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IS 9968-1 (1988): Elastomer insulated cables, Part 1: For working voltages upto and including 1 100 V [ETD 9: Power Cables]

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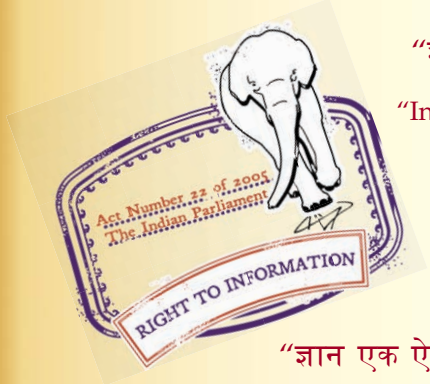

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS : 9968 (Part 1) - 1988
(Reaffirmed 2000)

Indian Standard

SPECIFICATION FOR ELASTOMER INSULATED CABLES

PART 1 FOR WORKING VOLTAGES UP TO AND INCLUDING 1 100 VOLTS

(First Revision)

Fourth Reprint FEBRUARY 2001

UDC 621·315·211 : 621·315·616·96 [678·074]

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 5 *May* 1989

AMENDMENT NO. 1 APRIL 1991

TO

IS 9968 (Part 1) : 1988 SPECIFICATION FOR ELASTOMER INSULATED CABLES

PART 1 FOR WORKING VOLTAGES UP TO AND INCLUDING 1 100 V

(First Revision)

(*Page* 2, *clause* **2.3**) — Insert the following clause after **2.3**:

'**2.4 Optional Tests** — Special tests to be carried out, when required, by agreement between the purchaser and the supplier.'

(*Page* 5, *clause* **21.3**) — Insert the following clause after **21.3**:

'**21.4 Optional Tests** — The following shall constitute the optional tests:

a) Flexing test for cords for use with electric irons.'

(*Page* 5, *clause* **22.3**) — Insert the following clause after **22.3**:

'**22.4 Flexing Test for Cords for Use with Electric Irons** — *see* Appendix B.'

(*Page* 10, *Appendix* A) — Insert the following Appendix B at the end:

'APPENDIX B

(*Clause* 22.4)

FLEXING TEST FOR CORDS FOR USE WITH ELECTRIC IRONS

B-1 The part of the iron comprising the cable entry fitted with the cord guard and the flexible cable or cord for which the iron is designed, is fixed to the oscillating member of an apparatus similar to that shown in Fig. 1

B-2 The sample is so mounted that the axis of oscillation is tangential to the outer surface of the part in which the cord guard is secured, and when the oscillating member is at the middle of its travel, the axis of the cable or cord, where it leaves the cord guard, is vertical.

B-3 A load having a mass equal to that of the iron but not less than 2 kg or more than 6 kg is attached to the cable or cord

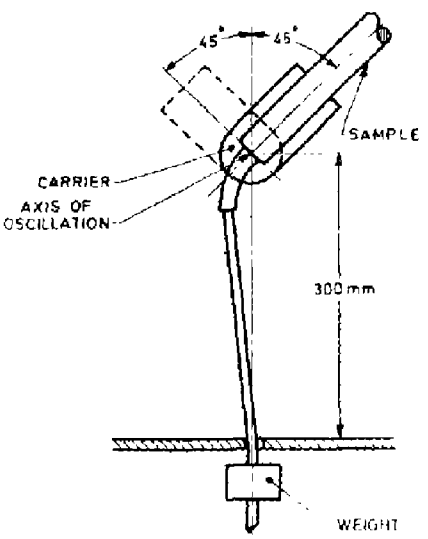

FIG. 1 FLEXING TEST APPARATUS

B-4 The oscillating member is moved backwards and forwards through an angle of 90° (45° on either side of the vertical), number of flexings, the sample is turned through 90° about the centre line of the cord guard.

B-5 After the test, the cord guard shall not have worked loose and neither the cord guard nor the flexible cable or cord shall show any damage within the meaning of this specification except that and give then 10 percent of the total number of conductor strands may have been broken.

NOTE — A flexing is one movement either backward or forward.'

AMENDMENT NO. 2 FEBRUARY 2006
TO

IS 9968 (PART 1) : 1988 SPECIFICATION FOR ELASTOMER INSULATED CABLES

PART 1 FOR WORKING VOLTAGES UP TO AND INCLUDING 1 100 VOLTS

(First Revision)

(*Page* 5, *clause* **22.2.2**, *line* 3) — Delete 'or between conductor and screen/armour'

(ET 09)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SPECIFICATION FOR ELASTOMER INSULATED CABLES

PART 1 FOR WORKING VOLTAGES UP TO AND INCLUDING 1 100 VOLTS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part 1) (First Revision) was adopted by the Bureau of Indian Standards on 25 August 1988, after the draft finalized by the Power Cables Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard was originally published in 1981. This revision has been brought out to take into account the experience gained since then. The opportunity has also been utilized to align the format of this specification with other specifications for different types of cables and to make reference to latest Indian Standards on conductor, insulation, sheath and methods of test for cables.

0.3 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 or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*)

SECTION 1 GENERAL

1. SCOPE

1.1 This standard specifies the requirements of elastomeric insulated cables for fixed wiring, flexible cables and flexible cords for electric power and lighting for operation at voltages up to and including 1 100 volts.

1.2 The following types of cables and cords are covered in this standard:

1.2.1 *Cables for Fixed Wiring*

a) Braided and compounded/varnished,

b) Elastomer sheathed (normal duty), and

c) Elastomer sheathed (normal duty) with earth continuity conductor.

1.2.2 *Flexible Cables*

a) Braided and varnished, and

b) Elastomer sheathed (heavy duty).

1.2.3 *Flexible Cords*

a) Braided

b) Elastomer sheathed (normal duty),

c) Unkinkable flexible cords — braided and compounded (workshop type), and

d) Unkinkable flexible cords — braided and compounded.

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

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 conductor temperature not exceeding the following:

Type of Insulation	*Normal Continuous Operation*	*Short-Circuit Condition*
Insulation for general service	60°C	200°C
Heat resisting insulation	90°C	250°C
Silicone rubber insulation	150°C	350°C

NOTE — The short-circuit temperatures mentioned above are based on intrinsic properties of the insulating materials It is essential that the accessories which are used in the above system with mechanical and/or soldered connections are suitable for the temperature

2. TERMINOLOGY

2.0 For the purpose of this standard, the definitions given in IS : 1885 (Part 32)-1971* shall apply, in addition to the following.

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

2.2 Type Tests — Tests required to be made before supply on a general commercial basis 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

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

*Electrotechnical vocabulary Part 32 Cables, conductors and accessories for electricity supplies

SECTION 2 MATERIALS

3. CONDUCTOR

3.1 Copper Conductor — The conductor shall be tinned annealed copper wires complying with the requirements of IS . 8130-1984*.

NOTE — The use of plain copper conductor is also permissible for cables with silicone rubber insulation

3.2 Aluminium Conductor — The conductor shall be composed of aluminium wires complying with the requirements of IS . 8130-1984*.

3.3 A separator tape made of suitable material may be applied over the conductor

4. INSULATION

4.1 Insulation for General Service — The insulation shall be of elastomer compound conforming to Type IE 1 of IS : 6380-1984†.

4.2 Heat Resisting Insulation — The insulation shall be of elastomer compound conforming to Type IE 2 of IS : 6380-1984†.

4.3 Silicone Rubber Insulation — The insulation shall be of silicone rubber conforming to Type IE 5 of IS . 6380-1984†.

5. TAPE

5.1 Proofed Tape — The proofed tape shall be closely woven textile, without selvedge, proofed on one side with rubber. The thickness of tape should be approximately 0·15 mm.

5.2 Polyethylene Terephthalate (PETP) Tape or Plastic Tape or Any Other Suitable Tape — The thickness of tape should be 0 012 5 mm (minimum).

5.3 Glass Tape — The glass tape shall be of suitable quality.

*Specification for conductors for insulated electric cables and flexible cords (*first revision*).

†Specification for elastomeric insulation and sheath of electric cables (*first revision*)

6. FILLERS

6.1 The fillers shall be of natural or synthetic fibres or elastomer. The filler material shall be suitable for the operating temperature and compatible with the insulating material.

7. BRAID

7.1 Textile Braid — The textile braid shall consist of textile material (natural or synthetic), such as cotton, artificial silk mercerized or rayon (excluding jute or hemp).

7.2 Glass Braid — The glass braid shall consist of glass fibre yarn of suitable quality.

8. SHEATH

8.1 General Service Insulated Cables and Flexible Cords

8.1.1 *Cables for Fixed Wiring and Flexible Cords* — The sheath shall consist of elastomeric compound complying with the requirements of Type SE 1 of IS . 6380-1984*.

8.1.2 *Flexible Cables* — The sheath shall consist of elastomeric compound complying with the requirements of Type SE 2 of IS : 6380-1984*.

8.2 Heat Resisting Insulated Cables

8.2.1 *Cables for Fixed Wiring and Flexible Cords* — The sheath shall consist of elastomeric compound complying with the requirements of Type SE 3 of IS : 6380-1984*.

8.2.2 *Flexible Cables* — The sheath shall consist of elastomeric compound complying with the requirements of Type SE 4 of IS . 6380-1984*.

*Specification for elastomeric insulation and sheath of electric cables (*first revision*)

9. COMPOUND AND VARNISH

9.1 Preservative Compound — Preservative compound shall be free from deleterious action on any part of the cable.

9.2 Varnish — Varnish shall be compatible with the operating temperature of the cable and applied to prevent fraying of glass yarn. It shall be free from deleterious action on any part of the cable.

SECTION 3 CONSTRUCTION

10. CONDUCTOR

10.1 Cables for Fixed Wiring — The construction of conductor for cables for fixed wiring shall be as follows

Nominal Cross-Sectional Area mm²		*Solid/ Stranded*	*Flexibility Class (Refer to IS : 8130-1984*)*
Copper	Aluminium		
1 and 1 5	1 5	Solid	Class 1
2 5 to 6	2 5 to 10	Solid/ Stranded	Class 1 for solid and class 2 for stranded
10 and above	16 and above	Stranded	Class 2

10.1.1 The conductors shall be circular

10.1.2 The earth continuity conductor shall be constructed from same material as main conductor

10.2 Flexible Cables and Cords - The conductor formation shall be according to Class 5 of IS 8130-1984*

11. SEPARATOR TAPE

11.1 The separator tape may be applied over the conductor as mentioned in the respective tables

*Specification for conductors for insulated electric cables and flexible cords (*first revision*)

12. INSULATION

12.1 The conductor, with or without separator, shall be provided with insulation in accordance *with respective tables.*

12.2 Thickness of Insulation — The average thickness of the insulation shall be not less than the nominal value (t_1) specified in respective tables.

12.3 Tolerance on Thickness of Insulation (t_1) — The smallest of the measured values of thickness of insulation shall not fall below the nominal value (t_1) specified in respective tables by more than 0 1 mm + 0 1 t_1

12.4 Application of Insulation — The insulation shall be so applied that it fits closely on the conductor (with or without separator) but shall not adhere to it The insulation, unless applied by the extrusion, shall be applied in two or more layers.

13. CORE IDENTIFICATION

13.1 The cores shall be identified either by colours or number in accordance with **13.2** using any one of the following methods

a) Numbered tapes,

b) Coloured insulation,

c) Coloured tape, and

d) Numbers printed on cores

13.2 The colour or number scheme shall be as given below

Numbers of Cores	*Rigid Cables*	*Flexible Cables*	*Flexible Cords*	*Numbers*
Single	Red, black, white, yellow or blue	Red, black, white, yellow or blue	Red, black, white, yellow or blue	—
Twin	Red and black	Red and black	Red and black	1, 2
Three	Red, yellow and blue	Red, yellow and blue	Red, black and green*	1, 2, 3
Four	Red, yellow, blue and black	Red, yellow, blue and green	Red, yellow blue and green*	1, 2, 3, 4
Five	—	Red, yellow, blue, black and green	—	1, 2, 3, 4, 5

*Green for ECC

13.2.1 When numerals are used for identification, these shall appear at intervals of not greater than 150 mm.

14. TAPE

14.1 Proofed tape or PETP tape or plastic tape or any other suitable tape may be applied over insulation as mentioned in the respective tables. The tape, when provided, shall be applied with an overlap.

15. BRAIDING

15.1 The braiding, as required in the respective tables, shall be applied reasonably close, but not so tight as to damage the insulation.

16. COMPOUNDING AND VARNISHING

16.1 The compounding or varnishing shall be provided as required in the respective tables.

17. LAYING UP OF CORES

17.1 In case of twin and multicore circular cables and cords, the cores shall be laid together with a suitable right hand lay. Fillers in interstices may be used to provide reasonable circularity of laid up cable.

17.1.1 The values of lay for flexible cables and cords shall be maximum 18 times the pitch circle diameter.

18. BINDER TAPE

18.1 The proofed tape or glass tape or PETP tape or plastic tape or any other suitable tape over laid up cores shall be applied as required in the respective tables with an overlap.

19. SHEATH

19.1 The sheath shall be applied by extrusion, wherever required, in the respective tables.

19.2 Thickness of Sheath — The average thickness of the sheath shall be not less than the nominal value (t_s) specified in respective tables.

19.3 Tolerance on Thickness of Sheath — The smallest of the measured values of thickness of sheath shall not fall below the nominal value (t_s) specified in respective tables by more than 0·2 mm + 0·2 t_s.

19.4 Colour — The colour of the sheath shall be black, unless any other is agreed between the purchaser and the supplier.

20. OVERALL DIAMETER

20.1 Overall diameter of flexible cords shall not exceed the values given in the appropriate tables.

SECTION 4 TESTS

21. CLASSIFICATION OF TESTS

21.1 Type Tests — The following shall constitute type tests:

Test	*For Requirements, Refer to*	*Test Methods (Refer to Part No. of IS 10810*)*
(1)	(2)	(3)
Persulphate test (for copper)	IS : 8130-1984†	4
Annealing test (for copper)	IS : 8130-1984†	1
Tensile test (for aluminium)	IS : 8130-1984†	2
Wrapping test (for aluminium)	IS : 8130-1984†	3
Conductor resistance test	IS : 8130-1984†	5
Test for thickness of insulation and sheath and overall diameter (where specified)	12, 19, 21 and Tables 1 to 10	6
Physical tests for insulation and sheath (as applicable).		
a) Tensile strength and elongation at break	IS . 6380-1984*	7
b) Ageing in air oven	IS : 6380-1984*	11
c) Ageing in air bomb	IS : 6380-1984*	56
d) Ageing in oxygen bomb	IS : 6380-1984*	16
e) Hot set	IS : 6380-1984*	30
f) Oil resistance	IS : 6380-1984*	31
g) Tear resistance	IS : 6380-1984*	17
Insulation resistance	IS : 6380-1984*	43
High voltage (water immersion) test	22.2	45
Flammability test (applicable to cables finished with SE 3 and SE 4 sheaths only)	22.3	53
Water absorption test (for insulation as applicable)	IS : 6380-1984*	28

*Methods of test for cables.

†Specification for conductors for insulated electric cables and flexible cords (*first revision*).

*Specification for elastomeric insulation and sheath of electric cables (*first revision*)

21.2 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, and overall diameter (where specified);

f) Tensile strength and elongation at break of insulation and sheath;

g) Hot set test for insulation and sheath (where applicable),

h) High voltage test, and

j) Insulation resistance test

21.2.1 A recommended sampling plan for acceptance tests is given in Appendix A.

21.3 Routine Tests — The following shall constitute the routine tests:

a) Conductor resistance test, and

b) High voltage test or spark test.

22. DETAILS OF TEST

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

22.2 High Voltage Test

22.2.1 *Water Immersion Test (Type Test)* — The core(s) shall be carefully removed from a sample approximately 3 metres long taken from the finished cable or cord. They shall be so immersed in a water bath at room temperature that their ends protrude at least 200 mm above the water level. After 24 hours, an ac voltage of 3 kV (rms) shall be applied between conductor 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 shall pass.

22.2.2 *Test on Completed Cables (Acceptance and Routine Test)* — This test shall be carried out between conductors or between conductor and screen/armour. The test voltage shall be 3 kV ac (rms) or 7·2 kV dc. The test shall be carried out at room temperature and the time of application shall be 5 minutes No failure of insulation shall occur.

22.2.2.1 Single-core cables shall be immersed in water at ambient temperature one hour before the test and the test voltage shall be applied between conductor and water. In case of single-core, braided and compounded, and braided and varnished cables, the core shall be subjected to spark test according to IS : 10810 (Part 44)-1984*.

22.2.3 *Spark Test (Routine Test)* — Spark test may be applied as an alternative to the high voltage test specified at **22.2.2.** It shall be made at the core stage during manufacture of cables and the potential difference between the electrode and the conductor shall be as specified below:

Nominal Thickness of Insulation		*Test Voltage* kV (rms)
Above mm	Up to and Including mm	
—	1·0	6
1·0	1·5	10
1·5	2·0	15
2·0	2·5	20
2·5	—	25

22.3 Flammability Test — Period of burning after removal of the 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.

*Methods of test for cables.

*Methods of test for cables : Part 44 Spark test.

SECTION 5 IDENTIFICATION, PACKING AND MARKING

23. IDENTIFICATION

23.1 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 or cord. In case, none of these methods can be employed, or if the purchaser so desires, colour identification threads 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 sheathed cables. The distance between any two consecutive printings, indentations or embossings shall be not more than 1 metre.

23.2 Cable Identification — Cables or cords shall be identified throughout the length of the cable or cords by the legends shown below, either printed or indented or embossed on the cable.

Type of Cable Insulation	*Legend*
Heat resisting rubber	HR 90
Silicon rubber	HR 150

NOTE 1 — Single tape bearing manufacturer's name or trade-mark and the legends mentioned above, if provided, shall also be acceptable against the requirements of **23.1** and **23.2**

NOTE 2 — No legend is required for general purpose rubber insulation.

23.3 Cable Code — The following code shall be used for designating the cable:

Constituent	*Code Letter*
Aluminium conductor	A
Elastomer insulation	R
Braiding, compounding or varnishing	B
Elastomer sheath	R
Earth continuity conductor	ECC

NOTE — When conductor material is copper, no code letter is required for conductor

24. PACKING AND MARKING

24.1 The cables and cords shall be either wound on drums (*see* IS : 10418-1982*) or reels or supplied in coils and packed.

24.2 The cable shall contain the following information either stencilled on the drum or contained in a label attached to it.

a) Reference to this Indian Standard, for example, 'Ref IS : 9968 (Part 1)';

b) Manufacturer's name, brand name or trade-mark;

c) Type of cable and voltage trade,

d) Number of cores;

e) Nominal cross-sectional area of the conductor;

f) Cable code;

g) Length of the cable on the drum/reel/coil;

h) Number of lengths on the reel, drum or coil (if more than one),

j) Direction of rotation of drum (by means of arrow),

k) Approximate gross weight;

m) Country of manufacture, and

n) Year of manufacture

24.2.1 The cable (reel, drum or label) may also be marked with the Standard Mark

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act 1986 and the Rules and Regulations made thereunder The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards

*Specification for drums for electric cables

TABLE 1 ELASTOMER INSULATED SINGLE-CORE TAPED OR UNTAPED TEXTILE BRAIDED AND COMPOUNDED CABLES

(*Clauses* 11 1, 12, 14 1, 15 1 *and* 16 1)

Construction
a) Tinned annealed copper or aluminium conductor (3 and 10.1)
b) Optional separator tape (3.3)
c) General service insulation (4.1)
d) Optional tape (5)
e) Textile braiding (7.1)
f) Textile braiding shall be treated with preservative compound (9)

NOMINAL CROSS-SECTIONAL AREA OF CONDUCTOR mm²	NOMINAL THICKNESS OF INSULATION (t_1) mm
1	1 0
1 5	1 0
2 5	1 0
4	1 0
6	1 0
10	1 2
16	1 2
25	1 4
35	1 4
50	1 6

TABLE 2 ELASTOMER INSULATED SINGLE-CORE, CIRCULAR, TWIN-CORE, THREE-CORE AND FOUR-CORE ELASTOMER SHEATHED CABLES

(*Clauses* 11 1, 12, 14 1 18 1 *and* 19)

Construction
a) Tinned annealed copper or aluminium conductor (3 and 10 1)
b) Optional separator tape (3 3)
c) Insulation :
1) General service elastomeric (4.1) or
2) Heat resisting elastomer (4.2)
d) Optional proofed tape (5)

Single-Core Cables	*2-, 3-and 4-Core Cables*
e) General service sheath (8.1.1) in case of general service insulation and heat resisting sheath (8 2.1) in case of heat resisting insulation	e) 2, 3 and 4 core cables laid up (17.1) f) Optional fillers (6.1) g) Optional binder tape (5) h) General service sheath (8.1.1) in case of general service insulation and heat resisting sheath (8.2 1) in case of heat resisting insulation

(*Continued*)

TABLE 2 ELASTOMER INSULATED SINGLE-CORE, CIRCULAR, TWIN-CORE, THREE-CORE AND FOUR-CORE ELASTOMER SHEATHED CABLES — *Contd*

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (t_1)	Nominal Thickness of Sheath (t_2)			
		Single-Core	Twin-Core	Three-Core	Four-Core
mm²	mm	mm	mm	mm	mm
1	1·0	1·0	1·0	1·0	1·1
1·5	1·0	1·0	1·0	1·1	1·1
2·5	1·0	1·0	1·1	1·1	1·1
4	1·0	1·0	1·2	1·2	1·2
6	1·0	1·0	1·2	1·2	1·3
10	1·2	1·1	1·3	1·4	1·4
16	1·2	1·1	1·4	1·4	1·5
25	1·4	1·2	1·5	1·6	1·7
35	1·4	1·2	1·6	1·7	1·8
50	1·6	1·3	1·8	1·8	2·0
70	1·6	1·4	1·9	2·0	2·1
95	1·8	1·4	2·1	2·2	2·4
120	1·8	1·5	2·2	2·3	2·5
150	2·0	1·6	2·4	2·5	2·7
185	2·2	1·7	2·6	2·7	2·9
240	2·4	1·8	2·8	3·0	3·2
300	2·6	1·9	3·0	3·2	3·5
400	2·8	2·0	3·2	3·4	3·8
500	3·0	2·2	—	—	—
630	3·0	2·3	—	—	—

TABLE 3 ELASTOMER INSULATED, FLAT TWIN-CORE CABLES (WITH AND WITHOUT ECC) AND FLAT THREE-CORE (WITHOUT ECC) ELASTOMER SHEATHED CABLES

(*Clauses* 11.1, 12 *and* 19)

Construction : a) Tinned annealed copper or aluminium conductor (3 and 10.1)

b) Optional separator tape (3.3)

c) General service elastomeric insulation (4.1)

Cables Without ECC

d) Two or three insulated cores laid side by side so as to form flat twin or flat three as the case may be; optional worming or filling (6.1)

e) Elastomeric sheath (8)

Cable with ECC

d) Two insulated cores laid side by side ; the earth continuity conductor (bare centrally placed between cores in the same plane)

e) Elastomeric sheath (8)

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (t_1)	Nominal Thickness of Sheath (t_2)		Nominal Cross-Sectional Area of Earth Continuity Conductor
		Flat Twin-Core	Flat Three-Core	
mm²	mm	mm	mm	mm²
1	*1·0*	*1·0*	*1·0*	*1*
1·5	1·0	1·0	1·1	1·5
2·5	1·0	1·1	1·1	1·5
4	1·0	1·2	1·2	1·5
6	1·0	1·2	1·2	2·5
10	1·2	1·3	1·4	4
16	1·2	1·4	1·4	6

TABLE 4 ELASTOMER INSULATED, SINGLE-CORE, TWIN-CORE, THREE-CORE AND FOUR-CORE GLASS FIBRE BRAIDED AND VARNISHED CABLES, AND CORDS

(*Clauses* 11.1, 12, 15.1 *and* 16.1)

Construction : a) Tinned annealed copper or aluminium conductor for cables for fixed wiring and tinned annealed copper for flexible cables and cords (3, 10.1 and 10.2)

b) Optional separator tape (3.3)

c) Silicone rubber insulation (4.3)

Single-Core Cables

d) Glass braid (7.2)

e) Treated with suitable varnish (9.2)

2-, 3- and 4-Core Cables

d) 2, 3 and 4 cores laid up (17.1) with optional fillers (6.1)

e) Glass braid (7.2)

g) Treated with suitable varnish (9.2)

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (t_1)	
	Cables for Fixed Wiring	Flexible Cables and Cords
mm²	mm	mm
0·5	—	1·0
0·75	—	1·0
1	1·0	1·0
1·5	1·0	1·0
2·5	1·0	1·0
4	1·0	1·0
6	1·0	1·0
10	1·2	1·2
16	1·2	1·2
25	1·2	1·2
35	1·4	1·4
50	1·6	1·6

NOTE — The use of plain copper conductor is also permissible for cables with silicone rubber insulation

TABLE 5 ELASTOMER INSULATED SINGLE-CORE, CIRCULAR, TWIN-CORE, THREE-CORE, FOUR-CORE AND FIVE-CORE ELASTOMER SHEATHED FLEXIBLE CABLES

(*Clauses* 11 1, 12, 18 1 *and* 19)

Construction : a) Tinned annealed copper conductor (3 and **10.2**)
b) Optional separator tape (**3.3**)
c) Insulation:
1) General service elastomeric (**4.1**), or
2) Heat resisting elastomeric (**4.2**)
d) Optional tape (**5**)

Single-Core Cables

e) Heavy duty sheath (**8.1.2**) in case of general purpose rubber insulation and heavyduty HOFR sheath (**8.2.2**) in case of heat resisting rubber insulation

2-, 3- 4- and 5 Core Cables

e) 2, 3, 4 and 5 cores laid up (**17.1**) optional fillers (**6.1**)
f) Optional binder tape (**5**)
g) Heavy duty sheath (**8.1.2**) in case of general purpose rubber insulation and heavy duty HOFR sheath (**8.2.2**) in case of heat resisting rubber insulation

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (t_1)	Nominal Thickness of Sheath (t_2)				
		Single-Core	Twin-Core	Three-Core	Four-Core	Five-Core
mm²	mm	mm	mm	mm	mm	mm
6	1 0	1 6	2 0	2 1	2 5	2 5
10	1 2	1 8	2 4	2 5	2 7	2 9
16	1 2	1 9	2 5	2 7	2 9	3 2
25	1 4	2 0	3 2	3 3	3 4	—
35	1 4	2 2	3 3	3 4	3 5	—
50	1 6	2 4	3 5	3 6	3 7	—
70	1 6	2 6	3 6	3 7	3 9	—
95	1 8	2 8	3 8	4 0	4 1	—
120	1 8	3 0	4 0	4 1	4 3	—
150	2 0	3 2	4 2	4 3	4 5	—
185	2 2	3 4	4 3	4 5	4 8	—
240	2 4	3 5	4 6	4 8	5 1	—
300	2 6	3 5	4 9	5 1	5 4	—
400	2 8	3 8	5 2	5 4	5 8	—
500	3 0	4 0	—	—	—	—
630	3 0	4 1	—	—	—	—

TABLE 6 ELASTOMER INSULATED, SINGLE-CORE, CIRCULAR-TWIN CORE, THREE-CORE AND FOUR-CORE ELASTOMER SHEATHED FLEXIBLE CORDS

(*Clauses* 11 1, 12, 18 1 *and* 19)

Construction . a) Tinned annealed copper conductor (3 and **10.2**)
b) Optional separator tape (**3.3**)
c) Insulation
1) General service elastomeric (**4.1**), or
2) Heat resisting elastomeric (**4.2**)
d) Optional tape (**5**)

Single-Core Cords

e) General service sheath (**8.1.1**) in case of general service insulation and heat resisting sheath (**8.2.1**) in case of heat resisting insulation

2-, 3- and 4-Core Cords

e) 2, 3 and 4 cores laid up (**17.1**) optional fillers (**6.1**)
f) Optional tape (**5**)
g) General service sheath (**8.1.1**) in case of general service insulation and heat resisting sheath (**8.2.1**) in case of heat resisting insulation

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (t_1)	Nominal Thickness of Sheath (t_2)				Overall Diameter *Max*			
		Single-Core	Two-Core	Three-Core	Four-Core	Single-Core	Two-Core	Three-Core	Four-Core
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9	(10)
mm²	mm	mm	mm	mm	mm	mm	mm	mm	mm
0 5	1 0	1 0	1 0	1 0	1 0	7 0	11 7	12 5	13 6
0·75	1 0	1 0	1 0	1 0	1 1	7 2	12 2	13 0	14 3
1	1 0	1 0	1 0	1 0	1 1	7 4	12 6	13 4	14 8
1 5	1 0	1 0	1 0	1 1	1 1	7 7	13 2	14 2	15 5
2 5	1 0	1 0	1 1	1 1	1 1	8 2	14 2	15 1	16 5
4	1 0	1 0	1 2	1 2	1 2	8 8	15 7	16 7	18 3

TABLE 7 ELASTOMER INSULATED TEXTILE BRAIDED, SINGLE AND TWISTED TWIN FLEXIBLE CORDS

(*Clauses* 11.1, 12 *and* 15.1)

Construction : a) Tinned annealed copper conductor (3 and 10.2)

b) Optional separator tape (3.3)

c) General service elastomeric insulation (4.1)

d) Braided with artificial silk mercerized or cotton (7.1)

e) In case of twisted twin flexible cord, two such braided cores shall be twisted together (17.1)

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (t_1)	Overall Diameter of Each Braided Core, *Max*
mm²	mm	mm
0.5	1.0	4.9
0.75	1.0	5.1
1	1.0	5.3
1.5	1.0	5.6
2.5	1.0	6.0

TABLE 8 ELASTOMER INSULATED, CIRCULAR, TWIN-CORE AND THREE-CORE, TEXTILE BRAIDED FLEXIBLE CORDS

(*Clauses* 11.1, 12 *and* 15.1)

Construction : a) Tinned annealed copper conductor (3 and 10.2)

b) Optional separator tape (3.3)

c) General service elastomeric insulation (4.1)

d) Two or three cores shall be twisted together (17.1)

e) Optional fillers (6.1)

f) Braided with artificial silk mercerized or cotton (7.1)

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (t_1)	Overall Diameter, *Max*	
		Two-Core	Three-Core
mm²	mm	mm	mm
0.5	1.0	8.3	9.0
0.75	1.0	8.7	9.5
1	1.0	9.1	9.9
1.5	1.0	9.7	10.5
2.5	1.0	10.5	11.3
4	1.0	11.7	12.6

TABLE 9 ELASTOMER INSULATED TWIN-CORE OR THREE-CORE UNKINKABLE FLEXIBLE CORDS (WORKSHOP TYPE)

(*Clauses* 11.1, 12.1, 15.1, 16.1 *and* 18.1)

Construction : a) Tinned annealed copper conductor (3 and 10.2)

b) Optional separator tape (3.3)

c) General service elastomeric insulation (4.1)

d) Two or three cores shall be twisted together (17.1)

e) Optional fillers (6.1)

f) Binder tape (18.1)

g) Textile braiding

h) Textile braiding shall be treated with preservative compound

Nominal Cross-Sectional Area of Conductor	Nominal Thickness of Insulation (t_1)	Overall Diameter, *Max*	
		Two-Core	Three-Core
mm²	mm	mm	mm
0.5	1.0	9.2	9.0
0.75	1.0	9.6	10.4
1	1.0	10.0	10.8
1.5	1.0	10.6	11.4
2.5	1.0	11.4	12.2
4	1.0	12.6	13.5

TABLE 10 ELASTOMER INSULATED, TWIN-CORE OR THREE-CORE UNKINKABLE FLEXIBLE CORDS (DOMESTIC TYPE)

(*Clauses* 11.1, 12, 15.1 *and* 17.1)

Construction : a) Tinned annealed copper conductors (3.1 and 10.2)

b) Optional separator tape (3.3)

c) General service elastomeric insulation (4.1)

d) Two or three cores shall be twisted together (17.1) with fillers of natural or synthetic fibres (6.1)

e) Elastomeric sheath (8.1.1)

f) Cotton braided (7.1) being semi-embedded in the sheath

Nominal Cross-Sectional Area	Nominal Thickness of Insulation (t_1)	Nominal Thickness of Sheath (t_2)		Overall Diameter, *Max*	
		Two-Core	Three-Core	Two-Core	Three-Core
mm²	mm	mm	mm	mm	mm
0.5	1.0	1.5	1.5	11.6	12.4
0.75	1.0	1.5	1.5	12.1	12.9
1.0	1.0	1.5	1.5	12.5	13.3
1.5	1.0	1.5	1.5	13.1	13.9
2.5	1.0	1.5	1.5	14.0	14.8
4.0	1.0	1.5	1.5	15.2	16.2

APPENDIX A

(*Clause* 21.2.1)

SAMPLING OF CABLES

A-1. LOT

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

A-2. SCALE OF SAMPLING

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

A-2.2 The number of samples to be selected shall depend on col 1 and 2 as indicated below. These samples shall be taken at random:

No. of Drums/Coils/ Reels in the Lot	*No. of Drums/ Coils/Reels to be Taken as Sample*	*Permissible No. of Defectives*
(*N*)	(*n*)	(*a*)
(1)	(2)	(3)
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

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

A-3. NUMBER OF TESTS AND CRITERION FOR CONFORMITY

A-3.1 Suitable lengths of test samples shall be taken from each of the drums selected. These test samples shall be subjected to each of the acceptance tests (*see* **21.2**). 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 under **A-2.2**, the lot shall be declared as conforming to the requirements of acceptance tests, otherwise not.

*Methods for random sampling.

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Printed by Reprography Unit, BIS, New Delhi