

**CONTROLS & INSTRUMENTATION (FB)****CI:PE:PQR:CAB****Rev. No: 00****Dt. : 13-04-202****PRE-QUALIFICATION REQUIREMENT (PQR)
GUIDELINES****CABLES REQUIREMENT [95-091] – MULTI-PAIR INSTRUMENTATION CABLE**

Sl. No.	Description	Bid Requirements	Vendor remarks
1	Type of Vendor	Vendor shall be the Original Equipment Manufacturer (OEM) of Multi-pair instrumentation cables. Vendor shall be active in the manufacturing & supplying of these cables for a period of at-least 5 years, as on the date of enquiry	Accepted / Not accepted
2	Proven Track record/Past Experience	Vendor shall demonstrate their capability of track record of having supplied at least one customer order of similar lot size and variety of cables, as per the present enquiry, to be deployed in any power plant or equivalent industrial applications in India, within last 4 years as on the date of enquiry. • Vendor shall submit the reference list (signed and sealed) with details of customer, project/site, year of supply, contact details & recent PO copies. • Vendor shall submit the copy of the largest purchase order in terms of Quantity & value, executed by them so far.	Accepted / Not accepted
3	Facilities required	All machineries and facilities that are required for the complete manufacturing of cables, shall be available inhouse.	Accepted / Not accepted

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		None of the major stages/processes (wire drawing, stranding, bunching, sheathing (extrusion/wrapping), armouring, printing, embossing) involved in the manufacturing of the cable, shall be off loaded or outsourced.	
4	Testing Facilities	Vendor shall have the facility to conduct acceptance, routine and type tests as per the enquiry, either in-house or at NABL accredited labs.	Accepted / Not accepted
5	Past Supply Association / Experience with BHEL	Previous purchase orders executed with BHEL, if any shall be referred to.	Accepted / Not accepted

	Commercial conditions	Vendor confirmation
Delivery term	Vendor shall quote unit price on FOR / Consignee basis inclusive of Packing & Forwarding, Freight & GST. Insurance will be on BHEL scope.	Accepted / Not accepted
Delivery days	The indicated delivery days is from document approval/manufacturing clearance for this GeM tender. Delivery date shall inclusive of all the activities like manufacturing, inspection, Packing & Forwarding and dispatch.	Accepted / Not accepted
Payment term	As per GEM T&C	Accepted / Not accepted
LD clause	As per GEM T&C	Accepted / Not accepted
Guarantee/ Warranty period	As per attached Technical specification	Accepted / Not accepted
MSE	If MSE vendor, submit latest Udyam Registration certificate	Attached / Not attached



429-024

**PURCHASE / MM / BOI
SUBDELIVERY - ENQUIRY - DEVIATION**

PAGE

1 OF 1

**SCHEDULE OF DEVIATION TO BOI
ENQUIRY NO:**

GeM Bid NO: : GEM/2021/B/1288844

DATE

19.06.2021

DESCRIPTION

Multipair Instrumentation Cable

SPECIFICATION

DS:TCI:145/DVC-F

Drawing No

QUALITY PLAN

VQP AND
TESTING REQUIREMENTS AS PER ANNEXURE 1

PACKING PROCEDURE

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DOCUMENT REFERENCE

BHEL ENQ.CALLED FOR

FIRM'S ALTERNATIVE OFFER

As Per Enquiry

CERTIFIED THAT OTHER THAN THE ABOVE DEVIATIONS, WE ARE ACCEPTING ALL THE OTHER SPECIFICATIONS AND REQUIREMENTS
IN FULL TO YOUR ENQUIRY.

STATION:

DATE:

SIGNATURE OF FIRM'S REPRESENTATIVE

FIRM SEAL

NOTE 1. Deviations should be taken only in the extreme case.

2. If necessary, use additional sheets with page control number.

/ On Bidder's office letter pad /

Self-Declaration

Enquiry No.	GeM Bid No: GEM/2021/B/1288844
Enquiry Date	19.06.2021

In line with Government public procurement order Number P-45021/2/2017-B.E-II dated 15.06.2017, and further modified order dt. 28.05.2018 & subsequent Order dt.04.06.2020 issued by DPIIT,

I / We hereby declare that I / We are a “Local Supplier” meeting the requirement of minimum local content (.....%) defined in the above government notification for the goods against above mentioned enquiry Number.

Details of location at which local value addition will be made is as follows:

Door No.	
Street / Address 1	
Street / Address 2	
District	
State	
Country	
PIN Code	

We also understand that the false declarations will be considered as breach of Integrity and liable for action.

For Company Name:

Seal:

Signature:

Date:

Place:

(Please fill all the yellow color field)



Bharat Heavy Electricals Limited

HIGH PRESSURE BOILER PLANT, TIRUCHIRAPPALLI 620 014.

Controls and Instrumentation/FB

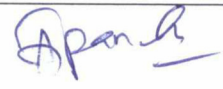
DATASHET FOR MULTI-PAIR

PAIR & OVERALL SHIELDED INSTRUMENTATION CABLE

(UNARMoured, TYPE-F)

DATASHEET NO. DS: TCI: 145-F/DVC

Revision History

Rev. No.	Date	Description	Prepared	Reviewed	Approved
00	09-02-2021	Initial Release	M. MURUGA PRABU		ASWINI KUMAR PANDA
					

**Data sheet for Multi-Pair, Pair & Overall Shielded, Instrumentation Cable
(Unarmoured, Type - F) DATASHEET NO. DS: TCI:145-F/DVC, Rev. 00**

Sl. No.	Parameter		Requirement
1	Applicable Standards		VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810. Latest edition of standards and amendments shall be taken care of.
2	Voltage grade	V	225
3	Temperature Rating	°C	70
4	Construction of cable		As per Constructional diagram enclosed with this Data sheet
5	No. of Pairs		2 Pair, 4 Pair, 8 Pair
6	Conductor:-		
a	Area of Conductor	Sq.mm	0.5 Sq.mm
b	No. of Strands / Strand Diameter (minimum) - for finished cable	No./ mm	7/0.3
c	Material		Annealed, Bare, Copper conductor
d	Grade / Standard		Electrolytic grade as per standard IS 8130
7	Insulation :-		
a	Material		PVC
b	Type and Standard		Extruded PVC type YI 3 as per standard VDE 0207
c	Thickness (Minimum/Nominal/Maximum)		0.25/0.3/0.35
d	Method of application		Extruded
e	Pair Identification		As per Data sheet
f	Volume Resistivity (Minimum)	Ω-cm	1×10^{14} at 20 deg. C & 1×10^{11} at 70 deg. C.
8	Lay for pairing (minimum)	Twist per metre	20
9	Direction of lay (for pairing)		Right Hand
10	No. of pairs for making a bundle	Pair	4 pairs laid up to form a bundle (Not applicable to 2 pair cable)

**Data sheet for Multi-Pair, Pair & Overall Shielded, Instrumentation Cable
(Unarmoured, Type - F) DATASHEET NO. DS: TCI:145-F/DVC, Rev. 00**

11	Lay for laid up pairs	Twist/ metre	4 - 6	
12	Lay for laid up Bundle	Twist/ metre	2 – 3 (Not applicable to 2 & 4 pair cable)	
13	Binding Material :-			
a	Binding		Single layer of binder tape shall be provided on each pair	
b	Type of Material		Polyester tape	
c	Thickness (minimum)	mm	0.028mm (28 micron)	
d	Coverage	%	100	
e	Overlap (minimum)	%	20	
14	Filler Material (wherever applicable)		Flame Retardant, Non Hygroscopic material, suitable for the operating temperature of the cable. Fillers shall not stick to the insulation	
15	Shielding:-			
a	Type of Material		Aluminium Mylar Tape	
b	Thickness (minimum)	mm	Pair Shielding → 0.028 Over all Shielding → 0.055	
c	Coverage	%	100	
d	Overlap (minimum)	%	20	
16	Drain wire for Shielding :-			
a	Material		Annealed, Tinned Electrolytic Copper	
b	No. of strands / Diameter of strand	No./mm	7/0.3	
c	Area of cross section	sq.mm	0.5 sq.mm	
d	Resistance of Drain wire @ 20°C (maximum)	Ω/km	30	
17	Outer Sheath:-			
a	Material		PVC, With FRLS Properties	
b	Type and Standard		Extruded PVC compound YM1 with FRLS Properties as per standard VDE 0207	
c	Thickness (Minimum/Nominal)	mm	1.8	>1.8
d	Method of application		Extruded	
e	Colour		BLUE	
18	Cable Marking on Outer sheath		Manufacturer's Name, Insulation material, Conductor size, Number of pairs, Voltage rating, Type of cable, Year of manufacture @ 625 mm Interval. Printing/Embossing shall be legible and indelible.	

**Data sheet for Multi-Pair, Pair & Overall Shielded, Instrumentation Cable
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19	Sequential marking on Outer sheath		Every 1 Metre for Progressive Length by printing. Every 5 Metre to read 'FRLS' by Embossing
20	Tolerance on Outer diameter	mm	± 2
21	Tolerance on Outer diameter for entire length	mm	1
22	Ovality	mm	1
23	Bending Radius (Minimum)		12 Times the OD of the Cable
24	Standard Packing Length	metre	1000
25	Tolerance on standard packing length	%	± 5
26	Non-standard Length		Last length shall be supplied in single length
27	Electrical Parameters at 20° C :-		
a	DC Resistance (maximum)	Ω/km	73.4
b	Short circuit rating of conductor for 1 second	KA	0.0575
c	Insulation Resistance (minimum)	$M\Omega/\text{km}$	100
d	Mutual Capacitance (maximum) @ 0.8 KHz	nF/km	120
e	Attenuation (maximum) @ 1 KHz	dB/km	1.2
f	Cross talk (minimum) @ 0.8 KHz	db	60
g	Characteristic Impedance (maximum) @ 1KHz	Ω	320
h	Test Voltage - Between Conductor- Conductor (minimum)	KV (rms)/minute	2/1
i	Test Voltage - Between Conductor - Shield (minimum)	V (rms)/minute	500/1
28	FRLS Properties of Outer Sheath :-		
a	Oxygen Index @ ambient temp. As per ASTM-D-2863	%	Not Less than 29%
b	Temperature Index @ oxygen index 21, As per ASTM-D-2863	° C	Not Less than 250

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c	Smoke density rating As per ASTM-D-2843	%	Shall not be more than 60%
d	Acid gas generation As per IEC 60754	%	Shall not be more than 20% by weight
e	Flammability Tests As per IEC 332, IEEE-383, SS-4241475, Clause-F3		Shall pass
f	Anti-Rodent and Termite test		Presence of lead shall be detected
29	Special properties for Outer sheath material		Shall be Resistant to Water, Fungus, Termite & Rodent attack
30	Inspection & Testing		As per annexure I. Vendor Quality plan covering the testing requirements as per Annexure I, shall be submitted after placement of Purchase Order.
31	Packing Details and Marking on Drum		Cables shall be supplied in Non-returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with waterproof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ Rubber caps secured by 'U' nails, so as to eliminate ingress of water during transportation, storage and erection. Wood preservative, anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS-10418. Each drum shall carry Manufacturer's name, Purchaser's name, Address and Contract number, Item number and type, size and length of cable and net, gross weight stencilled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction of rotation in which it should be rolled.

Data sheet for Multi-Pair, Pair & Overall Shielded, Instrumentation Cable (Unarmoured, Type - F) DATASHEET NO. DS: TCI:145-F/DVC, Rev. 00

Colour coding and Numerical order of cores → As per VDE-0815

The twisted pair of conductors are identified by 8 colours to form 1 Bundle.

Pair	Colour
1	Blue & Red
2	Grey & Yellow
3	Green & Brown
4	White & Black

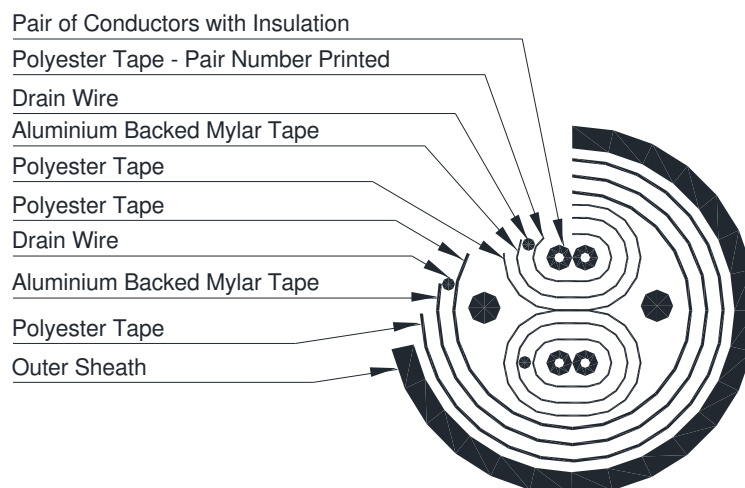
The same colours appear in all the Bundles.

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The Numerical order of the cores are identified by coloured Rings (ranging from 1 to 4) on the insulation @ 50 mm interval. This clause is not applicable to 2 pair and 4 pair cables.

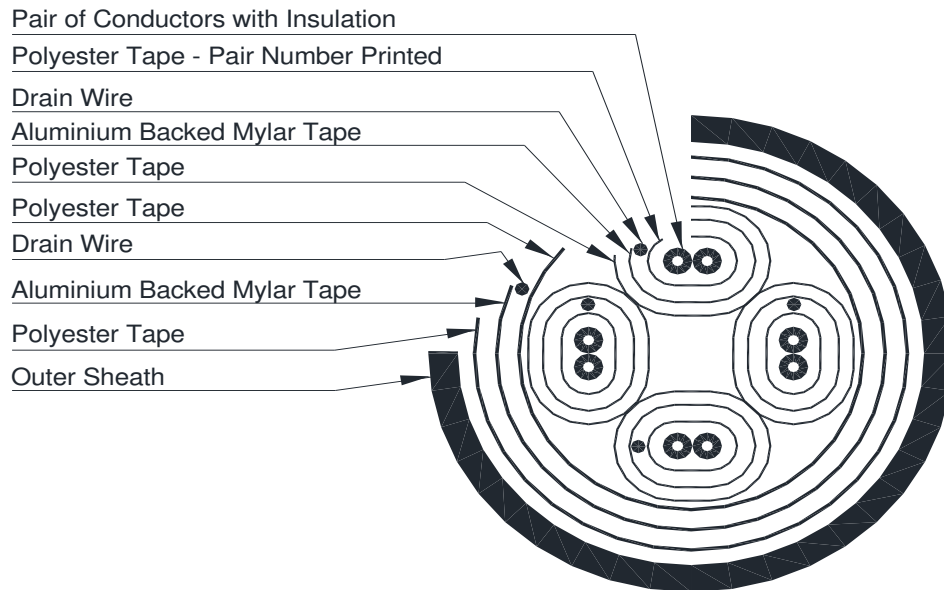
Cable	8 Pair, 12 Pair, 16 Pair, 20 Pair, 24 Pair, 28 Pair & 32 Pair							
Bundle Number	1 st Bundle	2 nd Bundle	3 rd Bundle	4 th Bundle	5 th Bundle	6 th Bundle	7 th Bundle	8 th Bundle
Number of Rings	1	2	3	4	1	2	3	4
Colour of Ring	Pink				Orange			

TYPICAL CONSTRUCTIONAL DIAGRAM OF A 2 PAIR, PAIR SHIELDED & OVER ALL SHIELDED CABLE

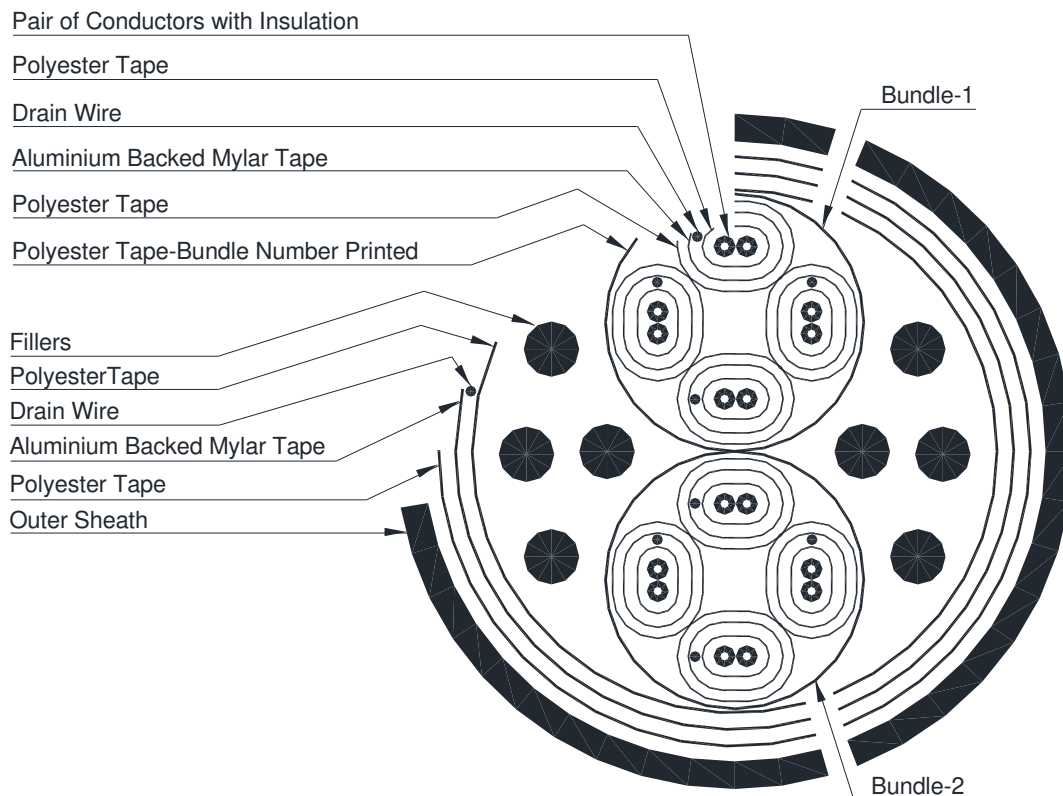


Data sheet for Multi-Pair, Pair & Overall Shielded, Instrumentation Cable (Unarmoured, Type - F) DATASHEET NO. DS: TCI:145-F/DVC, Rev. 00

TYPICAL CONSTRUCTIONAL DIAGRAM OF A 4 PAIR, PAIR SHIELDED & OVER ALL SHIELDED CABLE



TYPICAL CONSTRUCTIONAL DIAGRAM OF A 8 PAIR, PAIR SHIELDED & OVER ALL SHIELDED CABLE



Applicability of Fillers will be decided by the vendor. Position, Shape and Number of fillers will be suitably decided by the vendor.

Data sheet for Multi-Pair, Pair & Overall Shielded, Instrumentation Cable (Unarmoured, Type - F) DATASHEET NO. DS: TCI:145-F/DVC, Rev. 00

Special Instructions to the Vendor :-	
Site Conditions	Dusty, Salty, corrosive & Heavily polluted
Over all Quantity Tolerance	(+) 0 / (-) 2 %
Guarantee	A Guarantee Certificate for 18 months of trouble-free operation/ performance from the date of shipment or 12 months from the date of commissioning whichever is earlier shall be furnished.
Confirmation to be given by the vendor during offer submission	1. Sub-Delivery Enquiry Deviation format shall be filled with "No Deviation", indicating the Data sheet and Quality Plan reference and shall be furnished along with the offer. 2. Technical deviation/non-conformance indicated elsewhere in the offer will not be considered. 3. In the absence of Sub-Delivery Enquiry Deviation format, the vendor's offer will not be evaluated. 4. All the vendor dependent data/values shall be filled in the Annexure attached and shall be submitted along with the offer.
After Purchase Order	1. Vendor shall submit the completely filled in annexure along with the datasheet to BHEL-Trichy. 2. Vendor shall start manufacturing only after approval of the datasheet.

TOLERANCE ON OUTER DIAMETER

Definition: -

This is the allowable Limits on the diameter of the actual cable from the Data sheet value /Design value.

The Data sheet indicates ± 2 mm. This means that if the Data sheet value / Design value of the cable diameter is 'X' mm, then all the actual cable diameter measured over the entire length / quantity shall fall within the Upper Limit 'X + 2' mm and the Lower Limit 'X - 2' mm. However, the following clauses must also be satisfied.

Example: -

Let the Data sheet value / Design value of the cable diameter be	} = 14 mm (X)
Then, the measurements of the actual cable diameter taken over the entire length shall fall between the Limits	} } } = 16 mm and 12 mm (X + 2) (X - 2)

Data sheet for Multi-Pair, Pair & Overall Shielded, Instrumentation Cable (Unarmoured, Type - F) DATASHEET NO. DS: TCI:145-F/DVC, Rev. 00

TOLERANCE ON OUTER DIAMETER FOR ENTIRE LENGTH

Definition: -

This is the maximum allowable difference between the Highest actual cable diameter and the Lowest actual cable diameter measured over a drum length.

The Data sheet indicates 1 mm. This means that if the Highest actual cable diameter is say, 'D1' mm, and the Lowest actual cable diameter is 'D2' mm, then, 'D1 - D2' shall be maximum 1 mm and 'D1' and 'D2' shall also fall within the Upper and Lower limits as above.

Example: -

Let the Highest actual cable diameter
measured be } = 16 mm (D1)

Let the Lowest actual cable diameter
measured be } = 15 mm (D2)

Then, Tolerance for the entire length } = 16 mm - 15 mm = 1 mm
(D1) (D2)

Comment: -

As the Highest actual cable diameter and Lowest actual cable diameter falls within the Upper and Lower Limits as above, and the difference between them is 1 mm maximum, the diameter values are acceptable.

OVALITY

Definition: -

This is the maximum allowable difference between the measurements of the actual cable diameter in 'x' and 'y' directions in any particular section.

The Data sheet indicates 1 mm. This means that if the actual cable diameters measured are say, 'D3' mm, and 'D4' mm, in 'x' and 'y' directions respectively in one particular section. Then, the difference between 'D3' and 'D4' shall be maximum 1 mm. Also 'D3' and 'D4' shall fall within the Upper and Lower limits as above.

Example: -

Let the actual cable diameter in 'x'
direction in one section be } = 16 mm (D3)

Let the actual cable diameter in 'y'
direction in the same section be } = 15 mm (D4)

Then, Ovality = 16 mm - 15 mm = 1 mm
(D3) (D4)

Comment: -

As the actual cable diameters measured in 'x' and 'y' directions of the same section fall within the Upper and Lower limits as above, and the difference between them is 1 mm maximum, the diameter values are acceptable.

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**Data sheet for Multi-Pair, Pair & Overall Shielded, Instrumentation Cable
(Unarmoured, Type - F) DATASHEET NO. DS: TCI:145-F/DVC, Rev. 00**

ANNEXURE

Vendor dependant dimensions of cables

Type of cable			2 Pair x 0.5 sq.mm.	4 Pair x 0.5 sq.mm.	8 Pair x 0.5 sq.mm.
1	Diameter over Conductor (Approx.)	mm	0.9		
2	Thickness of Insulation	mm	0.25 – 0.35		
3	Diameter over insulated conductor (Approx.)	mm	1.4 – 1.6		
4	Diameter Over laid up pair (Approx.)	mm			
5	Diameter over Outer Sheath (Approx.)	mm			
6	Weight of cable	kg/km			

Annexure-1 : Testing requirements for instrumentation cable.

Projects : DVC lot – 2 Combustion Modification R&M projects (DVC Mejia Unit 4, DVC Mejia Units 5&6, DVC Chandrapura Units 7 & 8)

A. General points:

- 1) Vendor Quality Plan(VQP) as per datasheet and testing requirements shall be submitted in the given format for BHEL/ DVC review and approval.
- 2) VQP shall cover raw materials, in process/stage inspection, routine, sample & type test as per relevant standards mentioned in the datasheet.
- 3) Vendor to take care of requirement of additional tests if any during QP approval stage without any additional cost to BHEL.

B. Tests:

- 1) All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- 2) However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client /Employers representative and submit the reports for approval.
- 3) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- 4) The following are the major tests and the same shall be taken care in addition to tests related to raw material & in-process.

I. Routine test:

- 1) Cond. Resistance
- 2) HV test
- 3) IR test (on drum length)
- 4) Drain wire continuity

II. Acceptance test

Characteristics	Quantum of check
1) Cond. Resistance (Cable & Drain Wire)	1 no. of each size & type
2) HV test	do
3) IR test	do
4) Constructional Details & Dimensions	
i. Constructional details	do
ii. Shield Al-mylar thickness	do
iii. Insulation thickness/dia	do

iv. Inner/Outer sheath thickness (as applicable)	do
v. Diameter over outer sheath	do
5) Outer sheath –colour, Marking/Embossing & End sealing	do
6) Length checking	do
7) Core – Band marking / Colour / Numbering	do
8) Overall Coverage/overlap of shield & continuity of drain wire.	do
9) Visual & Surface Finish	do
10) Thermal Stability (Insulation & Sheath)	do
11) Electrical Parameters (Mutual capacitance, Cross talk, Attenuation, Characteristic Impedance as applicable)	do
12) Persulphate test (For Drain wire)	do
13) Swedish chimney test (overall cable)	1 no. /complete lot offered #
14) FRLS test for outer sheath for OI (Oxygen Index), TI (Temperature index). SDR (Smoke Density Rating) & HCL Emission.	do
15) TS & % Elongation test of Insulation & Sheath (Before and After ageing)	do
16) Volume Resistivity (At room and elevated Temperature)	do
17) Armouring Dimension & Zn coating (If applicable)	do

- Irrespective of size and type.

III. Type tests:

- 1) Cond. Resistance (Cable & Drain Wire)
- 2) HV test
- 3) IR test
- 4) Constructional Details & Dimensions
 - i. Constructional details
 - ii. Shield Al-mylar thickness
- 5) Insulation
 - i. Insulation thickness/dia
 - ii. Loss of mass test
 - iii. Tensile strength & % of elongation of insulation (before & after ageing)
 - iv. Heat shock
 - v. Hot formation
 - vi. Shrinkage test
 - vii. Bleeding & Blooming test
- 6) Sheath
 - i. Outer sheath thickness
 - ii. Diameter over outer sheath

- iii. Loss of mass test
 - iv. Tensile strength & % of elongation of outer sheath (before & after ageing)
 - v. Heat Shock
 - vi. Hot formation
 - vii. Shrinkage test
 - viii. Bleeding & Blooming test
 - ix. Colour fastness to water
 - x. Cold blend/ Cold impact test
- 7) Outer sheath - colour, Marking/Embossing & End sealing.
 - 8) Core – Band marking/colour/ Numbering
 - 9) Overall Coverage/overlap of shield & Continuity of drain wire.
 - 10) Thermal Stability (Insulation & Sheath)
 - 11) Electrical Parameters (Mutual capacitance, cross talk, Attenuation, Characteristic Impedance as applicable)
 - 12) Persulphate Test (For Drain wire)
 - 13) Flammability test (As per IEEE 383)
 - 14) Swedish chimney test(overall cable)
 - 15) FRLS test for outer sheath for OI (Oxygen Index), TI (Temperature Index), SDR (Smoke Density Rating) & HCL Emission.
 - 16) Noise Interference test. (As per IEEE March 1967 (Min. 60 dB))
 - 17) Volume Resistivity (At room and Elevated Temperature)

Note: Vendor shall give compliance for this document vide “No deviation certificate” during enquiry stage. VQP shall be prepared by taking care of above testing requirements and to be submitted for BHEL/DVC review and approval after placement of purchase order.