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CONTROL CABLES																																	
<div style="margin-bottom: 10px;"> 1.0 SCOPE: This specification governs the quality requirements of design, manufacture, testing packing at manufacturers work and delivery at site, of control cables for power plant applications in refineries. </div> <div> 2.0 APPLICABLE STANDARDS: <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">IS:1554 (Part I)</td> <td>- PVC insulated (heavy duty) electric cables part-I for working voltages up to and including 1100V.</td> </tr> <tr> <td>IS-8130</td> <td>- Conductors for insulated electric cables and flexible cords.</td> </tr> <tr> <td>IS-5831</td> <td>- PVC insulation and sheath of electric cables.</td> </tr> <tr> <td>IS-3975</td> <td>- Mild steel formed wires, and tapes for armouring of cables.</td> </tr> <tr> <td>IS-3961(Part. 2)</td> <td>- Recommended current ratings for cables : Part-2 PVC insulated and PVC sheathed heavy duty cables.</td> </tr> <tr> <td>IS-4826</td> <td>- Specification for hot dipped galvanised coatings on round steel wires.</td> </tr> <tr> <td>ASTM-D2863</td> <td>- Standard for critical oxygen index and temperature index test</td> </tr> <tr> <td>IEC-754-1</td> <td>- Test on gases evolved during combustion of materials from cables– Part I: Determination of amount of halogen acid gas</td> </tr> <tr> <td>ASTM-D2843</td> <td>- Standard for smoke generation test</td> </tr> <tr> <td>IEC-332-1</td> <td>- Tests on electric cables under fire conditions – Part I: Test on a single vertical insulated wire or cable.</td> </tr> <tr> <td>IS-10810 Part 53</td> <td>- Flammability test.</td> </tr> <tr> <td>IS:209</td> <td>- Zinc ingot - specification.</td> </tr> <tr> <td>IS:10418</td> <td>- Wooden drums for electric cables</td> </tr> <tr> <td>IS:10810 Part 40</td> <td>- Uniformity of zinc coating on steel armour.</td> </tr> </table> <p style="margin-top: 10px;">The cables shall also conform to the provisions of Indian Electricity Rules and other statutory regulations as applicable.</p> </div>						IS:1554 (Part I)	- PVC insulated (heavy duty) electric cables part-I for working voltages up to and including 1100V.	IS-8130	- Conductors for insulated electric cables and flexible cords.	IS-5831	- PVC insulation and sheath of electric cables.	IS-3975	- Mild steel formed wires, and tapes for armouring of cables.	IS-3961(Part. 2)	- Recommended current ratings for cables : Part-2 PVC insulated and PVC sheathed heavy duty cables.	IS-4826	- Specification for hot dipped galvanised coatings on round steel wires.	ASTM-D2863	- Standard for critical oxygen index and temperature index test	IEC-754-1	- Test on gases evolved during combustion of materials from cables– Part I: Determination of amount of halogen acid gas	ASTM-D2843	- Standard for smoke generation test	IEC-332-1	- Tests on electric cables under fire conditions – Part I: Test on a single vertical insulated wire or cable.	IS-10810 Part 53	- Flammability test.	IS:209	- Zinc ingot - specification.	IS:10418	- Wooden drums for electric cables	IS:10810 Part 40	- Uniformity of zinc coating on steel armour.
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3.0 CONSTRUCTIONAL REQUIREMENTS:

- 3.1 Voltage grade : 650/1100 V.
- 3.2 Conductor : Stranded E.C grade High Conductivity Copper class 2 as per IS-8130.
- 3.3 Type of cable : Armoured multicore cable
- 3.4 No of cores/Core identification : As per variants/as per IS 1554
- 3.5 Inner sheath : Type ST-1 Extruded PVC.
- 3.6 Armour : Armouring shall be as per method (b) of IS-1554 (part-1).
- (i) calculated dia under armour <13 mm –GI wire armour
- (ii) calculated dia under armour >13 mm –GI strip armour
- 3.7 Outer sheath : Type ST-1 , Extruded PVC with FRLS property.
- 3.8 No of wires &dia of each wire : 7 no/0.67 each for 2.5 sqmm
7 no /0.52mm each for 1.5 sqmm
- 3.9 Insulation : Extruded PVC type A IS:5831.
Nominal Thickness as per IS:1554.

4.0 TESTS:

All acceptance and routine tests shall be carried out on all cables at vendor's works in the presence of purchaser's representative. Wherever FRLS PVC sheaths are specified, cables shall be tested to demonstrate FRLS properties. Type test reports of similar cables whenever they are called for shall be furnished.If the same are not available then the vendor shall carry out the test in a recognized laboratory at his own cost without any cost or time implication to BHEL/Customer.

5.0 GENERAL:

- 5.1 Cables shall be delivered in maximum possible lengths of not less than 1000 m neatly rolled on non returnable wooden drums (seasoned wood), with both ends sealed with moisture proof sealing .

If non-standard drum lengths are specified the same shall be supplied. On the flange of the drum necessary information such as project title ,manufacturer's name ,type ,size ,voltage grade of the cable ,BHEL material code ,length of cable shall be printed .An arrow shall be printed on the drum with suitable instructions to show the direction of rotation of the drum.

- 5.2 Sequential marking of the type and size of cable , BHEL material code , voltage grade, shall be provided on the outer sheath at every one metre. The embossing shall be legible and indelible.



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- 5.3 PVC/Rubber end caps shall be supplied free of cost for each drum with a minimum of eight per thousand metre length. In addition, ends of the cables shall be properly sealed with caps to avoid ingress of water during transportation and storage.
- 5.4 A tolerance of $\pm 3\%$ shall be permissible for each drum. However overall tolerance on each size of cable shall be limited to $\pm 2\%$. If specified cable drum shall be supplied without negative tolerance.
- 6.0 **CHARACTERISTICS FOR FRLS PVC:**
- Outer sheathing material of cables supplied under this specification, wherever FRLS PVC sheathing is called for shall meet the following requirements:
- 6.1 The critical oxygen index value shall be greater than 29% at room temperature when tested as per ASTM-D 2863.
- 6.2 Temperature index shall be greater than 250°C at a normal oxygen content of 21% in air when tested as per ASTM-D 2863.
- 6.3 The acid gas generation shall be less than 20% by weight when tested as per IEC 754-1.
- 6.4 Smoke density rating shall be 60% maximum when tested as per ASTM-D 2843.
- 6.5 The finished cable shall pass the flammability test as per IEC-332-1 and IS:10810 – Part 53.
- 7.0 Acceptance tests as per IS-1554(part-2) and the following special tests to be performed on the cables as per sampling plan. These tests are required to be witnessed by BHEL/Customer before despatch of cables.
- i) Accelerated water absorption test for insulation as per NEMA-WC-5. Sampling for this test to be done randomly and once for each size per order wise provided outer remains same.
 - ii) Dielectric Retention test: The dielectric strength of the cable insulation tested in accordance with NEMA-WC-5 at 75 deg cel ± 1 deg cel shall not be less than 50% of the original dielectric strength. Test certificates with respect to this test (not older than one year) from recognised testing laboratory to be furnished for BHEL review before despatch clearance of cables. In case test certificates are not available test to be conducted by the vendor at his own cost in any of the recognised test laboratory before despatch clearance of cables.
 - iii) Oxygen index test: The test shall be carried out as per ASTM D2863. Sampling shall be as per sampling plan.
 - iv) Flammability test: The test shall be carried out as per IS 10810(part 61 & 62)(category AF). And IS-10810 (part 63) for smoke density. Sampling for these tests to be done randomly once for each size per order wise provided outer sheath remains same.

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v) Test for rodent and termite repulsion property: The vendors shall furnish the test details to analyse the property by chemical method.Sampling to be done for every offered lot/size as per sampling plan.

8.0 DOCUMENTATION:

- 8.1 12 copies of filled in technical data sheets (in given format only).Quality schedules and type test certificates along with the bid.
- 8.2 12 copies of final data sheets for BHEL approval after releasing LOI.
- 8.3 12 copies of test certificates and technical data sheets with in one week after inspection.
- 8.4 QAP shall be furnished along with the offer.

9.0 GUARANTEE:

The cables shall be guaranteed for satisfactory operation of 18 months from the date of Despatch or 12 months from the date of commissioning which ever is earlier.



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**PLANT PURCHASING SPECIFICATION
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S.NO.	DESCRIPTION OF CABLE (SQMM)	MATERIAL CODE	Remarks
1.	3C x 2.5, 1.1 KV, PVC/FRLS, CU		
2.	3C x 1.5, 1.1KV, PVC/FRLS, CU		
3.	7C x 2.5, 1.1KV, PVC/FRLS, CU		
4.	10 x 2.5, 1.1KV, PVC/FRLS, CU		
5.	12C x 2.5, 1.1KV, PVC/FRLS, CU		
6.	16C x 2.5, 1.1KV, PVC/FRLS, CU		
7.	19C x 2.5, 1.1KV, PVC/FRLS, CU		
8.	24C x 2.5, 1.1KV, PVC/FRLS, CU		
9.	5C x 1.5, 1.1KV, PVC/FRLS, CU		
10.	7C x 1.5, 1.1KV, PVC/FRLS, CU		
11.	5C x 2.5, 1.1KV, PVC/FRLS, CU		
12.	10 x 1.5, 1.1KV, PVC/FRLS, CU		
13.	12C x 1.5, 1.1KV, PVC/FRLS, CU		
14.	16C x 1.5, 1.1KV, PVC/FRLS, CU		
15.	19C x 1.5, 1.1KV, PVC/FRLS, CU		
16.	24C x 1.5, 1.1KV, PVC/FRLS, CU		

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TECHNICAL DATA SHEETS:

Sl.No.	Description	Purchaser' s requirement	Vendor's compliance
CONTROL CABLE			
1	Make		
2	Type (i) multicore cable (CU)	YWY	
3	Applicable standards	as per cl 2.0 OF HY28598	
4	Voltage grade		
5	Suitable for system with :		
	a) Service voltage	1100 V	
	b) Neutral earthed/unearthed	earthed	
6	Maximum conductor temperature		
	a) Continuous Deg. C	70 deg cel	
	b) Short time Deg. C	160 deg cel	
7	Conductor		
	a) Material	Copper	
	b) Size (sq.mm) main/neutral	AS PER VARIANT	
	c) No. of wires & diameter of each wire(No./mm)	AS PER CLAUSE 3.8 OF HY28598	
8	Insulation		
	a) Material	Extruded PVC	
	b) Type	Type A IS 5831	
	c) Thickness (nominal) mm	AS PER IS-1554	
9	Inner sheath		
	a) Material	EXTRUDED PVC	
	b) Type	ST-1	
	c) Thickness (nominal) mm	IS-1554	
	d) Extruded Yes/No	yes	
	e) Approx. outside dia over inner sheath mm.	AS PER IS-1554	
10	Armouring		
	a) Material		
	(i) dia below armour < 13mm	GI WIRE	
	(ii) dia below armour >13 mm	GI strips	
	b) Size (No. of wires X dia of each wire)	Method (b) of IS-1554	
	c) Dia over armour	AS PER IS-1554	
	d) DC Resistance at 20 deg cel (ohms/km)	As per IS	



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Sl.No.	Description	Purchaser' s requirement	Vendor's compliance
11	Overall sheath		
	a) Material	EXTRUDED PVC	
	b) Type	ST-1 with FRLS properties	
	c) Thickness (nominal) mm	IS-1554	
12	Approx. overall diameter (mm)	AS PER IS-1554	
13	Standard drum length with tolerance (M)	1000 mtrs	
14	Net weight of cable (Kg/KM)		
15	Continuous current rating for standard IS condition laid direct : Amps.		
	a) In ground		
	b) In duct		
	c) In air		
16	Short circuit current for 1-sec. (KA)		
17	Electrical parameters at maximum		
	Operating temp. (Ohm/KM)		
	a) Resistance		
	b) Reactance at 50Hz		
	c) Capacitance		
18	Recommended minimum bending radius		
19	Derating factors for following temp in air&ground		
	a) at 30 deg cel		
	b) at 35 deg cel		
	c) at 40 deg cel		
	d) at 45 deg cel		
	e) at 50 deg cel		
20	Cable identification code	As per cl. 5.2 of HY28598	
21	List of routine and type tests certificates reqd.	YES	
22	PVC used for Sl.No. 8, 9 and 11 are not recycled PVC	YES	