



उत्पाद मैनुअल

आई एस 9968 (भाग 2): 2002 के अनुसार
इलास्टोमेर विद्युत रोधक केबल की विशिष्ट - भाग 2 - 3.3 केवी से 33 केवी तक कार्यकारी वोल्टेज
के लिए

दस्तावेज संख्या – पी एम/आई एस 9968 (भाग 2)/ 2/ अक्टूबर 2021

भारतीय मानक ब्यूरो की स्कीम-I (अनुरूपता मूल्यांकन) विनियम, 2018 के तहत यह उत्पाद मैनुअल प्रमाणीकरण के प्रचालन में रीति और पारिश्रिता 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 दस्तावेज का उपयोग किया जा सकता है।

PRODUCT MANUAL FOR

**Elastomer insulated cables for working voltages from 3.3. kV up to and
including 33kV**

ACCORDING to IS 9968 (Part 2) : 2002

Document No.- PM/ IS 9968 (Pt 2)/ 2/ October 2021

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.

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1.	Product	:	IS 9968 (Pt 2): 2002	
	Title	:	Elastomer insulated cables for working voltages from 3.3. kV up to and including 33kV	
	No. of Amendments	:	2	
2.	Sampling Guidelines:			
a)	Raw material	:	(i)Tinned annealed copper wires/ aluminium wires	IS 8130
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) Elastomer insulated cable- 20 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: Heat resisting Elastomer Insulated, Armoured /Unarmoured, Cables with stranded/flexible Aluminium/ Copper Conductor, Conductor Class 2/5, Inner Sheath Type SE3/ST2, Outer Sheath Type SE4/ST2 for working Voltages up to and including..... kV, 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. Type of Conductor – Cables for fixed installation: Class 2
For flexible cables: Class 5
 - iii. No. of Cores (Single Core, Multicore)
 - iv. Type of Inner Sheath (SE3, ST2)
 - v. Type of Outer Sheath (SE4, ST2)
 - vi. Armoured/ Unarmoured
 - vii. Voltage Grade Uo/U
2. The following relaxation may be given when a variety is tested for all the requirements:

Variety Tested	Additional Variety that may be covered
Multicore	Single Core
Sheath type SE3	Sheath type ST2
Sheath type SE4	Sheath type ST2
Armoured	Unarmoured
Particular Voltage Grade Uo/U	Grades up to and including Voltage Grade Uo/U

3. The Firm shall declare the Varieties and Sizes of various Cables they intend to cover in the Licence. Cable of any Size (Nominal Cross-Sectional Area of Conductor) and no. of Cores (preferably the largest) 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.
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.

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 Tensile Testing Machine	Annealing Test for Copper (Cl 22.1), Tensile test for Aluminium (Cl 22.1), Tensile test and elongation at break of insulation and sheath (Cl 22.1), Ageing in Air Oven (Cl 22.1)
2	Micrometer	Annealing test for Copper (Cl 22.1) , Tensile test for Aluminium (Cl 22.1), Test for Overall diameter (Cl 22.1)
3	Steel Scale	Annealing Test for Copper (Cl 22.1) , Tensile test for aluminium (Cl 22.1) , Hot Set Test (Cl 22.1)
4	Hot Set Test Apparatus (Hot air oven with grips for suspension and weights)	Hot Set Test for insulation and sheath (Cl 22.1)
5	Water Bath	High Voltage test (Cl 22.1) , Insulation Resistance test (Cl 22.1)
6	Conditioning chamber	Tensile test and elongation at break of insulation and sheath (Cl 22.1)
7	Vernier Caliper	Test for thickness of insulation and sheath (Cl 22.1)
8	Micro ohm meter	Conductor resistance test (Cl 22.1)
9	Million Mega ohm meter	Insulation Resistance Test (Cl 22.1)
10	Dumb-bell cutting press	Tensile strength and elongation at break of insulation and sheath. (Cl 22.1)
11	Thermometer	Hot Set test for insulation and sheath (Cl 22.1)
12	AC High Voltage tester	High Voltage test (Cl 22.1)
13	DC High Voltage Tester	High Voltage Test (Cl 22.1)
15	Standard Resistance Box	Insulation Resistance Test (Cl 22.1)
16	Hot air ageing oven with air flow meter, digital temperature control and hour meter	Ageing in air oven (Cl 22.1), Loss Of Mass Test (Cl. 22.1)
17	Air Bomb apparatus	Ageing in air bomb (Cl 22.1)

18	Flammability test chamber with burner and Copper wire	Flammability test (Cl 22.1)
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19	Petroleum based oil, SAE 30 viscosity grade	Oil Resistance (Cl 22.1)
20	Water absorption test apparatus (AC Voltage source, water tank with heating arrangement and insulated mats)	Water absorption test (Cl 22.1)
21	Partial Discharge Test apparatus	Partial Discharge Test (Cl 22.1)
22	Impulse Withstand Test apparatus	Impulse Withstand Test (Cl 22.1)
23	Heating Cycle Test apparatus	Heating Cycle Test (Cl 22.1)
24	Di-electric Power factor Test apparatus	Di-electric Power factor Test (Cl. 22.1)
25	Bending Test apparatus	Bending Test (Cl. 22.1)
26	Thermal stability test apparatus with pH paper & tubes	Thermal Stability Test (Cl. 22.1)
27	Balance Digital	Flammability Test (Cl. 22.1), Thermal Stability Test (Cl. 22.1), Loss of Mass Test (Cl.22.1)
28	Hot Air oven with thermostatic Temp. controller	Heat shock, (Cl. 22.1), Hot Deformation Test (Cl.22.1), Shrinkage Test (Cl.22.1)
29	Heat Shock Mandrels	Heat Shock (Cl. 22.1)
30	Hot Deformation Apparatus with weight	Hot Deformation test (Cl.22.1)
Tests for round steel wire/formed steel wire (strip) armour		
1	Curvature Gauge	Measurement of thickness test for clause 13.3
2	Torsion test Apparatus	For Torsion test as per Clause 20.4 (c)
3	Mandrels (15 times the nom. Thickness of Strip 0.5 mm)	For Winding test as per Clause 20.4 (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 Clause 20.4 (e)

5	Beaker (500 ml with a watch glass), Antimony Chloride, Conc. Hydro Chloric Acid, Stripping Solution, Trichloroethylene, Spirit	For Mass of Zinc Coating testing as per Clause 20.4 (f)
6	Digital Tensile Testing Machine, Micrometer, Conditioning chamber, Dumb-bell cutting press	Tensile strength and elongation at break Cl. 20.4 (a, b)
7	Million Mega ohm meter, Water Bath	Resistivity Cl. 20.4 (g)

The above list is indicative only and may not be treated as exhaustive.

ANNEX C**Scheme of Inspection And Testing**

1. LABORATORY - A laboratory shall be maintained which shall be suitably equipped (as per the requirement given in column 2 of Table 1) and staffed, where different tests given in the specification shall be carried out in accordance with the methods given in the specification.

1.1 The manufacturer shall prepare a calibration plan for the test equipment.

2. TEST RECORDS – The manufacturer shall maintain test records for the tests carried out to establish conformity.

3. LABELLING AND MARKING – In addition to requirements of IS 9968 (Pt 2): 2002, Identification in code or otherwise shall be stencilled on drum, in order that the date of manufacture and control unit can be traced back to factory records.

4. CONTROL UNIT – A cable of continuous length manufactured/ extruded under similar conditions of production for one nominal cross-sectional area and class of conductor shall constitute a control unit.

5. LEVELS OF CONTROL - The tests as indicated in column 1 of [Table 1](#) and the levels of control in column 3 of [Table 1](#), shall be carried out on the whole production of the factory which is covered by this plan and appropriate records maintained in accordance with paragraph 2 above.

6. REJECTIONS – 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: Subcontracting permitted	Levels of Control	
Cl.	Requirement	Test		Test Methods		No. of Sample	Frequency
		Clause	Ref	Part Ref of IS 10810			
	Purity test for Cu	Table 4	IS 191	-	S	One	Each consignment. Further testing is not required if ISI marked or accompanied with TC.
22.3(a)	Conductor resistance	7.3, Table 1, 2, 3	IS 8130	5	R	One	Entire length of core after extrusion of insulation. If so desired routine tests may be conducted on entire length of control unit before cutting into individual coils.
22.3(c)	High voltage test	23.7.2	IS 9968 (Pt 2)	45	R	One	
22.3(b)	Partial discharge test (for screened cables)	23.2	IS 9968 (Pt 2)	46	R	One	Each length of finished cable
7	Tape	7.1,7.2,7.3, 12.1	IS 9968 (Pt 2)	-	R	Two	Each control unit
9	Centre & Fillers	9		-	R	One	Each length of finished cable
20.2.2	Braid	20.2.2		-	R		
13.4	Separator tape (where applicable)	13.4		-	R		
8	Screening	8		-	R		
18	Laying up of cores	18.1, 18.2		-	R		
18	Binder tape	18.3		-	R		
24	Identification	24.1, 24.2, 24.3		-	R		
22.1	Persulphate test (for tinned Copper)	7.1.1	IS 8130	4	R	One	Each control unit
22.1	Annealing test (for Copper)	7.1.2.1, 7.2.3		1	R	One	Every consignment of wire
22.1	Tensile test (for	7.2.1		2	R	Three	Each control unit

	Aluminium)						
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22.1	Wrapping test (for Aluminium)	7.2.2		3	R	Three	Each control unit
22.1	Conductor resistance test	7.3, Table 1, 2, 3		5	R	One	Each control unit
22.1(b) (1)	Tests for round steel wire/formed steel wire (strip) armour Dimensions	20.2.1 & 20.2.2	IS 9968 (Pt 2)	36	R	One	Each consignment of armour wires/ strips received. No further testing is required if accompanied with TC or ISI marked
(2) i	Physical tests on round/ formed wire Tensile strength	20.4(a)	IS 9968 (Pt 2)	37	R	One	
ii	Elongation at break	20.4(b)	IS 9968 (Pt 2)	37	R	One	
iii	Torsion test for formed wires	20.4(c)	IS 9968 (Pt 2)	38	R	One	
iv	Winding test for formed wires	20.4(d)	IS 9968 (Pt 2)	39	R	One	
v	Uniformity of zinc coating	20.4(e)	IS 9968 (Pt 2)	40	R	One	
vi	Mass of zinc coating	20.4(f)	IS 9968 (Pt 2)	41	R	One	
vii	Resistivity	20.4(g)	IS 9968 (Pt 2)	42	R	One	
22.1(c) 1	Physical tests for insulation and sheath (as applicable) Thickness of insulation and sheath and overall diameter	15, 19 and 21	IS 9968 (Pt 2)	6	R	Two	Each control unit
2	Tensile strength and elongation at break of Insulation and Sheath	4.1	IS 6380/	7	R		
3	Ageing in air oven	4.1		11	R		

4	Ageing in air bomb	4.1	IS 5381	56	R	One	Cable of the same size and type manufactured in a week
5	Hot set test	4.1		30	R		
6	Oil resistance test	4.1		31	R		
7	Tear resistance test	4.1		17	R		
8	Shrinkage test	4.1		12	R		
9	Hot deformation test	4.1		15	R		
10	Loss of mass in air oven	4.1		10	R		
11	Heat shock	4.1		14	R		
12	Thermal stability	4.1		60	R		
22.1(d)	Insulation resistance	4.1	IS 6380	43	R	One	Cable of each size & type manufactured in a fortnight
22.1(f)	Bending test followed by partial discharge test	23.3	IS 9968 (Pt 2)	50	R		
22.1(g)	Dielectric power factor test	23.4	IS 9968 (Pt 2)	48	R		
22.1(h)	Heating cycle test followed by partial discharge test	23.5	IS 9968 (Pt 2)	49	R		
22.1(j)	Impulse withstand test	23.6	IS 9968 (Pt 2)	47	R		
22.1(k)	High voltage test for four hours	23.7	IS 9968 (Pt 2)	45	R		
22.1(n)	Flammability test	22.8	IS 9968 (Pt 2)	53	R		
22.1(m)	Water absorption test	4.1	IS 6380	28	R	As per agreement between manufacturer and purchaser	Each length of cable of the same size and type manufactured in a week from the same batch of insulation
22.4	Ozone resistance test (Optional test)	4.1	IS 6380	-	-		
22.4	Cold impacts test for PVC sheath (optional test)	IS 5831					

Note-1: Sub-contracting is permitted to a laboratory recognized by the Bureau or Government laboratories empanelled by the Bureau.

Note-2: Levels of control given in column 3 are only recommendatory in nature. The manufacturer may define the control unit/batch/lot and submit his own levels of control in column 3 with proper justification for approval by BO Head.

ANNEX D

Possible Tests in a day

- a) Dimensions
- b) Annealing test (for Copper wires)
- c) Tensile test (for Aluminium)
- d) Wrapping test (for Aluminium)
- e) Conductor Resistance Test
- f) Test for thickness of insulation and sheath and overall diameter
- g) Physical test for insulation and sheath (Tensile and elongation at break)
- h) Insulation resistance
- i) Flammability Test