उत्पाद मैन्युअल
आई एस 7098 (भाग-1) : 2025 के अनुसार
अनुप्रस्थ जुड़े हुए पोलीइथाइलीन विद्युतरोधी ताप स्थायी ढक़े क़ेबल के लिए
दस्तावेज़ संख्या – पीएम/आईएस 7098 (Part 1)/3/ अगस्त 2025

भारतीय मानक ब्यूरो की स्कीम-I (अनुरूपता मूलयाांकन) विनियम, 2018 के तहत यह उत्पाद मैन्युअल प्रमाणीकरण के प्रचालन में रीति और पारिर्शिता की सुसंगतता सुनिश्चित करने के लिए सभी क्षेत्रीय/शाखा कार्यालयों और लाइसेंसी द्वारा संदर्भ सामग्री के रूप में उपयोग किया जाएगा। बीआईएस प्रमाणीकरण लाइसेंस/ प्रमाणपत्र प्राप्त करने के इच्छुक भावी आवेदकों द्वारा भी इस दस्तावेज़ का उपयोग किया जा सकता है ।

PRODUCT MANUAL FOR
CROSSLINKED POLYETHYLENE INSULATED THERMOPLASTIC SHEATHED CABLES
Part 1 For Working Voltages up to and including 1100 Volts
ACCORDING TO IS 7098 (Part 1) : 2025
Document No - PM/IS 7098 (Pt 1)/3/ Aug 2025

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure coherence of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations, 2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification licence/certificate.

भारतीय मानक ब्यूरो

BUREAU OF INDIAN STANDARDS

मानक भवन, ९, बहादुर शाह ज़फ़र मार्ग

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New Delhi – 110002

PRODUCT MANUAL FOR
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1.	**Product Standard**	:	IS 7098 (Pt 1): 2025	
	Title	:	Crosslinked Polyethylene Insulated Thermoplastic Sheathed Cables Part 1- for working voltages up to and including 1100 V	
	No. of Amendments	:	Nil	
2.	**Sampling Guidelines:**			
a)	**Raw material**	:	Plain copper/ aluminium wires	IS 8130
			Armour material	IS 3975
b)	**Grouping guidelines**	:	Please refer ANNEX – A	
c)	**Sample Size**	:	(i) Copper/Aluminium wire (before stranding) - 5 meters (ii) Cu wire – 100 g (for Cu purity test) (iii) Armour material – 5 meters (iv) XLPE insulated Thermoplastic sheathed Cable - 15 meters	
3.	**List of Test Equipment**	:	Please refer ANNEX – B	
4.	**Scheme of Inspection and Testing**	:	Please refer ANNEX – C	
5.	**Possible tests in a day**	:	Please refer ANNEX - D	
6.	**Scope of the Licence :** Crosslinked Polyethylene Insulated, PVC/PE/LSHF Sheathed Cables for electric supply and control purposes, Armoured/Unarmoured, with Aluminium/Copper Conductor, Class 1/2, Category 01/C1/C2/C3, except/suitable for use in Mines, excluding/including Low Temperature Applications, for working Voltages up to and including 1100 V, for the following varieties: a) Single Core for Sizes upto and including ….. mm². b) Multi-core upto and including …. Cores, Sizes upto and including ….. mm².			

ANNEX A

Grouping Guidelines

1. Each variety of Cable shall be tested for GoL/CSoL considering the following:

   i. Material for Conductor – Aluminium, Copper
   ii. Construction of Conductor – Solid (Class 1), Stranded (Class 2)
   iii. Outer Sheath of Cable- PVC/PE/LSHF
   iv. No. of Cores (Single Core to Multicore)
   v. Armoured/Unarmoured
   vi. Category of Cable [(01, C1(FR), C2(FR-LSH), C3 (LSHF)]
   vii. Cables intended for use in Mines
   viii. Low Temperature Application

2. The following relaxation may be given when a variety is tested for all the requirements and the manufacturing process remains the same:

Variety Tested	**Additional Variety that may be covered**
Stranded (Class 2)	Solid (Class 1)
Multicore	Upto the No. of core tested
Armoured	Unarmoured
Category of Cable tested	
(a) C3 (LSHF)	(a) C2 (FR-LSH), C1(FR) and 01
(b) C2 (FR-LSH)	(b) C1(FR) and 01
(c) C1(FR)	(c) 01

3. Firm shall declare the Varieties and Sizes of various Cables they intend to cover in the Licence. Cable with the largest Size (Nominal Cross Sectional Area of Conductor), and maximum No. of cores, intended to be covered in the Licence may be drawn for Testing. The Scope of Licence may be restricted based on the Manufacturing and Testing capabilities of the Manufacturer. The Conductor Cross Sectional Area recommended for Grant of Licence/CSoL shall not be larger than that of the tested cable.

4. During the operation of the Licence, BO shall ensure that all the Varieties covered in the Licence are tested in rotation to the extent possible. Only one Factory Sample and one Market Sample shall be drawn during an operative period of one year. Out of the above, one sample shall be tested for all tests and another for all tests excluding type tests.

5. A typical example for drawal of samples to cover the entire Varieties under the Scope of the Licence is given below for the purpose of general guidance:

   a. Sample 1: Three Core, Armoured, Cable with Stranded (Class 2) Copper Conductor, Category C3, suitable for use in Mines.

   and

   b. Sample 2: Single Core, Unarmoured, Cable with Solid (Class 1) Aluminium Conductor, Category 01, including Low Temperature Applications.

ANNEX B

List Of Test Equipment

Major test equipment required to test as per the Indian Standard

Sl. No.	Description of the Test Equipment	Tests used in with Clause Reference
1	Digital Vernier Calliper	Measurement of thickness & Outer Dia. for Cl 10.2, 13.3, 14.3, 15.3, 16.1 and 16.2
2	Steel Scale	Measurement of dimensions for Cl 14.3, 16.1 and 16.2
3	Digital Micro meter	Measurement of Wire Dia. For Cl 10.2, 13.3, 14.3, 15.3, 16.1 and 16.2
4	Measuring Microscope	Measurement of thickness for Cl 10.2, 13.3, 16.1 and 16.2
5	Graduate Magnifying Glass	Measurement of dimensions for Cl 10.2, 13.3, 16.1 and 16.2
6	Tensile Testing Machine	Tensile Strength, Elongation Test & Annealing Test for Cl 16.1 and 16.2
7	Dumb-Bell Cutting Machine with Die	Tensile Strength & Elongation Test for Cl 16.1 and 16.2
8	Hot Air oven with thermostatic Temp. controller	Heat Shock, Hot Deformation & Shrinkage Test for Clause 16.1
9	Thermal Ageing Oven with Thermostatic Temperature control, Air flow Meter & Hour Meter	After Ageing Tensile Strength, Elongation Test & Loss Of Mass Test for Cl 16.1 and 16.2
10	Water Bath with thermostatic temp. control Stirrer & Hour Meter,	Water immersion A.C. & D.C. Test, Insulation Resistance Constant & Volume Resistivity Test for Cl. 16.1 and 16.2
11	Million Mega ohm Meter	Insulation Resistance constant/ Volume Resistivity Test for Cl 16.1 and 16.2
12	Heat Shock Mandrels	Heat Shock Test for Cl 16.1
13	Cold Bend Mandrels	Cold Bend Test for Cl 16.4 (optional requirement)
14	Cold Impact Apparatus	Cold Impact Test for Cl 16.4 (optional requirement)

15	Hot Deformation Apparatus with weight	Hot Deformation Test for Cl 16.1
16	Physical Weighing Balance with Weight	Loss of Mass Test & Thermal Stability Test for Cl. 16.1
17	Double Kelvin Bridge with galvanometer, D.C. Source& Conductivity attachment	Conductor Resistance Test for Cl 16.1, 16.2 and 16.3
18	Flammability Test apparatus with burner, Gas cylinder, Scale, Stopwatch & 0.71 mm copper wire	Flammability Test for Cl 16.2, 17.3
19	Conditioning chamber & Defreezer with Humidity. Indicator	Tensile Strength, Elongation Test, cold bend, cold Impact & Thermal stability Test for Cl 16.1 and 16.2
20	AC Spark Tester	For Spark Testing
21	D.C. High Voltage	D.C. High Voltage Test for Cl 16.1, 16.2 and 16.3
22	A C. high voltage	A.C. High Voltage Test for Cl 16.1, 16.2 and 16.3
23	H.V. Mega Ohm Box	Insulation Resistance Test for Cl 16.1 and 16.2
24	Glass Thermometer	Conductor & Insulation Resistance Test for Cl 16.1, 16.2 and 16.3
25	Balance Digital	Flammability Test for Cl 17.3
26	Stop Watch	Flammability Test for Cl 17.3
27	Thermal stability test apparatus with pH paper & tubes	Thermal Stability Test for Cl 15.1 (e),vii
28	Room Thermometer	Flammability Test, Shrinkage, Annealing & Elongation Test for Cl. 16.1 and 16.2
29	Combustion boat, combustion tube, glass flowmeter, thermometer (250 to 550 degrees), furnace(500 degrees), desiccator	Carbon Black Content for Cl. 16.1
30	Water Absorption (Gravimetric)	Water absorption test.16.1
31	Air Conditioner	For Maintain Room Temp.

Additional Testing Equipment for Armour Testing (in case non ISI Strip/wire is used)		
1	Curvature Gauge	Measurement of thickness test for Cl 14.3
2	Torsion test Apparatus	For Torsion test as per Cl 14.6 (c)
3	Mandrels (15 times the nom. Thickness of Strip 0.5 mm)	For Winding test as per Cl 14.6 (d)
4	Glass Container, Copper Sulphate Solution, Distilled Water, Hot Plate, Copper Carbonate or Copper Hydroxide, Hydrometer, Suitable Glassware	For Uniformity of Zinc Coating Testing as per Cl 14.6 (e)
5	Beaker (500 mi with a watch glass), Antimony Chloride, Conc. Hydro Chloric Acid, Stripping Solution, Trichloroethylene, Spirit	For Mass of Zinc Coating testing as per Cl 14.6 (f)
Additional Testing Equipment for Testing of Category C1(FR), C2(FR-LSH), C3(LSHF)		
1	Oxygen Index test apparatus, Oxygen & Nitrogen gas	For Oxygen Index temperature And Temperature Index Testing as per Cl 16.5 & 16.10
2	Flame Retardation Test (for Single Cable) Apparatus, Ignition Fluid	For Flame Retardation Testing (for Single Cable) as per Cl 16.6
3	Flame Retardation Test (for Bunched Cable) Apparatus	For Flame Retardation Testing (for Bunched Cable) as per Cl 16.7
4	Tube Furnace, Quartz Combustion Tube, Porcelain combustion tube, Wash Bottles (03 Nos.), Glass Tubing and Silicon Rubber Stoppers, Air Flow Meter, Sodium Hydroxide Soln.(0.1 N), Nitric Acid Soln.(6 N), Silver Nitrate Soln.(0.1 N), Ammonium Thiocynate Soln.(0.1 N), Ferric Ammonium Soln.(40 %), Potassium Hydroxide (0.1 N), Sulphuric Acid (0.1 N)	For Halogen Acid Gas Evolution Testing as per Cl 16.9
5	Cubic enclosure, tray, smoke mixer, photometric system	Light Transmission for Cl 17.11
6	Test apparatus as per Annex-F of IS 17505 (part 1)	pH and Conductivity for Cl. 17.10

The above lists are indicative only and may not be treated as exhaustive.

ANNEX C

SCHEME OF INSPECTION AND TESTING

1. QUALITY ASSURANCE PLAN

1.1 It is expected that manufacturers (licensees/applicants) will implement a Quality Assurance plan that is a plan of regular testing and in-process controls, designed to ensure that the product bearing the Standard Mark conforms to all requirements of the Indian Standard.

1.2 The manufacturers shall define a Quality Assurance Plan defining the control unit (i.e. lot/batch etc.) and the levels of control (i.e. the frequency and number of samples for conducting the different tests as per the Indian Standard) and submit the same to BIS Branch Office for information. The manufacturer shall comply with the same and maintain test records in accordance with para 2.4.

1.3 RECOMMENDED LEVELS OF CONTROL/CONTROL UNIT:

For the guidance of manufacturers, the recommended definition of control unit is: *Crosslinked Polyethylene Insulated Thermoplastic Sheathed Cables of continuous length extruded in a day under similar conditions of production for same sheathing material and same nominal cross-sectional area, type and class of conductor* shall constitute a control unit.

1.3.1 For the guidance of manufacturers in preparing the Quality Assurance Plan, recommended levels of control are given in Table 1.

1.3.2 The manufacturer shall ensure inspection and testing as per the Quality Assurance Plan submitted by them on the whole production of the factory which is covered by this plan. Alternatively, the manufacturer has the option of adherence to the quality plan as per levels of control recommended in column 3 of Table 1.

1.4 However, all manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard.

2. ENSURING COMPLIANCE THROUGH TESTING

2.1 It is expected that manufacturers (licensees/applicants) will establish a suitably equipped and staffed in house laboratory (In house testing facility) for testing at least those parameters of the Indian Standard which require routine testing for ensuring quality of the product. This includes in-process controls as may be defined and put in place by the manufacturer and testing parameters/requirements which can only be performed in the factory.

2.2 For the guidance of manufacturers, Table 1 of this manual provides the recommended levels of control is given below. Column 2 of Table 1 indicates routine tests where test equipment is required in house as "R" or other tests which can be subcontracted as "S". Subcontracting is permitted to BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.3 For MSME manufacturers, the requirement of maintaining a laboratory/in-house testing facility for routine tests (indicated as "R" in Column 2 of Table 1) is also optional.

2.3.1 MSME manufacturers may utilize common cluster based facilities as per guidelines for the utilization of cluster based test facilities by MSMEs or the provisions of Sharing of testing facilities or get testing done from BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.4 Large Scale manufacturers shall maintain an in-house laboratory equipped at least with test facilities for routine tests (indicated as "R" in Column 2 of Table 1), where different tests given in the specification shall be carried out in accordance with the method given in the specification. They shall also implement a calibration plan for the in-house test equipment.

2.4.1 Alternatively, in lieu of an in-house laboratory, large scale manufacturers can also utilize the provisions of Sharing of testing facilities as per the Guidelines for Grant of Licence available on BIS website www.bis.gov.in. (Under Conformity Assessment>Product Certification Process). Even for subcontracted tests, provisions for sharing of testing facilities can be utilized.

2.5 TEST RECORDS

The manufacturers maintaining an in-house laboratory or utilizing common cluster based facilities or shared test facilities shall maintain test records for the tests carried out to establish conformity. For the tests being subcontracted to BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025, test reports issued by the laboratories shall be available for inspection by BIS.

3. PACKING AND MARKING

3.1 The Standard Mark as given in the Schedule of the licence shall be incorporated legibly and indelibly on the sheath of cables either by printing, indentation or embossing, provided always that the material so marked conforms to each requirement of the specification.

3.2 Packing and Marking shall be done as per Cl. 19 of IS 7098 (part 1): 2025.

3.3 Additional Marking requirements: The following additional marking requirement shall be marked on each of the packaging of the cables "For BIS certification details please visit www.bis.gov.in"

4. HYGIENIC CONDITIONS (if applicable) – NA.

5. REJECTION

All the production which conforms to the Indian Standard and covered under the scope of this licence shall be marked with the Standard Mark. Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act, 2016.

TABLE 1

(1)					(2)	(3)		
Test Details					**Test equipment requirement** R: required (or) S: Sub-contracting permitted	**Levels of Control**		
Cl.	Requirement	Test		Test Methods		No. of Sample	Frequency	Remarks
		Cl	Ref	Part Ref of IS 10810				
16.1(i)	***Tests on Conductor***							
a)	Annealing test (*for copper*)	7.1.2	IS 8130	1	S	one	Each consignment of raw material received	Further testing is not required if ISI marked or accompanied with TC.
b)	Tensile test (*for Aluminium*)	7.2.1		2	S	one		
c)	Wrapping test (*for Aluminium*)	7.2.2		3	S	one		
d)	Resistance test	7.3, Table 1, 2		5	S	one		
4	Purity test for Cu	Table 1	IS 12444	-	S	One		
16.1(ii)	***Test for round steel wire/formed steel wire Armour***	14.3, 14.6(a) to 14.6(g)	IS 7098 (Pt 1)	36 to 42	S	one	Each consignment of raw material received	No further testing is required if accompanied with TC or ISI marked.
4 to 8	Materials	4 to 8	IS 7098 (Pt 1)	-	R	one	Firm to have adequate in -process controls to check compliance of this parameter as per the tolerances given in the Indian Standard. However, appropriate records shall be maintained by the manufacturer for evidence of conformity.	
9	Construction of conductor	9	IS 7098 (Pt 1)	-	R	one		
10.4	Application of insulation	10.4	IS 7098 (Pt 1)	-	R	one		
11	Core identification	11	IS 7098 (Pt 1)	-	R	one		
12	Laying up of cores	12	IS 7098 (Pt 1)	-	R	one		

13	Inner sheath covering	13	IS 7098 (Pt 1)	-	R	one		
14	Armouring	14	IS 7098 (Pt 1)	-	R	one		
15	Outer Sheath covering	15	IS 7098 (Pt 1)	-	R	one		
16.1(iii)	Thickness of insulation and sheath	**10, 13** and **15**, Table 3,Table 5 and Table **7**	IS 7098 (Pt 1)	6	R	one	Each Control unit	
16.1(iv)	***Physical tests for insulation***							
a)	Tensile strength and elongation at break without ageing	Table 1	IS 7098 (Pt 1)	7	R	one	Each Control unit	
b)	Tensile strength and elongation at break after ageing in air oven	Table 1	IS 7098 (Pt 1)	11	S	one	Cable of each size and type manufactured in a month	Additional samples shall be tested whenever there is a change in formulation of the XLPE compound or in the manufacturing process
c)	Hot Set test	Table 1	IS 7098 (Pt 1)	30	S	one		
d)	Shrinkage test	Table 1	IS 7098 (Pt 1)	12	S	one		
e)	Water absorption (gravimetric)	Table 1	IS 7098 (Pt 1)	33	S	one		
16.1(v)	***Physical tests for outer sheath***							
a)	***PVC Sheath***							
1)	Tensile strength and elongation at break without ageing	Table 2	IS 5831	7	R	one	Each Control unit	
2)	Tensile strength and elongation at break after ageing in air oven	Table 2	IS 5831	11	S	one	Cable of each size and type manufactured in a month	Additional samples shall be tested whenever there is a change in formulation of the XLPE compound or in the manufacturing process
3)	Loss of mass in air oven	Table 2	IS 5831	10	S	one		
4)	Shrinkage test	Table 2	IS 5831	12	S	one		
5)	Hot deformation test	Table 2	IS 5831	15	S	one		
6)	Heat shock test	Table 2	IS 5831	14	S	one		
7)	Thermal stability test	Table 2	IS 5831	60	S	one		

b)	***PE Sheath***							
1)	Carbon black content	Table 1A	IS 7098 (Pt 1)	32	S	One	Cable of each size and type manufactured in a month	Additional samples shall be tested whenever there is a change in formulation of the XLPE compound or in the manufacturing process
2)	Tensile strength and elongation at break without ageing	Table 1A	IS 7098 (Pt 1)	7	R	One	Each Control unit	
	Tensile strength and elongation at break after ageing in air oven	Table 1A	IS 7098 (Pt 1)	7	S	One	Cable of each size and type manufactured in a month	Additional samples shall be tested whenever there is a change in formulation of the XLPE compound or in the manufacturing process
3)	Hot deformation test	Table 1A	IS 7098 (Pt 1)	15	S	One		
4)	Shrinkage test	Table 1A	IS 7098 (Pt 1)	12	S	One		
c)	***LSHF Sheath***							
1)	Tensile strength and elongation at break without ageing	Table 1B	IS 7098 (Pt 1)	7	R	One	Each Control unit	
	Tensile strength and elongation at break after ageing in air oven	Table 1B	IS 7098 (Pt 1)	7	S	One	Cable of each size and type manufactured in a month	Additional samples shall be tested whenever there is a change in formulation of the XLPE compound or in the manufacturing process
2)	Hot deformation test	Table 1B	IS 7098 (Pt 1)	15	S	One		
3)	Water absorption test (for Type ST8)	Table 1B	IS 7098 (Pt 1)	33	S	One		
4)	Shrinkage test (for type ST12)	Table 1B	IS 7098 (Pt 1)	12	S	One		
16.1(vi)	Insulation resistance test (volume resistivity)	Table 1	IS 7098 (Pt 1)	43	R	one	Each Control unit	
16.1(vii)	High voltage test	17.2	IS 7098 (Pt 1)	45	R	one		
16.3 (i)	Conductor Resistance	7.3, Table 1 & 2	IS 8130	5	R	one		

16.1(viii)	Flammability test	17.3	IS 7098 (Pt 1)	53	S	one	Cable of each size and type manufactured in a month	Additional samples shall be tested whenever there is a change in formulation of the XLPE compound or in the manufacturing process.
16.4(i)	Cold bend test for outer sheath	16.4 (i)	IS 5831 or Table 1B	20	As per agreement between purchaser and supplier			
16.4(ii)	Cold impact test for outer sheath	16.4 (ii)		21				
16.4(iii)	Cold elongation test for LSHF sheath	Table 1B	IS 7098 (Pt 1)	7				
16.4(iv)	Resistance test for armour (other than mining cables)	14.5.1	IS 7098 (Pt 1)	42				
	Additional type tests for cables with improved fire performance							
Annex A	Oxygen Index	17.4	IS 7098 (Pt 1)	58	S	One	Cable of each size and type manufactured in three months	Additional samples shall be tested whenever there is a change in formulation of the XLPE compound or in the manufacturing process.
	Flame Retardance Test on single cable	17.5		61				
	Flame Retardance Test on bunched cable	17.6		62				
	Test for Halogen acid evolution (for Category C2 & C3)	17.7		59				
	Smoke Density (for Category C2 & C3)	17.8		IS 13360 (part6/sec9)				
	Temperature index	17.9		64				
	Test for pH and conductivity (for Category C3)	17.10		17.10				
	Test for light transmission (for Category C3)	17.11		63				

ANNEX D

Possible Tests in a day

i. Dimensions

ii. Annealing Test (for Copper wires)

iii. Tensile Test (for Al wires)

iv. Wrapping test (for Al wires)

v. Conductor Resistance

vi. Tensile Test (before ageing) on Insulation and Sheath

vii. Shrinkage Test

viii. Heat Shock Test

ix. Insulation Resistance Test

x. HV Test (at Room Temperature)

xi. Flammability Test