

**VOLUME II**

**5 X 800 MW YADADRI STPS**  
**TSGENCO**

**TECHNICAL SPECIFICATION**

**FOR**

***LT XLPE POWER CABLES***

**SPECIFICATION NO: *PE-TS-417-507-E012***

***REVISION: 01***



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

385304/2021/PS-PEM-EL



DOCUMENT TITLE

# TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. PE-TS- 417-507-E012

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DATE: 14.07.20221

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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 LT XLPE POWER CABLES conforming to this specification.
- 1.2 General technical requirements of the LT 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

| <b><u>S.No.</u></b> | <b><u>Reference Clause No. of Section- II</u></b> | <b><u>Specific Requirement/ Change</u></b> |
|---------------------|---------------------------------------------------|--------------------------------------------|
|                     |                                                   |                                            |
|                     |                                                   |                                            |

## 4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

- 4.1 Documents/drawings shall be submitted after placement of order for BHEL and customer approval which has been specified in NIT.
- 4.2 Drawings/ documents shall be submitted through Document Management System (DMS).

### NOTE-

1. Vendor shall submit drawing/document submission/BHEL comments/ re-submission schedule after approval of documents.
2. Standard Quality Plan along with its annexure as enclosed in the technical specification is to be appended with cover sheet bearing document number and description as specified in NIT. 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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|  |                                                             |  |                                       |
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**DATA SHEET-A**

|     |                                                                                                                                                                               |                                                                                                                                        |                                               |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| 1.0 | Type of Cable                                                                                                                                                                 | Flame Retardant Low Smoke (FR-LSH)                                                                                                     |                                               |
| 2.0 | Standard applicable in general(Latest amendment to be referred if any)                                                                                                        | IS:7098 (Part-1), IS:8130, IS:5831, IS:10810, IS:3975, ASTM:2843, ASTM:2863, IEC-754-1, IEC:60332 (Part-1), IEC:60332-3-23, IEEE:60383 |                                               |
| 3.0 | Voltage Grade                                                                                                                                                                 | 1.1kV                                                                                                                                  |                                               |
| 4.0 | Number of cores, cross sectional area of conductors and quantities                                                                                                            | As per BOQ-Cum-Price Schedule                                                                                                          |                                               |
| 5.0 | <b>FAULT CHARACTERISTICS</b>                                                                                                                                                  |                                                                                                                                        |                                               |
|     | Fault Level                                                                                                                                                                   | 50kA (rms)                                                                                                                             |                                               |
|     | Fault Clearing Time                                                                                                                                                           | 0.5 sec for breaker operated supply feeders & 0.2 sec for breaker operated motor feeders                                               |                                               |
| 6.0 | <b>CONDUCTOR</b>                                                                                                                                                              |                                                                                                                                        |                                               |
| (a) | Material                                                                                                                                                                      | Plain Aluminium                                                                                                                        | Plain Copper                                  |
|     | Grade and Class                                                                                                                                                               | Stranded & compacted, H2 grade, Class 2                                                                                                | Stranded, annealed high conductivity, Class 2 |
| (b) | Standard Applicable                                                                                                                                                           | IS: 8130                                                                                                                               |                                               |
| (c) | Shape                                                                                                                                                                         | Circular / shaped as per IS                                                                                                            |                                               |
| (d) | Min. number and diameter of strands for main and neutral conductor<br><br>[Neutral conductor cross section w.r.t main conductor shall be as per Table-2 of IS: 7098 (Part-1)] | As per Table-2 of IS: 8130                                                                                                             |                                               |
| 7.0 | <b>INSULATION</b>                                                                                                                                                             |                                                                                                                                        |                                               |
| (a) | Material                                                                                                                                                                      | Cross-Linked Polyethylene(XLPE)                                                                                                        |                                               |
| (b) | Standard Applicable                                                                                                                                                           | IS: 7098 (Part-1)                                                                                                                      |                                               |
| (c) | Continuous withstand temperature                                                                                                                                              | 90°C                                                                                                                                   |                                               |
| (d) | Short-circuit withstand temperature                                                                                                                                           | 250°C                                                                                                                                  |                                               |
| (e) | Method of application                                                                                                                                                         | By extrusion; sleeve extrusion not permitted.                                                                                          |                                               |
| (f) | Nominal Thickness of insulation                                                                                                                                               | As per IS: 7098 (Part-1)                                                                                                               |                                               |
| 8.0 | <b>CORE IDENTIFICATION</b>                                                                                                                                                    | Colour coding as per IS:7098(Part-1)                                                                                                   |                                               |
| 9.0 | <b>INNER SHEATH</b>                                                                                                                                                           |                                                                                                                                        |                                               |
| (a) | Material                                                                                                                                                                      | HRPVC Type ST-2                                                                                                                        |                                               |
| (b) | Standard Applicable                                                                                                                                                           | IS: 7098 (Part-1) & IS: 5831                                                                                                           |                                               |
| (c) | Colour                                                                                                                                                                        | Black                                                                                                                                  |                                               |
| (d) | Whether FR-LSH                                                                                                                                                                | [ <input type="checkbox"/> ]YES    [ <input type="checkbox"/> ]NO                                                                      |                                               |
| (e) | Inner sheath applicable for single core cable                                                                                                                                 | [ <input type="checkbox"/> ]YES    [ <input type="checkbox"/> ]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:                                                                                                                                                            |                                                                                                                                        |                                               |



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| (i)   | With fillers                                   | Pressure/Vacuum extruded                                                                                                                                                                                                                                                                                                 |
| (ii)  | Without fillers                                | Pressure extruded                                                                                                                                                                                                                                                                                                        |
| (2)   | Single-core cables:                            | Pressure/Vacuum extruded                                                                                                                                                                                                                                                                                                 |
| 10.0  | <b>ARMOUR</b>                                  |                                                                                                                                                                                                                                                                                                                          |
| (a)   | Applicable                                     | [ <input checked="" type="checkbox"/> ]YES [ <input type="checkbox"/> ]NO                                                                                                                                                                                                                                                |
| (b)   | Material:                                      |                                                                                                                                                                                                                                                                                                                          |
| (i)   | Single core cables                             | Aluminium Round Wire H4 grade to IS: 8130                                                                                                                                                                                                                                                                                |
| (ii)  | Multi-core cables                              | Galvanised Steel Round Wire                                                                                                                                                                                                                                                                                              |
| (iii) | Standard Applicable                            | Dimension as per IS: 7098 (Part-1) Table-6 and tolerance on dimension as per IS:3975                                                                                                                                                                                                                                     |
| (c)   | Minimum Coverage                               | 90%                                                                                                                                                                                                                                                                                                                      |
| (d)   | Gap between armour wires                       | Shall not exceed one armour wire space<br>(No cross-over/ over-riding)                                                                                                                                                                                                                                                   |
| (e)   | Breaking load of joint                         | 95 % of normal armour                                                                                                                                                                                                                                                                                                    |
| 11.0  | <b>OUTERSHEATH</b>                             |                                                                                                                                                                                                                                                                                                                          |
| (a)   | Material                                       | HRPVC 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-8 of IS: 7098 (Part-1)                                                                                                                                                                                                                                                                                      |
| (f)   | Marking                                        | Cable size (cross section area and no. of cores) and voltage grade @ 5m (by embossing)<br>Word "XLPE" "FR-LSH" etc, @ 5m (by embossing)<br>Manufacturer's name and/ or trade name, IS No. and year of manufacture @ 5m (by embossing)<br>TSGENCO @ 5m (by printing)<br>Progressive sequential marking @ 1m (by printing) |
| 12.0  | <b>FR-LSH CHARACTERISTICS</b>                  |                                                                                                                                                                                                                                                                                                                          |
| (a)   | Oxygen index                                   | Min 29 (As per IS 7098-I /ASTMD 2863)                                                                                                                                                                                                                                                                                    |
| (b)   | Temperature index                              | The measured value of temperature index shall be 21 at a temperature of 250°C (As per IS 7098-I /ASTMD 2863)                                                                                                                                                                                                             |
| (c)   | Acid gas generation                            | Max. 20% by weight (As per IS 7098-I /IEC-60754-1)                                                                                                                                                                                                                                                                       |
| (d)   | Smoke density rating                           | The cables shall meet the requirements of light transmission of minimum 40% after the test (As per IS 7098-I /ASTM D 2843)                                                                                                                                                                                               |
| (e)   | <b>Flammability Test</b>                       |                                                                                                                                                                                                                                                                                                                          |
| (i)   | Flammability test for single cable             | [ <input checked="" type="checkbox"/> ]YES [ <input type="checkbox"/> ]NO<br>As per:<br>(a) IEC-60332 Part-1 [ <input checked="" type="checkbox"/> ]                                                                                                                                                                     |
| (ii)  | Flammability test for bunched cables           | [ <input checked="" type="checkbox"/> ]YES [ <input type="checkbox"/> ]NO<br>As per: (a) IEC-60332 Part-3-23, CAT-B                                                                                                                                                                                                      |
| (iii) | As per Swedish Chimney test SEN-SS-424-1475-F3 | [ <input checked="" type="checkbox"/> ]YES [ <input type="checkbox"/> ]NO                                                                                                                                                                                                                                                |
| 13.0  | <b>Anti-rodent and Termite repulsion Test</b>  | [ <input checked="" type="checkbox"/> ]YES [ <input type="checkbox"/> ]NO<br><br>The test shall be carried out to note the presence of rodent and termite repelling chemical in PVC compound. Normal procedure is that a few chippings of the PVC compound are slowly ignited in a porcelain                             |



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|      |                                                                         | dish or crucible in a muffle furnace at about 600°C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium sulphide solution is placed on a thick filter paper and it is allowed to soak. The spot is touched with a drop of above extract. A black spot indicates the presence of anti-termite & rodent compound. |
| 14.0 | <b>Anti-Fungal Test</b>                                                 | [ ] YES [ <input checked="" type="checkbox"/> ] NO                                                                                                                                                                                                                                                                                                                       |
| 15.0 | <b>Special Tests</b>                                                    |                                                                                                                                                                                                                                                                                                                                                                          |
| (a)  | <b>Hydrolytic Stability as per ASTM D 3137 :81 (Duration:- 14 days)</b> | [ ] YES [ <input checked="" type="checkbox"/> ] NO                                                                                                                                                                                                                                                                                                                       |
| (b)  | <b>UV Radiation Test as per BS EN ISO 4892-2 (Duration:- 14 days)</b>   | [ ] YES [ <input checked="" type="checkbox"/> ] NO                                                                                                                                                                                                                                                                                                                       |
| 16.0 | <b>TOLERANCE ON OUTER DIAMETER</b>                                      | Up to 30mm; ±1.5mm<br>Above 30mm; ±5% or ± 2mm, whichever is less.                                                                                                                                                                                                                                                                                                       |
| 17.0 | <b>MINIMUM BENDING RADIUS</b>                                           |                                                                                                                                                                                                                                                                                                                                                                          |
| (a)  | Single core cables                                                      | 15 x O.D.                                                                                                                                                                                                                                                                                                                                                                |
| (b)  | Multi core cables                                                       | 12 x O.D.                                                                                                                                                                                                                                                                                                                                                                |
| 18.0 | <b>SAFE PULLING FORCE</b>                                               |                                                                                                                                                                                                                                                                                                                                                                          |
| (a)  | Aluminium conductor cable                                               | 30 N/ sq. mm.                                                                                                                                                                                                                                                                                                                                                            |
| (b)  | Copper conductor cable                                                  | 50 N/ sq. mm.                                                                                                                                                                                                                                                                                                                                                            |
| 19.0 | <b>CABLE DRUMS</b>                                                      |                                                                                                                                                                                                                                                                                                                                                                          |
| (a)  | Type of Drum                                                            | Wooden as per IS 10418                                                                                                                                                                                                                                                                                                                                                   |
| (b)  | Standard drum length                                                    | 500m (±) 5% / 1000m (±) 5%. (as specified in BOQ-Cum-<br>Priced Schedule)                                                                                                                                                                                                                                                                                                |
| (c)  | Painting                                                                | Entire surface to be painted                                                                                                                                                                                                                                                                                                                                             |
| (d)  | Outermost Layer                                                         | To be covered with waterproof polyethylene                                                                                                                                                                                                                                                                                                                               |
| (e)  | Particular information on Drum                                          | a) TSGENCO<br>b) Manufacturer's name or trade make<br>c) Type of cable & voltage grade<br>d) Year of manufacture<br>e) Type of insulation e.g. XLPE<br>f) No. of core and size of cables<br>g) Cable code e.g. FRLSH<br>h) Length of cable on drum<br>i) No. of length on drum, if more than one<br>j) Direction of rotation, by arrow<br>k) Approx. gross mass.         |
| 20.0 | <b>SEA WORTHY PACKING</b>                                               | [ ] YES [ <input checked="" type="checkbox"/> ] NO                                                                                                                                                                                                                                                                                                                       |

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|                                                                                   |                                                                                   |                                        |
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**DATASHEET C**

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

| S.No.          |                                                                                                            | Unit        | Description |
|----------------|------------------------------------------------------------------------------------------------------------|-------------|-------------|
| 1.0            | <b>General</b>                                                                                             | -           |             |
| 1.1            | Name of manufacturer                                                                                       | -           |             |
| 1.2            | Place of Manufacture                                                                                       | -           |             |
| 2.0            | <b>Standards Applicable</b>                                                                                |             |             |
| 2.1            | <b>IS: 7098 Part-I</b><br>For general specification of XLPE Cables                                         | -           | YES         |
| 2.2            | <b>IS: 8130</b><br>For conductor material                                                                  | -           | YES         |
| 2.3            | <b>IS: 5831</b><br>For material of inner sheath & outer sheath.                                            | -           | YES         |
| 2.4            | <b>IS: 3975 / IS: 8130</b><br>For armour of 3 core/ single core cables                                     | -           | YES         |
| 2.5            | <b>IS: 10810</b><br>For method of tests                                                                    | -           | YES         |
| 2.6            | <b>IS:10418</b><br>For cable drums                                                                         | -           | YES         |
| 2.7            | <b>ASTMD-2863</b><br>For oxygen index test                                                                 | -           | YES         |
| 2.8            | <b>ASTMD-2843</b><br>For smoke density test                                                                | -           | YES         |
| 2.9            | <b>SS:424-14-75 &amp; IEC-332-III-Cat-B &amp; CAT-A,<br/>IEC-332-I/ IEEE: 383</b><br>For flammability test | -           | YES         |
| 2.10           | <b>IEC-754-1</b><br>For Acid gas generation                                                                | -           | YES         |
| 2.11           | Current rating of cables conforms to                                                                       | -           |             |
| 2.12           | Short circuit rating conforms to                                                                           | -           |             |
| 2.13           | Formula for calculating short circuit current for<br>Different duration                                    | -           |             |
| 3.0            | (a) Installation Conditions at site                                                                        | deg. C      |             |
|                | i) Ambient air temperature                                                                                 | deg. C      |             |
|                | ii) Ground temperature                                                                                     | cm          |             |
|                | iii) Depth of laying of cables buried in ground                                                            | deg. C cm/W |             |
|                | (b) Installation conditions for current rating specified at clause 6.3                                     |             |             |
| 4.0            | CHARACTERISTICS OF FRLS SHEATH                                                                             |             |             |
|                | (a) Oxygen index                                                                                           |             |             |
| NAME OF VENDOR |                                                                                                            | SEAL        | REV.        |
|                |                                                                                                            |             |             |
| NAME           | SIGNATURE                                                                                                  |             |             |
|                | DATE                                                                                                       |             |             |

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|     | (b) Temperature index                                                |                   |  |
|     | (c) Acid gas generation                                              |                   |  |
|     | (d) Smoke density rating                                             |                   |  |
| 5.0 | CABLE DRUMS                                                          |                   |  |
|     | (a) Type & construction                                              |                   |  |
|     | (b) Standard drum length                                             |                   |  |
|     | (c) Tolerance on drum length                                         |                   |  |
| 6.0 | INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE |                   |  |
| 6.1 | No. of cores x size                                                  |                   |  |
| 6.2 | Voltage grade (Uo/U)                                                 | kV                |  |
| 6.3 | Base current ratings (*) based on Cl. 3.0                            |                   |  |
|     | (a) In air                                                           | Amp               |  |
|     | (b) In ground                                                        | Amp               |  |
|     | (c) ducts                                                            | Amp               |  |
| 6.4 | Short circuit rating                                                 | kA,Sec            |  |
| 6.5 | (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             |  |
| 6.6 | CONDUCTOR                                                            |                   |  |
|     | (a) Material type & grade                                            | -                 |  |
|     | (b) No & dia of wires in each core before stranding                  | no x mm           |  |
|     | (c) Shape                                                            | -                 |  |
| 6.7 | XLPE INSULATION                                                      |                   |  |
|     | (a) Nominal thickness of insulation                                  | mm                |  |
|     | (b) Method of Curing                                                 | -                 |  |
| 6.8 | 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 and shape of fillers (if used)                               |                   |  |

NAME OF VENDOR

NAME

SIGNATURE

DATE

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|      | e) Colour                                                |        |  |
| 6.9  | ARMOUR                                                   |        |  |
|      | (a) Material                                             |        |  |
|      | (i) Single core cables                                   |        |  |
|      | (ii) Multi-core cables                                   |        |  |
|      | (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 Aluminium round wire          |        |  |
| 6.10 | PVC ST2 FRLS OUTERSHEATH                                 |        |  |
|      | (a) Nominal thickness of outer sheath                    | mm     |  |
| 6.11 | 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     |  |
| 6.12 | Tolerance on overall diameter                            | (±) mm |  |
| 6.13 | Minimum bending radius                                   | x O.D  |  |
| 6.14 | Safe Pulling Force                                       | kG     |  |
| 6.15 | Weight of cable                                          | kg./km |  |
|      | (a) Weight of conductor                                  | MT/km  |  |
|      | (b) Weight of XLPE insulation                            | MT/km  |  |
|      | (c) Weight of PVC (Inner Sheath, Outer Sheath & Fillers) | kg./km |  |
|      | (d) Weight of Armour (As applicable)                     | kg./km |  |
| 6.16 | Dimension of drum                                        | mm     |  |
| 6.17 | Shipping weight                                          | kg     |  |
| 6.18 | Cable marking on outer sheath                            |        |  |

(\*) 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 |      |      |  |

385304/2021/PS-PEM-EL



# TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. PE-TS-417-507-E012

VOLUME II

SECTION II

REVISION 1

DATE: 14.07.21

## SECTION-II

## STANDARD TECHNICAL REQUIREMENTS



## TECHNICAL SPECIFICATION FOR LT XLPE Power Cable

SPECIFICATION NO. PE-TS-417-507-E012

VOLUME II

SECTION II

REVISION 01

DATE: 14.07.21

Sheet 1 of 2

### 1.0 CODES AND STANDARDS

- 1.1 The material shall comply with all currently applicable safety codes and statutory regulations of India as well as of the locality where the material is to be installed.
- 1.2 The design, material, construction, manufacture, inspection and testing of LT XLPE POWER Cable shall conform to the latest revision of relevant standards as per Data Sheet-A.
- 1.3 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

### 2.0 TECHNICAL REQUIREMENTS

- 2.1 LT XLPE POWER Cable shall be supplied as per technical particulars specified in Data Sheet – A.

### 3.0 QUALITY ASSURANCE, TESTING & INSPECTION

- 3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E002, Rev-02) as attached with the specification without any deviations. At contract stage (project specific), 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, routine / acceptance testing and special testing requirements shall be as per Annexure –A to QAP. Charges for all these tests for all the equipments & 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 wooden.
- 4.2 For 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. 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



## TECHNICAL SPECIFICATION FOR LT XLPE Power Cable

SPECIFICATION NO. PE-TS-417-507-E012

VOLUME II

SECTION II

REVISION 01

DATE: 14.07.21

Sheet 2 of 2

finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum.

- 4.3 Each drum shall carry manufacturer's name, purchaser'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.

|                                                                                   |                                                          |  |                                  |  |                      |  |                                            |  |                      |  |
|-----------------------------------------------------------------------------------|----------------------------------------------------------|--|----------------------------------|--|----------------------|--|--------------------------------------------|--|----------------------|--|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> |  | <b>STANDARD QUALITY PLAN</b>     |  |                      |  | <b>SPEC. NO :</b>                          |  | <b>DATE:</b>         |  |
|                                                                                   |                                                          |  | <b>CUSTOMER :</b>                |  |                      |  | <b>QP NO.: PE-QP-999-507-E002, REV 02.</b> |  |                      |  |
|                                                                                   |                                                          |  | <b>PROJECT:</b>                  |  |                      |  | <b>PO NO.:</b>                             |  |                      |  |
|                                                                                   |                                                          |  | <b>ITEM: LT XLPE POWER CABLE</b> |  | <b>SYSTEM: CABLE</b> |  | <b>SECTION: II</b>                         |  | <b>SHEET 1 OF 12</b> |  |

| Sl. No. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK |     | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY |    |   | REMARKS |
|---------|-------------------------|-----------------|-------|---------------|------------------|-----|--------------------|------------------|------------------|--------|----|---|---------|
| 1       | 2                       | 3               | 4     | 5             | 6                |     | 7                  | 8                | 9                | *      | ** |   |         |
|         |                         |                 |       |               | M                | C/N |                    |                  |                  | D      | M  | C | N       |

|            |                                     |                         |    |                  |                   |                   |                              |                              |            |   |     |   |   |  |
|------------|-------------------------------------|-------------------------|----|------------------|-------------------|-------------------|------------------------------|------------------------------|------------|---|-----|---|---|--|
| <b>1.0</b> | <b>RAW MATERIALS</b>                |                         |    |                  |                   |                   |                              |                              |            |   |     |   |   |  |
| <b>1.1</b> | <b>Aluminium /Copper Rods</b>       | <b>GENERAL :</b>        |    |                  |                   |                   |                              |                              |            |   |     |   |   |  |
|            | <b>(Conductor/ Armour Wire)</b>     | 1. Physical properties  | MA | Physical Tests   | Sample/ Batch     | Sample / Batch    | IS:8130 (Al), IS:613 (Cu)    | IS:8130 (Al), IS:613 (Cu)    | Test Cert. | ✓ | P/V | V | - |  |
|            |                                     | 2. Elec. Properties     | MA | Electrical Tests | Sample/ Batch     | Sample / Batch    | -do-                         | -do-                         | -do-       | ✓ | P/V | V | - |  |
|            |                                     | <b>SPECIFIC CHECKS:</b> |    |                  |                   |                   |                              |                              |            |   |     |   |   |  |
|            |                                     | a) Make                 | MA | Verify           | 100%              | 100%              | Manufacturer approved source | Manufacturer approved source | Test Cert. | ✓ | P   | V | - |  |
|            |                                     | b) Grade                | MA | -do-             | -do-              | -do-              | IS:8130 (Al), IS:613 (Cu)    | IS:8130 (Al), IS:613 (Cu)    | -do-       | ✓ | P   | V | - |  |
|            |                                     | c) Resistivity          | MA | Electrical Tests | Manufacturer std. | Manufacturer std. | IS:613 (Cu), IS:5082 (Al)    | IS:613 (Cu), IS:5082 (Al)    | -do-       | ✓ | P   | V | - |  |
| <b>1.2</b> | <b>XLPE Compound for insulation</b> | <b>GENERAL :</b>        |    |                  |                   |                   |                              |                              |            |   |     |   |   |  |
|            |                                     | 1. Physical properties  | MA | Physical Tests   | Sample/ Batch     | Sample / Batch    | IS 7098-I                    | IS 7098-I                    | Test Cert. | ✓ | P   | V | - |  |

| BHEL         |                    |                   |              |                    |                      |
|--------------|--------------------|-------------------|--------------|--------------------|----------------------|
| ENGINEERING  |                    |                   | QUALITY      |                    |                      |
|              | Sign & Date        | Name              |              | Sign & Date        | Name                 |
| Prepared by: | <i>[Signature]</i> | VIKAS KUMAR SINGH | Checked by:  | <i>[Signature]</i> | KUNAL GANDHI         |
| Reviewed by: | <i>[Signature]</i> | MANISH SHUKLA     | Reviewed by: | <i>[Signature]</i> | RITESH KUMAR JAISWAL |

| BIDDER/ SUPPLIER |  |
|------------------|--|
| Sign & Date      |  |
| Seal             |  |

| FOR CUSTOMER REVIEW & APPROVAL |             |      |      |
|--------------------------------|-------------|------|------|
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|                                | Sign & Date | Name | Seal |
| Reviewed by:                   |             |      |      |
| Approved by:                   |             |      |      |

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|-----------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------|--|----------------------|--|--------------------------------------------|--|----------------------|--|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> | <b>STANDARD QUALITY PLAN</b>     |  |                      |  | <b>SPEC. NO :</b>                          |  | <b>DATE:</b>         |  |
|                                                                                   |                                                          | <b>CUSTOMER :</b>                |  |                      |  | <b>QP NO.: PE-QP-999-507-E002, REV 02.</b> |  |                      |  |
|                                                                                   |                                                          | <b>PROJECT:</b>                  |  |                      |  | <b>PO NO.:</b>                             |  |                      |  |
|                                                                                   |                                                          | <b>ITEM: LT XLPE POWER CABLE</b> |  | <b>SYSTEM: CABLE</b> |  | <b>SECTION: II</b>                         |  | <b>SHEET 2 OF 12</b> |  |

| Sl. No. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | REMARKS     |
|---------|-------------------------|-----------------|-------|---------------|------------------|--------------------|------------------|------------------|--------|-------------|
| 1       | 2                       | 3               | 4     | 5             | 6                | 7                  | 8                | 9                | *<br>D | **<br>M C N |
|         |                         |                 |       |               | M C/N            |                    |                  |                  |        |             |

|     |                           |                                    |    |                    |               |                |                              |                              |            |   |     |   |   |  |
|-----|---------------------------|------------------------------------|----|--------------------|---------------|----------------|------------------------------|------------------------------|------------|---|-----|---|---|--|
|     |                           | 2. Elec. Properties                | MA | Electrical Tests   | Sample/ Batch | Sample / Batch | -do-                         | -do-                         | -do-       | ✓ | P   | V | - |  |
|     |                           | <b>SPECIFIC CHECKS:</b>            |    |                    |               |                |                              |                              |            |   |     |   |   |  |
|     |                           | a) Make                            | MA | Verify             | 100%          | 100%           | Manufacturer approved source | Manufacturer approved source | Test Cert. | ✓ | P/V | V | - |  |
|     |                           | b) Type/ Grade                     | MA | -do-               | -do-          | -do-           | -do-                         | -do-                         | -do-       | ✓ | P/V | V | - |  |
|     |                           | c) Shelf life/ Storage condition   | MA | -do-               | -do-          | -do-           | -do-                         | -do-                         | -do-       | ✓ | P/V | V | - |  |
| 1.3 | PVC Compound (for sheath) | <b>GENERAL:</b>                    |    |                    |               |                |                              |                              |            |   |     |   |   |  |
|     |                           | 1. Physical properties             | MA | Physical Tests     | Sample/ Batch | Sample / Batch | IS 5831                      | IS 5831                      | Test Cert. | ✓ | P/V | V | - |  |
|     |                           | 2. Elec. Properties                | MA | Electrical Tests   | Sample/ Batch | Sample / Batch | -do-                         | -do-                         | -do-       | ✓ | P/V | V | - |  |
|     |                           | 3. FRLS Properties (as applicable) | CR | Chemical/ Environ. | Sample/ Batch | Sample / Batch | Approved datasheet           | Approved datasheet           | -do-       | ✓ | P/V | V | - |  |
|     |                           | <b>SPECIFIC CHECKS:</b>            |    |                    |               |                |                              |                              |            |   |     |   |   |  |

| BHEL         |                           |                   |              |                           |                      |
|--------------|---------------------------|-------------------|--------------|---------------------------|----------------------|
| ENGINEERING  |                           |                   | QUALITY      |                           |                      |
|              | Sign & Date               | Name              |              | Sign & Date               | Name                 |
| Prepared by: | <i>Vikas</i><br>18/03/20  | VIKAS KUMAR SINGH | Checked by:  | <i>Kunal</i><br>19/03/20  | KUNAL GANDHI         |
| Reviewed by: | <i>Manish</i><br>18/03/20 | MANISH SHUKLA     | Reviewed by: | <i>Ritesh</i><br>19/03/20 | RITESH KUMAR JAISWAL |

| BIDDER/ SUPPLIER |  |
|------------------|--|
| Sign & Date      |  |
| Seal             |  |

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| Approved by:                   |             |      |      |

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|-----------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------|----------------------|--------------------------------------------|----------------------|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> | <b>STANDARD QUALITY PLAN</b>     |                      | <b>SPEC. NO :</b>                          | <b>DATE:</b>         |
|                                                                                   |                                                          | <b>CUSTOMER :</b>                |                      | <b>QP NO.: PE-QP-999-507-E002, REV 02.</b> |                      |
|                                                                                   |                                                          | <b>PROJECT:</b>                  |                      | <b>PO NO.:</b>                             |                      |
|                                                                                   |                                                          | <b>ITEM: LT XLPE POWER CABLE</b> | <b>SYSTEM: CABLE</b> | <b>SECTION: II</b>                         | <b>SHEET 3 OF 12</b> |

| Sl. No. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | REMARKS     |
|---------|-------------------------|-----------------|-------|---------------|------------------|--------------------|------------------|------------------|--------|-------------|
| 1       | 2                       | 3               | 4     | 5             | 6                | 7                  | 8                | 9                | *<br>D | **<br>M C N |
|         |                         |                 |       |               | M C/N            |                    |                  |                  |        |             |

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|-----|-------------------------|----------------------------------|----|--------|------|------|------------------------------|------------------------------|------------|---|---|---|---|----------------------------------------------------------------------------------------------------------------------------------------|
|     |                         | a) Make                          | MA | Verify | 100% | 100% | Manufacturer approved source | Manufacturer approved source | Test Cert. | ✓ | P | V | - |                                                                                                                                        |
|     |                         | b) Type/ Grade                   | MA | -do-   | -do- | -do- | Approved datasheet           | Approved datasheet           | -do-       | ✓ | P | V | - |                                                                                                                                        |
|     |                         | c) Shelf life/ Storage condition | MA | -do-   | -do- | -do- | Compound Manufacturer std.   | Compound Manufacturer std.   | -do-       | ✓ | P | V | - |                                                                                                                                        |
|     |                         |                                  |    |        |      |      |                              |                              |            |   |   |   |   |                                                                                                                                        |
| 1.4 | Fillers (as applicable) | 1. Make                          | MA | Verify | 100% | 100% | Manufacturer approved source | Manufacturer approved source | Test Cert. | ✓ | P | V | - | Fillers material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other |

| BHEL         |                            |                   |              |                            |                      |
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| ENGINEERING  |                            |                   | QUALITY      |                            |                      |
| Prepared by: | Sign & Date                | Name              | Checked by:  | Sign & Date                | Name                 |
|              | <i>Vikas</i><br>18/03/2020 | VIKAS KUMAR SINGH |              | <i>Kunal</i><br>19/3/20    | KUNAL GANDHI         |
| Reviewed by: | Sign & Date                | Name              | Reviewed by: | Sign & Date                | Name                 |
|              | <i>Manish</i><br>18/03/20  | MANISH SHUKLA     |              | <i>Ritesh</i><br>19/3/2020 | RITESH KUMAR JAISWAL |

| BIDDER/ SUPPLIER |  |
|------------------|--|
| Sign & Date      |  |
| Seal             |  |

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|                                | Sign & Date | Name | Seal |
| Reviewed by:                   |             |      |      |
| Approved by:                   |             |      |      |

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|-----------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------|--|----------------------|--|--------------------------------------------|--|----------------------|--|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> | <b>STANDARD QUALITY PLAN</b>     |  |                      |  | <b>SPEC. NO :</b>                          |  | <b>DATE:</b>         |  |
|                                                                                   |                                                          | <b>CUSTOMER :</b>                |  |                      |  | <b>QP NO.:</b> PE-QP-999-507-E002, REV 02. |  |                      |  |
|                                                                                   |                                                          | <b>PROJECT:</b>                  |  |                      |  | <b>PO NO.:</b>                             |  |                      |  |
|                                                                                   |                                                          | <b>ITEM:</b> LT XLPE POWER CABLE |  | <b>SYSTEM:</b> CABLE |  | <b>SECTION: II</b>                         |  | <b>SHEET 4 OF 12</b> |  |

| Sl. No. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | REMARKS     |
|---------|-------------------------|-----------------|-------|---------------|------------------|--------------------|------------------|------------------|--------|-------------|
| 1       | 2                       | 3               | 4     | 5             | 6                | 7                  | 8                | 9                | *<br>D | **<br>M C N |
|         |                         |                 |       |               | M C/N            |                    |                  |                  |        |             |

|     |                                                        |                                 |    |                             |                   |                   |                              |                              |            |   |     |   |   |                     |
|-----|--------------------------------------------------------|---------------------------------|----|-----------------------------|-------------------|-------------------|------------------------------|------------------------------|------------|---|-----|---|---|---------------------|
|     |                                                        |                                 |    |                             |                   |                   |                              |                              |            |   |     |   |   | component of cable) |
|     |                                                        | 2. Type/ Grade                  | MA | -do-                        | -do-              | -do-              | Appd. Data Sheet             | Appd. Data Sheet             | -do-       | ✓ | P/V | V | - |                     |
| 1.5 | Galvanised steel wire/strip for Armour (as applicable) | <b>GENERAL:</b>                 |    |                             |                   |                   |                              |                              |            |   |     |   |   |                     |
|     |                                                        | 1. Make                         | MA | Verify                      | Manufacturer std. | Manufacturer std. | Manufacturer approved source | Manufacturer approved source | Test Cert. | ✓ | P   | V | - |                     |
|     |                                                        | 2. Dimension                    | MA | Measurement                 | -do-              | -do-              | Appd. Data Sheet             | Appd. Data Sheet             | -do-       |   | P/V | - | - |                     |
|     |                                                        | 3. Phy. and Elec. Properties    | MA | Physical & Electrical Tests | Sample*           | Sample*           | -do-                         | -do-                         | -do-       | ✓ | P/V | V | - |                     |
|     |                                                        | 4. Galvanization Quality        | MA | Galv. Tests                 | -do-              | -do-              | IS 3975                      | IS 3975                      | -do-       |   | P/V | - | - |                     |
| 1.6 | Wooden Drum                                            | 1. Phy. & Constructional checks | MA |                             | Mfr's Plant Std.  | Mfr's Plant Std.  | IS 10418                     | IS 10418                     | Test Cert. | ✓ | P   | V | - |                     |

| BHEL         |               |                   |              |               |                      |
|--------------|---------------|-------------------|--------------|---------------|----------------------|
| ENGINEERING  |               |                   | QUALITY      |               |                      |
| Prepared by: | Sign & Date   | Name              | Checked by:  | Sign & Date   | Name                 |
|              | <i>Vikas</i>  | VIKAS KUMAR SINGH |              | <i>Kunal</i>  | KUNAL GANDHI         |
| Reviewed by: | Sign & Date   | Name              | Reviewed by: | Sign & Date   | Name                 |
|              | <i>Manish</i> | MANISH SHUKLA     |              | <i>Ritesh</i> | RITESH KUMAR JAISWAL |

| BIDDER/ SUPPLIER |  |
|------------------|--|
| Sign & Date      |  |
| Seal             |  |

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| Reviewed by:                   | Sign & Date | Name | Seal |
| Approved by:                   |             |      |      |

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|-----------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------|----------------------|--------------------------------------------|----------------------|--------------|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> | <b>STANDARD QUALITY PLAN</b>     |                      | <b>SPEC. NO :</b>                          |                      | <b>DATE:</b> |
|                                                                                   |                                                          | <b>CUSTOMER :</b>                |                      | <b>QP NO.:</b> PE-QP-999-507-E002, REV 02. |                      |              |
|                                                                                   |                                                          | <b>PROJECT:</b>                  |                      | <b>PO NO.:</b>                             |                      |              |
|                                                                                   |                                                          | <b>ITEM:</b> LT XLPE POWER CABLE | <b>SYSTEM:</b> CABLE | <b>SECTION:</b> II                         | <b>SHEET 5 OF 12</b> |              |

| 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                | *<br>D | **<br>M C N |
|         |                         |                |        |               | M C/N            |                    |                   |                  |        |             |

|     |              |                           |    |              |                  |                  |                         |                         |                                  |   |   |   |   |                             |
|-----|--------------|---------------------------|----|--------------|------------------|------------------|-------------------------|-------------------------|----------------------------------|---|---|---|---|-----------------------------|
|     |              | 2. Anti termite treatment | MA | Chem.        | Mfr's Plant Std. | Mfr's Plant Std. | Mfr's Plant Std.        | Mfr's Plant Std.        | -do-                             | ✓ | P | V | - |                             |
| 1.7 | Steel Drum # | 1. Dimension              | MA | Meas.        | Mfr's Plant Std. | Mfr's Plant Std. | Approved drg            | Approved drg            | Test Cert.                       | ✓ | P | V | - | # If required, as per spec. |
|     |              | 2. Surface finish         | MA | Visual       | -do-             | -do-             | -                       | Surface shall be smooth | -do-                             | ✓ | P | V | - |                             |
| 2.0 | IN PROCESS   |                           |    |              |                  |                  |                         |                         |                                  |   |   |   |   |                             |
| 2.1 | Wire Drawing | 1. Size                   | MA | Dimension al | Plant Mfg. Std.  | Plant Mfg. Std.  | Approved datasheet      | Approved datasheet      | Inspe ction Repor t/ Test report | ✓ | P | V | - |                             |
|     |              | 2. Surface finish         | MA | Visual       | -do-             | -do-             | Surface shall be smooth | Surface shall be smooth | -do-                             | ✓ | P | V | - |                             |

| BHEL         |                           |                   |              |                          |                      |
|--------------|---------------------------|-------------------|--------------|--------------------------|----------------------|
| ENGINEERING  |                           |                   | QUALITY      |                          |                      |
| Prepared by: | Sign & Date               | Name              | Checked by:  | Sign & Date              | Name                 |
|              | <i>Manish</i><br>18/03/20 | VIKAS KUMAR SINGH |              | <i>Kunal</i><br>19/3/20  | KUNAL GANDHI         |
| Reviewed by: | Sign & Date               | Name              | Reviewed by: | Sign & Date              | Name                 |
|              | <i>Manish</i><br>18/03/20 | MANISH SHUKLA     |              | <i>Ritesh</i><br>19/3/20 | RITESH KUMAR JAISWAL |

| BIDDER/ SUPPLIER |  |
|------------------|--|
| Sign & Date      |  |
| Seal             |  |

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| Approved by:                   |             |      |      |

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|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> |  | <b>STANDARD QUALITY PLAN</b>     |  |                      |  | <b>SPEC. NO :</b>                          |  | <b>DATE:</b>         |  |
|                                                                                  |                                                          |  | <b>CUSTOMER :</b>                |  |                      |  | <b>QP NO.:</b> PE-QP-999-507-E002, REV 02. |  |                      |  |
|                                                                                  |                                                          |  | <b>PROJECT:</b>                  |  |                      |  | <b>PO NO.:</b>                             |  |                      |  |
|                                                                                  |                                                          |  | <b>ITEM:</b> LT XLPE POWER CABLE |  | <b>SYSTEM:</b> CABLE |  | <b>SECTION: II</b>                         |  | <b>SHEET 6 OF 12</b> |  |

| 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                | *<br>D | **<br>M C N |
|         |                         |                |        |               | M C/N            |                    |                   |                  |        |             |

|     |                                              |                                     |    |               |                              |                 |                         |                         |                                  |      |   |   |   |  |
|-----|----------------------------------------------|-------------------------------------|----|---------------|------------------------------|-----------------|-------------------------|-------------------------|----------------------------------|------|---|---|---|--|
|     |                                              | 3. % of Elongation                  | MA | Mechanical    | -do-                         | -do-            | IS 8130                 | IS 8130                 | -do-                             | ✓    | P | V | - |  |
| 2.2 | Stranding of wires                           | 1. No. of wires                     | MA | Counting      | Plant Mfg. Std.              | Plant Mfg. Std. | Appd. Datasheet         | Appd. Datasheet         | Inspe ction Repor t/ Test report | ✓    | P | V | - |  |
|     |                                              | 2. Resistance                       | CR | Electrical    | -do-                         | -               | -do-                    | -do-                    | -do-                             | -do- | P | - | - |  |
|     |                                              | 3. Sequence, lay length & Direction | MA | Visual, Meas. | One Sample of each size/ lot | -               | Mfrs Std.               | Mfrs Std.               | -do-                             |      | P | - | - |  |
|     |                                              | 4. Surface Finish                   | MA | Visual        | 100%                         | -               | Surface shall be smooth | Surface shall be smooth | -do-                             |      | P | - | - |  |
|     |                                              | 5. Dimension                        | MA | Measurem ent  | One Sample of each size/ lot | -               | Appd. Datasheet         | Appd. Datasheet         | -do-                             |      | P | - | - |  |
| 2.3 | Core Insulation (XLPE) (No repair permitted) |                                     |    |               |                              |                 |                         |                         |                                  |      |   |   |   |  |

|                    |                           |                   |                |                                 |                      |                         |  |                                           |             |      |      |
|--------------------|---------------------------|-------------------|----------------|---------------------------------|----------------------|-------------------------|--|-------------------------------------------|-------------|------|------|
| <b>BHEL</b>        |                           |                   |                |                                 |                      | <b>BIDDER/ SUPPLIER</b> |  | <b>FOR CUSTOMER REVIEW &amp; APPROVAL</b> |             |      |      |
| <b>ENGINEERING</b> |                           |                   | <b>QUALITY</b> |                                 |                      | Sign & Date             |  | Doc No:                                   |             |      |      |
| Prepared by:       | Sign & Date               | Name              | Checked by:    | Sign & Date                     | Name                 | Seal                    |  | Reviewed by:                              | Sign & Date | Name | Seal |
|                    | <i>Manish</i><br>18/03/20 | VIKAS KUMAR SINGH |                | <i>Kunal Gandhi</i><br>18/03/20 | KUNAL GANDHI         |                         |  | Approved by:                              |             |      |      |
| Reviewed by:       | <i>Manish</i><br>18/03/20 | MANISH SHUKLA     | Reviewed by:   | <i>Ritesh Kumar</i><br>18/03/20 | RITESH KUMAR JAISWAL |                         |  |                                           |             |      |      |

|                                                                                   |                                                          |  |                                  |  |                      |  |                                            |  |                      |  |
|-----------------------------------------------------------------------------------|----------------------------------------------------------|--|----------------------------------|--|----------------------|--|--------------------------------------------|--|----------------------|--|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> |  | <b>STANDARD QUALITY PLAN</b>     |  |                      |  | <b>SPEC. NO :</b>                          |  | <b>DATE:</b>         |  |
|                                                                                   |                                                          |  | <b>CUSTOMER :</b>                |  |                      |  | <b>QP NO.: PE-QP-999-507-E002, REV 02.</b> |  |                      |  |
|                                                                                   |                                                          |  | <b>PROJECT:</b>                  |  |                      |  | <b>PO NO.:</b>                             |  |                      |  |
|                                                                                   |                                                          |  | <b>ITEM: LT XLPE POWER CABLE</b> |  | <b>SYSTEM: CABLE</b> |  | <b>SECTION: II</b>                         |  | <b>SHEET 7 OF 12</b> |  |

| Sl. No. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK |     | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD |   | AGENCY |   |   | REMARKS |
|---------|-------------------------|-----------------|-------|---------------|------------------|-----|--------------------|------------------|------------------|---|--------|---|---|---------|
| 1       | 2                       | 3               | 4     | 5             | 6                |     | 7                  | 8                | 9                | * | **     |   |   |         |
|         |                         |                 |       |               | M                | C/N |                    |                  |                  | D | M      | C | N |         |

|     |             |                                       |    |             |                              |                              |                                                             |                                                             |                                |            |   |   |   |  |
|-----|-------------|---------------------------------------|----|-------------|------------------------------|------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|--------------------------------|------------|---|---|---|--|
|     |             | 1. Surface finish                     | MA | Visual      | 100%                         | 100%                         | Free from bulging, burnt particles, lumps, cuts & scratches | Free from bulging, burnt particles, lumps, cuts & scratches | Inspection Report/ Test report | ✓          | P | V | - |  |
|     |             | 2. Eccentricity & Ovality #           | CR | Measurement | One Sample of each size/ lot | One Sample of each size/ lot | Mnfr's Std                                                  | Mnfr's Std                                                  | -do-                           | ✓          | P | V | - |  |
|     |             | 3. Insulation Thickness               | CR | Measurement | -do-                         | -                            | Appd. Datasheet                                             | Appd. Datasheet                                             | -do-                           |            | P | - | - |  |
|     |             | 4. Dia over insulation                | MA | Measurement | -do-                         | -                            | -do-                                                        | -do-                                                        | -do-                           |            | P | - | - |  |
|     |             | 5. Tensile Strength & % Elongation    | MA | Mechanical  | 100%                         | -                            | IS:1554-I, IS:5831                                          | IS:1554-I, IS:5831                                          | -do-                           |            | P | - | - |  |
|     |             | 6. Spark Test or Water immersion test | CR | Electrical  | 100%                         | -                            | Mnfr's Std                                                  | Mnfr's Std                                                  | -do-                           | Mnfr's Std | P | - | - |  |
| 2.4 | Core Laying | 1. Dia over laid up core              | MA | Measurement | One Sample of each size/ lot | -                            | Appd. Datasheet                                             | Appd. Datasheet                                             | Inspection Report/ Test report |            | P | - | - |  |

|                    |                 |                   |                |                |                      |                         |  |                                           |             |      |      |
|--------------------|-----------------|-------------------|----------------|----------------|----------------------|-------------------------|--|-------------------------------------------|-------------|------|------|
| <b>BHEL</b>        |                 |                   |                |                |                      | <b>BIDDER/ SUPPLIER</b> |  | <b>FOR CUSTOMER REVIEW &amp; APPROVAL</b> |             |      |      |
| <b>ENGINEERING</b> |                 |                   | <b>QUALITY</b> |                |                      | Sign & Date             |  | Doc No:                                   |             |      |      |
| Prepared by:       | Sign & Date     | Name              | Checked by:    | Sign & Date    | Name                 | Seal                    |  |                                           | Sign & Date | Name | Seal |
|                    | <i>Manish</i>   | VIKAS KUMAR SINGH |                | <i>Kunal</i>   | KUNAL GANDHI         |                         |  |                                           |             |      |      |
| Reviewed by:       | <i>Manish</i>   | MANISH SHUKLA     | Reviewed by:   | <i>Ritesh</i>  | RITESH KUMAR JAISWAL |                         |  | Reviewed by:                              |             |      |      |
|                    | <i>18/03/20</i> |                   |                | <i>19/3/20</i> |                      |                         |  | Approved by:                              |             |      |      |
|                    | <i>18/03/20</i> |                   |                | <i>19/3/20</i> |                      |                         |  |                                           |             |      |      |

|                                                                                   |                                                          |                              |                    |                                            |              |
|-----------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------|--------------------|--------------------------------------------|--------------|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> | <b>STANDARD QUALITY PLAN</b> |                    | <b>SPEC. NO :</b>                          | <b>DATE:</b> |
|                                                                                   |                                                          | <b>CUSTOMER :</b>            |                    | <b>QP NO.:</b> PE-QP-999-507-E002, REV 02. |              |
|                                                                                   |                                                          | <b>PROJECT:</b>              |                    | <b>PO NO.:</b>                             |              |
| <b>ITEM:</b> LT XLPE POWER CABLE                                                  |                                                          | <b>SYSTEM:</b> CABLE         | <b>SECTION:</b> II | <b>SHEET 8 OF 12</b>                       |              |

| Sl. No. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | REMARKS     |
|---------|-------------------------|-----------------|-------|---------------|------------------|--------------------|------------------|------------------|--------|-------------|
| 1       | 2                       | 3               | 4     | 5             | 6                | 7                  | 8                | 9                | *<br>D | **<br>M C N |
|         |                         |                 |       |               | M C/N            |                    |                  |                  |        |             |

|     |                                        |                                |    |                |                              |   |                         |                         |                                |  |   |   |   |  |
|-----|----------------------------------------|--------------------------------|----|----------------|------------------------------|---|-------------------------|-------------------------|--------------------------------|--|---|---|---|--|
|     |                                        | 2. Sequence of lay & direction | MA | Visual & Meas. | -do-                         | - | IS 7098-I & Mfr. Std.   | IS 7098-I & Mfr. Std.   | -do-                           |  | P | - | - |  |
|     |                                        |                                |    |                |                              | - |                         |                         |                                |  |   |   |   |  |
| 2.5 | Inner Sheath Extrusion (as applicable) | 1. Surface finish              | MA | Visual         | 100%                         | - | Surface shall be smooth | Surface shall be smooth | Inspection Report/ Test report |  | P | - | - |  |
|     |                                        | 2. Thickness                   | CR | Measurement    | One Sample of each size/ lot | - | Appd. Datasheet         | Appd. Datasheet         | -do-                           |  | P | - | - |  |
|     |                                        | 3. Dia over inner sheath       | MA | -do-           | -do-                         | - | -do-                    | -do-                    | -do-                           |  | P | - | - |  |
|     |                                        |                                |    |                |                              |   |                         |                         |                                |  |   |   |   |  |
| 2.6 | Armour (as applicable)                 | 1. No. of wires/Strips         | MA | Counting       | At the start of the process  | - | Mnfr's Std              | Mnfr's Std              | Inspection Report/ Test report |  | P | - | - |  |
|     |                                        | 2. Lay length / Direction      | MA | Visual & Meas. | -do-                         | - | Mfr. Std.               | Mfr. Std.               | -do-                           |  | P | - | - |  |
|     |                                        | 3. Dia over armouring          | MA | Measurement    | -do-                         | - | Appd. Datasheet         | Appd. Datasheet         | -do-                           |  | P | - | - |  |

|                    |             |                |              |                         |      |                                           |             |      |      |
|--------------------|-------------|----------------|--------------|-------------------------|------|-------------------------------------------|-------------|------|------|
| <b>BHEL</b>        |             |                |              | <b>BIDDER/ SUPPLIER</b> |      | <b>FOR CUSTOMER REVIEW &amp; APPROVAL</b> |             |      |      |
| <b>ENGINEERING</b> |             | <b>QUALITY</b> |              | Sign & Date             |      | Doc No:                                   |             |      |      |
| Prepared by:       | Sign & Date | Name           | Checked by:  | Sign & Date             | Name | Reviewed by:                              | Sign & Date | Name | Seal |
| Reviewed by:       |             |                | Reviewed by: |                         |      | Approved by:                              |             |      |      |

18/03/20

19/3/2020

|                                                                                   |                                                          |                              |                    |                                            |                      |
|-----------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------|--------------------|--------------------------------------------|----------------------|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> | <b>STANDARD QUALITY PLAN</b> |                    | <b>SPEC. NO :</b>                          | <b>DATE:</b>         |
|                                                                                   |                                                          | <b>CUSTOMER :</b>            |                    | <b>QP NO.: PE-QP-999-507-E002, REV 02.</b> |                      |
|                                                                                   |                                                          | <b>PROJECT:</b>              |                    | <b>PO NO.:</b>                             |                      |
| <b>ITEM: LT XLPE POWER CABLE</b>                                                  |                                                          | <b>SYSTEM: CABLE</b>         | <b>SECTION: II</b> |                                            | <b>SHEET 9 OF 12</b> |

| Sl. No. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | REMARKS     |
|---------|-------------------------|-----------------|-------|---------------|------------------|--------------------|------------------|------------------|--------|-------------|
| 1       | 2                       | 3               | 4     | 5             | 6                | 7                  | 8                | 9                | *<br>D | **<br>M C N |

|     |                                              |                                  |    |                                |                              |      |                         |                         |                                |   |   |   |   |                           |
|-----|----------------------------------------------|----------------------------------|----|--------------------------------|------------------------------|------|-------------------------|-------------------------|--------------------------------|---|---|---|---|---------------------------|
|     |                                              | 4. Coverage                      | MA | Measurement                    | -do-                         | -    | -do-                    | -do-                    | -do-                           |   | P | - | - |                           |
| 2.7 | Outer Sheath Extrusion (No repair permitted) | 1. Surface finish                | MA | Visual                         | 100%                         | -    | Surface shall be smooth | Surface shall be smooth | Inspection Report/ Test report |   | P | - | - |                           |
|     |                                              | 2. Sheath Thickness              | CR | Measurement                    | One Sample of each size/ lot | -    | Appd. Datasheet         | Appd. Datasheet         | -do-                           |   | P | - | - |                           |
|     |                                              | 3. Dia over outer sheath         | MA | -do-                           | -do-                         | -    | -do-                    | -do-                    | -do-                           |   | P | - | - |                           |
|     |                                              | 4. Embossing/ Sequential Marking | MA | Visual                         | 100%                         | -    | Approved data sheet     | Approved data sheet     | -do-                           |   | P | - | - |                           |
| 3.0 | Final Inspection (INTERNAL)                  | 1. Routine Test (Refer Note-H)   | CR | Electrical Tests & Measurement | 100%                         | 100% | #                       | #                       | -do-                           | ✓ | P | V | V | #: Refer Annexure-A to QP |

| BHEL         |                             |                   |              |                             |                      |
|--------------|-----------------------------|-------------------|--------------|-----------------------------|----------------------|
| ENGINEERING  |                             |                   | QUALITY      |                             |                      |
|              | Sign & Date                 | Name              |              | Sign & Date                 | Name                 |
| Prepared by: | <i>Vikas</i><br>18/03/2020  | VIKAS KUMAR SINGH | Checked by:  | <i>Kunal</i><br>18/03/2020  | KUNAL GANDHI         |
| Reviewed by: | <i>Manish</i><br>18/03/2020 | MANISH SHUKLA     | Reviewed by: | <i>Ritesh</i><br>18/03/2020 | RITESH KUMAR JAISWAL |

| BIDDER/ SUPPLIER |  |
|------------------|--|
| Sign & Date      |  |
| Seal             |  |

| FOR CUSTOMER REVIEW & APPROVAL |             |      |      |
|--------------------------------|-------------|------|------|
| Doc No:                        |             |      |      |
|                                | Sign & Date | Name | Seal |
| Reviewed by:                   |             |      |      |
| Approved by:                   |             |      |      |

|                                                                                   |                                                          |  |                                  |  |                      |  |                                            |  |                       |  |
|-----------------------------------------------------------------------------------|----------------------------------------------------------|--|----------------------------------|--|----------------------|--|--------------------------------------------|--|-----------------------|--|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> |  | <b>STANDARD QUALITY PLAN</b>     |  |                      |  | <b>SPEC. NO :</b>                          |  | <b>DATE:</b>          |  |
|                                                                                   |                                                          |  | <b>CUSTOMER :</b>                |  |                      |  | <b>QP NO.:</b> PE-QP-999-507-E002, REV 02. |  |                       |  |
|                                                                                   |                                                          |  | <b>PROJECT:</b>                  |  |                      |  | <b>PO NO.:</b>                             |  |                       |  |
|                                                                                   |                                                          |  | <b>ITEM:</b> LT XLPE POWER CABLE |  | <b>SYSTEM:</b> CABLE |  | <b>SECTION: II</b>                         |  | <b>SHEET 10 OF 12</b> |  |

| SI. No. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | REMARKS     |
|---------|-------------------------|-----------------|-------|---------------|------------------|--------------------|------------------|------------------|--------|-------------|
| 1       | 2                       | 3               | 4     | 5             | 6                | 7                  | 8                | 9                | *<br>D | **<br>M C N |
|         |                         |                 |       |               | M C/N            |                    |                  |                  |        |             |

|     |                             |                                               |    |                                |                      |                      |                 |                                                                       |                                |   |   |   |   |  |
|-----|-----------------------------|-----------------------------------------------|----|--------------------------------|----------------------|----------------------|-----------------|-----------------------------------------------------------------------|--------------------------------|---|---|---|---|--|
| 4.0 | Final Inspection (EXTERNAL) | 1. Finish & Length (Cable & cable drum)       | MA | Visual                         | One drum in each Lot | One drum in each Lot | Appd. Datasheet | Free from Porosity, Bulging, Burnt particles, lumps, cuts & scratches | Inspection Report/ Test report | ✓ | P | W | W |  |
|     |                             | 2. Dimension                                  | MA | -do-                           | IS 7098-I            | IS 7098-I            | Appd. Datasheet | Appd. Datasheet                                                       | -do-                           | ✓ | P | W | W |  |
|     |                             | 3. Armouring - Coverage & No. of Wires/Strips | MA | Visual & Meas.                 | -do-                 | -do-                 | -do-            | -do-                                                                  | -do-                           | ✓ | P | W | W |  |
|     |                             | 4. Marking & Colour Coding                    | MA | Visual                         | -do-                 | -do-                 | -do-            | -do-                                                                  | -do-                           | ✓ | P | W | W |  |
|     |                             | 5. Acceptance Tests (Refer Note-H)            | CR | Phy, Elect. Tests & FRLS Tests | Sample #             | Sample #             | #               | -do-                                                                  | -do-                           | ✓ | P | W | W |  |
|     |                             | 6. Type Tests (Refer Note-H)                  | CR | Physical & Electrical Tests    | Sample #             | Sample #             | -do-            | -do-                                                                  | -do-                           | ✓ | P | W | W |  |

| BHEL         |                                  |                   |              |                                  |                      |
|--------------|----------------------------------|-------------------|--------------|----------------------------------|----------------------|
| ENGINEERING  |                                  |                   | QUALITY      |                                  |                      |
|              | Sign & Date                      | Name              |              | Sign & Date                      | Name                 |
| Prepared by: | <i>[Signature]</i><br>18-03-2020 | VIKAS KUMAR SINGH | Checked by:  | <i>[Signature]</i><br>18/03/2020 | KUNAL GANDHI         |
| Reviewed by: | <i>[Signature]</i><br>18/03/2020 | MANISH SHUKLA     | Reviewed by: | <i>[Signature]</i><br>19/03/2020 | RITESH KUMAR JAISWAL |

| BIDDER/ SUPPLIER |  |
|------------------|--|
| Sign & Date      |  |
| Seal             |  |

| FOR CUSTOMER REVIEW & APPROVAL |             |      |      |
|--------------------------------|-------------|------|------|
| Doc No:                        |             |      |      |
|                                | Sign & Date | Name | Seal |
| Reviewed by:                   |             |      |      |
| Approved by:                   |             |      |      |

|                                                                                   |                                                          |  |                                  |  |                      |  |                                            |  |                       |  |
|-----------------------------------------------------------------------------------|----------------------------------------------------------|--|----------------------------------|--|----------------------|--|--------------------------------------------|--|-----------------------|--|
|  | <b>MANUFACTURER/ BIDDER/ SUPPLIER NAME &amp; ADDRESS</b> |  | <b>STANDARD QUALITY PLAN</b>     |  |                      |  | <b>SPEC. NO :</b>                          |  | <b>DATE:</b>          |  |
|                                                                                   |                                                          |  | <b>CUSTOMER :</b>                |  |                      |  | <b>QP NO.: PE-QP-999-507-E002, REV 02.</b> |  |                       |  |
|                                                                                   |                                                          |  | <b>PROJECT:</b>                  |  |                      |  | <b>PO NO.:</b>                             |  |                       |  |
|                                                                                   |                                                          |  | <b>ITEM: LT XLPE POWER CABLE</b> |  | <b>SYSTEM: CABLE</b> |  | <b>SECTION: II</b>                         |  | <b>SHEET 11 OF 12</b> |  |

| Sl. No. | COMPONENTS & OPERATIONS | CHARACTERISTICS | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | AGENCY | REMARKS |
|---------|-------------------------|-----------------|-------|---------------|------------------|--------------------|------------------|------------------|--------|---------|
| 1       | 2                       | 3               | 4     | 5             | 6                | 7                  | 8                | 9                | *      | **      |
|         |                         |                 |       |               | M C/N            |                    |                  |                  | D      | M C N   |

|     |         |                                  |    |        |      |      |                 |                 |      |   |   |   |  |
|-----|---------|----------------------------------|----|--------|------|------|-----------------|-----------------|------|---|---|---|--|
| 5.0 | Packing | End sealing / Polythene wrapping | MA | Visual | 100% | 100% | Appd. Datasheet | Appd. Datasheet | -do- | ✓ | P | W |  |
|-----|---------|----------------------------------|----|--------|------|------|-----------------|-----------------|------|---|---|---|--|

**NOTES:**

- Joins 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 routine tests, acceptance tests & 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.
- Project specific QP to be prepared in line with this standard QP.
- In case of export jobs, sea worthy packing as per BHEL technical specification shall be carried out.

**LEGENDS:**

| BHEL         |             |         |              | BIDDER/ SUPPLIER |      | FOR CUSTOMER REVIEW & APPROVAL |             |      |      |
|--------------|-------------|---------|--------------|------------------|------|--------------------------------|-------------|------|------|
| ENGINEERING  |             | QUALITY |              | Sign & Date      |      | Doc No:                        |             |      |      |
| Prepared by: | Sign & Date | Name    | Checked by:  | Sign & Date      | Name |                                | Sign & Date | Name | Seal |
| Reviewed by: |             |         | Reviewed by: |                  |      | Reviewed by:                   |             |      |      |
|              |             |         |              |                  |      | Approved by:                   |             |      |      |

|                                                                                   |                                                  |                 |                           |                  |                     |                       |                                     |                     |                   |         |
|-----------------------------------------------------------------------------------|--------------------------------------------------|-----------------|---------------------------|------------------|---------------------|-----------------------|-------------------------------------|---------------------|-------------------|---------|
|  | MANUFACTURER/ BIDDER/<br>SUPPLIER NAME & ADDRESS |                 | STANDARD QUALITY PLAN     |                  |                     |                       | SPEC. NO :                          |                     | DATE:             |         |
|                                                                                   |                                                  |                 | CUSTOMER :                |                  |                     |                       | QP NO.: PE-QP-999-507-E002, REV 02. |                     |                   |         |
|                                                                                   |                                                  |                 | PROJECT:                  |                  |                     |                       | PO NO.:                             |                     |                   |         |
|                                                                                   |                                                  |                 | ITEM: LT XLPE POWER CABLE |                  | SYSTEM: CABLE       |                       | SECTION: II                         |                     | SHEET 12<br>OF 12 |         |
| Sl. No.                                                                           | COMPONENTS<br>& OPERATIONS                       | CHARACTERISTICS | CLASS                     | TYPE OF<br>CHECK | QUANTUM OF<br>CHECK | REFERENCE<br>DOCUMENT | ACCEPTANCE<br>NORMS                 | FORMAT OF<br>RECORD | AGENCY            | REMARKS |
| 1                                                                                 | 2                                                | 3               | 4                         | 5                | 6                   | 7                     | 8                                   | 9                   | *                 | **      |
|                                                                                   |                                                  |                 |                           |                  | M C/N               |                       |                                     |                     | D                 | M C N   |

\*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: | <i>Manish</i><br>18.03.2020 | VIKAS KUMAR SINGH | Checked by:  | <i>Kunal</i><br>19/3/20  | KUNAL GANDHI         |                  |  |                                |             |      |      |
| Reviewed by: | <i>Manish</i><br>18/03/20   | MANISH SHUKLA     | Reviewed by: | <i>Ritesh</i><br>19/3/20 | RITESH KUMAR JAISWAL |                  |  |                                |             |      |      |

|                                                                                   |                  |                |                                               |                       |
|-----------------------------------------------------------------------------------|------------------|----------------|-----------------------------------------------|-----------------------|
|  | ANNEXURE-A TO QP | CUSTOMER:      | PROJECT TITLE                                 | SPECIFICATION NUMBER: |
|                                                                                   |                  | BIDDER/VENDOR: | QUALITY PLAN NUMBER : PE-QP-999-507-E002, R02 | SPECIFICATION TITLE:  |
|                                                                                   | SHEET 1 OF 3     | SYSTEM: CABLE  | ITEM: LT XLPE POWER CABLE                     | 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 on each type and size of cable, inclusive of measurement of armour DC resistance of power cables on one drum out of every 10 drums of cable.
  - FRLS & Flammability Test to be conducted only on one sample/ lot.

## 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 to be carried out on 1 drum out of every 10 drums chosen at random for acceptance of the lot for every size.
  - Flammability Test to be conducted only on one sample/ lot.
- Flammability Test to be conducted only on one sample/ lot.

## C. Routine Test Conduction:

- Tests for which "R" is indicated in the 'Test Conduction Required As' column below shall be conducted as Routine tests.

## D. Tests listed in S.No-7.0 &amp; 8.0 shall be conducted only on one sample / lot.

**Note:** Routine tests to be carried out on each drum of cables.

| 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      | <i>Internal in process Test Report to be furnished for acceptance test</i> |
| II.    | Tensile test        | For aluminium conductor only<br>(Not applicable for compacted circular or shaped conductor) | T, A                        | IS 10810 Pt 2      |                                                                            |
| III.   | Wrapping test       | For aluminium conductor only<br>(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         |                                  |                   |              |                               |              |
|--------------|----------------------------------|-------------------|--------------|-------------------------------|--------------|
| ENGINEERING  |                                  |                   | QUALITY      |                               |              |
|              | Sign & Date                      | Name              |              | Sign & Date                   | Name         |
| Prepared by: | <i>[Signature]</i><br>18-03-2020 | VIKAS KUMAR SINGH | Checked by:  | <i>[Signature]</i><br>18/3/20 | KUNAL GANDHI |
| Reviewed by: | <i>[Signature]</i>               | MANISH SHUKLA     | Reviewed by: | <i>[Signature]</i>            | RITESH KUMAR |

| BIDDER/ SUPPLIER |  |
|------------------|--|
| Sign & Date      |  |
| Seal             |  |

| FOR CUSTOMER REVIEW & APPROVAL |             |      |      |
|--------------------------------|-------------|------|------|
| Doc No:                        |             |      |      |
|                                | Sign & Date | Name | Seal |
| Reviewed by:                   |             |      |      |
| Approved by:                   |             |      |      |

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|                                                                                   |                  |                |                                               |                       |
|-----------------------------------------------------------------------------------|------------------|----------------|-----------------------------------------------|-----------------------|
|  | ANNEXURE-A TO QP | CUSTOMER:      | PROJECT TITLE                                 | SPECIFICATION NUMBER: |
|                                                                                   |                  | BIDDER/VENDOR: | QUALITY PLAN NUMBER : PE-QP-999-507-E002, R02 | SPECIFICATION TITLE:  |
|                                                                                   | SHEET 2 OF 3     | SYSTEM: CABLE  | ITEM: LT XLPE POWER CABLE                     | DOC. NO.              |

| S. No.     | TEST                                                       | APPLICABLE FOR                                                      | TEST CONDUCTION REQUIRED AS | REFERENCE STANDARD | REMARKS |
|------------|------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------|--------------------|---------|
| <b>2.0</b> | <b>Tests for Armour Wires/Strips</b>                       |                                                                     |                             |                    |         |
| 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 / Adhesion 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                                              | Applicable for Aluminium wire & GS wire                             | A                           | IS 10810 Pt 3      |         |
| <b>3.0</b> | <b>Physical Tests for XLPE Insulation &amp; PVC sheath</b> |                                                                     |                             |                    |         |
| I.         | Test for thickness                                         | Applicable for XLPE insulation, PVC inner sheath & PVC outer sheath | T, A                        | IS 10810 Pt 6      |         |
| II.        | Tensile strength and elongation test at break              | Applicable for XLPE insulation & PVC outer sheath                   |                             |                    |         |
| (a)        | Before ageing                                              |                                                                     | T, A                        | IS 10810 Pt 7      |         |
| (b)        | After ageing                                               |                                                                     | T, A                        | IS 10810 Pt 7      |         |
| III.       | Ageing in air oven                                         | Applicable for XLPE insulation & PVC outer sheath                   | T                           | IS 10810 Pt 11     |         |
| IV.        | Loss of mass in air oven test                              | For PVC outer sheath only                                           | T                           | IS 10810 Pt 10     |         |
| V.         | Hot deformation test                                       | For PVC outer sheath only                                           | T                           | IS 10810 Pt 15     |         |
| VI.        | Heat shock test                                            | For PVC outer sheath only                                           | T                           | IS 10810 Pt 14     |         |
| VII.       | Shrinkage test                                             | For XLPE insulation & PVC outer sheath only                         | T                           | IS 10810 Pt 12     |         |
| VIII.      | Thermal stability test                                     | For PVC outer sheath only                                           | T                           | IS 10810 Pt 60     |         |
| IX.        | Hot set test                                               | For XLPE insulation only                                            | T, A                        | IS 10810 Pt 30     |         |
| X.         | Water absorption (gravimetric) test                        | For XLPE insulation only                                            | T                           | IS 10810 Pt 33     |         |
| <b>4.0</b> | <b>Improved Fire performance (FR-LSH) Tests</b>            |                                                                     |                             |                    |         |

| BHEL         |                                                                                     |                   |              |                                                                                     |              |
|--------------|-------------------------------------------------------------------------------------|-------------------|--------------|-------------------------------------------------------------------------------------|--------------|
| ENGINEERING  |                                                                                     |                   | QUALITY      |                                                                                     |              |
|              | Sign & Date                                                                         | Name              |              | Sign & Date                                                                         | Name         |
| Prepared by: |  | VIKAS KUMAR SINGH | Checked by:  |  | KUNAL GANDHI |
| Reviewed by: |  | MANISH SHUKLA     | Reviewed by: |  | RITESH KUMAR |

| BIDDER/ SUPPLIER |  |
|------------------|--|
| Sign & Date      |  |
| Seal             |  |

| FOR CUSTOMER REVIEW & APPROVAL |             |      |      |
|--------------------------------|-------------|------|------|
| Doc No:                        |             |      |      |
|                                | Sign & Date | Name | Seal |
| Reviewed by:                   |             |      |      |
| Approved by:                   |             |      |      |

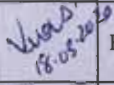
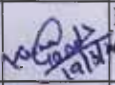
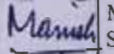
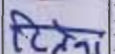
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|-----------------------------------------------------------------------------------|------------------|--|----------------|-----------------------------------------------|-----------------------|
|  | ANNEXURE-A TO QP |  | CUSTOMER:      | PROJECT TITLE                                 | SPECIFICATION NUMBER: |
|                                                                                   | SHEET 3 OF 3     |  | BIDDER/VENDOR: | QUALITY PLAN NUMBER : PE-QP-999-507-E002, R02 | SPECIFICATION TITLE:  |
|                                                                                   |                  |  | SYSTEM: CABLE  | ITEM: LT XLPE POWER CABLE                     | DOC. NO.              |

| S. No.     | TEST                                                   | APPLICABLE FOR            | TEST CONDUCTION REQUIRED AS | REFERENCE STANDARD                          | REMARKS                                                                          |
|------------|--------------------------------------------------------|---------------------------|-----------------------------|---------------------------------------------|----------------------------------------------------------------------------------|
| I.         | Oxygen index test                                      | For PVC outer sheath only | T, A                        | IS 10810 Pt 58 / ASTM D 2863/ NES 715-1     | <u>Applicable for Inner Sheath also, if the same is indicated in Datasheet-A</u> |
| II.        | Smoke density test                                     | For PVC outer sheath only | T, A                        | IS 10810 Pt 63 / ASTM D 2843                |                                                                                  |
| III.       | Acid gas generation test                               | For PVC outer sheath only | T, A                        | IS 10810 Pt 59 / IEC-754-1                  |                                                                                  |
| IV.        | Temperature Index Test                                 | For PVC outer sheath only | T                           | IS 10810 Pt 64 / ASTM D 2863                |                                                                                  |
| <b>5.0</b> | <b>Flammability Tests</b>                              |                           |                             |                                             |                                                                                  |
| I.         | Flammability test for bunched cables                   | For complete cable        | T                           | IS 10810 Pt 62/ IEC-60332 (Part-3-23-Cat-B) | <u>Test &amp; Category applicable as indicated in Datasheet-A</u>                |
| II.        | Flammability test for single cable                     | For complete cable        | T, A                        | IS: 10810 Pt 61 / 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                                 |                                                                                  |
| <b>6.0</b> | <b>Electrical Tests</b>                                |                           |                             |                                             |                                                                                  |
| 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                              |                                                                                  |
| <b>7.0</b> | <b>Anti-rodent and Termite Repulsion test</b>          | For PVC outer sheath only | A                           | Refer Note                                  | <u>Test applicable if indicated in Datasheet-A</u>                               |
| <b>8.0</b> | <b>Anti-Fungal Test</b>                                | For PVC outer sheath only | A                           | --                                          |                                                                                  |
| <b>9.0</b> | <b>Special Tests</b>                                   |                           |                             |                                             |                                                                                  |
| I.         | Hydrolytic Stability Test                              | For complete cable        | **                          | ASTM D 3137:81                              | <u>Test applicable if indicated in Datasheet-A</u>                               |
| II.        | Ultraviolet Radiation Test                             | For complete cable        | **                          | BS EN ISO 4892-2                            |                                                                                  |

**\*\* These tests shall be conducted on one sample for the entire contract and duration of these tests shall be 14 days.**

Note: A few chipping of the PVC compound is slowly ignited on a porcelain dish or cubicle in a muffle furnace at about 60-degree C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). Place a drop of aqueous sodium sulphide solution on a thick filter paper and allow soaking. Touch the spot with a drop of above extract. A black spot indicates the presence of lead, the anti-termite and rodent compound.

| 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 |                  |  | Approved by:                   |             |      |      |

