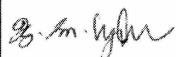


TITLE : TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEMS FOR ESP  
ITEM : SCREENED CABLE  
CUSTOMER : FGD - MAITREE BANGLADESH 2X660MW

| NAME     |                  | DESIGNATION | SIGNATURE                                                                             | DATE       |
|----------|------------------|-------------|---------------------------------------------------------------------------------------|------------|
| PREPARED | SRITHARUN        | AE          |    | 18.08.2018 |
| CHECKED  | A K PALANISAMY   | DM          |    | 18.08.2018 |
| APPROVED | M JEYAMURUGANAND | AGM         |  | 18.08.2018 |

ISSUED BY  
**EDC – ECI**

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**1.0.0 SCOPE:**

1.1.0 The scope of supply of SCREENED CABLES includes design, manufacture, inspection, testing, packing and delivery.

**2.0.0 APPLICATION:**

2.1.0 The cable to be supplied under this specification is intended to use for carrying the following signals.

1. Micro-amp., milli-volt DC signals between various instruments and PLC/DCS.
2. 4-20mA DC analogue signals between various instruments and PLC/DCS.
3.  $\pm 10$ mA current loop serial communication between various sub units of Flue Gas De-sulphurization (FGD) System.

**3.0.0 APPLICABLE STANDARDS:**

3.1.0 The screened cable shall be manufactured, tested and packed as per the following standards (Latest issues and their amendments). In case of any conflict between these standards and this Technical specification, the later shall prevail to the extent of such difference. In case of any conflict between these standards, the most stringent condition shall prevail,

- |       |            |   |                                                                                                                        |
|-------|------------|---|------------------------------------------------------------------------------------------------------------------------|
| 3.1.1 | IEEE 383   | - | Standard for type test of Class II electric cables, field splices & connections for Nuclear power generating stations. |
| 3.1.2 | ASTMD 2843 | - | Standard test method for density of smoke from the burning or decomposition of plastics                                |
| 3.1.3 | ASTMD 2863 | - | Standard test method for measuring the min. oxygen concentration to support candle like construction of plastics.      |
| 3.1.4 | IEC 754    | - | Test on gases evolved during combustion of Electric cables (Part-I).                                                   |
| 3.1.5 | SS 4241475 | - | Flammability testing of cables.                                                                                        |
| 3.1.6 | VDE 0207   | - | Insulation and Sheathing compounds for cables and flexible cords.                                                      |
| 3.1.7 | VDE 0472   | - | Rules for testing insulated cables and flexible cords.                                                                 |
| 3.1.8 | VDE 0815   | - | Wiring cables for telecommunication and data processing system.                                                        |
| 3.1.9 | VDE 0816   | - | Color coding                                                                                                           |

3.1.10 IEC 332 (Part-3 category-B) - Test on electric cables under fire conditions.

**4.0.0 SITE ENVIRONMENT:**

4.1.0 Ambient Temperature : 5 deg.C to 50 deg.C.

4.1.1 Design Ambient Temperature : 50 deg.C.

4.1.2 Relative Humidity : 100 %.

**5.0.0 CONSTRUCTION OF SCREENED CABLE:**

The conductors shall be formed by multi stranded Annealed Tinned Copper conductor. Such multi strand conductors shall be insulated with PVC. Two such cores shall be twisted with 50mm (MAX) lay, and shall be MELINEX tapped with of thickness 0.028mm (min.) with 100% coverage and min.20% (min) overlap. Such taped pair (each) shall be 100% screened with 20% (min) overlap using 0.06mm thick Aluminium Mylar tape. A drain wire of size 0.51 sq.mm. Then a POLYSTER TAPE shall be provided on such screened pair with 100% coverage and 20% (min.) overlap for screen isolation.

Such screened pairs shall be laid up, collectively 100% screened with 20 %( min) overlap using 0.06mm thick ALUMINIUM MYLAR TAPE. Then a drain wire of 0.51 sq.mm formed by 7 strands shall be provided touching aluminium.

Such laid-up cables shall be provided with FRLS-PVC outer sheath.

**6.0.0 SPECIFICATION OF SCREENED CABLE:**

**6.1.0 CONDUCTOR:**

6.1.1 Material : High conductivity Annealed Bare copper of electrolytic grade, as per VDE 0815.

6.1.2 Cross section area of conductor : As per enquiry.

6.1.3 Construction : Multistranded

6.1.4 Number of strands : 7 (minimum).

6.1.5 Shape : True circular before stranding, uniform quality free from defects.

**6.2.0 INSULATION:**

6.2.1 Material : PVC compound Y13 as per VDE 0207 (part 4).

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- 6.2.2 Method of appln. : Extrusion.
- 6.2.3 Thickness : 0.3 mm (Nominal) However higher Thickness shall be provided if required, to meet clause 6.14.1 to 6.14.7 of this specification and to meet the HV test.
- 6.2.4 Colour : As per VDE 0816.
- 6.2.5 Shade of colour : As per IEC 304.
- 6.2.6 Maximum Lay length of twin cores : 50mm (approximate).
- 6.2.7 Sequence of twisting of twin cores. : Right hand.
- 6.3.0 TAPING OVER LAID UP CORES:**
- 6.3.1 Material : MELINEX.
- 6.3.2 Thickness : 0.028mm (min).
- 6.3.3 Coverage : 100%.
- 6.3.4 Overlap : Min. 20%.
- 6.4.0 INDIVIDUAL PAIR SCREENING:**
- 6.4.1 Material : ALUMINIUM MYLAR TAPE.
- 6.4.2 Coverage : 100%.
- 6.4.3 Overlap : 20% (min.).
- 6.4.4 Thickness : 0.06mm(min).
- 6.5.0 DRAIN WIRE (INDIVIDUAL SCREEN):**
- 6.5.1 Material : Annealed tinned copper.
- 6.5.2 Area of cross sec. : 0.51 sq.mm (20 AWG).
- 6.5.3 Construction : Multistranded.
- 6.5.4 No. of strands : 7.

**6.6.0 SCREEN ISOLATION :( INDIVIDUAL PAIR SCREEN)**

|       |           |   |                |
|-------|-----------|---|----------------|
| 6.6.1 | Material  | : | POLYSTER TAPE  |
| 6.6.2 | Coverage  | : | 100%.          |
| 6.6.3 | Overlap   | : | 20% (min.).    |
| 6.6.4 | Thickness | : | 0.028mm (min). |

**6.7.0 OVERALL SCREEN:**

|       |           |   |                      |
|-------|-----------|---|----------------------|
| 6.7.1 | Material  | : | ALUMINIUM MYLAR TAPE |
| 6.7.2 | Coverage  | : | 100%.                |
| 6.7.3 | Overlap   | : | 20% (min.).          |
| 6.7.4 | Thickness | : | 0.06mm (min)         |

**6.8.0 DRAIN WIRE (OVERALL SCREEN)**

|       |                       |   |                        |
|-------|-----------------------|---|------------------------|
| 6.8.1 | Material              | : | Annealed tinned copper |
| 6.8.2 | Area of cross section | : | 0.51 sq.mm (20 AWG).   |
| 6.8.3 | Construction          | : | Multistranded.         |
| 6.8.4 | No.of strands         | : | 7.                     |

**6.9.0 FILLERS (IF PROVIDED) :**

|       |          |   |                                                                                                      |
|-------|----------|---|------------------------------------------------------------------------------------------------------|
| 6.9.1 | Material | : | Non-hygrosopic, flame retardant,<br>moisture resistant, suitable for the<br>operating temp of cable. |
|-------|----------|---|------------------------------------------------------------------------------------------------------|

**6.10.0 INNERSHEATH & ARMOURING:**

Inner sheath and armouring are not required.

**6.11.0 OUTER SHEATH:**

|        |                  |   |                                                        |
|--------|------------------|---|--------------------------------------------------------|
| 6.11.1 | Material         | : | YM1 PVC as per VDE 0207 PART 5,<br>with FRLS property. |
| 6.11.2 | Method of appln. | : | Extrusion.                                             |

6.11.3 Nominal thickness : As per VDE 0816 guide-lines. However the thickness shall not be less than 1.8 mm, in any case.

6.11.4 Colour : Sky Blue.

**6.12.0 ADDITIONAL REQUIREMENT OF OUTER SHEATH:  
(REQUIREMENT OF FRLS PROPERTIES)**

6.12.1 Oxygen index : Not less than 29 (when tested as per ASTM D 2863).

6.12.2 Temperature Index : Not less than 250 Deg.C at 21 oxygen Index (when tested as per ASTM D 2863)

6.12.3 Max.acid gas generation by weight : Not more than 20% (when tested as per IEC 754 - I).

6.12.4 Smoke density rating : 60% max. When tested as per ASTM D 2843. The supplier shall plot the graph as per the referred standard & to show that the average area under the curve shall not be more than 60 % .

6.12.5 Flammability : Complete cable shall pass the flammability test as per IEEE 383 and IEC 332 (part 3 category B).

6.12.6 Flame resistance : Complete cable shall meet the flame resistance requirement as per SS 4241475 Complete cable shall be as per category F3.

**6.13.0 SPECIAL REQUIREMENT OF SCREENED CABLE  
( AT 20 deg C +/- 3 deg C )**

6.13.1 Characteristic impedance :  $320 \sqrt{\frac{\Omega}{\mu}} \text{ (max.) at 1 KHz.}$

6.13.2 Mutual capacitance between conductors at 0.8 KHz : 100 nF/km (max.).

6.13.3 Noise interference : Better than 60 dB.

6.13.4 Attenuation at 1 KHz : Max. 1.2 dB/Km.

6.13.6 Max Conductor loop resistance : 73.4 Ohm/km (max)

6.13.7 Insulation resistance : 100 M Ohm/km (min)

**7.0.0 GENERAL REQUIREMENTS:**

7.1.0 The cable shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operation conditions. The cable shall be suitable for laying in wet & dry locations in trays, conduits, ducts, trenches etc.

7.1.1 The cable shall be designed for a steady state continuous conductor temperature of 70 deg.C.

7.1.2 The cable shall comply with latest edition of VDE 0815, VDE 0207 part 4 & 5 & 6 VDE 0816, VDE 0472 standards including the amendments, read along with this specification. However the voltage grade of the cable shall be 1100V AC.

7.1.3 Allowable tolerance on overall diameter of the cable shall be +/- 2 mm (max.) over the declared value in the technical data sheet. The variation in diameter & the ovality at any cross section shall not be more than 1.0 mm.

7.1.4 The cable shall be capable of withstanding a conductor temperature of 160°C during a short circuit.

7.1.5 Repaired cables shall not be offered and the same will not be accepted.

7.1.6 Progressive automatic on line sequential marking of the length of cable in metres at Every one metre shall be provided on the outer sheath of all cables.

7.1.6 Progressive marking at 5 meter interval with Manufacturers name, type of insulation, FRLS, Cable Size (Cross-section & No. of Pairs), Voltage grade, Year of Manufacture, BHEL-BAP by embossing.

7.1.7 The cable shall be supplied in Non-returnable drum in coil form of min. length of 1000 meters ±5%.

7.1.8 The pairs of cable shall be identified by colour coding. The colour coding and cable identification shall be as per VDE 0815.

7.1.9 Non – hygroscopic PVC/ POLYTHELENE sheet shall be provided on the surface of the barrel of the drum & over outermost layer of the cable.

7.1.10 Cable accessories such as harnessing components, markers, bedding, binding tape etc. shall also have flame retardant quality.

7.1.11 The dielectric strength shall be as follows :

Conductor to conductor 3KV for 5 min.

Conductor to screen 0.5KV for 5 min.

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**8.0.0 PACKING AND MARKING:**

- 8.1.0 Sea Worthy packing as per specification ref:PE-TS-888-100-A001 shall be provided. The cable shall be wound on a non-returnable steel drum in length of 1000 metres  $\pm 5\%$  and packed. Cut bits or not acceptable. Over all quantity tolerance against each size shall be +0%, -2%.
- 8.1.1 The steel drum shall be provided as per relevant IEC & entire surface to be painted.
- 8.1.2 The ends of the cable shall be sealed by means of non-hygroscopic sealing material.
- 8.1.3 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.

**9.0.0 DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT:**

The data sheet shall be submitted in SOFT MEDIA for approval, within 10 days from the date of order.

**10.0.0 INSPECTION AND TESTING:**

- 10.1.0 The cable shall be inspected and tested based on the following documents.
1. Approved Quality Plan.
  2. BHEL Technical Specification (TEP).
  3. BHEL Purchase order.
  4. BHEL/Customer approved supplier's data sheet.

- 11.0.0 This specification meets customer contract specification. Hence no deviation shall be taken by the supplier.

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