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Indian Standard

CONVEYOR AND ELEVATOR TEXTILE BELTING — SPECIFICATION

PART 5 FIRE RESISTANT BELTING FOR SURFACE APPLICATION

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BUREAU OF INDIAN STANDARDS
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Indian Standard

CONVEYOR AND ELEVATOR TEXTILE BELTING — SPECIFICATION

PART 5 FIRE RESISTANT BELTING FOR SURFACE APPLICATION

1 SCOPE

This standard (Part 5) covers the requirements of fire resistant antistatic rubber and/or PVC conveyor and elevator textile reinforced belting for use in surface installations where fire hazards exist.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
1891 (Part 1) : 1993	Conveyor and elevator textile belting—Specification : Part 1 General purpose belting (*fourth revision*) (*under print*)
3400 (Part 4) : 1987	Methods of test for vulcanized rubbers : Part 4 Accelerated ageing (*second revision*)
4240 : 1984	Glossary of conveyors terms and definition (*first revision*)

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 4240 : 1984 shall apply.

4 TYPES

The belt types shall be according to Table 4 of IS 1891 (Part 1) : 1993.

5 CONSTRUCTION

5.1 The belting shall consist of a carcass having covers of fire resistant rubber and/or PVC. The carcass shall consist either of one or more plies of woven fabric or of solid woven fabric and shall be impregnated with fire resistant rubber or plastic mix. The whole shall either be fused or vulcanized together in a uniform manner.

5.2 For carcass protection in plied belting, layer or layers of open-mesh or cord fabric (termed as breaker) may be placed between the cover and the carcass or may be embedded in the cover. Where such a layer is incorporated, it shall be considered to be part of the cover thickness and not counted as a fabric ply. Alternatively, a fabric pile may be integrally woven with a solid woven carcass on either one or both sides, in which case it shall be considered to be part of the carcass thickness.

6 FABRIC

The fabric used shall be made of cotton or polyamide or any other synthetic material or combination thereof evenly and firmly woven and free from manufacturing faults as is normal in the best manufacturing practice.

7 COVER

7.1 The rubber used in the top and bottom cover of the belting shall be of fire resistant, antistatic (FRAS) grade. The value of tensile strength and elongation of rubber cover when removed from the belt and tested as per the method described in Annex B of IS 1891 (Part 1) : 1993, shall not be less than the values given in Table 1.

Table 1 Fire Resistant Grade Rubber Cover — Tensile Properties

Grade	Minimum Tensile Strength (MPa)	Minimum Elongation at Break (Percent)
Fire resistant antistatic (FRAS)	17	350

NOTE — Where plastics or rubber/plastic mix material is used for the cover the value of tensile strength and elongation at break shall be as agreed to between manufacturer and purchaser.

7.2 In case of rubber cover, after ageing for 72 h at 70 ±1°C in accordance with the requirements of IS 3400 (Part 4) : 1987 the tensile strength and elongation at break of the rubber cover shall not vary from the original unaged values by more than the amount specified below:

	Change (Percent)
Tensile strength	+ 10
	− 20
Elongation	+ 10
	− 25

8 ADHESION

The adhesion between the cover and the carcass and between the adjacent plies shall be such that when tested in the manner described in Annex G of IS 1891 (Part 1) : 1993, the force required to cause the separation shall be as given in Table 2.

Table 2 Force for Adhesion Testing

Sl No.	Test	Force, *Min* (kN/m Width)
i)	Adhesion between adjacent plies	4·5
ii)	Adhesion between cover and carcass:	
	a) Covers up to and including 1·00 mm thick	No test
	b) Covers over 1·00 mm and up to and including 1·50 mm thick	3·15
	c) Covers over 1·50 mm thick	3·50

Note — No individual value obtained at the time of measurement shall be below the value specified by more than 0·80 kN/m width.

9 FIRE RESISTANCE

9.1 Drum Friction Test

9.1.1 For each test conducted in accordance with Annex A, the belting shall show no sign of flame, spark or glow. The drum temperature shall not exceed 325°C and the belting shall part within the 3 h test period.

9.1.2 The drum friction test shall be carried out for the purpose of approval of new belt construction. Frequency of this test for supplies of an approved belt construction may be as agreed to between the manufacturer and the purchaser and considered a type test.

9.2 Flame Test

For each set of four samples, when tested in accordance with Annex B, the average duration of the flame shall not exceed 40 seconds and the average duration of glow shall not exceed 120 seconds.

9.3 Electrical Surface Resistance Test (Anti-static Test)

When tested in accordance with Annex C, the electrical resistance of each of the averages shall not exceed 300 megaohms.

10 STANDARD MARK

Details available with Bureau of Indian Standards.

11 OTHER REQUIREMENTS

Any other requirements not specifically mentioned in this standard shall be as prescribed in IS 1891 (Part 1) : 1993.

ANNEX A

(*Clause* 9.1)

METHOD OF TEST FOR FIRE RESISTANCE (DRUM FRICTION TEST)

A-1 TEST PIECES

A-1.1 Cut two test pieces of the belt each 150 ±2 mm wide and approximately 1·5 metre long.

A-2 APPARATUS

A typical general arrangement of drum friction apparatus is shown in Fig. 1.

A-2.1 The drum friction test apparatus shall consist of a steel drum of diameter 210 ± 1 mm, a length 355 ± 1 mm and thickness $6{\cdot}25 \pm 0{\cdot}5$ mm and ends should be closed.

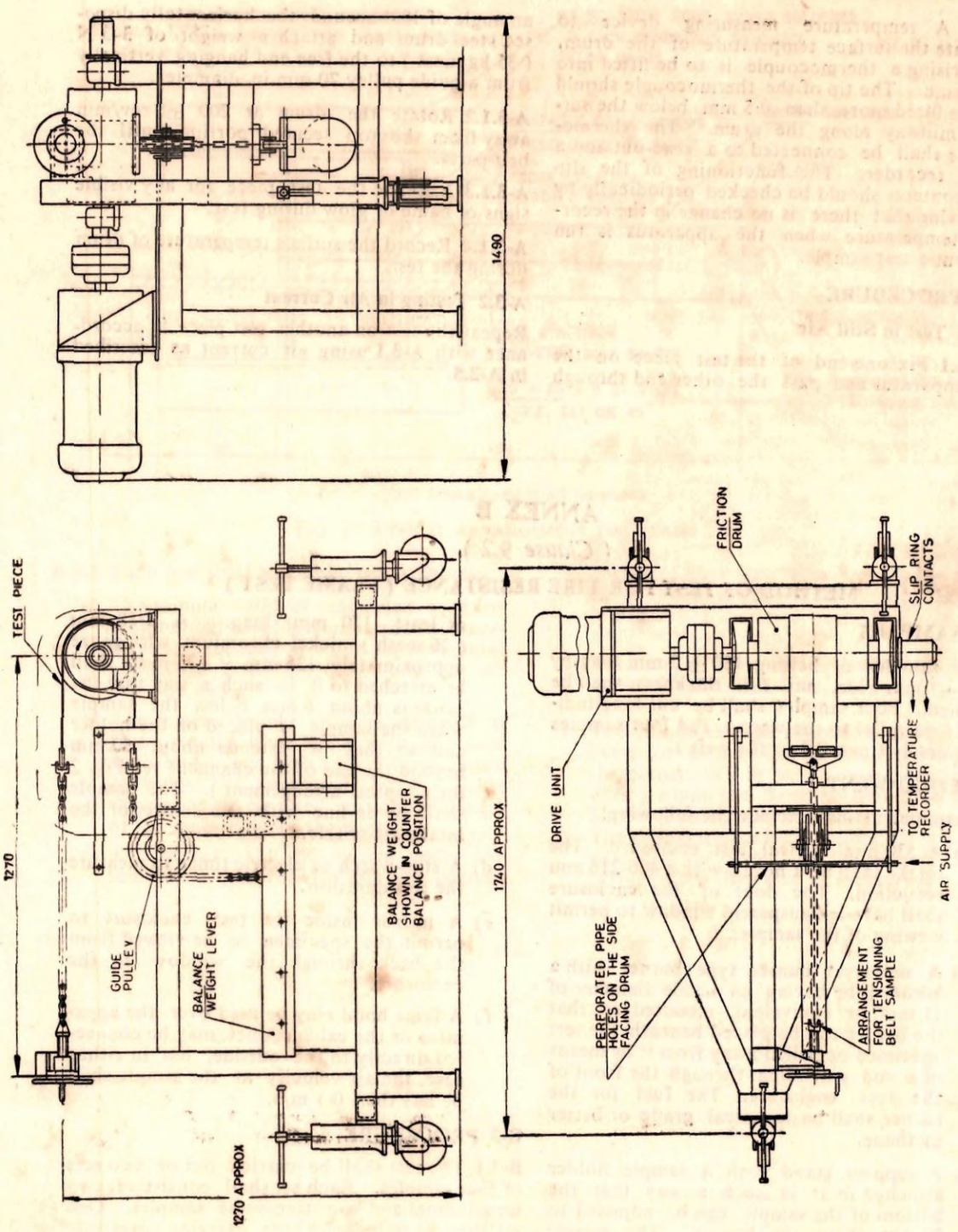
A-2.2 A motor of approximately 7·5 kW is required for the test.

A-2.3 It is recommended that transmission of power to the rotating drum should be by means of chain and spocket. Suitable gear ratio may be selected to give the drum a rotational speed of 200 ± 5 rev/min.

A-2.4 The drive should be fully guarded for safety and not left exposed.

A-2.5 Suitable means shall be available for providing an air current having velocity of $2{\cdot}0 \pm 0{\cdot}1$ m/s when measured with the test piece in position at a distance of 200 mm from the surface of the drum.

NOTE — The air current can be produced by a blower fan or from a perforated pipe supplied with compressed air. In the latter case a pipe 10 mm to 13 mm internal diameter, perforated along one side with row of holes (0·8 mm to 1·5 mm diameter) should be fixed horizontally at the back of the drum (i. e. between the top and bottom portions of the belt) at a distance of 600 mm from the drum centre and in the same horizontal plane with the row of holes facing the drum. Approximately 20 kPa air pressure is required at the pipe. The actual air velocity should be measured by an anemometor and should be checked at regular intervals.



All dimensions in millimetres.

FIG. 1 GENERAL ARRANGEMENT OF DRUM FRICTION TESTING APPARATUS

A-2.6 A temperature measuring device to indicate the surface temperature of the drum, comprising a thermocouple is to be fitted into the drum. The tip of the thermocouple should not be fitted more than 0·5 mm below the surface midway along the drum. The thermocouple shall be connected to a read-out and a chart recorder. The functioning of the slip ring contacts should be checked periodically by observing that there is no change in the recorded temperature when the apparatus is run without a test sample.

A-3 PROCEDURE

A-3.1 Test in Still Air

A-3.1.1 Fix one end of the test piece on the test apparatus and pass the other end through an angle of 180° around the horizontally disposed steel drum and attach a weight of 343 N (35 kg mass) to the free end hanging vertically from a guide pulley 70 mm in diameter.

A-3.1.2 Rotate the drum at 200 ±5 rev/min away from the top secured portion until the belt parts.

A-3.1.3 Examine the test piece for any visible signs of flame or glow during test.

A-3.1.4 Record the surface temperature of drum during the test.

A-3.2 Testing in Air Current

Repeat the test on another test piece in accordance with **A-3.1** using air current as described in **A-2.5**.

ANNEX B

(*Clause* 9.2)

METHOD OF TEST FOR FIRE RESISTANCE (FLAME TEST)

B-1 SAMPLES

Eight samples of belting 150 ± 2 mm long by 12·5 ±1 mm wide, and full thickness, shall be supplied. Four samples shall be cut longitudinally (parrallel to the warp) and four samples transversely (parallel to the weft).

B-2 EQUIPMENT

The equipment shall include the following:

a) A 530 mm cubical test enclosure. The intake shall be a nozzle with a 406-216 mm reduction. The door of the enclosure shall have a transparent window to permit viewing of the sample.

b) A universal Bunsen type burner with a burner tube having an inside diameter of 11 mm or equivalent, mounted so that the burner can be placed beneath the test specimen or pulled away from it by means of a rod extending through the front of the test enclosure. The fuel for the burner shall be technical grade or better methane.

c) A support stand with a sample holder attached to it in such a way that the bottom of the sample can be adjusted to 25 mm above the burner. The sample holder shall consist of a V-shaped stainless steel channel about 6 mm thick and at least 120 mm long. A 1·18 mm (16 mesh) nickel chromium wire gauze approximately 125 mm × 125 mm, shall be attached to it in such a way that the gauze is about 6 mm below the sample when the sample is placed on the holder and so that it extends about 50 mm beyond the end of the channel (*see* Fig. 2 for a typical arrangement). The sample shall be in-line with the centre of the intake air nozzle.

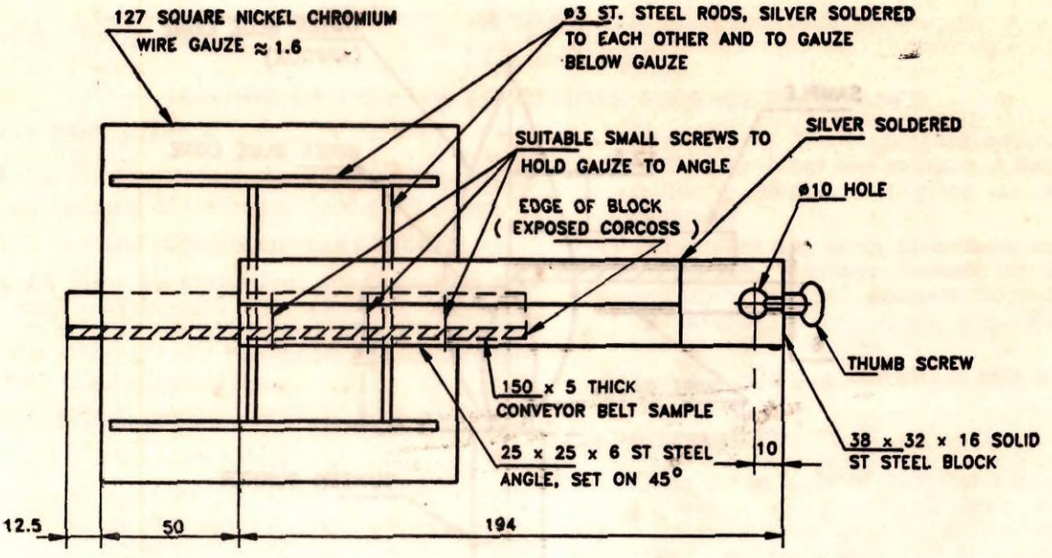
d) A stop-watch or electric timer to measure the test duration.

e) A mirror inside the test enclosure to permit the specimen to be viewed from the back through the window in the enclosure.

f) A fume hood may be used over the apparatus or the exhaust duct may be connected directly to the outside, but in either case, the air velocity at the sample shall be less than 0·1 m/s.

B-3 PROCEDURE

B-3.1 The test shall be carried out on two sets of four samples. Each set shall consist of two longitudinal and two transverse samples. One set shall be tested with the carrying cover side of the belting nearest the burner and the other set with the pulley side nearest the burner.



All dimensions in millimetres.

FIG. 2 TYPICAL ARRANGEMENT FOR FLAME TEST

B-3.2 Each test shall be conducted as follows:

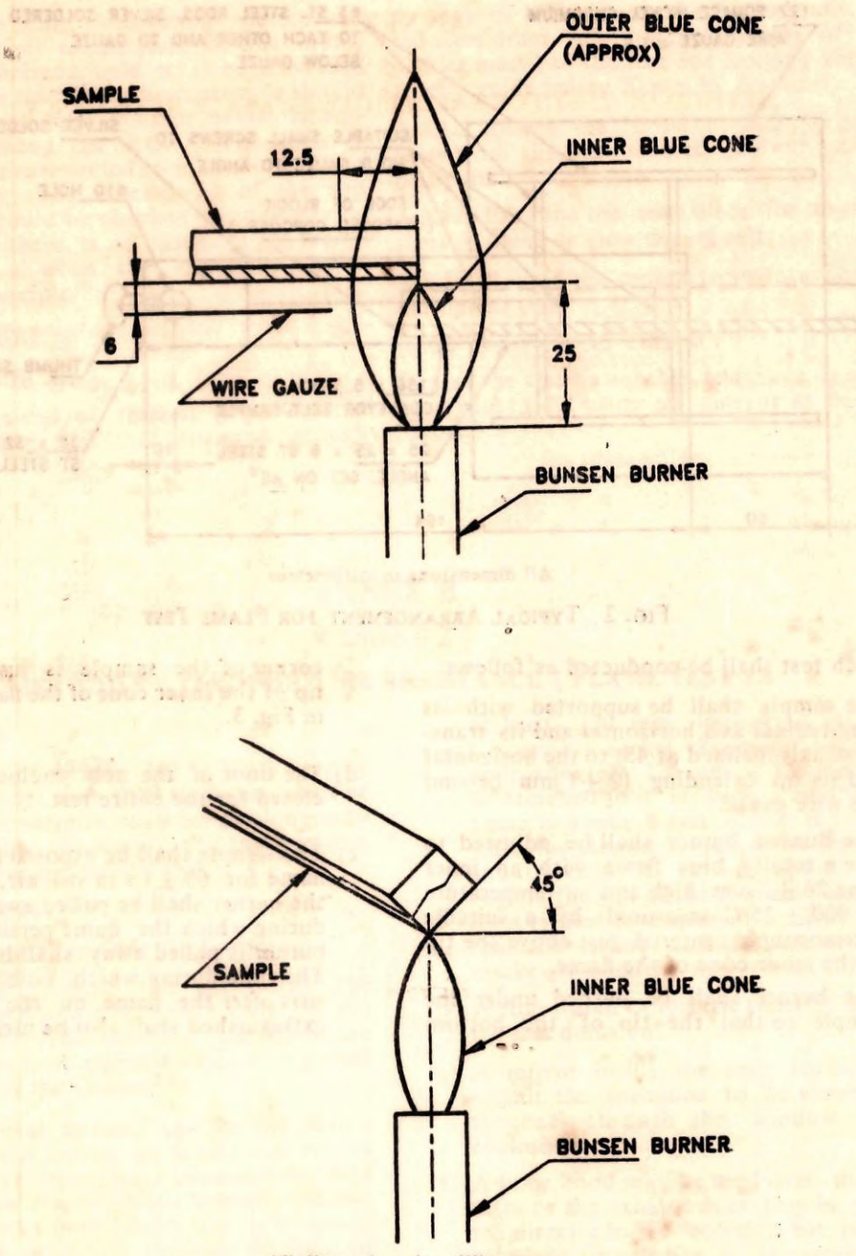
a) The sample shall be supported with its longitudinal axis horizontal and its transverse axis inclined at 45° to the horizontal and its tip extending 12 ±1 mm beyond the wire gauze.

b) The Bunsen burner shall be adjusted to give a totally blue flame with an inner cone 24 ±1 mm high and a temperature of 900 ± 25°C measured by a suitable thermocouple centered just above the tip of the inner cone of the flame.

c) The burner shall be pushed under the sample so that the tip of the bottom corner of the sample is just above the tip of the inner cone of the flame as shown in Fig. 3.

d) The door of the test enclosure shall be closed for the entire test.

e) The sample shall be exposed to the burner flame for 60 ±1 s in still air, after which the burner shall be pulled away. The time during which the flame persists after the burner is pulled away shall be measured. The time during which visible glow persists after the flame on the sample has extinguished shall also be measured.



All dimensions in millimetres.

FIG. 3 LOCATION OF FLAME FOR FLAME TEST

ANNEX C

(*Clause* 9.3)

METHOD OF TEST FOR ELECTRICAL SURFACE RESISTANCE

C-1 TEST PIECES

C-1.1 Cut two test pieces 300 mm² out of the full thickness of the belt including the covers.

C-2 CONDITIONING OF TEST PIECES

C-2.1 Prior to evaluation, condition the test pieces in a standard atmosphere of 65±5 percent relative humidity and 27 ±2°C temperature for at least two hours and immediately test at that temperature.

C-3 APPARATUS

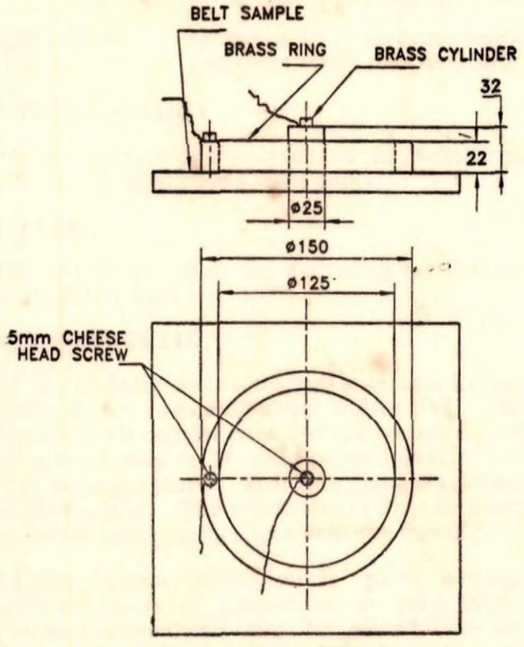
C-3.1 The apparatus shall consist of:

a) a plate of insulating material, slightly larger than the test piece (a clean sheet of polyethylene, or other material with resistivity not less than that of polyethylene, and 1·5 mm thick or more is recommended).

b) two cylindrical and coaxial brass electrodes, the base of one being circular and the other annular of dimensions given in Fig. 4. The minimum mass of outer and inner electrode shall be 900 g and 115 g respectively. The bases of the electrodes shall be machined and polished. A flexible insulated wire is connected to each electrode.

c) a resistance measuring instrument capable of giving readings between 10^5 ohms and 10^{10} ohms and accurate to within 5 percent of the true value over this range; and

d) a source of direct current at 1 000 volts maximum.



All dimensions in millimetres.

FIG. 4 TEST LAYOUT SHOWING SUITABLE WORKING DIMENSIONS OF BRASS CONTACT PIECES

C-4 PROCEDURE

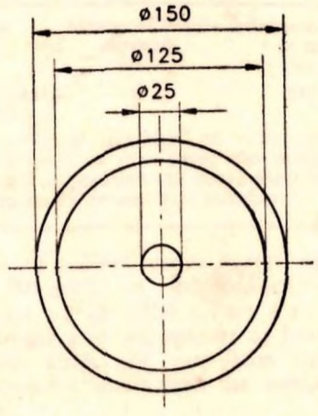
C-4.1 Clean the surfaces of the test piece by dusting and rubbing with Fuller's earth using a clean pad of cloth or cotton wool. After all traces of the powder have been cleaned away, wipe the surface with a clean cloth moistened with distilled water, dry it with a clean cloth.

C-4.2 On one of the surfaces of the test piece, paint two circles, the dimensions of which are given in Fig. 5 with a liquid consisting of:

a) 800 parts by mass of anhydrous polyethylene glycol of molecular mass 600;

b) 200 parts by mass of water; and

c) one part by mass of soft soap, or other conducting liquid having at least the same electrical conductivity.



All dimensions in millimetres.

FIG. 5 DESIGN TO BE PAINTED ON TEST PIECE

C-4.2.1 It is important that the circles should be accurately painted and any excess liquid should be wiped away with a clean cotton wool

pad. After drying ensure that the resistance between any two points one or the other of the painted rings does not exceed 10 ohms; otherwise discard the test piece and prepare a fresh sample.

C-4.3 Place the test piece on the piece of insulating material, with the painted rings on the top. Clean the lower faces of the electrodes and place these accurately over the painted rings on the test piece.

C-4.3.1 If the sample does not have a flat surface but the cover has undulations due to carcass, the contact between the belt surface, and electrodes may be improved by first placing on each painted ring on the test piece a sheet of metal foil cut to the same dimensions as the rings. The electrodes are then placed on the foil.

C-4.4 Connect the outer electrode to the earth or low voltage terminal of the measuring instrument and the inner electrode to the high voltage terminal. The leads should not touch each other, the test piece or any part of the apparatus except the terminals to which each is connected.

C-4.5 Measure the resistance by applying the voltage for at least one minute.

C-4.6 Ensure that the resistance does not change appreciably when pressure is exerted over the electrodes. Take care not to breathe on the test piece as any condensation of moisture on the surface will falsify the results.

C-4.7 The test shall be carried out on the carrying cover side and pulley cover side of both samples. The resistance for both carrying cover side shall be averaged and the resistance for both pully cover sides shall be averaged.