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भारतीय मानक

1100 वोल्ट तक की कार्यकारी वोल्टता के लिए पी वी सी रोधित केबल — विशिष्टि

(तीसरा पुनरीक्षण)

Indian Standard

PVC INSULATED CABLES FOR WORKING VOLTAGES UP TO AND INCLUDING 1 100 VOLTS — SPECIFICATION

(Third Revision)

(Incorporating Amendment Nos. 1, 2, 3 & 4)

UDC 621.315.211 [621.315.616.96]

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FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards on 19 February 1990, after the draft finalized by the Power Cables Sectional Committee had been approved by the Electrotechnical Division Council.

This standard was originally published in 1955 and was subsequently revised in 1964 when it was split up in two parts, Part 1 dealing with copper conductors and Part 2 dealing with aluminium conductors. Second revision was brought out in 1977, when the two parts were merged, including the requirements of weatherproof cables previously covered in IS 3035 (Part 1) : 1965. The two voltage grades specified as 250/440 V and 650/1 100 V were also merged. The third revision of this standard has been brought out to take into account the experience gained since then to align with the international practices, to the extent considered appropriate.

Major changes in this revision include the rationalisation of terms used for the type of cables for use under special conditions, inclusion of single core flexible cables and five core flexible cords, stipulation of overall dimensions and updating the references to the Indian Standards on conductor, insulation, sheath and methods of tests. Also for single core sheathed cables the process of single extrusion of insulation and sheath has been eliminated.

While preparing this standard, assistance has been drawn from the following:

IEC Pub 227 :	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V. International Electrotechnical Commission.
227-1 (1979) Part 1 :	General requirements
227-2 (1979) Part 2 :	Test methods
227-3 (1979) Part 3 :	Non-sheathed cables for fixed wiring
227-4 (1979) Part 4 :	Sheathed cables for fixed wiring
227-5 (1979) Part 5 :	Flexible cables (cords)
IEC Pub 719 : 1981	Calculation of the lower and upper limits for the average outer dimensions of cables with circular copper conductors and of rated voltage up to and including 450/750 V. International Electrotechnical Commission.
BS : 6500 : 1984	Insulated flexible cords and cables. British Standards Institution.

This edition 4.4 incorporates Amendment No. 1 (April 1998), Amendment No. 2 (January 2001), Amendment No. 3 (May 2006) and Amendment No. 4 (January 2007). Side bar indicates modification of the text as the result of incorporation of the amendments.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PVC INSULATED CABLES FOR WORKING VOLTAGES UP TO AND INCLUDING 1 100 VOLTS — SPECIFICATION

(Third Revision)

SECTION 1 GENERAL

1 SCOPE

1.1 This standard covers the requirements and tests for the following types of unarmoured PVC insulated cables with copper or aluminium conductors and flexible cords with copper conductors for electric power and lighting (including cables for outdoor use and cables for low temperature conditions) for voltages up to and including 1100 V.

NOTES

1 For cables for outdoor use, the cables shall meet the requirements of additional ageing test (*see* **15.4**).

2 The cables intended for low-temperature conditions shall meet the requirements of cold bend or cold impact test whichever is applicable (*see* **15.4**).

1.1.1 *Types of Cables*

a) Cables for fixed wiring:
   i) Single core (unsheathed):
   ii) Single core (sheathed);
   iii) Circular twin, three and four core (sheathed);
   iv) Flat twin with or without ECC (sheathed); and
   v) Flat three core (sheathed).

b) Flexible cables, single core (unsheathed).

c) Flexible cords:
   i) Single core (unsheathed);
   ii) Single core (sheathed);
   iii) Parallel twin (unsheathed);
   iv) Twisted twin (unsheathed);
   v) Circular twin, three, four and five core (sheathed); and
   vi) Flat twin (sheathed).

1.2 This standard also covers cables with improved fire performance, categories C1 and C2, as given in Annex B. For such cables additional requirements have been included wherever necessary in **8.2, 15.1.1, 15.2.1** and **17.2**.

NOTE — Normal cables to the standard can be classified as meeting the requirements of category 01.

1.3 The cables covered in this standard are suitable for use on ac single phase or three phase (earthed or unearthed) systems for rated voltages up to and including 1 100 V. These cables may be used on dc systems for rated voltages up to and including 1 500 V.

1.4 The cables covered in this standard are suitable for use where the combination of ambient temperature and temperature rise due to load results in a continuous conductor temperature not exceeding 70°C.

1.5 The cables covered in this standard are also suitable for use under outdoor or low temperature conditions provided these meet the additional requirements as given under type tests. For still lower temperature, the purchaser may specify the additional requirements.

1.6 The following types of cables are not covered in this standard:

i) Telephone cables
ii) PVC data transmission cables
iii) Instrumentation cables
iv) PVC insulated screened communication cables (braid/wires/tapes)
v) Flexible power cord other than PVC insulated.

2 REFERENCES

2.1 The standards given in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 1885 (Part 32) : 1971 and IS 10810 (Part 10) : 1984 shall apply.

3.2 Type Tests

Tests required to be made before supply on a general commercial basis on a type of cable in order to demonstrate satisfactory performance characteristics to meet the intended application.

NOTE — These tests are of such a nature that after they have been made they need not be repeated unless changes are made in the cable materials or design which might change the performance characteristics.

3.3 Acceptance Tests

Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

3.4 Routine Tests

Tests made by manufacturer on all finished cable lengths to demonstrate the integrity of the cable.

3.5 Optional Tests

Special tests to be carried out when required by agreement between the purchaser and the supplier.

SECTION 2 MATERIALS

4 CONDUCTOR

4.1 Copper Conductor

The conductor shall be composed of plain annealed high conductivity copper wires complying with IS 8130 : 1984.

4.2 Aluminium Conductor

The conductor shall be composed of aluminium wires complying with IS 8130 : 1984.

4.3 A separator tape made of suitable material may be applied over conductor at the discretion of the manufacturer.

5 INSULATION

5.1 The insulation shall be of PVC compound conforming to the requirements of Type A of IS 5831 : 1984.

6 FILLERS

6.1 The fillers shall consist of vulcanized rubber, unvulcanized rubber, thermoplastic compound or textile materials.

6.2 The filler materials shall be suitable for operating temperature of the cable and compatible with other components of the cable. These shall not be harder than PVC used for insulation and sheath.

7 BINDER TAPE

7.1 Binder tape shall consist of plastic or proofed textile material.

8 SHEATH

8.1 The sheath shall consist of PVC compound conforming to the requirements of ST 1 type of IS 5831 : 1984.

8.2 For cables with improved fire performance, the insulation/sheath (as applicable) shall, in addition, meet the requirement of tests applicable for the required category (*see* **15.1.1** and **15.2.1**).

SECTION 3 CONSTRUCTION

9 CONDUCTOR

9.0 Nominal cross sectional area of conductor of cables covered in this standard is given in respective tables.

9.1 Cables for Fixed Wiring

The construction of conductors for fixed wiring shall be as given in Table 1.

9.1.1 Conductors of nominal area less than 16 mm^2 shall be circular only. Conductors of nominal area 16 mm^2 and above may be circular or shaped.

9.2 Flexible Cables and Cords

The conductor shall be according to flexibility Class 5 of IS 8130 : 1984.

9.3 A separator tape may be applied over the conductor (*see* **4.3**).

10 INSULATION

10.1 The conductor shall be provided with PVC insulation applied by extrusion.

10.2 Thickness of Insulation

The average thickness of insulation shall be not less than the nominal value (ti) specified in Tables 2 to 6.

10.3 Tolerance on Thickness of Insulation

The smallest of the measured values of thickness of insulation shall not fall below the nominal value (ti) specified in the relevant tables by more than (0.1 mm + 0.1 ti).

10.4 Application of Insulation

The insulation shall be so applied that it fits closely on the conductor and it shall be possible to remove it without damage to the conductor.

11 CORE IDENTIFICATION

11.1 Cores shall be indentified by different colouring of PVC insulation. The colour scheme as given in Table 7 shall be adopted.

12 LAYING-UP OF CORES

12.1 Flat Twin and Three-Core Cables (Without ECC)

Two or three cores shall be laid side by side.

12.2 Flat Twin Cables (with ECC)

Two cores with a bare ECC shall be laid side by side in the same plane (ECC occupying the central position).

12.3 Circular Twin, Three- and Four-Core Cables

Two, three or four cores shall be laid together with a suitable right-hand lay. The interstices between the cores may be filled with fillers. A binder tape may be applied over the laid-up cores.

12.4 Circular Twin, Three, Four and Five Core Flexible Cords

Two, three, four or five cores shall be twisted together with a suitable right-hand lay. The interstices may be filled with sheathing material, fillers or strengthening cords of textile or any other suitable material.

12.5 Parallel Twin (Unsheathed) Flexible Cords

Two conductors shall be laid parallel and insulated simultaneously such that the cores can be separated readily without damage.

12.6 Twisted Twin (Unsheathed) Flexible Cords

Two cores shall be twisted together with a suitable right hand lay.

12.7 Flat Twin (Sheathed) Flexible Cords

Two cores shall be laid side by side.

13 SHEATHING

13.1 The sheath, where applicable, shall be applied by extrusion. It shall be applied:

a) Over the insulation in case of single-core cables, and
b) Over the laid-up cores in other cases.

13.1.1 The sheath shall be so applied that it fits closely on the laid-up cores and it shall be possible to remove it without damage to the insulation.

13.2 Colour of the Sheath

The colour of the sheath shall be black or any other colour as agreed to between the purchaser and the supplier.

13.2.1 For weatherproof cables, the colour of sheath shall be black only.

13.3 Thickness of Sheath

The thickness of PVC sheath, determined by taking the average of a number of measurements, shall be not less than the nominal value (ts) specified in Tables 4 and 5; and the smallest of the measured values shall not fall below the nominal value (ts) specified in Tables 4 and 5 by more than 0.2 mm + 0.2 ts.

14 OVERALL DIMENSIONS

14.1 The mean overall dimensions of the cables shall not exceed the limits specified in Tables 2 to 6.

14.1.1 *Ovality*

The difference between maximum and minimum measured values of overall diameter of sheathed circular cables shall not exceed 15 percent of the maximum measured value at the same cross-section.

SECTION 4 TESTS

15 CLASSIFICATION OF TESTS

15.1 Type Tests

The tests given in Table 8 shall constitute type tests.

15.1.1 The tests given in Table 8A shall constitute additional type tests for cables with improved fire performance as per the categories given in Annex B.

15.2 Acceptance Tests

The following shall constitute acceptance tests:

a) Annealing test (for copper),
b) Tensile test (for aluminium),
c) Wrapping test (for aluminium),
d) Conductor resistance test,
e) Test for thickness of insulation and sheath,
f) Tensile strength and elongation at break of insulation and sheath,
g) Insulation resistance test,
h) High voltage test, and
j) Flammability test.

15.2.1 The following shall constitute additional acceptance tests for cables with improved fire performance as per the categories given in Annex B:

Category	Test
01	No additional Test
C1	a) Oxygen index test
C2	a) Oxygen index test
	b) Test for halogen acid gas evolution
	c) Test for smoke density

15.2.2 A recommended sampling plan for acceptance tests is given in Annex C.

15.3 Routine Tests

The following shall constitute routine tests:

a) Conductor resistance test, and
b) High voltage test.

15.4 Optional Test

The test given in Table 9 shall constitute optional tests.

16 DETAILS OF TESTS

16.1 Methods of Tests

Unless otherwise stated, the tests shall be carried out in accordance with appropriate part of IS 10810, taking into account the additional information given in this standard.

16.2 High Voltage Test (Water Immersion Test) (Type Test)

16.2.1 *ac Test*

The core(s) shall be carefully removed from a sample approximately 3 m long from the finished cable. They shall be so immersed in a water-bath at 60±3°C that their ends protrude at least 200 mm above the water-level. After 24 hours, a voltage of 3 kV (rms) shall be applied between conductors and water. This voltage shall be raised to 6 kV (rms) within 10 seconds and held constant at this value for 5 minutes. If the sample fails in this test, one more sample shall be subjected to this test, which should pass.

16.2.2 *dc Test*

The cores which have passed the preliminary test given in **16.2.1** shall be subsequently tested with a dc voltage of 1.2 kV in the same water-bath at the same temperature.

The conductors shall be connected to the negative pole and water to the positive pole of dc supply by means of a copper electrode. The core shall withstand this dc voltage test for 240 hours without breakdown.

The voltage shall be applied continuously, but if there are any unavoidable interruptions during the 4 hours period, that period shall be increased by the time of interruptions. The total of such interruptions shall not exceed 1 hour otherwise the test shall be started again.

16.3 High Voltage Test (at Room Temperature) (Acceptance and Routine Test)

16.3.1 The cables and cords shall withstand without breakdown an ac voltage of 3 kV (rms) or a dc voltage of 7.2 kV applied for a period of 5 min for each test connection.

16.3.1.1 Single-core cables shall be immersed in water at ambient temperature one hour before the testing and the test voltage shall be applied between conductor and water for the specified period.

16.4 Spark Test (Routine Test)

Spark test may be carried out as an alternate to high voltage on single core unsheathed cables. The voltage shall be as specified below:

Thickness of Insulation mm	*Test Voltage* kV (rms)
Up to and including 1.0	6
Above 1.0 and up to and including 1.5	10
Above 1.5 and up to and including 2.0	15
Above 2.0 and up to and including 2.5	20
Above 2.5	25

16.5 Flammability Test

The period of burning after removal of flame shall not exceed 60 seconds and the unaffected (uncharred) portion from the lower edge of the top clamp shall be at least 50 mm.

16.6 Additional Ageing Test (For Cables for Outdoor Use)

16.6.1 *Ageing of Sample*

A sample of at least 3 m long, of the finished cable shall be suspended in a heating chamber and exposed to a temperature of 80±2°C during a period of 168 hours. Immediately after this, the sample shall be placed in a bath of boiling water for a period of 8 hours and in a water-bath at 25°C for 16 hours. This procedure shall be repeated on 5 successive days. The ends of the sample shall protrude at least 200 mm above the water level.

16.6.2 *Testing and Evaluation*

A sample, 5 m long, taken from the conditioned sample shall be tested for high voltage test in accordance with **16.3**. The test has however, to be carried out on the finished cable and in a water bath at 60±3°C.

16.6.2.1 The remaining conditioned sample shall be submitted to cold bend cold impact test as appropriate.

16.7 Flexing Test

Under consideration.

16.8 Oxygen Index Test

The test on samples of insulation/sheath (as applicable) shall be done at 27 ± 2°C. The oxygen index shall not be less than 29.

16.9 Test for Halogen Acid Gas Evolution

The level of HCl evolved shall not exceed 20 percent by weight.

16.10 Test for Temperature Index

The measured value of Temperature Index shall be 21 at a temperature of 250°C.

16.11 Measurement of Smoke Density Rating — Under Preparation

SECTION 5 IDENTIFICATION, PACKING AND MARKING

17 IDENTIFICATION

17.1 Manufacturer's Identification

The manufacturer shall be identified throughout the length of the cable by means of a tape bearing the manufacturer's name or trade-mark, or by manufacturer's name or trade-mark being printed, indented or embossed on the cable. In case none of these methods can be employed, or if the purchaser so desires, colour identification thread(s) in accordance with a scheme to be

approved by the Bureau of Indian Standards shall be employed. The printing, indentation or embossing shall be done on the insulation in case of unsheathed cables and on the sheath in case of sheathed cables. The distance between any two consecutive printings, indentations or embossings shall be not more than 1 m.

17.2 The following special cables shall be identified by indenting, embossing or printing the appropriate legend throughout the cable length, in addition to the existing marking requirements.

	Type of Cable	*Legend*
i)	Improved fire performance or Category C1	FR
ii)	Improved fire performance or Category C2	FR-LSH

17.3 Cable Code

The following code shall be used for designating the cable:

Constituent	*Code Letter*
Aluminium conductor	A
PVC insulation	Y
PVC sheath	Y
Earth continuity conductor	(ECC)
Suitable for outdoor use	OU
Suitable for low temperature	SZ

NOTE — No code letter is required when the conductor material is copper.

18 PACKING AND MARKING

18.1 The cable shall be either wound on drums (*see* IS 10418 : 1982) reels or supplies in coils packed.

18.2 The cable shall carry the following information either stencilled on the reel or drum or contained in a label attached to it:

a) Reference to this Indian Standard, for example, Reel/IS 694;
b) Manufacturer's name, brand name or trade-mark;
c) Type of cable and voltage grade;
d) Number of cores;
e) Nominal cross-sectional area of conductor;
f) Cable code;
g) Colour of core (in case of single core cables);
h) Length of cable on the reel, drum or coil;
j) Number of lengths on the reel, drum or coil (if more than one);
k) Direction of rotation of drum (by means of arrow);
m) Approximate gross mass;
n) Country of manufacture;
p) Year of manufacture; and
q) The word 'suitable for outdoor use' or 'suitable for low temperature', wherever applicable.

18.2.1 The cable (packed coil, reel, drum or label) may also be marked with the Standard Mark.

SECTION 6 TABLES

Table 1 Construction of Conductor

(*Clause* 9.1)

Nominal Cross-sectional Area		Solid/Stranded	Flexibility Class
Copper mm^2	Aluminium mm^2		
Up to and including 6 mm^2	Up to and including 10 mm^2	Solid/Stranded	Class 1 (Table 1) or Class 2 (Table 2) of IS 8130 : 1984
Above 6 mm^2	Above 10 mm^2	Stranded	Class 2 (Table 2) of IS 8130 : 1984

Table 2 Single-Core PVC Insulated (Unsheathed) Cables

(*Clauses* 10.2 *and* 14.1)

Nominal Cross-Sectional Area of Conductor mm^2	Nominal Thickness of Insulation (t_i) mm	Overall Diameter, *Max* mm	Nominal Cross-Sectional Area of Conductor mm^2	Nominal Thickness of Insulation (t_i)	Overall Diameter, *Max* mm
(1)	(2)	(3)	(1)	(2)	(3)
1*	0.7	3.2	50	1.4	13.0
1.5	0.7	3.4	70	1.4	15.0
2.5	0.8	4.2	95	1.6	17.5
4	0.8	4.8	120	1.6	19.0
6	0.8	5.6	150	1.8	21.0
10	1.0	7.0	185	2.0	23.5
16	1.0	8.2	240	2.2	26.5
25	1.2	10.0	300	2.4	29.5
35	1.2	11.5	400	2.6	33.5
			500	2.8	37.5
			630	2.8	42.0

*For copper conductors only.

Table 3 Flexible PVC Insulated (Unsheathed) Cords

(*Clauses* 10.2 *and* 14.1)

Nominal Cross-Sectional Area of Conductor mm^2	Nominal Thickness of Insulation (t_i) mm	Overall Dimensions, *Max*		
		Single Core mm	Parallel Twin mm	Twisted Twin mm
(1)	(2)	(3)	(4)	(5)
0.5	0.6	2.6	2.6 × 5.2	5.2
0.75	0.6	2.8	2.8 × 5.6	5.6
1	0.6	3.0	3.0 × 6.0	6.0
1.5	0.6	3.8	3.3 × 6.6	6.6
2.5	0.7	4.0	4.0 × 8.0	8.0
4	0.8	4.8	4.8 × 9.6	9.6

Table 4 Single Core Unsheathed Flexible Cables

(*Clauses* 10.2 *and* 14.1)

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (t_i)	Overall Diameter, *Max*
mm^2	mm	mm
(1)	(2)	(3)
6	0.8	6.4
10	1.0	8.0
16	1.0	9.6
25	1.2	11.5
35	1.2	13.0
50	1.4	15.0

Table 5 PVC Insulated and sheathed Cables

(*Clauses* 10.2, 13.3, *and* 14.1)

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (*t*i)	Nominal Thickness of Sheath (*t*s)				Nominal Cross-Sectional Area of ECC	Overall Dimensions, *Max*						
		Single Core	Twin Core	Three Core	Four Core		Single Core	Twin Core Circular	Three Core Circular	Four Core Circular	Flat Twin Core without ECC	Flat Twin Core with ECC	Flat Three Core without ECC
mm^2	mm	mm	mm	mm	mm	mm^2	mm	mm	mm	mm	mm	mm	mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1*	0.6	0.8	0.9	0.9	0.9	1.0	4.7	8.2	8.6	9.2	7.8× 5.0	9.2×5.0	10.5× 5.0
1.5	0.6	0.8	0.9	0.9	0.9	1.5	5.0	8.8	9.2	10.0	8.4× 5.4	10.2×5.4	11.5× 5.4
2.5	0.7	0.8	1.0	1.0	1.0	1.5	5.8	10.5	11.0	12.0	10.0× 6.4	12.0×6.4	14.0× 6.4
4	0.8	0.9	1.0	1.1	1.1	1.5	6.8	12.0	13.0	14.0	11.5× 7.2	13.5×7.2	16.5× 7.2
6	0.8	0.9	1.1	1.1	1.2	2.5	7.8	13.5	14.5	15.5	13.0× 8.0	15.5×8.0	18.0× 8.0
10	1.0	0.9	1.2	1.2	1.3	4.0	8.8	16.5	17.5	19.5	16.0× 9.6	19.0×9.6	22.5× 9.6
16	1.0	1.0	1.3	1.3	1.4	6.0	10.5	19.0	20.0	22.5	18.5×11.0	22.0×11.0	26.5×11.0
25	1.2	1.1	1.4	1.5	1.6	—	12.5	23.0	24.5	27.5	22.5×13.0	—	32.5×13.5
35	1.2	1.1	1.5	1.6	1.7	—	13.5	25.5	27.5	30.5	25.5×14.5	—	36.0×15.0
50	1.4	1.2	1.6	1.7	1.8	—	15.5	29.5	31.5	35.0	29.0×16.5	—	41.5×17.0

*For copper conductors only.

Table 6 Flexible PVC Insulated and Sheathed Cords

(*Clauses* 10.2, 13.3 *and* 14.1)

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (*ti*)	Nominal Thickness of Sheath (*t*s)					Overall Dimensions, *Max*						
		Single Core	Tow Core	Three Core	Four Core	Five Core	Single Core	Flat Twin	Circular Twin	Three Core	Flat Three Core	Four Core	Five Core
mm^2	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
0.5	0.6	0.9	0.9	0.9	0.9	0.9	4.5	4.9× 7.2	7.2	7.6	4.9 × 9.6	8.2	9.0
0.75	0.6	0.9	0.9	0.9	0.9	0.9	4.7	5.2× 7.8	7.8	8.2	5.2 ×10.5	8.8	9.6
1	0.6	0.9	0.9	0.9	0.9	1.0	4.9	5.4× 8.0	8.0	8.6	5.4 ×11.0	9.4	10.5
1.5	0.6	0.9	0.9	0.9	1.0	1.0	5.4	5.6× 8.6	8.6	9.2	5.6 ×12.0	10.5	11.0
2.5	0.7	1.0	1.0	1.0	1.0	1.0	6.2	6.6×10.5	10.5	11.0	6.6 ×14.0	12.0	13.0
4	0.8	1.0	1.0	1.0	1.0	1.1	7.0	7.4×12.0	12.0	12.5	7.4 ×16.5	14.0	15.5

Table 7 Core Identification

(*Clause* 11.1)

	Cables for Fixed Wiring	Flexible Cords	Flexible Cables
1	Core Red, Black, Yellow, Blue, White or Grey	Red, Black, Yellow, Blue, White or Grey	Red, Black, Yellow, Blue, White or Grey
2	Core Red and Black	Red and Black	—
3	Cores Red, Yellow and Blue	Red, Black and Yellow-green (for ECC)	—
4	Cores Red, Yellow, Blue and Black	Red, Yellow, Blue and Yellow-green (for ECC)	—
5	Cores	Red, Yellow, Blue, Black and Grey	—

NOTES

1 In case of single-core cables used for control wiring of switchgear etc, colour other than the above shall be permissible as agreed to between the purchaser and the supplier.

2 The colour of insulation for parallel twin flexible cords may be Red, Black, Yellow, Blue, white or Grey. The cores may be identified by a longitudinal rib on one core.

3 For the time being, green colour for ECC is also permissible.

Table 8 Type Tests

(*Clause* 15.1)

Test	For Requirements, Ref	For Test Method, Ref Part No. of IS 10810
a) Tests on conductor		
i) Annealing test (for copper)	IS 8130 : 1984	1
ii) Tensile test (for aluminium)	IS 8130 : 1984	2
iii) Wrapping test (for aluminium)	IS 8130 : 1984	3
iv) Resistance test	IS 8130 : 1984	5
b) Test for overall dimensions and thickness of insulation and sheath	10, 13, 14 Tables 1 to 5 of IS 694	6
c) Physical tests for insulation and sheath		
i) Tensile strength and elongation at break	IS 5831 : 1984	7
ii) Loss of mass test	IS 5831 : 1984	10
iii) Ageing in air oven	IS 5831 : 1984	11
iv) Shrinkage test	IS 5831 : 1984	12
v) Heat shock test	IS 5831 : 1984	14
vi) Hot deformation	IS 5831 : 1984	15
d) Insulation resistance	IS 5831 : 1984	43
e) High voltage test (water immersion test)	16.2 of IS 694	45
f) Flammability test	16.5 of IS 694	53

Table 8A Additional Type Tests for Cables with Improved Fire Performance

(*Clause* 15.1.1)

Category	Tests	For Requirement Ref	For Test Methods Ref Part No. of IS 10810
(1)	(2)	(3)	(4)
01	No Additional tests	—	—
C1	a) Oxygen index test	16.8	58
	b) Temperature index	16.13	64
C2	a) Oxygen index test	16.8	58
	b) Smoke density	16.14	Under Preparation
	c) Test for halogen acid gas evolution	16.12	59
	d) Temperature index	16.13	64

NOTES

1 For category C1, tests (a) and (b) are to be performed on samples taken from outer sheath, as applicable, and prepared in the manner given in the relevant test method.

2 For category C2, tests (a), (b), (c) and (d) are to be performed on samples taken from outer sheath, as applicable, and prepared in the manner given in the relevant test method.

Table 9 Optional Tests

(*Clause* 15.4)

Test	For Requirements, Ref	For Test Method, Ref Part No. IS 10810
a) Cold bend test	IS 5831 : 1984	20
b) Cold impact test	IS 5831 : 1984	23
c) Additional ageing test	16.6 of IS 694	—
d) Flexing test	16.7 of IS 694	—

NOTE — It shall be permissible to carry out the routine tests on manufacturing lengths in place of individual shipping lengths.

ANNEX A

(*Clause* 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*	*IS No.*	*Title*
1885 (Part 32) : 1971	Electrotechnical vocabulary: Part 32 Cables, conductors and accessories for electricity supply	5831 : 1984	Specification for PVC insulation and sheath of electric cables (*first revision*)
3035 (Part 1) : 1965	Specification for thermoplastic insulated weatherproof cables: Part 1 PVC insulated and PVC sheathed	8130 : 1984	Specification for conductors for insulated electric cables and flexible cords (*first revision*)
4905 : 1968	Methods for random sampling	10418 : 1982	Specification for drums for electric cables
		10810 : 1984	Methods of test for cables

ANNEX B

(*Clauses* 1.2, 15.1.1 *and* 15.2.1)

CLASSIFICATION OF CABLES FOR IMPROVED FIRE PERFORMANCE

Category	Environment Description	Type	Cable Definition
01	Cable in open areas	—	Flame retardant, Single cable self-extinguishing, does not propagate flame
C1	Cables in constrained areas	FR	Flame retardant, does not propagate fire even when installed in groups in vertical ducts
C2	Cables in constrained areas with limited human activity and/or presence of sophisticated systems	FR-LSH	Flame retardant cables with reduced halogen evolution and smoke

ANNEX C

(*Clause* 15.2.2)

SAMPLING OF CABLES

C-1 LOT

C-1.1 In any consignment the cables of the same size and type manufactured under essentially similar conditions of production shall be grouped together to constitute a lot.

C-2 SCALE OF SAMPLING

C-2.1 Samples shall be taken and tested from each lot for ascertaining the conformity of the lot to the requirements of the specification.

C-2.2 The number of samples to be selected shall depend on col 1 and 2 of the following table. These samples shall be taken at random.

Number of Drums/ Coils/Reels in the Lot	*Number of Drums/Coils/ Reels to be Taken as Sample*	*Permissible Number of Defectives*
(N)	(n)	(a)
Up to 25	3	0
26 to 50	5	0
51 to 100	8	0
101 to 300	13	1
301 and above	20	1

C-2.2.1 In order to ensure the randomness of selection, procedure given in IS 4905 : 1968 may be followed.

C-3 NUMBER OF TESTS AND CRITERION FOR CONFORMITY

C-3.1 From each of the drum/coils/reels selected according to col 1 and 2 of the above table, suitable lengths of test samples shall be taken. These test samples shall be subjected to each of the acceptance tests. A test sample is called defective if it fails in any one of the acceptance tests. If the number of defectives is less than or equal to the corresponding permissible number given in col 3 of the above table, the lot shall be declared as conforming to the requirements of the acceptance tests; otherwise not.

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