temperature shall be 35 deg.C, if 2x100% air conditioning system is provided. | | | | | | | | | | | | | | | | | | | |
| 1.02.00 | All equipments shall be suitable for rated frequency of 50Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification. The step-up voltage level for the project shall be 400 KV. The turbo generator unit will be connected to its own step-up transformers for feeding power into the EHV grid. The overall system shall be designed considering voltage variation of +/- 5% and fault level of 50kA for 400KV and 40kA for 220 KV system. Under black start condition the minimum fault level of 1000 MVA shall be considered at 400KV voltage level and voltage variation at 400kV may be considered as +/-10% till system stabilization. | | | | | | | | | | | | | | | | | | | |
| 1.03.00 | Contractor shall provide fully compatible electrical system, equipments, accessories and services for the entire station/plant in his scope as well as those specifically required by the Employer. | | | | | | | | | | | | | | | | | | | |
| 1.04.00 | All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and International Codes & Standards, especially the Indian Statutory Regulations. | | | | | | | | | | | | | | | | | | | |
| 1.05.00 | <p>The auxiliary AC voltage supply arrangement shall have 33 kV, 11 kV, 3.3KV and 415V systems. It shall be designed to limit voltage variations as given below under worst operating condition:</p> <table border="0" data-bbox="344 1077 1445 1234"> <tr> <td>a)</td> <td>33KV/11KV/3.3KV (MV)</td> <td>+/- 6%</td> </tr> <tr> <td>b)</td> <td>415 V/240 V</td> <td>+/- 10%</td> </tr> <tr> <td>c)</td> <td>220V DC</td> <td>-15% to +10% However the nominal continuous DC power supply shall be 240V.</td> </tr> </table> | | | | a) | 33KV/11KV/3.3KV (MV) | +/- 6% | b) | 415 V/240 V | +/- 10% | c) | 220V DC | -15% to +10% However the nominal continuous DC power supply shall be 240V. | | | | | | | |
| a) | 33KV/11KV/3.3KV (MV) | +/- 6% | | | | | | | | | | | | | | | | | | |
| b) | 415 V/240 V | +/- 10% | | | | | | | | | | | | | | | | | | |
| c) | 220V DC | -15% to +10% However the nominal continuous DC power supply shall be 240V. | | | | | | | | | | | | | | | | | | |
| 1.06.00 | <p>The voltage level for motors shall be as follows:</p> <table border="0" data-bbox="344 1312 1414 1570"> <tr> <td>a)</td> <td>Upto 0.2 KW</td> <td>:</td> <td>Single phase 240V AC / 3 phase 415V AC</td> </tr> <tr> <td>b)</td> <td>Above 0.2 KW and upto 200 KW</td> <td>:</td> <td>3 phase, 415V AC</td> </tr> <tr> <td>c)</td> <td>Above 200 KW and upto 1500 KW</td> <td>:</td> <td>3 phase, 3.3 kV AC</td> </tr> <tr> <td>d)</td> <td>Above 1500 KW</td> <td>:</td> <td>11 kV</td> </tr> </table> <p>The bidder may adopt 415V/3.3 KV for the drives rated in the range of 160-210 KW.</p> <p>For CHP conveyor motor's rating above 160 kW, 3.3 KV, three phase AC supply is to be used.</p> <p>The voltage rating of the drives indicated above is for basic guideline. Minor variations in above can be accepted on case to case basis based on techno-economic considerations of the various sub-systems.</p> <p>Voltage rating for special purpose motors viz, VFD and screw compressors, shall be as per manufacturer's standard. All the motors ratings on Stacker/ reclaimers shall be 415V ac supply only.</p> | | | | a) | Upto 0.2 KW | : | Single phase 240V AC / 3 phase 415V AC | b) | Above 0.2 KW and upto 200 KW | : | 3 phase, 415V AC | c) | Above 200 KW and upto 1500 KW | : | 3 phase, 3.3 kV AC | d) | Above 1500 KW | : | 11 kV |
| a) | Upto 0.2 KW | : | Single phase 240V AC / 3 phase 415V AC | | | | | | | | | | | | | | | | | |
| b) | Above 0.2 KW and upto 200 KW | : | 3 phase, 415V AC | | | | | | | | | | | | | | | | | |
| c) | Above 200 KW and upto 1500 KW | : | 3 phase, 3.3 kV AC | | | | | | | | | | | | | | | | | |
| d) | Above 1500 KW | : | 11 kV | | | | | | | | | | | | | | | | | |
| NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE | TECHNICAL SPECIFICATIONS SECTION – VI, PART-B | SUB-SECTION-B0 GENERAL ELECTRICAL SPECIFICATION | PAGE 1 OF 11 | | | | | | | | | | | | | | | | | |

| CLAUSE NO. | PROJECT INFORMATION | | |  |
|--|--|--|---|---|
| 1.07.00 | <p>The preferred AC control supply voltage shall be 110V for all 415 V non breaker controlled feeders. Control supply voltages other than above may be offered by bidder based on the bidder's standard proven practice.</p> | | | |
| 1.08.00 | <p>The designed fault levels for 11 KV & 3.3 KV systems shall be restricted to 40 kA rms for 1 second and 50 kA rms for 1 second for 415 V systems. The 33 KV system equipments shall have a minimum short circuit fault withstand rating of 12.5 kA for 1 second.</p> | | | |
| 1.09.00 | <p>The nominal voltage of main DC system shall be 220V. DC batteries shall be designed for continuous float operation with trickle charge, hence all the associated components like batteries, battery chargers, DC motors, relays, contactors, timers etc shall be suitable for continuous operation at the maximum continuous battery float voltage including suitable temperature correction factors. The operational limits of variation of DC voltage is (+)10 % to (-)15%.</p> <p>In addition, the bidder may propose 110V, 48V or 24V systems as per requirements of control and instrumentation of his equipment and design.</p> | | | |
| 1.10.00 | <p>The Contractor shall furnish calculations of maximum loading and fault levels under the most onerous conditions for the various equipment/systems as defined else where in the specification to prove adequacy of their parameters. In case any equipment or system is found to be inadequate, it shall be changed/ modified without any additional liability to the Employer.</p> | | | |
| <p align="center">NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p> | <p align="center">TECHNICAL SPECIFICATIONS SECTION – VI, PART-B</p> | <p align="center">SUB-SECTION-B0 GENERAL ELECTRICAL SPECIFICATION</p> | <p align="center">PAGE 2 OF 11</p> | |



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SECTION - 'C'

SPECIFIC TECHNICAL REQUIREMENTS



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SECTION C

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1.0 SCOPE OF ENQUIRY

- 1.1 This enquiry covers the supply of the LT power cables conforming to this specification.
- 1.2 General technical requirements of the cables are indicated in Section-D and Datasheet-A. Project specific technical/ quality requirements/ changes are listed below.
- 1.3 Cables shall conform in all respects to the requirements stipulated in all the above parts of the specification.
- 1.4 The stipulations of Section-C, followed by those of Datasheet-A shall prevail in case of any conflict between the stipulations of Section-C, Datasheet-A and Section-D.

2.0 BILL OF QUANTITIES:

- 2.1 Quantity requirements shall be as per Annexure-A (Bill of Quantities (BOQ)) enclosed.
- 2.2 Delivery schedule (i.e. contractual calendar dates) for the package shall be as per NIT. Supplies shall be completed conforming to the lot requirements stipulated in the BOQ within the overall delivery schedule.
- 2.3 The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ in the unit price schedule enclosed with this specification. The unit prices shall apply for adjustment of variation in quantity as stipulated above.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

- 3.1 Specific technical requirements shall be as listed below:

3.2 Technical:

| <u>S.No.</u> | <u>Reference Clause No. of Section- D (if any)</u> | <u>Specific Requirement/ Change</u> |
|---------------------|---|---|
| 1 | 2.4.1 b, c & d | May be read as 2.4.1 (b). Additionally "The type tests are required to be conducted as indicated in Annexure to QAP and the same shall be offered for inspection (Conduction of type tests shall be witnessed by BHEL). Bidder to indicate unit price of cables inclusive of type test charges. No separate charges shall be payable for type tests. |
| 2 | 2.4.1 e | Refer S. No. 1 above. |
| 3 | 4.1 | Two signed and stamped copies of the following shall be furnished by all bidders as technical offer : (i) Un-priced Price Schedule (Annexure-A, as enclosed with the specification) with bidder's signature and company stamp. (ii) A copy of "Instruction to Bidders for Preparing Technical Offer" sheet, with bidder's signature and company stamp. (iii) A copy of "List Of Contents" sheet, with bidder's signature and company stamp. (iv) A copy of "Quality Plan including Annexure to QAP" sheet, with bidder's signature and company stamp. |

No other documentation is required to be submitted as



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technical offer. Any information contained in other parts of the offer (e.g. covering letter, annexures, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer.

3.3 Quality/ Inspection:

| <u>S.No.</u> | <u>Reference Clause No. of Section- D (if any)</u> | <u>Specific Requirement/ Change</u> |
|---------------------|---|---|
| 1 | 2.2 | QP (Including Annexure to QAP) enclosed with spec. shall be stamped and signed by bidders as token of acceptance. The QP shall be submitted during contract stage for customer/BHEL approval without any commercial implications to BHEL. |
| 2 | 2.4.1.d | All Test shall be conducted as per contract. Conduction of testing requirements mentioned in data sheet-A & Annexure to QAP. |
| | | Quality assurance details of NTPC is attached as annexure-C |

3.4 The successful bidder shall submit the standard list of raw material suppliers/ sub-vendors for approval without any commercial implications. Changes to the same, if proposed by any bidder, shall be to BHEL approval.

3.5 Quality Plan applicable for project:

Standard Quality Plan no. (Enclosed with specification)

3.6 The Bidder/ Sub Vendor should have manufactured and supplied prior to the date of Techno-Commercial bid opening (i.e. 28.11.2013)the following:

(a) At least 100 km of aluminium conductor, XLPE insulated, PVC sheathed power cables of 1.1kV or higher grade in one single contract

(b) At least 100 km of aluminium conductor, PVC insulated, PVC sheathed power cables of 1.1kV or higher grade in one single contract

(c) At least one (1) km of flame retardant low smoke cables.

(d) 1.1kV or higher grade power cable of minimum 630sq.mm conductor size.



TECHNICAL SPECIFICATION FOR
1.1 kV LT PVC POWER CABLES

SPECIFICATION NO. PE-TS- 405-507-E005

VOLUME II B

SECTION C

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4. LIST OF STANDARD DELIVERABLES FOR LT PVC POWER CABLES TO BE SUBMITTED BY SUCCESSFUL BIDDER

| LT PVC POWER CABLES | | | |
|----------------------------|---|----------------------------|--|
| SL. No. | DOCUMENT TITLE | DWG. / DOCUMENT No. | SUBMISSION SCHEDULE |
| 1 | Data Sheet for LT PVC Power cables | PE-V0-405-507-E111 | Within Two weeks from the date of LOI |
| 2 | Cross-sectional Drawings for LT PVC Power cables | PE-V0-405-507-E112 | Within Two weeks from the date of LOI |
| 3 | Quality Plan for LT PVC Power cables | PE-V0-405-507-E913 | Within Two weeks from the date of LOI |
| 4 | Type Test Reports for Tests conducted for this contract | PE-V0-405-507-E114 | Within a week from the date of conduction of Type Test |

5.0 DOCUMENT DISTRIBUTION SCHEDULE FOR THE PROJECT SHALL BE AS BELOW

| S.No | Description of Drgs/Docs | No of Prints | No of ROMs/DVDs/Portable Hard Disk | CD |
|--|---|--------------|------------------------------------|----|
| 1 | Drawings, Data sheets, Design calculations, Purchase specifications and other documents | | | |
| | First submission and submission with major changes | | | |
| | ▪ Layout (A0&A1 sizes) | 4 | - | |
| | ▪ Other Drawings/Documents (A0&A1 sizes) | 2 | - | |
| | ▪ P&ID (All sizes) | 4 | - | |
| | a) Final drawings/documents (Directly to site) | 6 | 2 | |
| | b) "As Built" Drawing/Documents (Directly to site) | 6 | 2 | |
| c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications | 2 | 2 | | |
| 2 | Erection Manual (Directly to site) | 4 sets | 2 | |
| 3 | Operation & Maintenance manual | | | |
| | i) First Submission | 1 set | -- | |
| | ii) Final Submission (Directly to site) | 4 sets | 2 | |
| 4 | Plant Hand Book | | | |
| | i) First Submission | 1 | 1 | |
| 5 | Commissioning and Performance Test Procedure manual | | | |
| | i) First Submission | 1 set | -- | |
| | ii) Final Submission (Directly to site) | 4 sets | 2 | |

| | | | |
|---|--|---------------------------------------|------------------|
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**ANNEXURE-A
BOQ CUM PRICE SCHEDULE**

(A) MAIN SUPPLY

(1.1)1.1 kV/ Aluminium conductor/ PVC insulated/ Unarmoured/Innersheath PVC Type ST2 (no inner sheath for single core cables)/ Outersheath Extruded FRLS PVC Type ST2 as per IS: 5831

| S. NO. | ITEM CODE | Cable Size (No. of cores x Cross section Area (sq.mm)) | Order Quantity (meters) | LOT-1 QUANTITY | Drum length (meters) | Unit price (Ex- works) Rs. | Total price (Ex- works) Rs. |
|--------|-------------|---|-------------------------------|-------------------|--------------------------------|----------------------------------|-----------------------------------|
| A1 | 507-29012-A | 2C-10 | 11000 | 7000 | 1000 | | |
| A2 | 507-29028-A | 2C-95 | 26000 | 16000 | 1000 | | |
| A3 | 507-29141-A | 2C-120 | 4000 | 3000 | 1000 | | |
| A4 | 507-29040-A | 3C-10 | 70000 | 42000 | 1000 | | |
| A5 | 507-29048-A | 3C-25 | 45000 | 27000 | 1000 | | |
| A6 | 507-29050-A | 3C-50 | 35000 | 21000 | 1000 | | |
| A7 | 507-29052-A | 3C-95 | 20000 | 12000 | 1000 | | |
| A8 | 507-29032-A | 3.5C-25 | 8000 | 5000 | 1000 | | |
| A9 | 507-29036-A | 3.5C-50 | 57000 | 35000 | 1000 | | |
| A10 | 507-29038-A | 3.5C-95 | 20000 | 12000 | 1000 | | |
| A11 | 507-29068-A | 1C-35 | 45000 | 27000 | 1000 | | |
| A12 | 507-29072-A | 1C-70 | 38000 | 23000 | 1000 | | |
| A13 | 507-29076-A | 1C-120 | 11000 | 7000 | 1000 | | |

(1.2)1.1 kV/ Aluminium conductor/ PVC insulated/ Armoured/Innersheath PVC Type ST2 (no inner sheath for single core cables)/ Outersheath Extruded FRLS PVC Type ST2 as per IS: 5831

| S. NO. | ITEM CODE | Cable Size (No. of cores x Cross section Area (sq.mm)) | Order Quantity (meters) | LOT-1 QUANTITY | Drum length (meters) | Unit price (Ex- works) Rs. | Total price (Ex- works) Rs. |
|--------|-------------|---|-------------------------------|-------------------|--------------------------------|----------------------------------|-----------------------------------|
| A14 | 507-29031-A | 3.5C-25 | 34000 | 21000 | 1000 | | |
| A15 | 507-29035-A | 3.5C-50 | 6000 | 4000 | 1000 | | |

(1.3)1.1 kV/ Copper conductor/ PVC insulated/ Armoured/Innersheath PVC Type ST2 (no inner sheath for single core cables)/ Outersheath Extruded FRLS PVC Type ST2 as per IS: 5831. With Yellow Outer Sheath.

| S. NO. | ITEM CODE | Cable Size (No. of cores x Cross section Area (sq.mm)) | Order Quantity (meters) | LOT-1 QUANTITY | Drum length (meters) | Unit price (Ex- works) Rs. | Total price (Ex- works) Rs. |
|--------|-------------|---|-------------------------------|-------------------|--------------------------------|----------------------------------|-----------------------------------|
| A16 | 507-29043-A | 3C-2.5 | 16000 | 10000 | 1000 | | |

(1.4)1.1 kV/ Copper conductor/ PVC insulated/ unarmoured/Innersheath PVC Type ST2 (no inner sheath for single core cables)/ Outersheath Extruded FRLS PVC Type ST2 as per IS: 5831

| S. NO. | ITEM CODE | Cable Size (No. of cores x Cross section Area (sq.mm)) | Order Quantity (meters) | LOT-1 QUANTITY | Drum length (meters) | Unit price (Ex- works) Rs. | Total price (Ex- works) Rs. |
|--------|-------------|---|-------------------------------|-------------------|--------------------------------|----------------------------------|-----------------------------------|
| A17 | 507-29016-A | 2C-2.5 | 146000 | 88000 | 1000 | | |
| A18 | 507-29044-A | 3C-2.5 | 332000 | 200000 | 1000 | | |

Notes :

1. The variation in quantities shall be as indicated in NIT.
2. The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ-Cum-Price Schedule enclosed with this specification. The unit prices shall apply for adjustment of variation in quantity as stipulated above.
3. Lot-1 Quantity indicated above shall be cleared for manufacturing along with LOI. However, manufacturing of the cables shall be taken up by the successful bidder only after approval of technical and quality documentation. Subsequent lots shall be cleared for manufacture based on progress of engineering and site requirements.
4. Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0%. Cables consumed for testing and inspection shall be to bidder's account.
5. Standard drum length shall be 1000 metres. Tolerance on individual drum length shall be $\pm 5\%$. 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. The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).
6. In case the quantities cleared by BHEL for manufacturing (in a lot) 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 implication.
7. Bidder shall indicate unit price of cables inclusive of type test charges. No separate Type Test charges are to be quoted by bidder.
8. Bidder shall quote for all sizes/types of cables as per specification, failing which their offer shall be rejected.
9. Delivery schedule of LOT-1 and subsequent lots shall be as per NIT.



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SECTION-D

STANDARD TECHNICAL SPECIFICATION



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1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for 1.1 kV PVC cables shall be as indicated in this section, in addition to those specified in Section-C and Datasheet-A as attached for project specific requirements.

2.0 QUALITY ASSURANCE REQUIREMENTS

2.1 Bidder shall confirm compliance with the BHEL Quality Plan as attached with the specification without any deviations. Minor changes in Quality Plan (which shall be to customer approval during contract stage) shall be without any commercial implication.

2.2 In the event of BHEL Quality Plan not being applicable for a project (as indicated in section-C of the project specification), the successful bidder shall submit the Manufacturing Quality Plan (MQP) for approval by BHEL/ Owner (as applicable) during detailed engineering stage without any commercial implications.

2.3 Bidders shall submit the list of proven sub-vendors for raw materials, which will be subject to BHEL/ customer approval.

2.4 Type testing requirements and routine/ acceptance testing requirements shall be as detailed below.

2.4.1 Type Tests on Cables

- a. All cables to be supplied shall conform to type tests as per relevant standards and proven type.
- b. The bidder shall furnish the reports of all the type tests listed in Annexure to QAP (enclosed with quality plan) carried out in within last five years of the date of bid opening. These reports should be for the tests conducted either in government approved third party laboratory or witnessed by client (such as major utilities/ industries) on identical/ similar cables to those ordered under this contract.
- c. In case bidder is not able to submit report of type test(s) conducted in last five years, or in case type tests report(s) are not found to be meeting the specification/ relevant standard requirements, then all such tests shall be conducted under this contract by the bidder free of cost to BHEL, and reports shall be submitted for approval. No charges shall be paid for testing under such circumstances. BHEL reserves the right to witness the testing for which due notice shall be given by the vendor.
- d. Irrespective of the bidder furnishing type test report as indicated above, BHEL may get type tests conducted as indicated in Annexure to QAP (enclosed with quality plan) and the same shall be offered for inspection (conduction of type tests shall be witnessed by BHEL). Separate price shall be quoted for the conduction of type testing per lot, which shall be used for cost comparison. A maximum of three lots shall be considered for price comparison purposes on account of type testing. However, type-testing charges shall be paid as per type test conducted.
- e. Minor changes in the final Type Test Procedures (which shall be to approval during contract stage) shall be without any commercial implication.

2.4.2 Routine and Acceptance Tests

- a. Routine testing shall be conducted in line with the applicable standards and as per the Manufacturing Quality Plan approved for the project for every lot offered for inspection.
- b. Acceptance tests shall be conducted on every lot offered for inspection as per details indicated in Annexure to QAP (enclosed with quality plan).
- c. Cost of conduction of routine and acceptance testing shall be deemed to have been included in the quoted supply prices.



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2.4.3 Cost of cables consumed for testing shall be to bidder's account.

3.0 PACKING

3.1 Cables shall be supplied in non-returnable heavy construction drums. All wooden parts shall be manufactured from seasoned wood treated with copper naphthenates / zinc naphthenates (refer IS: 401). 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.

4.0 PROJECT SPECIFIC TECHNICAL AND QUALITY DOCUMENTATION TO BE SUBMITTED

4.1 By All Bidders

As technical offer:

- a) A copy of "Instruction to bidder's for preparing technical offer" as enclosed with enquiry with bidder's signature and company seal.
- b) A copy of "List of contents" as enclosed with enquiry with bidder's signature and company seal.
- c) A copy of Annexure-A (BOQ-Cum-Price schedule) as enclosed with enquiry with bidder's signature and company seal.
- d) A copy of Datasheet-A as enclosed with enquiry with bidder's signature and company seal.
- e) A copy of Quality Plan(including Annexure to QAP) as enclosed with enquiry with bidder's signature and company seal.

No other documentation is required to be submitted as technical offer. Any information contained in other parts of the offer (e.g. covering letter, annexures, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer.

4.2 By Successful Bidder (for approval during contract stage)

- a. Datasheet C and derating factors in the format provided to the successful bidder along with LOI.
- b. Cross-section drawings of the cables
- c. Manufacturing Quality Plan in case BHEL SQP is not applicable.
- d. List of sub-vendors/ suppliers of raw materials
- e. Type Test Procedure
- f. Field Quality Plan
- g. Technical catalogues/ literature for the cables.

4.3 Two copies of the above documentation shall be submitted for first review. Number of copies to be submitted for second and subsequent submissions (till Cat-I approval is accorded), and those for final distribution prints of approved documentation and test certificates shall be as indicated separately in section C.

4.4 Wherever required, soft copy of all approved technical/ quality documentation shall be submitted as specified without any additional commercial implication. Soft copies may be required both in native file format (e.g. MS Word/ MS Excel) as well as PDF files.



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DATASHEET A



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DATA SHEET-A

| | | |
|------|---|---|
| 1.0 | Type of Cable | LT PVC POWER CABLE OF FRLS TYPE |
| 2.0 | Standard applicable in general | IS: 1554 PART (I) |
| 3.0 | Voltage Grade | 1.1kV |
| 4.0 | Number of cores, cross sectional area of conductors | As per Annexure-A (BOQ cum price schedule) |
| 5.0 | Formula for calculating short circuit current for different durations | $I_{sh} = k A / \sqrt{t}$ where, I_{sh} = Short circuit current in kA t = Fault clearing time in sec. K = a constant = 0.076 for Aluminium conductor PVC insulation = 0.115 for copper conductor PVC insulation |
| 6.0 | Installation Conditions for specified current rating | |
| (a) | Ambient air temperature | 50 deg. C |
| (b) | Ambient temp. for underground cable | 50 deg. C |
| (c) | Thermal resistivity of soil | 150 deg. C cm/W |
| 7.0 | CONDUCTOR | |
| (a) | Material | Aluminium |
| | Grade and Class | STRANDED COMPACTED PLAIN Aluminium OF H2 GRADE & CLASS 2. |
| (b) | Standard Applicable | IS: 8130 |
| | Shape | Circular / shaped as per IS |
| (d) | Min. number of strands | As per Table-2 of IS: 8130 |
| 8.0 | INSULATION | |
| (a) | Material | PVC |
| (b) | Standard Applicable | IS: 5831 |
| (c) | Continuous withstand temperature | 70°C |
| (d) | Short-circuit withstand temperature | 160°C |
| (e) | Method of application | By extrusion; sleeve extrusion not permitted. |
| 9.0 | CORE IDENTIFICATION | Colour coding as per IS. |
| 10.0 | INNER SHEATH | |
| (a) | Material | PVC Type ST2 as per IS: 5831 |
| (b) | Colour | Black |
| (c) | Whether FRLS | No |
| (d) | Fillers | Acceptable |
| (e) | Material of fillers (if permitted) | Same as inner sheath (Material of filler to be |



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| | | compatible with that of inner sheath) |
| (f) | Method of application | |
| (1) | Multi-core cables: | |
| (i) | With fillers | Pressure/Vacuum extruded |
| (ii) | Without fillers | Pressure extruded |
| 11.0 | ARMOUR (where applicable) | |
| (a) | Material: | |
| (i) | Single core cables | Aluminium Round Wire H4 grade to IS: 8130 |
| (ii) | Multi-core cables | Galvanised Steel Round Wire / Formed wire armour conforming to (i) Type 'a' / 'b' as per Table- 5 of IS 1554-I and (ii) IS 3975 as per requirements. |
| (b) | Minimum Coverage | 90% |
| (c) | Gap between armour wires | Shall not exceed one armour wire space (No cross-over/ over-riding) |
| (d) | Breaking load of joint | 95 % of normal armour |
| 12.0 | OUTERSHEATH | |
| (a) | Material | Extruded FRLS PVC Type ST2 as per IS: 5831 |
| (b) | Colour | Black (Yellow for 3CX2.5 sq.mm CU armoured cable only (Refer BOQ CUM Price Schedule)) |
| (c) | Whether FRLS | Yes |
| (d) | Method of application | Extruded |
| (e) | Marking | Manufacturer's name and /or trade mark year of manufacture, Type of insulation, IS Number(s) Cable size (cross section area of conductor and no. of cores) – (To be embossed) voltage grade -(To be embossed) Word "FRLS" @ 5m (by embossing) 'BHEL-PEM' @5m (by embossing) Progressive Sequential marking of length of the cable in metres at every one meter (by embossing) |
| 13.0 | TEST CONDUCTED | |
| (a) | Oxygen index test | Min 29(As per ASTM D2863 ,IS 10810 part-58 |
| (b) | Temperature index test | Minimum 250°C at oxygen index 21 (ASTM-D-2863) |
| (c) | Acid gas generation test | Max. 20% (as per IEC-754-1) |
| (d) | Smoke density rating test | Max.60% (As per ASTM-D-2843) |
| (e) | Flammability Test | As per IEC: 332-III CAT-B, IEEE: 383 & SS: 424:1475 (Class-F3), IS: 10810. |
| 14.0 | TOLERANCE ON OUTER DIAMETER | ± 2mm |
| 15.0 | TEST MINIMUM BENDING RADIUS | |
| (a) | Single core cables | 15 x O.D. |
| (b) | Multi core cables | 12 x O.D. |



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| | | |
|------|--------------------------------------|--|
| 16.0 | SAFE PULLING FORCE | |
| (a) | Aluminium conductor cable | 30 N/ sq. mm. |
| (b) | Copper conductor cable | 50 N/ sq. mm. |
| 17.0 | CABLE DRUMS | |
| (a) | Type & construction | Wooden drum ,As per IS 10418 |
| (b) | Standard drum length | 1000m (\pm) 5% |
| (c) | Wooden Drum | The surface of the drum and the outer most cable layer shall be covered with water proof cover. 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. Wood preservative anti-termite treatment shall be applied to the entire drum. |
| (d) | Particular information on cable drum | The cable drum should carry the following details in printed form. <ul style="list-style-type: none"> a) Manufacturer's name or trademark, purchaser's name, address and contract number. b) Type of cable & voltage grade. c) Year of manufacture. d) Type of insulation e.g. PVC. e) No. of core and size of cables. f) Cable code. g) Length of cable on drum. h) No. of length on drum, if more than one. i) Direction of rotation, by arrow. j) Approx. gross mass. k) IS/IEC number and ISI mark A tag containing same information shall be attached to the leading end of the cable. |

| | | |
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DATA SHEET- C

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

- 1.1 Name of manufacturer :
- 1.2 Place of Manufacture :
- 2.1 Current rating of cables conforms to :
- 2.2 Short circuit rating conforms to :
- 3.1 Formula for calculating short circuit current for different durations as per Clause-5 of Data Sheet-A :


OR

Whether curve for short time current v/s time for different cables enclosed :

4.0 INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE

- 4.1 No. of cores x size :
- 4.2 Base current ratings (*) based on Clause 6.0 of Data Sheet-A
- a) In air : Amp
- b) In ground : Amp
- c) ducts : Amp
- 4.3 Short circuit rating : kA, sec.
- 4.4 a) D.C. resistance of conductor at : ohm/km

| | | | | | |
|----------------|-----------|------|------|------|--|
| NAME OF VENDOR | | | SEAL | REV. | |
| NAME | SIGNATURE | DATE | | | |
| | | | | | |

| | | |
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20 deg. C

- b) A.C. resistance of conductor at 90 deg. C : ohm/km
- c) Reactance of cable at normal frequency : ohm/km

4.5 CONDUCTOR

- a) Material type & grade :
- b) No & dia of wires in each core before stranding : no x mm

4.6 PVC INSULATION

- a) Minimum & Nominal thickness of insulation : mm


4.7 PVC ST2 INNERSHEATH

- a) Thickness (min.) : mm
- b) Method of application
- 1) Multi-core cables
- i) With fillers :
- ii) With out fillers : Pressure Extruded
- c) Type of fillers (if used) : PVC type ST2 as per IS 5831
- Shape of fillers (if used) :
- d) Colour :

4.8 ARMOUR

- a) Material
- i) Single core cables :

| | | | | | |
|----------------|-----------|------|------|------|--|
| NAME OF VENDOR | | | SEAL | REV. | |
| NAME | SIGNATURE | DATE | | | |
| | | | | | |

| | | |
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- ii) Multi-core cables :
- b) Size/ dimensions :
- c) Minimum no. of wires :
- d) Maximum resistivity of GS wire :
- e) Maximum resistivity of Aluminium round wire :

4.9 PVC ST2 FRLS OUTERSHEATH

- a) Minimum thickness of outer sheath : mm
- b) Colour :

4.10 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

4.11 Weight of cable : kg./km

4.12 Dimension of drum : mm

4.13 Shipping weight : kg.

(*) 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. | |
| NAME | SIGNATURE | DATE | | | |
| | | | | | |

Bidder shall indicate unit price of cables inclusive of type test charges. No separate Type Test charges are to be quoted by bidder. As also mentioned in the BOQ cum unprice schedule



| | | | | | | |
|---|------------------------|---|-------|--|---|-----|
| Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables | | STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION) | | QP. NO. 0000-999-QOE-S-041 REV-00 DATE: 03-02-12 Page 1 of 11 VALID UP TO: 02-02-15 | REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG | |
| Sl. No | Component & Operations | Characteristics | Class | Type of check | Quantum of check | C/N |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Instructions: 1) 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 cable drum. 2) Cable manufacturer to maintain all quality control records identified as per all QP stages enumerated below whether it is identified for NTPC verification or witness or not. | | | | | | |

| Sl. No | Raw material/ Brought out Items | Verify | Type of check | Quantum of check | M | C/N | Acceptance Norms | | | | Remarks | | | | | |
|--------|--|--|---------------|-------------------------------|--------|---------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|-------------|---|----|----|----|--------------|
| | | | | | | | D* | M | C | N | | | | | | |
| 1.01 | Aluminum | 1. Make | MA | 100% | 100% | -- | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | QCR | V | -- | -- | -- | -- |
| | | 2. Resistivity | MA | As per Cable Mnfr Std. | Elect | -- | IS5082 | IS5082 | IS5082 | IS5082 | -do- | P | -- | -- | -- | -- |
| 1.02 | PVC / XLPE/compound for insulation | 1. Make | MA | --do-- | Verify | 100% | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | --do-- | V | V | -- | -- | -- |
| | | 2. Type/ Grade | MA | 100% | Verify | 100% | NTPC ADS | NTPC ADS | NTPC ADS | NTPC ADS | --do-- | V | V | V | -- | -- |
| | | 3. All acceptance test as per manufacturer norms including thermal stability test for PVC insulation | MA | As per manufacturer norms | Verify | As per manufacturer norms | NTPC ADS | NTPC ADS | NTPC ADS | NTPC ADS | --do-- | V | V | V | V | Refer note 1 |
| 1.03 | PVC Compound for Inner sheath | 1. Make | MA | --do-- | Verify | --do-- | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | --do-- | V | V | V | V | V |
| | | 2. Type/ Grade | MA | --do-- | Verify | --do-- | NTPC ADS | NTPC ADS | NTPC ADS | NTPC ADS | --do-- | V | V | V | V | V |
| 1.04 | Steel wire / Formed Wire (As applicable) | 1. Make | MA | --do-- | Verify | --do-- | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | --do-- | V | V | V | V | V |
| | | 2. Dimension | MA | 1 sample from each size / lot | Meas | -- | NTPC APPROVED DATA SHEET & IS 3975 | NTPC APPROVED DATA SHEET & IS 3975 | NTPC APPROVED DATA SHEET & IS 3975 | NTPC APPROVED DATA SHEET & IS 3975 | --do-- | P | -- | -- | -- | -- |
| | | 3. All acceptance tests as per IS 3975 | MA | As per IS 3975 | Verify | -- | IS 3975 | IS 3975 | IS 3975 | IS 3975 | Supplier TC | V | V | V | V | V |
| 1.05 | PVC compound for Sheath | 1. Make | MA | As per manufacturer norms | Verify | 100% | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | MANUFACTURER APPROVED SOURCES | QCR | V | V | V | V | V |
| | | 2. Type / Grade | MA | 100% | Verify | 100% | NTPC ADS | NTPC ADS | NTPC ADS | NTPC ADS | QCR | V | V | V | V | V |
| | | 3. All acceptance test as per manufacturer norms | MA | As per manufacturer norms | Verify | As per manufacturer norms | NTPC ADS | NTPC ADS | NTPC ADS | NTPC ADS | QCR | V | V | V | V | Refer note 1 |

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" FORMAT NO:QS-01-QAI-P-10/F3-R1



| Sl. No | Component & Operations | Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables | STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION) | | | | Reference Document | Acceptance Norms | Record Format | Agency | | | Remarks |
|----------|---------------------------------------|--|--|---------------|----------------------------------|--|---|------------------|---------------|--------|---|--|---------|
| | | | Class | Type of check | Quantum of check | | | | | D* | M | C | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | | 11 | |
| 1.06 | Wooden Drum | 4. Thermal Stability | MA | Chem | One sample / Batch | NTPC ADS | NTPC ADS | QCR | P | | | | |
| 1.07 | Steel Drum | 5. Oxygen Index | MA | Chem | --do-- | NTPC ADS/ IS 10810 Part 58 | NTPC ADS/ IS 10810 Part 58 | --do-- | P | | | | |
| | | 6. Acid Gas Emission | MA | Chem | One sample / Batch | NTPC ADS / IEC60754 | NTPC ADS / IEC60754 | QCR | P | | | | |
| | | 1. Dimension | MI | Meas | Manuf. Std. | IS 10418 | IS 10418 | --do-- | P | | | | |
| | | 2. Anti termite treatment | MI | Chem | Cable manuf. std | CABLE MANUF. STD. | CABLE MANUF. STD. | COC | V | | | COC from drum manuf. | |
| | | 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-- | | | --do-- | P | | | | |
| | | 3. Tensile test | CR | Mech | --do-- | NTPC ADS | NTPC ADS | --do-- | P | | | Refer Sl. No.3.03(iii) | |
| | | 4. Wrapping test | CR | Mech | --do-- | --do-- | --do-- | --do-- | P | | | | |
| | | 1. No. of wires | MA | Meas | --do-- | NTPC ADS | NTPC ADS | --do-- | P | | | | |
| | | 2. Dia of wire | MA | Meas | --do-- | --do-- | --do-- | --do-- | P | | | | |
| | | 3. Dimension of Conductor | MA | Meas | --do-- | --do-- | --do-- | --do-- | P | | | | |
| | | 4. Direction of lay | MA | Visual | --do-- | --do-- | --do-- | --do-- | P | | | | |
| | | 5. Records of strand breakage / welding during conductor stranding | MA | Verify | --do-- | IS 8130 | IS 8130 | --do-- | P | | | | |
| | | 6. Surface finish | MA | Visual | --do-- | --do-- | --do-- | --do-- | P | | | | |
| | | 7. DC Resistance | CR | Meas | --do-- | IS8130/NTPC ADS | IS8130/NTPC ADS | --do-- | P | | | | |
| 2.03 | Insulation extrusion | 1. Surface finish | MA | Visual | One sample/Settin g of each size | NTPC spec | SHOULD BE SMOOTH. NO POROSITY IS PERMITTED. | QCR | P | | | XLPE/PVC compound shall be preferably loaded in to extruder by suction method. | |

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FORMAT NO:QS-01-QAI-P-10/F3-RI

| Sl. No | Component & Operations | Item: 1.1 KV Power (XLPE & PVC) FRLS cables | Characteristics | Class | Type of check | | Quantum of check | | Reference Document | Acceptance Norms | Record Format | APPROVED BY | | | Remarks |
|--------|----------------------------|---|--------------------------|-------|---------------|----------------------------------|------------------|------|------------------------------------|------------------------------------|---------------|-------------|----|----|--|
| | | | | | M | C/N | M | C | | | | N | | | |
| 1 | 2 | 3 | 2. Colour of cores | 4 | 5 | 6 | 6 | 6 | 7 | 8 | 9 | 10 | 11 | 11 | |
| | | | 3. Thickness | CR | Meas | --do-- | -- | -- | NTPC ADS | NTPC ADS | --do-- | P | -- | -- | |
| | | | 4. Spark Test | CR | Elect | 100% | 100% | 100% | CABLE MANUF. STD. | No FAILURE | --do-- | P | V | V | 1. Spark test failure record is to be verified. 2. Core repairing not permitted |
| | | | 5. Hot Set | CR | Mech | One sample/Settin g of each size | -- | -- | IS 7098- Part I | IS 7098- Part I | --do-- | P | -- | -- | Sample is to be taken from both top & bottom end |
| 2.04 | Laying up | | 1. Core sequence | MA | Visual | --do-- | -- | -- | IS 1554 (Part I) & IS 7098- Part I | IS 1554 (Part I) & IS 7098- Part I | --do-- | P | -- | -- | |
| | | | 2. Direction of lay | MA | Visual | --do-- | -- | -- | --do-- | --do-- | --do-- | P | -- | -- | |
| | | | 3. Dia over laid up core | MA | Meas | --do-- | -- | -- | NTPC ADS | NTPC ADS | --do-- | P | -- | -- | |
| 2.05 | Inner Sheath | | 1. Colour | MA | Visual | --do-- | -- | -- | --do-- | --do-- | --do-- | P | -- | -- | |
| | | | 2. Surface Finish | MA | Visual | 100% | -- | -- | NTPC SPECIFICATION | FISH EYE, BLOW HOLE NOT PERMITTED | --do-- | P | -- | -- | |
| | | | 3. Thickness | MA | Meas | One sample/Settin g of each size | -- | -- | NTPC ADS | NTPC ADS | --do-- | P | -- | -- | |
| | | | 4. Dia over inner sheath | MI | Meas | --do-- | -- | -- | --do-- | --do-- | --do-- | P | -- | -- | |
| 2.06 | Armouring (As Applicable) | | 1. Dimension | MA | Meas | --do-- | -- | -- | --do-- | --do-- | --do-- | P | -- | -- | |
| | | | 2. No. of wires / strip | MA | Meas. | --do-- | -- | -- | --do-- | --do-- | --do-- | P | -- | -- | |
| | | | 3. Direction of lay | MA | Visual | --do-- | -- | -- | IS 1554 (Part I) & IS 7098- Part I | IS 1554 (Part I) & IS 7098- Part I | QCR | P | -- | -- | |



Page 3 of 11

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
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 FORMAT NO:QS-01-QAI-P-10/F3-R1

| Sl. No | Component & Operations | Item: 1.1 KV Power (XLPE & PVC) FRLS cables | STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION) | | | Reference Document | REVIEWED BY INDERJIT SINGH VIKRAM TALWAR RAJEEV GARG | APPROVED BY [Signature] [Signature] [Signature] | Remarks | | | | | | |
|--------|------------------------|---|--|---------------|----------------------------------|--------------------|---|--|------------------|----|---|---|---|--|--|
| | | | Class | Type of check | Quantum of check M C/N | | | | Acceptance Norms | D* | M | C | N | | |
| 1 | 2 | Characteristics | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | | | | |
| | | 4.Coverage & Quality of armouring | MA | Meas. | 100% | | 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. The breaking load of armour wire joint shall not be less than 95% of that armour wire / formed wire. (As per NTPC specification) | QCR | P | -- | | | | | |
| | | 5 Dia over armouring | MA | Meas. | One sample/Settin g of each size | | NTPC ADS | --do-- | P | -- | | | | | PVC FRLS compound shall be preferably loaded in to extruder by suction method. |
| 2.07 | 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-- | P | -- | | | | | |
| | | 2.Colour of sheath | MA | Visual | One sample/Settin g of each size | | NTPC ADS | --do-- | P | -- | | | | | |
| | | 3. Dia over outer sheath | MA | Meas | --do-- | | NTPC ADS | --do-- | P | -- | | | | | |
| | | 4.Thickness of outer sheath | CR | Meas | --do-- | | --do-- | --do-- | P | -- | | | | | |
| | | 5. Embossing quality | MA | Visual | 100% | | Drum no., IS1554-1 / IS7098-1,Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (As per NTPC specification) | --do-- | P | -- | | | | | Drum no. on cable may be embossed/print ed |
| | | 6. Sequential marking | MA | Visual | Full length | | Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible. (A s per NTPC specification) | --do-- | P | -- | | | | | |
| C | 3.01 | Finished Cables | CR | Doc. | 100% | | NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part) & IS 7098- Part 1 | NTPC SPECIFICATION / NTPC ADS / IS 1554 (Part) & IS 7098- Part 1 | ✓ | P | V | V | V | | |
| | | All type tests as per NTPC specification | | | 100% | | | | | | | | | | |

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FORMAT NO:QS-01-QAL-P-10/F3-R1

| Sl. No | Component & Operations | Characteristics | Class | Type of check | Quantum of check | | Reference Document | Acceptance Norms | Record Format | Agency | | | Remarks |
|---|---|---|--|---|--|--|---|---|---------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------------|
| | | | | | M | C/N | | | | D* | M | C | |
| Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables | | | | | | | | | | | | | |
| STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION) | | | | | | | | | | | | | |
| QP. NO. 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 5 of 11 VALID UP TO: 02-02-15 | | | | | | | | | | | | | |
| REVIEWED BY INDERJIT SINGH gh-tem VIKRAM TALWAR WJ RAJEEV GARG | | | | | | | | | | | | | |
| APPROVED BY A.K. GARG NTPC | | | | | | | | | | | | | |
| 3.02 | Routine Tests | 3 1.High Voltage test at room temperature 2.Conductor Resistance | 4 CR | 5 Elect | 6 100% | 100% | 7 NTPC ADS / IS 1554 (Part 1) & IS 7098- Part I | 8 NTPC ADS / IS 1554 (Part 1) & IS 7098- Part I | 9 Test certificate | 10 P | W | W | 11 Refer note 2 |
| 3.03 | Acceptance Tests | | | | | | | | | | | | |
| 3.03 (i) | Construction of finished Cable | 1. OD of Cable 2. Laying of core 3. Core Identification 4. Colour of outer sheath 5. Inner sheath thickness 6. Inner sheath colour | MA CR CR MA CR MA | Meas. Visual Visual Visual Meas Visual | Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098- Part I --do-- --do-- --do-- --do-- - do - - do - | --do-- --do-- --do-- --do-- --do-- --do-- | NTPC ADS NTPC ADS / IS 1554 (Part 1) & IS 7098- Part I --do-- NTPC ADS NTPC ADS --do-- - do - | NTPC ADS NTPC ADS / IS 1554 (Part 1) & IS 7098- Part I --do-- --do-- --do-- --do-- --do-- | ✓ ✓ ✓ ✓ ✓ ✓ | P P P P P P | W W W W W W | W W W W W W | |
| 3.03 (ii) | Armour wires/ Formed wires (if applicable) | 1. Dimensions 2. No. of wires/ formed wire 3. Tensile test 4. Elongation test 5. Torsion test (for round wires only) 6. Wrapping test 7. Resistance test | CR CR CR CR CR CR CR | Meas Mech Mech Mech Mech Mech Mech | --do-- -- do -- --do-- --do-- --do-- --do-- --do-- | --do-- --do-- --do-- --do-- --do-- --do-- --do-- | NTPC ADS /IS 1554(Part1)/IS3975 --do-- --do-- --do-- --do-- --do-- --do-- --do-- | NTPC ADS /IS 1554(Part1) /IS3975 --do-- --do-- --do-- --do-- --do-- --do-- --do-- | ✓ ✓ ✓ ✓ ✓ ✓ ✓ | P P P P P P P | W W W W W W W | W W W W W W W | |

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 FORMAT NO:QS-01-QAL-P-10/F3-RI

| Sl. No | Component & Operations | Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables | STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION) | | | Reference Document | Acceptance Norms | Record Format | APPROVED BY | | | | | |
|------------|------------------------|---|--|---------------|--|--------------------------------|---------------------------------|------------------|-------------|----|---|---------|--|---|
| | | | Class | Type of check | Quantum of check | | | | M | C | N | Remarks | | |
| 1 | 2 | Characteristics | 4 | 5 | M C/N | 7 | 8 | 9 | 10 | 11 | | | | |
| | | 8. Mass of Zinc coating | CR | Mech | Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098-Part I | NTPC ADS /IS1554(Part1)/IS3975 | NTPC ADS /IS1554(Part1) /IS3975 | Test certificate | ✓ | 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 | | |
| 3.03 (iii) | Conductor | 1. Resistance Test | CR | Elect | --do-- | --do-- | --do-- | --do-- | ✓ | P | W | W | | |
| | | 2. Tensile test (For aluminum conductor only) | CR | Mech | Each type & size of cables as per sampling plan of IS 1554 (Part 1)/7098(Part-1) | NTPC ADS/ IS 8130 | NTPC ADS/ IS 8130 | --do-- | ✓ | P | W | W | | Test report of manufacturer to be reviewed as per SL No. 2.01 for Tensile test & wrapping test (for Aluminum) in case this test is not applicable for cable under inspection as per IS 8130 cl. 6.2 |
| | | 3. Wrapping test (For aluminum conductor only) | CR | Mech | --do-- | --do-- | --do-- | --do-- | ✓ | P | P | W | | --do-- |



| Sl. No | Component & Operations | Characteristics | Class | Type of check | Quantum of check | | Reference Document | Acceptance Norms | Record Format | Agency | | | | Remarks |
|---|----------------------------------|---|---------------------------------------|--|--|--|---|---|----------------------------------|----------------------------|----------------------------|----------------------------|---|---------|
| | | | | | M | C/N | | | | D* | M | C | N | |
| Item: 1.1 KV Power PVC FRLS Insulated cables STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION) QP. NO. 0000-999- QOE- S-041 REV-00 DATE: 03-02-12 Page 7 of 11 VALID UP TO: 02-02-15 REVIEWED BY: INDERJIT SINGH Gh-10 VIKRAM TALWAR RAJEEV GARG | | | | | | | | | | | | | | |
| 3.03 (IV) | PVC/XLPE/Insulation & PVC Sheath | 1. Thickness of insulation & PVC Sheath 2. Tensile strength & elongation at break of insulation & outer sheath (before ageing) 3. Tensile strength & elongation at break of insulation & outer sheath (after Ageing) 4. Insulation resistance (Volume resistivity method) 5. High voltage test at room temperature 6. Hot Set test (for XLPE insulation only) 7. Thermal stability on PVC Insulation and outer sheath | 4 CR CR CR CR CR CR | 5 Meas Mech Mech Elect Elect Phy Chem | 6 Each type & size of cables as per sampling plan of IS 1554 (Part 1)/IS7098(Part-1) Each type & size of cables as per sampling plan of IS 1554 (Part 1)/IS7098(Part-1) Refer Note 3 Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098-Part 1 Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098-Part 1 --do-- One sample of each offered lot of all offered sizes | 7 NTPC ADS/IS 1554(Part1) & IS 7098 Part 1 NTPC ADS/IS 1554(Part) & IS 7098 Part 1 --do-- --do-- --do-- --do-- | 8 NTPC ADS/IS 1554(Part1) & IS 7098 Part 1 NTPC ADS/IS 1554(Part1) & IS 7098 Part 1 --do-- --do-- --do-- --do-- | 9 Test Certificate Test Certificate --do-- --do-- --do-- --do-- | 10 P P P P P P | W W W W W W | W W W W W W | W W W W W W | 11 Refer Note 3 Also Refer Note 3 Refer Note 3 Refer Note 3 Refer Note 3 Refer Note 3 | |

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| Sl. No | Component & Operations | Characteristics | Class | Type of check | Quantum of check | | Reference Document | Acceptance Norms | Record Format | Agency | | | | Remarks |
|--|------------------------|--|-------|---------------|---|--|--------------------|------------------|---------------|--------|----|---|---|---------|
| | | | | | M | C/N | | | | D* | M | C | N | |
| <p>Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables</p> <p>STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION)</p> <p>QP. NO. 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 8 of 11 VALID UP TO: 02-02-15</p> <p>REVIEWED BY INDERJIT SINGH Grewal VIKRAM TALWAR RAJEEV Singh</p> <p>APPROVED BY A.K. Garg Approved Dt.... N.T.P.C., Noida</p> | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | | | |
| | | 8. Oxygen index Test on outer sheath 9. Smoke density rating test on outer sheath 10. Acid gas generation test on outer sheath 11. Flammability test on completed cable 12. Surface finish & length measurement. | CR | Chem | One sample of each offered lot of all offered sizes | NTPC ADS / IS10810 Part 58 | NTPC A.D.S | --do-- | P | W | W | | | |
| | | | CR | Chem | One sample of each offered lot of all offered sizes | NTPC ADS & ASTM D2843 | NTPC ADS | --do-- | P | W | W | | | |
| | | | CR | Chem | One sample of each offered lot of all offered sizes | NTPC ADS & IEC 60754-1 | NTPC ADS | Test Certificate | P | W | W | | | |
| | | | CR | Chem | Refer Note 4 | NTPC ADS & IEC 60332 Part-3 (Category-B) | NTPC ADS | --do-- | P | W | W | | | |
| | | | CR | Visual & Meas | One length of each size | (1) Drum no. (2) IS1554-1/IS7098-1. Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (3) Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible | NTPC ADS | --do-- | P | W | W | | Pimple, Fish Eye, Burnt particles, Blow Hole etc. not permitted. Repairing on outer sheath not permitted. | |
| 4 | Packing | 13. 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 | NTPC ADS | --do-- | P | W | W | | | |
| | | 1. Sealing | MA | Visual | 100% | (1) IS1554(Part-1) & IS 7098-Part 1 (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. | NTPC ADS | QCR | P | -- | -- | | | |
| 4.01 | Identification | NTPC Sealing | MA | Visual | 100% | Sealing shall be visible | NTPC ADS | QCR | P | V | V | | | |

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

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 is to carry out ageing test & test report is to be reviewed (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.
 2(b) **In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre/ Regional Offices**,- Routine Test are to be witnessed by Main Contractor & NTPC. This is in addition to manufacturer internal test report to be verified by NTPC at the time of final inspection.
Refer table on page 10 & 11 of 11 for Sampling & Acceptance criteria.
- 3) For PVC insulated LT power cable :- For cables with OD less than equal to 30 mm, any size of cable may be clubbed together. For cables where OD is more than 30 mm, clubbing to be done for cables having similar ODs. For XLPE insulated LT Power cable: Clubbing to be done for cables having similar ODs.
- 4) **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**

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"
 FORMAT NO:QS-01-QAI-P-10/F3-R1

| | | | | | | | | | | | | |
|---|------------------------|--|-------|---|------------------|--|------------------|--|---------|---|---|---|
|  | | Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables | | STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION) | | QP. NO. 0000-999- QOE- S-041 REV-00 DATE : 03-02-12 Page 10 of 11 VALID UP TO: 02-02-15 | | REVIEWED BY INDERJIT SINGH Grewal VIKRAM TALWAR RAJEEV GARG | | APPROVED BY  A.K. Garg | | |
| Sl. No | Component & Operations | Characteristics | Class | Type of check | Quantum of check | Reference Document | Acceptance Norms | Record Format | Remarks | | | |
| 1 | 2 | 3 | 4 | 5 | M C/N | 7 | 8 | 9 | D* | M | C | N |
| Sampling & Acceptance Criteria | | | | | | | | | | | | |

| Criteria | Manufacturer experience prerequisite | Condition | Testing procedure | Remarks |
|--|--|---|---|---|
| <p>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 +/- 15% tolerance (final values should be more than the minimum values indicated in relevant standard) of the Type Test report</p> | <p>In case of Manufacturers/ Supplier who have supplied cables in the past through Corporate Centre / Regional offices</p> | <p>In case of sizes/ type which meet the criteria</p> | <p>1 Sample of PVC insulation & outer sheath per type of cables offered 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. 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.</p> <p>Particular size/ type will be put on ageing test as per IS. This test shall be witnessed by NTPC.</p> | <p>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.</p> |



| Sl. No | Component & Operations | Characteristics | Class | Type of check | Quantum of check | | Reference Document | Acceptance Norms | Record Format | Agency | | | Remarks |
|--------|---|-----------------|-------|---|--|--|--------------------|------------------|---------------|--------|---|---|---------|
| | | | | | M | C/N | | | | D* | M | C | |
| 1 | Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | | |
| | | | | 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 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 | | | | | | | | |

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" FORMAT NO:QS-01-QAL-P-10/F3-RI

**L.T POWER CABLES
(1.1 KV PVC & XLPE CABLES)**

| Attributes / Characteristics | Make, Rating, Type & TC | Dimension/surface finish | Mechanical Properties | Chemical Composition | Electrical Properties | Spark Test | Hot set test (XLPE) | Lay length / Sequence | Armour coverage, Cross over, looseness, Gap between two armour wire/strip | Sequential marking/surface finish /cable length | Tensile strength, elongation before & after ageing of insulation & outer sheath | Thermal Stability of insulation and outer sheath * | Anti termite treatment on wooden drums | Constructional / requirement as per NTPC Spec. | Routine and acceptance test as per Relevant Standard and NTPC specification | FRLS Test |
|--|-------------------------|--------------------------|-----------------------|----------------------|-----------------------|------------|---------------------|-----------------------|---|---|---|--|--|--|---|-----------|
| Aluminum (IS-8130) | Y | Y | Y | Y | Y | | | | | | | | | | | |
| PVC Compound (IS-5831) | Y | | Y | | Y | | | | | | Y | | | | | |
| XLPE Compound(IS-7098 Part-I) | Y | | Y | | Y | | Y | | | | Y | | | | | |
| FRLS PVC Compound(IS-5831) ASTM-D-2843/ IS 10810 (Part-58) IEC-60754 Part-I | Y | | Y | | | | | | | | Y | | | | | |
| Armour wire/strip (IS-3975) | Y | Y | Y | | | | | | | | | | | | | |
| Insulated Core | | Y | | | | Y | Y | | | | | Y | | | | |
| Laid up core | | Y | | | | | | Y | | | | | | | | |
| PVC Inner sheath | | Y | | | | | | | | | | | | | | |
| Armouring | | Y | | | | | | | Y | | | | | | | |
| Outer sheath | | Y | | | | | | | | Y | Y | Y | | | | Y |
| Finish cable (IS-1554 & 7098 – Part-1) ASTM-D-2843/ IS 10810 (Part- - 58) IEC-60754 Part-I Swedish Chimney SS 4241475 for (F3 category) Flammability test IEC-60332 Part –3 Cat-B | Y | Y | | | | | | | Y | Y | Y | Y | | Y | Y | Y |
| Wooden drum (IS-10418) / Steel drum | | Y | | | | | | | | | | | Y | | | |

Note: This is an indicative list of test/checks. The manufacturer is to furnish a detailed quality plan indicating the practice and procedure along with relevant supporting documents.

2. Not applicable for XLPE insulation

| | | |
|-----------|---|-----------------------------------|
| | ROUTINE TESTS | |
| | Routine tests shall be carried out on each drum of finished cables for all types & sizes. Following shall constitute routine tests: | |
| 1) | Conductor Resistance test | |
| 2) | High voltage test at room temperature | |
| | ACCEPTANCE TESTS | |
| | Following Acceptance tests shall be carried out for each type and size of the cables on the cable drums selected at random as per sampling plan mentioned in IS: 1554 Part 1 & IS 7098 Part-I | |
| A) | For Conductor | |
| 1) | Annealing test | For copper conductor only |
| 2) | Tensile test | For aluminium conductor only |
| 3) | Wrapping test | For aluminium conductor only |
| 4) | Resistance test | |
| B) | For Armour Wires / Formed Wires (If applicable) | |
| 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 defects | |
| C) | For PVC / XLPE insulation & PVC Sheath | |
| 1) | Test for thickness | |
| 2) | Hot set test | For XLPE insulation only |
| 3) | Tensile strength & Elongation before ageing | |
| D) | For completed cables | |
| 1) | Insulation resistance test (Volume resistivity method) | |
| 2) | High voltage test at room temperature | |

- E) Following tests shall be carried out and only one sample shall be taken from each offered lot of all sizes for these tests:-**
- 1) Thermal stability test on PVC insulation and outer sheath
 - 2) Oxygen index test on outer sheath
 - 3) Smoke density rating test on outer sheath as per ASTM –D 2843
 - 4) Acid gas generation test on outer sheath as per IEC –60 754 (Part 1)

F) Ageing test on PVC / XLPE insulation and PVC outer sheath as per following:

In case of regular manufacturers:-

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.

In case values of tensile strength & elongation (before ageing) of PVC insulation & outer sheath are within +/- 15% of the type test reports then 1 sample from sizes which meet the criteria will be put on accelerated ageing test. The accelerated ageing test procedure for PVC insulation & outer sheath: sample to be put in air oven at temperature of 130^oc +/- 2^oc for 5 hours, tensile strength & elongation acceptance norms as per relevant IS.

However in case the tensile strength and elongation values are not within +/- 15% of type test values then 1 sample of that particular size of cable will be tested for tensile strength & elongation after ageing test as per relevant IS.

For XLPE insulation: 1 sample of every size will be put on ageing test as per relevant IS.

In case of new manufacturers / suppliers (supplying first time to NTPC through corporate contract):-

Samples as per relevant IS from every size & type of cable in the offered lot shall be tested for tensile strength & elongation before ageing. 1 Samples from every size & type of cable in the offered lot shall be tested for tensile strength & elongation after ageing test as per IS.

G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable as per following sampling plan.

The test shall be carried out on every size & type of power cable offered for inspection as an acceptance test. This test will be carried out using composite sampling i.e. irrespective of sizes of cables of a particular type, may be tested together as per calculations in line with the IEC (all sizes will be covered)

H) Following tests shall be carried on one length of each size of offered lot:

Surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
LT PVC POWER CABLES
3 x 660 MW North Karanpura TPP****ANNEXURE TO QAP**

SPECIFICATION NO. PE-TS-405-507-E005

VOLUME II B

SECTION

REVISION 0

DATE: 05.04.2016

SHEET

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS**A. Type Test Conduction:**

1. Tests for which “T” is indicated in the ‘Test Conduction Required As’ column below shall be conducted as Type Test.
2. Sampling:
 - a) Type test shall be conducted & witnessed on one size (sample) of every lot of control cable.
 - b) Type test shall be conducted & witnessed on one size (sample) per type (Cu/ Al conductor) of every lot for power cable.
 - c) Flammability Test to be conducted only on one sample/ lot.

B. Acceptance Test Conduction:

1. Tests for which “A” is indicated in the ‘Test Conduction Required As’ column below shall be conducted as Acceptance tests.
2. Sampling:
 - a) Sampling for acceptance tests shall be as per Appendix-B of IS: 1554 Part-I.
 - b) Flammability Test to be conducted only on one sample/ lot.

C. Routine Test Conduction:

1. Tests for which “R” is indicated in the ‘Test Conduction Required As’ column below shall be conducted as Routine tests.

| <u>S. No.</u> | <u>TEST</u> | <u>APPLICABLE FOR</u> | <u>TEST CONDUCTION REQUIRED AS</u> | <u>REFERENCE STANDARD</u> | <u>REMARKS</u> |
|---------------|---|---------------------------------|------------------------------------|---------------------------|--|
| 1.0 | Tests for Conductor | | | | |
| I. | Annealing test | For copper conductor | T, A | IS 10810 Pt 1 | <i>In process records shall be furnished to inspector at the time of inspection.</i> |
| II. | Tensile Test | For aluminium conductor | T, A | IS 10810 Pt 2 | |
| III. | Wrapping test | For aluminium conductor | T, A | IS 10810 Pt 3 | |
| IV. | Resistance test | For copper/ aluminium conductor | T, A, R | IS 10810 Pt 5 | |
| | | | | | |
| 2.0 | Tests for Round Steel Wires/Strips | | | | |
| I. | Measurement of dimensions | For GS Round wire/Strip | T, A | IS 10810 Pt 36 | |
| II. | Tensile test | For GS Round wire/Strip | T, A | IS 10810 Pt 37 | |
| III. | Elongation test | For GS Round wire/Strip | T, A | IS 10810 Pt 37 | |



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SPECIFICATION NO. PE-TS-405-507-E005

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| <u>S. No.</u> | <u>TEST</u> | <u>APPLICABLE FOR</u> | <u>TEST CONDUCTION REQUIRED AS</u> | <u>REFERENCE STANDARD</u> | <u>REMARKS</u> |
|---------------|---|--|------------------------------------|---------------------------|----------------|
| IV. | Torsion test | For GS Round wire | T, A | IS 10810 Pt 38 | |
| V. | Winding test | For GS Formed wire | T, A | IS 10810 Pt 39 | |
| VI. | Resistivity test | For GS wire/Strip | T, A | IS 10810 Pt 42 | |
| VII. | Uniformity of Zinc coating test | For G. S. wires/Strip | T, A | IS 10810 Pt 40 | |
| VIII. | Mass of Zinc coating test | For G. S. wires/Strip | T, A | IS 10810 Pt 41 | |
| 3.0 | Physical Tests for PVC Insulation & PVC sheath | | | | |
| I. | Test for thickness | Applicable for PVC insulation, PVC inner sheath & PVC outer sheath | T, A | IS 10810 Pt 6 | |
| II. | Tensile strength and elongation test at break | Applicable for PVC insulation & PVC outer sheath | T, A | IS 10810 Pt 7 | |
| III. | Ageing in air oven | Applicable for PVC insulation & PVC outer sheath | T | IS 10810 Pt 11 | |
| IV. | Loss of mass in air oven test | Applicable for PVC insulation & PVC outer sheath | T | IS 10810 Pt 10 | |
| V. | Hot deformation test | Applicable for PVC insulation & PVC outer sheath | T | IS 10810 Pt 15 | |
| VI. | Heat shock test | Applicable for PVC insulation & PVC outer sheath | T | IS 10810 Pt 14 | |
| VII. | Shrinkage test | For PVC insulation & PVC outer sheath only | T | IS 10810 Pt 12 | |
| VIII. | Thermal stability test | Applicable for PVC insulation & PVC outer sheath | T | IS 10810 Pt 60 | |
| 4.0 | Improved Fire performance (FR-LSH) Tests\$ | | | | |
| I. | Oxygen index test | For PVC outer sheath only ^(S) | T, A | ASTMD 2863 | |
| II. | Smoke density test | For PVC outer sheath only ^(S) | T, A | ASTM D2843 | |
| III. | Acid gas generation test | For PVC outer sheath only ^(S) | T, A | IEC-754-1 | |
| IV. | Temperature Index Test | For PVC outer sheath only ^(S) | T | ASTMD 2863 | |
| 5.0 | Flammability Tests | | | | |



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| <u>S. No.</u> | <u>TEST</u> | <u>APPLICABLE FOR</u> | <u>TEST CONDUCTION REQUIRED AS</u> | <u>REFERENCE STANDARD</u> | <u>REMARKS</u> |
|---------------|--|-----------------------|------------------------------------|--|----------------|
| I. | Flammability test for single cable | For complete cable | T, A | IS: 1554 Part-I (As per category C2)/ IEC-60332 (Part-3) Category-B | |
| II. | Flammability test for bunched cables | For complete cable | T | IS: 1554 Part-1 (As per category C2)/ IEC-60332 Part-3-23, Category-B / Category-A | |
| III. | Swedish chimney test | For complete cable | A | SEN SS 424 1475 | |
| IV. | Flammability test | For complete cable | A | IEEE:383 | |
| 6.0 | Electrical Tests | | | | |
| I. | High Voltage Test (Water Immersion test) | On Cores | T | IS 10810 Pt 45 | |
| II. | High Voltage Test at Room Temperature | For complete cable | T, A, R | IS 10810 Pt 45 | |
| III. | Insulation Resistance Test (Volume resistivity method) | For complete cable | T, A | IS 10810 Pt 43 | |