Draft Indian Standard
(For comments only)

POLYVINYL CHLORIDE INSULATED SCREENED FLEXIBLE SHEATHED CABLES/CORDS WITH TWO OR MORE FLEXIBLE CONDUCTOR RATED VOLTAGES UP TO AND INCLUDING 1100 V

1 GENERAL

1.1 Scope

This standard covers general requirements of multicore cables/cords with flexible annealed bare/tinned copper conductor, insulated and sheathed (if any) with polyvinyl chloride (PVC) for rated voltages up to and including 1100 V ac, 50 Hz used in electric power and control application for indoor and low temperature use. These cables may be used on dc systems for rated voltages up to and including 1 500 V to earth. This standard also includes cables with fire performance category in FR (Flame retardant) and category FR-LSH (Flame retardant low smoke and halogen) with conductor temperature not exceeding 70°C or 85°C. These cables need to comply the testing requirements as specified for the respective category.

NOTES

1 The term cord is used for the flexible cables up to 5 cores covering the sizes up to 2.5 mm^2.

2 The cables covered in this standard are suitable for use on ac single or three phase (earthed or unearthed) systems for rated voltages U_O/U up to and including 1100 V, 50 Hz. The cables may be used on dc system for rated voltages up to and including 1500 V to earth.

3 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 or 85°C.

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

a) Telephone cables,
b) PVC data transmission cables,
c) Instrumentation cables,
d) Flexible power cord other than PVC insulated.

The specification is divided into following 3 sections, namely:

Section 1 General requirements
Section 2 Screened Sheathed Multicore cables/cords for control application

2 REFERENCES

The standards given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below:

IS No.	*Title*
1885 (Part 32) :	Electrotechnical vocabulary: Part 321993/IEC 50- Electric cables
5831 : 1984	PVC insulation and sheath of electric cables
8130 : 1984	Conductors for insulated electric cables and flexible cords 10810 Methods of test for cables:
(Part 0) : 1984	General
(Part 1) : 1984	Annealing test for wires used in Conductors
(Part 4) : 1984	Persulphate test of conductor
(Part 5) : 1984	Conductor resistance test
(Part 6) : 1984	Thickness of thermoplastic and elastomeric insulation and sheath (Part 7) : 1984 Tensile strength and elongation at break of thermoplastic andelastomeric insulation and sheath
(Part 10) : 1984	Loss of mass test (Part 11) : 1984 Thermal ageing in air(Part 12) : 1984 Shrinkage test
(Part 14) :1984	Heat shock test (Part 15) : 1984 Hot deformationtest(Part 20) : 1984 Cold bend test
(Part 21) : 1984	Cold impact test
(Part 31) : 1984	Oil Resistance test
(Part 43) : 1984	Insulation resistance
(Part 44) : 1984	Spark test
(Part 45) :1984	High voltage test (Part 53) :1984 Flammability test (Part 58) : 1998 Oxygen index test
(Part 59) :1988	Determination of the amount of halogen acid gas evolved during combustion of polymeric materials taken from cables
(Part 60) : 1988	Thermal stability of PVC insulation and sheath
(Part 64) : 2003	Measurement of temperature index
13360-6-9	Determination of density of smoke of burning or decomposing plastics

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1885 (Part 32) and IS 10810 (Part 0) and the following shall apply.

3.1 Polyvinyl Chloride Compound (PVC) — Combination of materials suitably selected, proportioned and treated, of which the characteristic constituent is the plastomer polyvinyl chloride or one of its copolymers. The same term also designates compounds containing both polyvinyl chloride and certain of its polymers.

3.2 Type of Compound — The category in which a compound is placed according to its properties, as determined by specific tests. The type designation is not directly related to the composition of the compound.

3.3 Type Tests — Tests required to be made before supplying a type of cable covered by this standard on a general commercial basis in order to demonstrate satisfactory performance characteristics to meet the intended application. 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 or manufacturing process, which might change the performance characteristics.

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

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

3.6 Rated Voltage — The rated voltage of a cable is the reference voltage for which the cable is designed and which serves to define the electrical tests.

The rated voltage is expresses by the combination of two values Uo/U expressed in volts:

Uo being the rms value between any insulated conductor and the earth.

U being the rms value between any two-phase conductors of multicore cable or of a system of single- core cables.

This condi**tion** apply both to the value U_0 and to the value U.

In dire**c**t current system the nominal voltage of the sys**tem**s shall not be higher than 1.5 times the rated **vo**lt**a**ge of the cable.

In an alternating current system, the rated voltage of a cable shall be at least equal to the nominal voltage of the system for which it is intended.

3.7 Nominal Value — The value by which a quantity is designated and which is often used in tables. Usually, in this standard, nominal values give rise to values to be checked by measurements taking into account specified tolerances.

SECTION 1 GENERAL REQUIREMENTS

4. CONDUCTOR

4.1 Material

The conductors shall consist of annealed, bare or tinnedof high conductivity copper wires complying with Class 5 as per IS 8130.

4.2 Nominal Cross section area

Value that identifies a particular size of conductor but not subjected to direct measurement

Note: Each particular size of the conductor in this standard is required to meet the maximum resistance value.

4.3 Electrical Resistance

The resistance of each conductor at 20°C shall be in accordance with the requirements of IS 8130 for the given class of conductor.

Compliance shall be checked by the test given in Table 1, Sl. No. (i) (a).Nominal cross-sectional area of conductor of cables covered in this standard are given in respective tables. In case of tinned copper conductor, the persulphatetest shall be conducted as per IS 10810 (Part 4) and shall meet the requirements specified in IS 8130.

5. INSULATION

5.1 Material

The insulation shall be of polyvinyl chloride compoundof the type specified for each type of cable given (*see also* Section 2):

Type C — Heat-resistant cables (HR)

Type D — Flexible cables and cords

The PVC shall conform to IS 5831, however specific to those tests mentioned in Table 1of this standard.

The Multi core Screened sheathed cables (*see* Se**c**tion 2) with fire performance for category FR a**nd** FR-LSH**, th**e sheath shall satisfy the relevant s**pec**ial FR/**FR-L**SHproperties.

standard.

The Multi core Screened sheathed cables (*see* Se**c**tion 2) withfire performance for category FR and FR-LSH**,** the sheath shall satisfy the relevant **s**pe**c**ial FR/FR-LSHproperties.

Note: However in case of cables with improved fire performance category FR or FR-LSH it is recommended all components of cables like insulation, inner sheath, filler and outer sheath preferably of FR or FR-LSH properties or as preferred and / or agreed between purchaser and manufacturer.

5.2 Application to the Conductor

The insulation shall be so applied by extrusion process that it fits as closely on the conductor. It shall be possible to remove it without damage to the insulation itself, to the conductor or to the tin coating, if any, by suitable method. Compliance shall be checkedby inspection and by manual test.

5.3 Thickness

The mean value of the thickness of insulation shall be not less than the specified nominal value for each type and size of cable given in table 3, of section 2.

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

5.4 Mechanical Properties before and after Ageing

The insulation shall have adequate mechanical strength and elasticity within the temperature limits to which it may be exposed in normal use.

The compliance shall be checked by carrying out tensile strength and elongation test, for respective type of PVC, ensuring the test values specified Table 1 of IS 5831, for appropriate type of PVC are met.

This condition apply both to the value U_0 and to the value U.

In direct current system the nominal voltage of the systems shall not be higher than 1.5 times the rated voltage of the cable.

6. FILLER

6.1 Material

The fillers shall be composed of one of the following or of any combination of the following:

a) A compound based on unvulcanized rubber or plastics; or
b) Natural or synthetic textiles; or
C) Polyethylene or Poly propylene
d) Paper; or
e) PVC

When the filler is composed of un-vulcanized rubber, there shall be no harmful interactions between its constituents and the insulation and/or the sheath.

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

6.2 Application

The fillers shall fill the spaces between the cores giving the assembly a practically circular shape. The fillers shall not adhere to be cores. Additional dummy cores of similar dimension can be used, if required to maintain circularity of laid up cores. The assembly of cores and fillers may be held together by a film or tape.

7 BINDER TAPE

Binder tape shall consist of plastic or proof textile material. This is optional and may be provided as per the agreement between the purchaser and the manufacturer.

8 INNER SHEATH

8.1 Material

The sheath shall be polyvinyl chloride compound of the type specified for each type of cable (*see also* Section 3) as given below:

a) *Type* ST2 — cables sheathed with 85°C HRPVC compound
b) *Type* ST3 — flexible cables

The PVC shall conform to IS 5831. Test requirements for these compounds are as per Table 2 of IS 5831.

Unless other wise specified the inner sheathing material shall confirm to category 01 Requirement.

Additionally the PVC compound shall also meet the requirement oil resistivity property, as

described in Clause 12.11. For the cables with fire performance category FR and FR-LSH, Inner sheathing compound Shall meet the requirements of FR or FR-LSH properties, if preferred and agreed between purchaser and supplier

8.2 Application

The inner sheath shall be applied by homogeneous extrusion process, preferably in a single layer, over the assembly of cores and fillers.

Note: Considering current extrusion process with skin coating etc.,

The inner sheath shall not adhere to the cores. A separator, consisting of a compatible film or tape, or talcum powder may be placed under the inner sheath.

8.3 Thickness

The mean value of the thickness shall not be less than the specified value for each type and size of cable shownin the tables 3. However, the thicknessof PVC inner sheath determined by taking average of numberof measurements, shall be not less than nominal value (t_S) specified in relevant tables and smallest of themeasured value shall not fall below the nominal value (t_S) specified by more than (0.1 mm + 0.15 t_S). Compliance shall be checked by testing the dimensional requirement as specified in Table 3 and tested as given in IS 10810 - Part 6

8.4 Mechanical Properties Before and After Ageing

The sheath shall have adequate mechanical strength and elasticity within the temperature limits to which it may be exposed in normal use.

The compliance shall be checked by carrying out Tensile strength and Elongation at break shall meet the requirements given in Table 2 of IS 5831, for respectivetype of PVC

9 SCREEN

The Screen shall be applied over the inner sheath in form of braiding process using plain or preferably tinned copper wires.

Diameter of copper wire diameter shall be as given table 3, which follows the following general guidance.

- Max. 0.16mm for d $\leq$ 10mm
- Max. 0.21mm for d $\geq$ 10mm $\leq$ 20mm
- Max. 0.26mm for d $\geq$ 20mm $\leq$ 30mm and
- Max. 0.31mm for d $\geq$ 20mm

Where d is the fictitious diameter under the braid, which is calculated by adding two times the specified nominal inner sheath thickness to the fictitious laid up diameter.

10. SHEATH

10.1 Material

The sheath shall be polyvinyl chloride compound ofthe type specified for each type of cable (*see also*Section 3) as given below:

a) *Type* ST2 — cables sheathed with 85°C HRPVC compound

b) *Type* ST3 — flexible cables

The PVC shall conform to IS 5831. Test requirements for these compounds are as per Table 2 of IS 5831.

Unless other wise specified the inner sheathing material shall confirm to category 01 Requirement.

Additionally the PVC compound shall also meet the requirement oil resistivity property, as described in Clause 12.11. For the cables with fire performance category FR and FR-LSH, Inner sheathing compound Shall meet the requirements of FR or FR-LSH properties, if preferred and agreed between purchaser and supplier

10.2 Application

The sheath shall be applied by homogeneous extrusion process, preferably in a single layer, over the Braided Screen.

Note: Considering current extrusion process with skin coating etc.,

The sheath shall not adhere to the Screens. This can be achieved by Tubular extrusion as close as possible over braiding without forming braiding impression over sheath and facilitating easy removal without damaging the screen.

10.3 Thickness

The mean value of the thickness shall not be less than the specified value for each type and size of cable shownin the tables 3. However, the thicknessof PVC inner sheath determined by taking average of numberof measurements, shall be not less than nominal value (t_S) specified in relevant tables and smallest of themeasured value shall not fall below the nominal value (t_S) specified by more than (0.1 mm + 0.15 t_S). Compliance shall be checked by testing the dimensional requirement as specified in Table 3 and tested as given in IS 10810 -Part 6.

10.4 Mechanical Properties Before and After Ageing

The sheath shall have adequate mechanical strength and elasticity within the temperature limits to which it may be exposed in normal use. The compliance shall be checked by carrying out Tensile strength and Elongation at break shall meet the requirements given in Table 2 of IS 5831, for respectivetype of PVC

11. Overall Dimension

The mean overall dimensions of the cables shall be within the limits specified in the table 3.

11.1 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.

12. TESTS

The testing on the cables will be conducted as given in Table 1 for each category of the cable listed under scope**.**

12.1 High Voltage Test (Water immersion Test) The cores shall be carefully removed from the sample of approximately 2 m multicore sheathed cable.. In case of single core cable, the cores should be selected from the coil. 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 h, voltage of3 kV (rms) shall be applied between conductors and water. This voltage shall be raised to 6 kV (rms) within10 s and held constant at this value for 5 min. If the sample fails in this test, one more sample shall be subjected to this test, which should pass.
The cores which have passed the preliminary test given in **12.1** shall be subsequently tested with a dc voltage of 1.2 kV in the same water-bath at the same temperature.

The conductor shall be connected to the negative pole and water to the positive pole of dc supply by meansof copper electrode. The core shall withstand this dc voltage test for total 240 h without breakdown.

12.2 High Voltage Test (at room temperature)

In case of multi core cables and cords, the same shall withstand without breakdown an ac voltage of 3 kV(r**m**s) or a d**c v**oltage of 7.2 kV applied for a period of 5 minutes for each connection.

12.3 Spark Test

Spark test may be carried out as an alternative to high voltage test as per Is 10810 (part 44) on single core unsheathed cables. The voltage shall be as specified below:

Thickness of Insulation In mm	Test Voltage k V (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 includig 2.5	20
Above 2.5	25

12.4 Flammability Test

The testing is conducted in accordance with IS 10810 (Part 53) . The period of burning after removal of flame shall not exceed 60 s and the unaffected portion from the lower edge of the top clamp shall be at least 50mm

12.5 Oxygen index test

The test shall be conducted as per Is 10810 (Part 58) on samples at 27±2°C. The oxygen index shall not be less than 29 Percent

12.6 Halogen Acid Evolution test

The test shall be conducted as per Is 10810 (Part 59) The level of halogen acid gas evolved shall not exceed 20 percent by weight.

12.7Temperature index test

The test shall be conducted as per Is 10810 (Part 64) The minimum measured value of temperature index shall be 21 percent at a temperature of 250°C

12.8 Smoke Density Rating Test

The test shall be conducted as per IS 13360-6-9. The smoke density rating shall be less than 60 %

12.9 Flex Test

Under consideration

12.10 Persulphate test

This test is conducted for the tinned copper conductor as per method specified in IS 10810 (Part 4) and shall meet the requirements specified in clause 6.1.1 of IS 8130.

12.11 Resistance to oil

The sheath material shall be subjected to ageing in oil and tested for Tensile strength and Elongation at break as per IS 10810-part 31 and the variation in Tensile strength and elongation at break shall be within ± 30 % of the before ageing value.

13. IDENTIFICATION

The manufacturer shall be identified throughout the length of the cable by manufacturers' 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 threads in accordance with the scheme to be approved by 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 printing, indentation or embossing shall not be more than 1 m

13.1 Durability

In case of printed marking, it shall be durable and compliance with the requirements. The compliance with requirement shall be checked by trying to remove the marking of manufacturer's name or trade-mark and the colours of cores or numerals by rubbing lightly ten times with a piece of cotton wool or cloth soaked in water.

13.2 Legibility

All markings shall be clear and legible. The colours of the identification threads shall be easy to recognize or easily made recognizable, if necessary, by cleaning **wit**h petrol or other suitable solvent

14. CORE IDENTIFICATION

C**o**re shall be identified, by colour coding as given in the table 2.

14.1 General Requirements

Identification of the cores of a cable shall be achieved by the use of coloured insulation or other suitable method. The colouring with skin type is allowed provided it meets the desired testing as given in the standard.

The colours shall be clearly identifiable and durable. Durability shall be checked by the test given in **14.1**.

14.1.1 *Colour Combination Yellow and Green*

In case of yellow-green cables used for earthing, the distribution of the colours shall comply with the following condition:

For every 15 mm length of core, one of these colours shall cover at least 30 percent and not more than 70 percent of the surface of the core, the other colour covering the remainder.

14.2 Core Identification by Numbers

In case of core identification with help of numbering

instead of colour identification following shall be applicable. The insulation of the cores shall be of the same colour and numbered sequentially, except for the core coloured green-and-yellow, if one is included. The yellow-green core, if any, shall comply with the requirement of **14.1.1** and shall be in the outer layer., as last core. The numbering shall start by number 1 in the inner layer. The numbers shall be printed in Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of the insulation. The numerals shall be legible.

14.2.1 Preferred Arrangement of Marking

The numbers shall be repeated, at regular intervals along the core, consecutive numbers being inverted in relation to each other.

When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.

The arrangement of the marks is shown in Fig. 1.

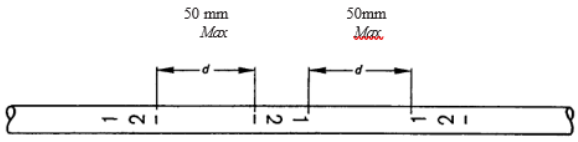

FIG. 1 PREFERRED ARRANGEMENT OF MARKING

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15. Cable Code

The following code shall be used for designation of cable:

Constituent	Code Letter
PVC insulation	Y
PVC Sheath	Y
PVC with FR Properties	FR
PVC with FR-LSH properties	FR-LSH

16. Sampling of Cables

See Annexure A

17. Packing and Marking

17.1 The cable shall be either wound on drums or reels or supplied in coils packed.

17.2 The cable shall carry the following information Either stenciled on the reel or drum or

contained in lable attached to it.

a. Reference to this Indian Standard IS……

b. Manufacturer's name, brand name or trademark

c. Type of cable and voltage graded.

d. Word "FR" for Flame Retardant PVC ,

e. Word "FR-LSH" for Flame retardant Low Smoke PVC
f. Number of cores

g. Nominal Cross sectional area of conductor

h. Word ATC for annealed tinned copper conductor.
i. Cable Code

j. Length of cable on reel, drum or coil

k. Number of lengths (if more than one length)

l. Direction of rotation of drums in case packed in wooden drums (by means of arrow)
m. Gross mass

n. Country of manufacture

o. Year of manufacture

17.2.1 BIS Certification Marking

The cable (packed coil, reel, drum or l**a**bel) may al**s**o be marked with the Standard Mark.

17.2.1.1 The use of the Standard Mark is governed bythe provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for theuse of the Standard Mark may be granted to the manufacturers or producers may be obtained from the Bureau of Indian Standards.

SECTION 2: SHEATHED MULTICORE CABLES /CORDS FOR FLEXIBLE APPLICATION

18. MULTICORE CIRCULAR PVC INSULATED AND SHEATHED CABLES/CORDS WITH FLEXIBLE CONDUCTOR (CLASS 5) FOR GENERAL PURPOSE (FOR MAXIMUM CONDUCTORTEMPERATURE 70°C OR 85°C)

18.1 Construction

18.1.1 Flexible Cables

18.1.1.1 The conductors shall comply with require requirements given in IS 8130 for Class 5.

a. Conductor material— Annealed bare copper or annealed tinned copper

b. No. of Conductors – for Flexible cables – 2 to 60 (refer Table 3)

c) Preferred number of conductors for flexible cables – 2,3,4,5,6,7,12,18,27,36,48 and 60

d) Sizes covered under flexible cables — 0.5 to 120 mm^2

NOTE — In general annealed tinned copper being used up to16 mm^2 only

18.1.2 Insulation

The insulation shall be PVC compound Type D in case of general purpose and Type C (HR) in case of HR PVC type cable as per IS 5831, applied around each conductor. The insulation thickness shall comply with specified values given in Table 3 for flexible cable and flexible cords.

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

18.1.3 Assembly of Cores

In case of circular cables with 2 core and above, the cores shall be twisted together, where appropriate in several concentric layers as the case may be, generally meeting the recommended plan for lay of cores as given in Table 4 .

The assembly of circular cord shall have a practically circular cross-section.

Alternate layer shall be of opposite direction. A Binder tape of suitable plastic or proof textile material, with 100 % coverage and approximately 20 % overlap is preferred or as required by the customer.

18.1.4 Inner Sheath

The inner sheath shall be PVC compound type PVC ST3 in case of general purpose and ST2 (HR) in case of HR PVC type as per IS 5831, applied around the laid up cores or over the binder tape. Unless otherwise agreed between manufacturer and purchaser the inner sheath material need not be with improved fire performance FR and FR-LSH. In such case the necessary care shall be taken for formulation to meet the additional special testing. The inner sheath thickness shall comply with the specified values given in Table 3 for flexible cable and flexible cords.

The assembly of circular cord shall have a practically circular cross-section.

The inner sheath may fill the space between cores thus forming a filling, but it shall not adhere to the cores. The assembly of cores may be surrounded by a separator, which shall not adhere to cores.

The thickness of PVC Inner sheath determined by taking average of number of measurements, shall not be less than nominal value (t_S) specified in Table 3 and the smallest of the measured values shall not fall below nominal value specified in Table 6 or Table 7 for flexible cables and flexible cords respectively by more than 0.1 mm + 0.15 t_S.

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

18.1.5 Screen

The screen shall be applied over inner sheath in form of braiding with plain annealed bare copper or Annealed tinned copper. The screen coverage shall be approximately 80 to 85%.

The diameter of the individual strands shall be as given in table 3

The screening efficiency shall be determined by measuring the transfer impedance. The value obtained shall not exceed 250 Ω/km at 30 MHz.

Transfer impedance test method?

18.1.6 Sheath

The sheath shall be PVC compound type PVC ST3 in case of general purpose and ST2 (HR)

in case of HR PVC type as per IS 5831, applied around the screen In case of improved fire performance , necessary care shall be taken for formulation to meet the additional special testing. The sheath thickness shall comply with the specified values given in Table 3 for flexible cable and flexible cords.

Table 1 Tests

(*Clauses* 1.1, 4.2 *and* 10)

Sl No.	Test	Category	Requirements, Ref to IS No./Clause of this Standard	Method of Test, Ref to Part of IS 10810
(1)	(2)	(3)	(4)	(5)
i)	*Routine tests*:			
a)	Conductor resistance test	01, FR and FR-LSH	IS 8130	5
b)	High voltage test or Spark test	01, FR and FR-LSH	10.2 or 10.3	45 or 44
ii)	*Acceptance tests*:			
a)	Annealing test (for copper)	01, FR and FR-LSH	IS 8130	1
b)	Conductor resistance test	01, FR and FR-LSH	IS 8130	5
c)	Test for thickness of insulation	01, FR and FR-LSH	Table 3	6
d)	Tensile strength and elongation at break of insulation	01, FR and FR-LSH	IS 8130	7
e)	Insulation resistance test	01, FR and FR-LSH	IS 8130	43
f)	High voltage test or spark test	01, FR and FR-LSH	10.2 or 10.3	45 or 44
J)	Flammability test	01, FR and FR-LSH	10.4	53
k)	Oxygen index test	FR and FR-LSH	10.5	58
m)	Test for temperature index	FR and FR-LSH	10.7	64
n)	Test for halogen acid gas evaluation		FR-LSH	10.6 59
o)	Test for smoke density rating		FR-LSH	10.8 13360-6-9
p)	Persulphate test (for tinned copper conductor cable only)	01, FR and FR-LSH	10.11	4
iii)	*Type tests*:			
a)	Tests on conductor:			
1)	Annealing test (for copper)	01, FR and FR-LSH	IS 8130	1
2)	Conductor resistance test	01, FR and FR-LSH	IS 8130	5
3)	Persulphate test (for tinned copper conductor cable only)	01, FR and FR-LSH	10.11 and 6.1.1 of IS 81304	
b)	Test for overall dimensions and thickness of insulation /sheath		Tables 3 6	
c)	Physical tests for insulation:	01, FR and FR-LSH	IS 5831	7
1)	Tensile strength and elongation at break	01, FR and FR-LSH	IS 5831	10
2)	Loss of mass test	01, FR and FR-LSH	IS 5831	11
3)	Ageing in air oven	01, FR and FR-LSH	IS 5831	12
4)	Shrinkage test	01, FR and FR-LSH	IS 5831	14
5)	Heat shock test	01, FR and FR-LSH	IS 5831	15
6)	Hot deformation	01, FR and FR-LSH	IS 5831	60
7)	Thermal stability	01, FR and FR-LSH	IS 5831	20
8)	Cold bend test	01, FR and FR-LSH	IS 5831	21
9)	Cold impact test	01, FR and FR-LSH	IS 5831	53
10)	Flammability test	01,, FR and FR-LSH	10.4	

11) Oxygen index test	FR and FR-LSH	10.5	58	
12) Test for temperature index	FR and FR-LSH	10.7	64	
13) Test for halogen acid gas evaluation		FR-LSH	10.6	59
14) Test for smoke density	FR-LSH	10.8	13360-6-9	
d) Physical tests for sheath (removed from the finished cable):				
1) Tensile strength and elongation at break	01, FR and FR-LSH	IS 5831	7	
2) Loss of mass test	01, FR and FR-LSH	IS 5831	10	
3) Ageing in air oven	01,, FR and FR-LSH	IS 5831	11	
4) Shrinkage test	01,, FR and FR-LSH	IS 5831	12	
5) Heat shock test	01, FR and FR-LSH	IS 5831	14	
6) Hot deformation	01, FR and FR-LSH	IS 5831	15	
7) Thermal stability	01, FR and FR-LSH	IS 5831	60	
8) Oxygen index test	FR and FR-LSH	10.5	58	
9) Test for temperature index	FR and FR-LSH	10.7	64	
10) Test for halogen acid gas evaluation		FR-LSH	10.6	59
11) Test for smoke density	FR-LSH	10.8	Under preparation	

Table 1 Tests

(*Clauses* 1.1, 4.2 *and* 10)

Sl No.	**Test**	**Category**	**Requirements, Ref to IS No./Clause of this Standard**	**Method of Test, Ref to Part of IS 10810**
(1)	(2)	(3)	(4)	(5)
e) Test on completed cable:				
1)	High Voltage test (Water immersion)	01, FR and FR-LSH	10.1	45
2)	High Voltage or Spark Test	01, FR and FR-LSH	10.2 or 10.3	45 or 44
3)	Insulation Resistance test	01, FR and FR-LSH	IS 5831	43
4)	Flammability Test	01, FR and FR-LSH	11.4	53
5)	Flex Test	01, FR and FR-LSH	11.9	Under consideration

NOTE — The properties/testing for FR /FR-LSH cables as mentioned in this standard is applicable only for the cables covered in this standard.

Table -2 Colour Code			
Sl.No.	No. of cores	Flexible cords	Flexible cable
1	2	Red, Black or	Red, Black or
2	2	Blue , black	Blue, Black
3	3	Blue, black, Brown or	Blue, black, Brown or
4	3	Blue , black, Yellow Green	Blue , black, Yellow Green
5	3	Red , yellow, blue	Red , yellow, blue
6	3	Red, Black , Yellow/Green	Red, Black , Yellow/Green
7	4	Blue, black, brown,black	Blue, black, brown,black
8	4	Blue, black, brown Yellow / Green	Blue, black, brown Yellow / Green
9	4	Red, Yellow, Blue, Black	Red, Yellow, Blue, Black
10	4	Red , yellow, blue, yellow/Green	Red , yellow, blue, yellow/Green
11	5	blue, Black,brown ,black, black	blue, Black,brown ,black, black
12	5	blue, Black,brown ,black, yellow /Green	blue, Black,brown ,black, yellow /Green
13	5	Red, Yellow, blue, Black , Grey	Red, Yellow, blue, Black , Grey
14	5	Red, Yellow, blue, Black , Yellow / Green	Red, Yellow, blue, Black , Yellow / Green
15	5	Yellow, Blue, green white and yellow/ Green	Yellow, Blue, green white and yellow/ Green
16	6	-	Red, Yellow, Blue, green white and yellow/ Green
17	6-60	-	All Cores shall be either in Blue or Black or Grey numbered or any other colour as agreed between purchaser and manufacturer with or without yellow Green

NOTES

1 For cables and cords with more than five cores, as an alternative, it is permissible to have all cores of the same colour. In such case, the cores shall be numbered sequentially (Hindu-Arabic numerals printed on the surface of the cores), starting with '1' for the innermost layer. The gap between two successive printings shall not exceed 50 mm.

The sheath is applied over screen by extrusion process. The thickness of PVC sheath determined by taking average of number of measurements, shall not be less than nominal value (t_s) specified in Table 3 and the smallest of the measured values shall not fall below nominal value specified in Table 3 by more than 0.1 mm + 0.15 t_s.

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

18.2 Ovality

The difference between maximum and minimum measured values of overall diameter of

18.3 Overall Dimensions

The mean overall dimensions of circular cords shall be within the limits given in Table 3.

18.4 **Tests**

Compliance with the requirements of 18.1 shall be checked by inspection and by tests given in Table 3.

Table -3

Sl.No.	No. of cores & Cross sectional area in mm²	Nominal insulation thickness in mm	Max. core diameter	Nominal inner sheath thickness in mm	Screen diameter in mm	Nominal outer sheath thickness in mm	Max. overall Diameter in mm
1	2 x 0.5	0.6	2.6	0.7	0.16	0.9	9.2
2	2 x 0.75	0.6	2.8	0.7	0.16	0.9	9.7
3	2 x 1.0	0.6	3	0.7	0.16	1.0	10.2
4	2 x 1.5	0.6	3.8	0.7	0.16	1.0	12.1
5	2 x 2.5	0.7	4	0.7	0.16	1.1	12.6
6	3 x 0.5	0.6	2.6	0.7	0.16	0.9	9.7
7	3 x 0.75	0.6	2.8	0.7	0.16	1.0	10.2
8	3 x 1.0	0.6	3	0.7	0.16	1.0	10.8
9	3 x 1.5	0.6	3.8	0.7	0.16	1.1	12.8
10	3 x 2.5	0.7	4	0.7	0.16	1.2	13.4
11	4 x 0.5	0.6	2.6	0.7	0.16	1.0	10.5
12	4 x 0.75	0.6	2.8	0.7	0.16	1.0	11.1
13	4 x 1.0	0.6	3	0.7	0.16	1.1	11.7
14	4 x 1.5	0.6	3.8	0.7	0.16	1.1	14.3
15	4 x 2.5	0.7	4	0.8	0.16	1.2	14.8
16	5 x 0.5	0.6	2.6	0.7	0.16	1.0	11.4
17	5 x 0.75	0.6	2.8	0.7	0.16	1.1	12.1
18	5 x 1.0	0.6	3	0.7	0.16	1.1	12.7
19	5 x 1.5	0.6	3.8	0.8	0.16	1.2	15.5
20	5 x 2.5	0.7	4	0.8	0.21	1.3	16.2
21	6 x 0.5	0.6	2.6	0.7	0.16	1.1	12.3
22	6 x 0.75	0.6	2.8	0.7	0.16	1.1	13.1
23	6 x 1.0	0.6	3	0.8	0.16	1.2	14.0
24	6 x 1.5	0.6	3.8	0.8	0.16	1.2	16.9
25	6 x 2.5	0.7	4	0.8	0.21	1.4	17.6
26	7 x 0.5	0.6	2.6	0.7	0.16	1.1	12.3
27	7 x 0.75	0.6	2.8	0.7	0.16	1.1	13.1
28	7 x 1.0	0.6	3	0.8	0.16	1.2	14.0
29	7 x 1.5	0.6	3.8	0.8	0.16	1.2	16.9
30	7 x 2.5	0.7	4	0.8	0.21	1.4	17.6
31	8 x 0.5	0.6	2.6	0.8	0.16	1.2	14.6
32	8 x 0.75	0.6	2.8	0.8	0.16	1.2	15.5
33	8 x 1.0	0.6	3	0.8	0.21	1.3	16.4
34	8 x 1.5	0.6	3.8	0.8	0.21	1.4	19.9
35	8 x 2.5	0.7	4	0.8	0.21	1.6	20.8
36	9 x 0.5	0.6	2.6	0.8	0.16	1.2	15.7
37	9 x 0.75	0.6	2.8	0.8	0.21	1.3	16.7
38	9 x 1.0	0.6	3	0.8	0.21	1.4	17.6
39	9 x 1.5	0.6	3.8	0.8	0.21	1.5	21.5
40	9 x 2.5	0.7	4	0.9	0.21	1.7	22.5

Table -3 - continued

Sl.No.	No. of cores & Cross sectional area in mm²	Nominal insulation thickness in mm	Max. core diameter	Nominal inner sheath thickness in mm	Screen diameter in mm	Nominal outer sheath thickness in mm	Max. overall Diameter in mm
41	10 x 0.5	0.6	2.6	0.8	0.16	1.2	15.7
42	10 x 0.75	0.6	2.8	0.8	0.21	1.3	16.7
43	10 x 1.0	0.6	3	0.8	0.21	1.4	17.6
44	10 x 1.5	0.6	3.8	0.8	0.21	1.5	21.5
45	10 x 2.5	0.7	4	0.9	0.21	1.7	22.5
46	11 x 0.5	0.6	2.6	0.8	0.16	1.2	15.7
47	11 x 0.75	0.6	2.8	0.8	0.21	1.3	16.7
48	11 x 1.0	0.6	3	0.8	0.21	1.4	17.6
49	11 x 1.5	0.6	3.8	0.8	0.21	1.5	21.5
50	11 x 2.5	0.7	4	0.9	0.21	1.7	22.5
51	12 x 0.5	0.6	2.6	0.8	0.21	1.3	16.2
52	12 x 0.75	0.6	2.8	0.8	0.21	1.4	17.2
53	12 x 1.0	0.6	3	0.8	0.21	1.4	18.2
54	12 x 1.5	0.6	3.8	0.8	0.21	1.5	22.2
55	12 x 2.5	0.7	4	0.9	0.21	1.7	23.2
56	13 x 0.5	0.6	2.6	0.8	0.21	1.3	17.0
57	13 x 0.75	0.6	2.8	0.8	0.21	1.4	18.1
58	13 x 1.0	0.6	3	0.8	0.21	1.5	19.1
59	13 x 1.5	0.6	3.8	0.8	0.21	1.6	23.4
60	13 x 2.5	0.7	4	0.9	0.21	1.8	24.4
61	14 x 0.5	0.6	2.6	0.8	0.21	1.3	17.0
62	14 x 0.75	0.6	2.8	0.8	0.21	1.4	18.1
63	14 x 1.0	0.6	3	0.8	0.21	1.5	19.1
64	14 x 1.5	0.6	3.8	0.8	0.21	1.6	23.4
65	14 x 2.5	0.7	4	0.9	0.21	1.8	24.4
66	15 x 0.5	0.6	2.6	0.8	0.21	1.4	17.9
67	15 x 0.75	0.6	2.8	0.8	0.21	1.5	19.0
68	15 x 1.0	0.6	3	0.8	0.21	1.5	20.2
69	15 x 1.5	0.6	3.8	0.9	0.21	1.7	24.7
70	15 x 2.5	0.7	4	0.9	0.21	1.9	26.1
71	16 x 0.5	0.6	2.6	0.8	0.21	1.4	17.9
72	16 x 0.75	0.6	2.8	0.8	0.21	1.5	19.0
73	16 x 1.0	0.6	3	0.8	0.21	1.5	20.2
74	16 x 1.5	0.6	3.8	0.9	0.21	1.7	24.7
75	16 x 2.5	0.7	4	0.9	0.21	1.9	26.1
76	17 x 0.5	0.6	2.6	0.8	0.21	1.4	18.8
77	17 x 0.75	0.6	2.8	0.8	0.21	1.5	20.1
78	17 x 1.0	0.6	3	0.9	0.21	1.6	21.3
79	17 x 1.5	0.6	3.8	0.9	0.21	1.7	26.3
80	17 x 2.5	0.7	4	0.9	0.21	2.0	27.5

Table -3 - continued

Sl.No.	No. of cores & Cross sectional area in mm²	Nominal insulation thickness in mm	Max. core diameter	Nominal inner sheath thickness in mm	Screen diameter in mm	Nominal outer sheath thickness in mm	Max. overall Diameter in mm
81	18 x 0.5	0.6	2.6	0.8	0.21	1.4	18.8
82	18 x 0.75	0.6	2.8	0.8	0.21	1.5	20.1
83	18 x 1.0	0.6	3	0.9	0.21	1.6	21.3
84	18 x 1.5	0.6	3.8	0.9	0.21	1.7	26.3
85	18 x 2.5	0.7	4	0.9	0.21	2.0	27.5
86	19 x 0.5	0.6	2.6	0.8	0.21	1.4	18.8
87	19 x 0.75	0.6	2.8	0.8	0.21	1.5	20.1
88	19 x 1.0	0.6	3	0.9	0.21	1.6	21.3
89	19 x 1.5	0.6	3.8	0.9	0.21	1.7	26.3
90	19 x 2.5	0.7	4	0.9	0.21	2.0	27.5
91	20 x 0.5	0.6	2.6	0.8	0.21	1.5	19.9
92	20 x 0.75	0.6	2.8	0.8	0.21	1.6	21.2
93	20 x 1.0	0.6	3	0.9	0.21	1.7	22.5
94	20 x 1.5	0.6	3.8	0.9	0.21	1.8	27.8
95	20 x 2.5	0.7	4	1.0	0.26	2.1	29.1
96	21 x 0.5	0.6	2.6	0.8	0.21	1.5	19.9
97	21 x 0.75	0.6	2.8	0.8	0.21	1.6	21.2
98	21 x 1.0	0.6	3	0.9	0.21	1.7	22.5
99	21 x 1.5	0.6	3.8	0.9	0.21	1.8	27.8
100	21 x 2.5	0.7	4	1.0	0.26	2.1	29.1
101	22 x 0.5	0.6	2.6	0.8	0.21	1.6	21.0
102	22 x 0.75	0.6	2.8	0.9	0.21	1.6	22.3
103	22 x 1.0	0.6	3	0.9	0.21	1.7	23.7
104	22 x 1.5	0.6	3.8	0.9	0.21	1.9	29.4
105	22 x 2.5	0.7	4	1.0	0.26	2.2	30.8
106	23 x 0.5	0.6	2.6	0.8	0.21	1.6	21.0
107	23 x 0.75	0.6	2.8	0.9	0.21	1.6	22.3
108	23 x 1.0	0.6	3	0.9	0.21	1.7	23.7
109	23 x 1.5	0.6	3.8	0.9	0.21	1.9	29.4
110	23 x 2.5	0.7	4	1.0	0.26	2.2	30.8
111	24 x 0.5	0.6	2.6	0.9	0.21	1.6	22.0
112	24 x 0.75	0.6	2.8	0.9	0.21	1.7	23.4
113	24 x 1.0	0.6	3	0.9	0.21	1.8	24.9
114	24 x 1.5	0.6	3.8	0.9	0.21	2.0	30.9
115	24 x 2.5	0.7	4	1.0	0.26	2.3	32.4
116	25 x 0.5	0.6	2.6	0.9	0.21	1.6	22.0
117	25 x 0.75	0.6	2.8	0.9	0.21	1.7	23.4
118	25 x 1.0	0.6	3	0.9	0.21	1.8	24.9
119	25 x 1.5	0.6	3.8	0.9	0.21	2.0	30.9
120	25 x 2.5	0.7	4	1.0	0.26	2.3	32.4

Table -3 - continued

Sl.No.	No. of cores & Cross sectional area in mm²	Nominal insulation thickness in mm	Max. core diameter	Nominal inner sheath thickness in mm	Screen diameter in mm	Nominal outer sheath thickness in mm	Max. overall Diameter in mm
121	26 x 0.5	0.6	2.6	0.9	0.21	1.6	22.0
122	26 x 0.75	0.6	2.8	0.9	0.21	1.7	23.4
123	26 x 1.0	0.6	3	0.9	0.21	1.8	24.9
124	26 x 1.5	0.6	3.8	0.9	0.21	2.0	30.9
125	26 x 2.5	0.7	4	1.0	0.26	2.3	32.4
126	27 x 0.5	0.6	2.6	0.9	0.21	1.6	22.5
127	27 x 0.75	0.6	2.8	0.9	0.21	1.7	23.9
128	27 x 1.0	0.6	3	0.9	0.21	1.8	25.7
129	27 x 1.5	0.6	3.8	0.9	0.21	2.0	31.6
130	27 x 2.5	0.7	4	1.0	0.26	2.3	33.1
131	28 x 0.5	0.6	2.6	0.9	0.21	1.7	23.3
132	28 x 0.75	0.6	2.8	0.9	0.21	1.8	24.8
133	28 x 1.0	0.6	3	0.9	0.21	1.9	26.6
134	28 x 1.5	0.6	3.8	1.0	0.21	2.1	32.8
135	28 x 2.5	0.7	4	1.0	0.26	2.4	34.3
136	29 x 0.5	0.6	2.6	0.9	0.21	1.7	23.3
137	29 x 0.75	0.6	2.8	0.9	0.21	1.8	24.8
138	29 x 1.0	0.6	3	0.9	0.21	1.9	26.6
139	29 x 1.5	0.6	3.8	1.0	0.21	2.1	32.8
140	29 x 2.5	0.7	4	1.0	0.26	2.4	34.3
141	30 x 0.5	0.6	2.6	0.9	0.21	1.7	23.3
142	30 x 0.75	0.6	2.8	0.9	0.21	1.8	24.8
143	30 x 1.0	0.6	3	0.9	0.21	1.9	26.6
144	30 x 1.5	0.6	3.8	1.0	0.21	2.1	32.8
145	30 x 2.5	0.7	4	1.0	0.26	2.4	34.3
146	31 x 0.5	0.6	2.6	0.9	0.21	1.7	24.2
147	31 x 0.75	0.6	2.8	0.9	0.21	1.8	26.0
148	31 x 1.0	0.6	3	0.9	0.21	2.0	27.6
149	31 x 1.5	0.6	3.8	1.0	0.26	2.1	34.1
150	31 x 2.5	0.7	4	1.1	0.26	2.5	35.7
151	32 x 0.5	0.6	2.6	0.9	0.21	1.7	24.2
152	32 x 0.75	0.6	2.8	0.9	0.21	1.8	26.0
153	32 x 1.0	0.6	3	0.9	0.21	2.0	27.6
154	32 x 1.5	0.6	3.8	1.0	0.26	2.1	34.1
155	32 x 2.5	0.7	4	1.1	0.26	2.5	35.7
156	33 x 0.5	0.6	2.6	0.9	0.21	1.7	24.2
157	33 x 0.75	0.6	2.8	0.9	0.21	1.8	26.0
158	33 x 1.0	0.6	3	0.9	0.21	2.0	27.6
159	33 x 1.5	0.6	3.8	1.0	0.26	2.1	34.1
160	33 x 2.5	0.7	4	1.1	0.26	2.5	35.7

Table -3 - continued

Sl.No.	No. of cores & Cross sectional area in mm²	Nominal insulation thickness in mm	Max. core diameter	Nominal inner sheath thickness in mm	Screen diameter in mm	Nominal outer sheath thickness in mm	Max. overall Diameter in mm
161	34 x 0.5	0.6	2.6	0.9	0.21	1.8	25.4
162	34 x 0.75	0.6	2.8	0.9	0.21	1.9	27.0
163	34 x 1.0	0.6	3	1.0	0.21	2.0	28.7
164	34 x 1.5	0.6	3.8	1.0	0.26	2.2	35.5
165	34 x 2.5	0.7	4	1.1	0.26	2.6	37.4
166	35 x 0.5	0.6	2.6	0.9	0.21	1.8	25.4
167	35 x 0.75	0.6	2.8	0.9	0.21	1.9	27.0
168	35 x 1.0	0.6	3	1.0	0.21	2.0	28.7
169	35 x 1.5	0.6	3.8	1.0	0.26	2.2	35.5
170	35 x 2.5	0.7	4	1.1	0.26	2.6	37.4
171	36 x 0.5	0.6	2.6	0.9	0.21	1.8	25.4
172	36 x 0.75	0.6	2.8	0.9	0.21	1.9	27.0
173	36 x 1.0	0.6	3	1.0	0.21	2.0	28.7
174	36 x 1.5	0.6	3.8	1.0	0.26	2.2	35.5
175	36 x 2.5	0.7	4	1.1	0.26	2.6	37.4
176	37 x 0.5	0.6	2.6	0.9	0.21	1.8	25.4
177	37 x 0.75	0.6	2.8	0.9	0.21	1.9	27.0
178	37 x 1.0	0.6	3	1.0	0.21	2.0	28.7
179	37 x 1.5	0.6	3.8	1.0	0.26	2.2	35.5
180	37 x 2.5	0.7	4	1.1	0.26	2.6	37.4
181	38 x 0.5	0.6	2.6	0.9	0.21	1.8	26.4
182	38 x 0.75	0.6	2.8	0.9	0.21	2.0	28.2
183	38 x 1.0	0.6	3	1.0	0.26	2.1	29.9
184	38 x 1.5	0.6	3.8	1.0	0.26	2.3	37.2
185	38 x 2.5	0.7	4	1.1	0.26	2.7	39.0
186	39 x 0.5	0.6	2.6	0.9	0.21	1.8	26.4
187	39 x 0.75	0.6	2.8	0.9	0.21	2.0	28.2
188	39 x 1.0	0.6	3	1.0	0.26	2.1	29.9
189	39 x 1.5	0.6	3.8	1.0	0.26	2.3	37.2
190	39 x 2.5	0.7	4	1.1	0.26	2.7	39.0
191	40 x 0.5	0.6	2.6	0.9	0.21	1.8	26.4
192	40 x 0.75	0.6	2.8	0.9	0.21	2.0	28.2
193	40 x 1.0	0.6	3	1.0	0.26	2.1	29.9
194	40 x 1.5	0.6	3.8	1.0	0.26	2.3	37.2
195	40 x 2.5	0.7	4	1.1	0.26	2.7	39.0
196	41 x 0.5	0.6	2.6	0.9	0.21	1.9	27.5
197	41 x 0.75	0.6	2.8	1.0	0.21	2.0	29.3
198	41 x 1.0	0.6	3	1.0	0.26	2.2	31.2
199	41 x 1.5	0.6	3.8	1.0	0.26	2.4	38.8
200	41 x 2.5	0.7	4	1.1	0.26	2.7	40.6

Table -3 - continued

Sl.No.	No. of cores & Cross sectional area in mm²	Nominal insulation thickness in mm	Max. core diameter	Nominal inner sheath thickness in mm	Screen diameter in mm	Nominal outer sheath thickness in mm	Max. overall Diameter in mm
201	42 x 0.5	0.6	2.6	0.9	0.21	1.9	27.5
202	42 x 0.75	0.6	2.8	1.0	0.21	2.0	29.3
203	42 x 1.0	0.6	3	1.0	0.26	2.2	31.2
204	42 x 1.5	0.6	3.8	1.0	0.26	2.4	38.8
205	42 x 2.5	0.7	4	1.1	0.26	2.7	40.6
206	43 x 0.5	0.6	2.6	0.9	0.21	1.9	27.5
207	43 x 0.75	0.6	2.8	1.0	0.21	2.0	29.3
208	43 x 1.0	0.6	3	1.0	0.26	2.2	31.2
209	43 x 1.5	0.6	3.8	1.0	0.26	2.4	38.8
210	43 x 2.5	0.7	4	1.1	0.26	2.7	40.6
211	44 x 0.5	0.6	2.6	0.9	0.21	2.0	28.5
212	44 x 0.75	0.6	2.8	1.0	0.26	2.1	30.4
213	44 x 1.0	0.6	3	1.0	0.26	2.2	32.4
214	44 x 1.5	0.6	3.8	1.0	0.26	2.4	40.3
215	44 x 2.5	0.7	4	1.1	0.26	2.8	42.2
216	45 x 0.5	0.6	2.6	0.9	0.21	2.0	28.5
217	45 x 0.75	0.6	2.8	1.0	0.26	2.1	30.4
218	45 x 1.0	0.6	3	1.0	0.26	2.2	32.4
219	45 x 1.5	0.6	3.8	1.0	0.26	2.4	40.3
220	45 x 2.5	0.7	4	1.1	0.26	2.8	42.2
221	46 x 0.5	0.6	2.6	0.9	0.21	2.0	28.5
222	46 x 0.75	0.6	2.8	1.0	0.26	2.1	30.4
223	46 x 1.0	0.6	3	1.0	0.26	2.2	32.4
224	46 x 1.5	0.6	3.8	1.0	0.26	2.4	40.3
225	46 x 2.5	0.7	4	1.1	0.26	2.8	42.2
226	47 x 0.5	0.6	2.6	0.9	0.21	2.0	28.5
227	47 x 0.75	0.6	2.8	1.0	0.26	2.1	30.4
228	47 x 1.0	0.6	3	1.0	0.26	2.2	32.4
229	47 x 1.5	0.6	3.8	1.0	0.26	2.4	40.3
230	47 x 2.5	0.7	4	1.1	0.26	2.8	42.2
231	48 x 0.5	0.6	2.6	0.9	0.21	2.0	29.0
232	48 x 0.75	0.6	2.8	1.0	0.26	2.1	30.9
233	48 x 1.0	0.6	3	1.0	0.26	2.3	32.9
234	48 x 1.5	0.6	3.8	1.1	0.26	2.5	41.0
235	48 x 2.5	0.7	4	1.2	0.31	2.9	43.0
236	49 x 0.5	0.6	2.6	0.9	0.21	2.0	29.0
237	49 x 0.75	0.6	2.8	1.0	0.26	2.1	30.9
238	49 x 1.0	0.6	3	1.0	0.26	2.3	32.9
239	49 x 1.5	0.6	3.8	1.1	0.26	2.5	41.0
240	49 x 2.5	0.7	4	1.2	0.31	2.9	43.0

Table -3 - continued							
Sl.No.	No. of cores & Cross sectional area in mm²	Nominal insulation thickness in mm	Max. core diameter	Nominal inner sheath thickness in mm	Screen diameter in mm	Nominal outer sheath thickness in mm	Max. overall Diameter in mm
241	50 x 0.5	0.6	2.6	0.9	0.21	2.0	29.0
242	50 x 0.75	0.6	2.8	1.0	0.26	2.1	30.9
243	50 x 1.0	0.6	3	1.0	0.26	2.3	32.9
244	50 x 1.5	0.6	3.8	1.1	0.26	2.5	41.0
245	50 x 2.5	0.7	4	1.2	0.31	2.9	43.0
246	51 x 0.5	0.6	2.6	1.0	0.21	2.0	29.8
247	51 x 0.75	0.6	2.8	1.0	0.26	2.2	31.8
248	51 x 1.0	0.6	3	1.0	0.26	2.3	33.8
249	51 x 1.5	0.6	3.8	1.1	0.26	2.5	42.2
250	51 x 2.5	0.7	4	1.2	0.31	3.0	44.2
251	52 x 0.5	0.6	2.6	1.0	0.21	2.0	29.8
252	52 x 0.75	0.6	2.8	1.0	0.26	2.2	31.8
253	52 x 1.0	0.6	3	1.0	0.26	2.3	33.8
254	52 x 1.5	0.6	3.8	1.1	0.26	2.5	42.2
255	52 x 2.5	0.7	4	1.2	0.31	3.0	44.2
256	53 x 0.5	0.6	2.6	1.0	0.21	2.1	30.2
257	53 x 0.75	0.6	2.8	1.0	0.26	2.2	32.3
258	53 x 1.0	0.6	3	1.0	0.26	2.4	34.3
259	53 x 1.5	0.6	3.8	1.1	0.26	2.6	42.8
260	53 x 2.5	0.7	4	1.2	0.31	3.0	44.9
261	54 x 0.5	0.6	2.6	1.0	0.21	2.1	30.2
262	54 x 0.75	0.6	2.8	1.0	0.26	2.2	32.3
263	54 x 1.0	0.6	3	1.0	0.26	2.4	34.3
264	54 x 1.5	0.6	3.8	1.1	0.26	2.6	42.8
265	54 x 2.5	0.7	4	1.2	0.31	3.0	44.9
266	55 x 0.5	0.6	2.6	1.0	0.21	2.1	30.2
267	55 x 0.75	0.6	2.8	1.0	0.26	2.2	32.3
268	55 x 1.0	0.6	3	1.0	0.26	2.4	34.3
269	55 x 1.5	0.6	3.8	1.1	0.26	2.6	42.8
270	55 x 2.5	0.7	4	1.2	0.31	3.0	44.9
271	56 x 0.5	0.6	2.6	1.0	0.26	2.1	30.7
272	56 x 0.75	0.6	2.8	1.0	0.26	2.2	32.8
273	56 x 1.0	0.6	3	1.0	0.26	2.4	34.9
274	56 x 1.5	0.6	3.8	1.1	0.26	2.6	43.5
275	56 x 2.5	0.7	4	1.2	0.31	3.1	45.6
276	57 x 0.5	0.6	2.6	1.0	0.26	2.1	30.7
277	57 x 0.75	0.6	2.8	1.0	0.26	2.2	32.8
278	57 x 1.0	0.6	3	1.0	0.26	2.4	34.9
279	57 x 1.5	0.6	3.8	1.1	0.26	2.6	43.5
280	57 x 2.5	0.7	4	1.2	0.31	3.1	45.6

Table -3 - continued

Sl.No.	No. of cores & Cross sectional area in mm²	Nominal insulation thickness in mm	Max. core diameter	Nominal inner sheath thickness in mm	Screen diameter in mm	Nominal outer sheath thickness in mm	Max. overall Diameter in mm
281	58 x 0.5	0.6	2.6	1.0	0.26	2.1	30.7
282	58 x 0.75	0.6	2.8	1.0	0.26	2.2	32.8
283	58 x 1.0	0.6	3	1.0	0.26	2.4	34.9
284	58 x 1.5	0.6	3.8	1.1	0.26	2.6	43.5
285	58 x 2.5	0.7	4	1.2	0.31	3.1	45.6
286	59 x 0.5	0.6	2.6	1.0	0.26	2.1	30.7
287	59 x 0.75	0.6	2.8	1.0	0.26	2.2	32.8
288	59 x 1.0	0.6	3	1.0	0.26	2.4	34.9
289	59 x 1.5	0.6	3.8	1.1	0.26	2.6	43.5
290	59 x 2.5	0.7	4	1.2	0.31	3.1	45.6
291	60 x 0.5	0.6	2.6	1.0	0.26	2.2	31.6
292	60 x 0.75	0.6	2.8	1.0	0.26	2.3	33.8
293	60 x 1.0	0.6	3	1.1	0.26	2.5	36.0
294	60 x 1.5	0.6	3.8	1.1	0.26	2.7	44.9
295	60 x 2.5	0.7	4	1.2	0.31	3.1	47.1
296	2 x 4.0	0.8	4.8	0.8	0.16	1.2	14.7
297	3 x 4.0	0.8	4.8	0.8	0.21	1.3	15.7
298	4 x 4.0	0.8	4.8	0.8	0.21	1.4	17.2
299	5 x 4.0	0.8	4.8	0.8	0.21	1.5	18.8
300	6 x 4.0	0.8	4.8	0.9	0.21	1.6	20.5
301	7 x 4.0	0.8	4.8	0.9	0.21	1.6	20.5
302	2 x 6.0	0.8	5.6	0.8	0.21	1.4	16.7
303	3 x 6.0	0.8	5.6	0.8	0.21	1.5	17.8
304	4 x 6.0	0.8	5.6	0.9	0.21	1.6	19.5
305	5 x 6.0	0.8	5.6	0.9	0.21	1.7	21.4
306	6 x 6.0	0.8	5.6	0.9	0.21	1.9	23.4
307	7 x 6.0	0.8	5.6	0.9	0.21	1.9	23.4
308	2 x 10	1.0	7	0.9	0.21	1.7	20.1
309	3 x 10	1.0	7	0.9	0.21	1.7	21.4
310	4 x 10	1.0	7	0.9	0.21	1.9	23.6
311	5 x 10	1.0	7	1.0	0.21	2.0	26.0
312	6 x 10	1.0	7	1.0	0.26	2.2	28.5
313	7 x 10	1.0	7	1.0	0.26	2.2	28.5
314	2 x 16	1.0	8.2	0.9	0.21	1.8	23.0
315	3 x 16	1.0	8.2	0.9	0.21	1.9	24.5
316	4 x 16	1.0	8.2	1.0	0.26	2.1	27.3
317	5 x 16	1.0	8.2	1.0	0.26	2.3	30.1
318	6 x 16	1.0	8.2	1.1	0.26	2.5	33.1
319	7 x 16	1.0	8.2	1.1	0.26	2.5	33.1

Table -3 - continued							
Sl.No.	No. of cores & Cross sectional area in mm²	Nominal insulation thickness in mm	Max. core diameter	Nominal inner sheath thickness in mm	Screen diameter in mm	Nominal outer sheath thickness in mm	Max. overall Diameter in mm
320	2 x 25	1.2	10	1.0	0.26	2.2	27.5
321	3 x 25	1.2	10	1.0	0.26	2.3	29.5
322	4 x 25	1.2	10	1.1	0.26	2.5	32.6
323	5 x 25	1.2	10	1.1	0.26	2.7	36.0
324	6 x 25	1.2	10	1.2	0.31	3.0	39.8
325	7 x 25	1.2	10	1.2	0.31	3.0	39.8
326	2 x 35	1.2	11.5	1.0	0.26	2.4	31.1
327	3 x 35	1.2	11.5	1.1	0.26	2.5	33.4
328	4 x 35	1.2	11.5	1.1	0.26	2.8	37.2
329	5 x 35	1.2	11.5	1.2	0.31	3.0	41.1
330	6 x 35	1.2	11.5	1.3	0.31	3.3	45.3
331	7 x 35	1.2	11.5	1.3	0.31	3.3	45.3
332	2 x 50	1.4	13	1.1	0.26	2.7	34.8
333	3 x 50	1.4	13	1.2	0.31	2.9	37.5
334	4 x 50	1.4	13	1.2	0.31	3.2	41.6
335	2 x 70	1.4	15	1.2	0.31	3.1	39.8
336	3 x 70	1.4	15	1.2	0.31	3.3	42.7
337	4 x 70	1.4	15	1.3	0.31	3.6	47.4
338	2 x 95	1.6	17.5	1.3	0.31	3.5	45.9
339	3 x 95	1.6	17.5	1.4	0.31	3.7	49.2
340	4 x 95	1.6	17.5	1.4	0.31	4.1	54.7
341	2 x 120	1.6	19	1.4	0.31	3.8	49.5
342	3 x 120	1.6	19	1.4	0.31	4.0	53.1
343	4 x 120	1.6	19	1.5	0.31	4.4	59.1
344	2 x 150	1.8	21	1.4	0.31	4.1	54.3
345	3 x 150	1.8	21	1.5	0.31	4.4	58.4
346	4 x 150	1.8	21	1.6	0.31	4.8	64.9

Table 4 - Recommended Lay up of cores (Clause 17.1.4)					
No. of Cores	Lay Up	No. of Cores	Lay Up	No. of Cores	Lay Up
2	2	22	2-7-13	42	2-8-13-19
3	3	23	2-8-13	43	2-8-14-19
4	4	24	2-8-14	44	2-8-14-20
5	5	25	2-8-15	45	2-8-14-21
6	6	26	3-9-14	46	3-9-14-20
7	1-6	27	3-9-15	47	3-9-15-20
8	1-7	28	3-9-16	48	3-9-15-21
9	1-8	29	4-10-15	49	3-9-15-22
10	2-8	30	4-10-16	50	3-9-16-22
11	3-8	31	4-10-17	51	4-10-16-21
12	3-9	32	5-11-16	52	4-10-16-22
13	3-10	33	5-11-17	53	4-10-16-23
14	4-10	34	5-11-18	54	4-10-17-23
15	5-10	35	5-12-18	55	4-11-17-23
16	5-11	36	0-6-12-18	56	5-11-17-23
17	5-12	37	1-6-12-18	57	5-11-17-24
18	0-6-12	38	1-6-12-19	58	5-11-18-24
19	1-6-12	39	1-6-13-19	59	5-11-18-24
20	1-7-12	40	1-7-13-19	60	0-6-12-18-24
21	1-7-13	41	1-7-13-20		

ANNEX A
(*Clause* 14)

SAMPLING OF CABLES

A-1 LOT

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.

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 requirement of the specification.

A-2.2 The number of samples to be selected shall depend on col 1 and col 2 of table 11. These samples

shall be taken at random.

A-2.2.1 In order to ensure the randomness of selection,

procedure given in IS 4905 may be followed.

A-3 NUMBER OF TESTS AND CRITERION FOR CONFORMITY

From each of the drum/coils/reels selected according to col 1 and col 2 of Table 11, 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 Table 11, the lot shall be declared as conforming to the requirements of the acceptance tests; otherwise not.

Table 11 Sampling of Cables
(*Clauses* A-2.2 *and* A-3)

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*)
(1)	(2)	(3)
Up to 50	3	0
51-100	5	0
101-300	8	0
301 and above	13	1