EDC 42:1

IS : 3181 - 1966

Indian Standard

SPECIFICATION FOR FIRE RESISTANT CONVEYOR BELTING FOR UNDERGROUND USE IN COAL MINES

(Tentative)

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Indian Standard

SPECIFICATION FOR FIRE RESISTANT CONVEYOR BELTING FOR UNDERGROUND USE IN COAL MINES

(Tentative)

0. FOREWORD

0.1 This Indian Standard (Tentative) was adopted by the Indian Standards Institution on 17 August 1966, after the draft finalized by the Pulleys and Belts Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 Coal mining in India is being increasingly mechanised and use of fire resistant conveyor belting has increased considerably in the past few years.

0.3 The International Organization for Standardization has published ISO/R 340-1963 Flame resistance of conveyor belts, specifications and method of test, on the flame resistance of conveyor belting. However, the Sectional Committee responsible for this standard decided to specify in the standard the flame resistance test given in the N.C.B. Specification No. 158/1960 Fire resistant conveyor belting, in preference to that specified in ISO/R 340-1963, as sufficient experience was not available in India on the suitability of the ISO flame resistance test for Indian conditions. It decided that the standard be published as a tentative standard and when more experience has been gained regarding the ISO fire resistance test, the position would be reviewed.

0.4 In preparing this specification, considerable assistance has been derived from the following recommendations and specifications:

ISO/R 251-1962 Widths and lengths of conveyor belts. International Organization for Standardization.

ISO/R 252-1962 Ply adhesion of conveyor belts. International Organization for Standardization.

ISO/R 282-1962 Sampling of conveyor belts. International Organization for Standardization.

ISO/R 284-1962 Electrical conductivity of conveyor belts. Specification and method of test. International Organization for Standardization.

Draft ISO Recommendation No. 768 Tear propagation resistance of the carcass of conveyor belts (Method of test). International Organization for Standardization.

N.C.B. Specification No. 158 : 1960 Fire resistant conveyor belting. National Coal Board, U.K.

B.S. 3289 : 1960 Specification for conveyor belting for underground use in coal mines. British Standards Institution.

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

1. SCOPE

1.1 This standard covers the requirements for conveyor belting made from fire resistant compounds and fabric reinforcement intended for underground use in coal mines.

2. CONSTRUCTION

2.1 The belting shall consist of plies of woven fabric or shall be of solid woven construction and shall be impregnated with a fire resistant compound and have a fire resistant cover, the whole being fused together in a uniform manner.

3. CARCASS AND REINFORCEMENT

3.1 Any natural or synthetic fibre or combination thereof may be used by the manufacturer for the carcass and for the reinforcement provided the test requirements, as specified, are complied with.

3.2 The fabric used shall be evenly and firmly woven and shall be as free from foreign matter and such defects as knots, lumps and irregularities of twist as is normal in the best manufacturing practice.

4. COVER AND EDGES

4.1 Cover — The cover of belts shall be made of fire resistant compound and shall be of the thickness as specified by the purchaser subject to the tolerances mentioned in **7.3**.

4.2 Edge — The edges of the belting shall be completely sealed by fire resistant compound of thickness not less than that of the cover. Where the edge cover material is manufactured and applied separately in the form

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

of a strip, it shall be fused to the edges of the surface covers and the fabric shall have good adhesion thereto, as specified in **10**.

4.3 The surfaces and edges of the finished belting shall be free from blisters, pitting or other surface flaws and shall be completely sealed against ingress of moisture.

4.4 The use of colouring matter in the cover compound and edge strip to identify the manufacturer or supplier shall be permitted.

5. TRANSVERSE JOINTS

5.1 In solid woven belts, there shall be no transverse joints in the fabric.

5.2 Transverse joints in the plies shall be made at an angle of about 45° and the minimum distance between transverse joints in the same ply shall be as follows:

a) *Outer Plies* — Transverse joints in the outer plies shall not be less than 75 m apart.

b) *Inner Plies* — Transverse joints in the inner plies shall not be less than 15 m apart, but there shall not be more than two joints in any one ply in each 150 m of belting.

5.3 Transverse joints in adjacent plies shall not be less than 3 m apart, and the joints in any of the plies shall not be closer than the width of the belt.

5.4 Where two plies, or one ply and a portion of another ply, are formed by folding the fabric at the edges transverse joints shall not be less than 3 m apart. To prevent the joint in one ply coinciding with the remaining portion of the same joint in another ply, the joint shall be constructed from fabric which has been bias cut at 45° before folding.

6. LONGITUDINAL JOINTS

6.1 In solid woven belting, there shall be no longitudinal joints in the fabric.

6.2 Spacing of Joints — Where there is a longitudinal joint in a ply, for belting up to and including 500 mm in width, the distance from either edge shall be not less than one-eighth of the width of the belting. For belting over 500 mm in width the distance of the joint from either edge shall be not less than 100 mm. In the inner plies, the joint shall be so arranged that they are evenly balanced on either side of the centre line of the belting, and no two joints in the inner plies shall coincide in adjoining plies.

6.3 Number of Joints — The outer ply of the belt up to and including 500 mm in width, shall not have more than one longitudinal joint and in

the case of belting over 500 mm in width, it shall not have more than two longitudinal joints.

7. DIMENSIONS AND TOLERANCES

7.1 Length — The length of the belting shall be as specified by the purchaser subject to the following tolerances:

a) For belts delivered in the endless state and mounted in that way $\pm$ 0·5 percent.

b) For open belts, the maximum difference between delivered length and the ordered length $^{+\ 2}_{-\ 0{\cdot}5}$ percent.

7.2 Width — The width of the belting shall be subject to the following tolerances:

	Tolerance
a) For widths up to and including 500 mm	$\pm$5 mm
b) For widths over 500 mm	$\pm$1 percent of the width

7.3 Cover Thickness — The thickness of the cover shall be as specified by the purchaser. The thickness of the covers derived in accordance with the method specified in Appendix A shall, unless otherwise agreed to, not fall below the specified value by more than 0·08 mm and the smallest of the measured value shall not fall below the specified value by more than 0·16 mm.

7.4 The belting shall be straight when laid flat and the thickness of the belt measured at five equally spaced points across the full width shall not vary from the mean value by more than 10 percent of the mean value.

8. TENSILE PROPERTIES

8.1 The average tensile strength and elongation of the finished belting, when tested as described in Appendix B, shall not be less than the values given in Tables 1 and 2.

8.1.1 Where multi-ply belts in a ply construction not shown in Table 1 are required, the appropriate values of the tensile values may be obtained by extrapolation.

9. TEAR STRENGTH

9.1 The average tear strength of the finished belting when tested as described in Appendix C shall in Sense A and Sense B be not less than the values given in Tables 3 and 4.

TABLE 1 TENSILE STRENGTH AND ELONGATION OF PLY WOVEN BELTING

(*Clauses* 8.1 *and* 8.1.1)

Belt Designation	Direction	Tensile Strength in kgf/mm Width for the Number of Plies				Percentage Elongation at Break
		3	4	5	6	
1A	Warp	—	23·0	28·0	32·7	15
	Weft	—	11·2	13·7	15·9	8
1AA	Warp	—	26·4	32·1	37·5	15
	Weft	—	12·1	14·8	17·4	8
1B	Warp	—	32·1	39·3	45·7	15
	Weft	—	14·8	18·0	21·1	8
1C	Warp	—	38·6	47·1	55·0	15
	Weft	—	18·6	22·7	26·4	8
2A	Warp	—	39·3	48·0	—	17
	Weft	—	21·4	26·1	—	18
2B	Warp	—	44·7	54·3	—	17
	Weft	—	24·1	29·5	—	18
2C	Warp	39·3	51·1	62·2	—	17
	Weft	21·4	27·9	34·0	—	18
3A	Warp	—	57·2	87·7	—	Values will be included later
	Weft	—	21·4	26·1	—	
3B	Warp	62·5	81·3	99·1	—	
	Weft	21·4	27·9	34·0	—	
3C	Warp	89·3	116·1	141·1	—	
	Weft	28·6	37·2	45·0	—	

TABLE 2 TENSILE STRENGTH AND ELONGATION OF SOLID WOVEN BELTING

(*Clause* 8.1)

Belt Designation	Direction	Tensile Strength, kgf/mm Width	Percentage Elongation at Break
4A	Warp	39·3	18
	Weft	21·4	19
4B	Warp	53·6	18
	Weft	26.8	19
4C	Warp	67·9	18
	Weft	26·8	19

TABLE 3 TEAR STRENGTH OF PLY WOVEN BELTING

(*Clause* 9.1)

Belt Designation	Tear Strength in kfg for the Number of Plies			
	3	4	5	6
1A	—	20·4	27·2	34·0
1AA	—	25·0	31·8	38·6
1B	—	29·5	36·3	43·1
1C	—	36·3	45·4	54·4
2A	—	90·8	113·4	—
2B	—	104·3	131·5	—
2C	90·8	117·9	149·7	—
3A, 3B, 3C	Tear strength values will be included later			

TABLE 4 TEAR STRENGTH OF SOLID WOVEN BELTING

(*Clause* 9.1)

Belt Designation	Tear Strength kgf
4A	113·4
4B	136·1
4C	136·1

9.1.1 Where multi-ply belts in a ply construction not shown in Table 3 are required, the appropriate values of the tear strength may be obtained by extrapolation.

10. ADHESION

10.1 The adhesion between the cover and plies and between the individual plies, shall be such that when tested as described in Appendix D, the average force in kgf/cm width required to cause separation of the plies at 25 mm/minute to 12·5 mm/minute shall be at least the following:

Between cover and ply	3·2 kgf/cm
Between adjacent plies	3·6 kgf/cm

10.2 The adhesion between the edge strip and the edge of the belt shall be not less than 0·7 kgf/mm of belt thickness when tested as described in Appendix E.

11. ELECTRICAL RESISTANCE

11.1 The electrical resistance shall be not more than 3×10^8 ohms when determined between electrodes placed on the surface of the belting in accordance with the method described in Appendix F.

12. FIRE RESISTANCE

12.1 The belting shall be completely non-ignitable when held stationary against a rotating steel drum in accordance with the drum friction test specified in Appendix G. The temperature of the surface of the drum during the above test shall at no time exceed 300°C.

12.1.1 The drum friction test should be carried out for the purpose of approval of a new belt construction. Frequency of this test for supplies of an approved belt construction may be agreed to between the supplier and the purchaser.

12.2 The belting shall be completely non-inflammable or self-extinguishing when a flame is removed from it in accordance with the flame test specified in Appendix H.

13. SAMPLING AND TESTING

13.1 Depending upon the length of the conveyor belting of the same characteristics (type, grade, width, etc) ordered, the samples shall be drawn in accordance with Table 5.

TABLE 5 SAMPLING PLAN FOR CONVEYOR BELTING

Length Ordered			No. of Samples*
From (Excluding)		To (Including)	
m		m	
		500	1
500	to	1 000	2
1 000	,,	2 000	3
2 000	,,	3 500	4
3 500	,,	5 000	5
5 000	,,	7 000	6
7 000	,,	10 000	7

*A sample shall consist of the full width of the finished belting and not less than 600 mm in length.

13.2 The samples shall be cut from the belting not less than 5 days after the completion of manufacture.

13.3 When placing the order, the purchaser shall state whether a test report is required and additional length for the sample, if required, shall be included in the total length ordered and paid for by the purchaser.

13.4 The manufacturer will supply, at his own cost, all labour and appliances for the tests. In the absence of facilities at his own premises for carrying out the prescribed tests, they shall be carried out by an approved authority at the cost of the vendor.

13.5 If, inspite of the manufacturer being able and willing to carry out the specified tests at his own premises, the purchaser require the test to be carried out by an independent authority, the cost of carrying out such independent testing, if the results are satisfactory, shall be borne by the purchaser. If the results are not satisfactory, the cost shall be borne by the manufacturer.

13.6 Retests and Rejection — Should any sample fail to comply with the specified test requirements, two additional samples shall be drawn and tested at the cost of the manufacturer after conditioning them in a standard atmosphere of 65 $\pm$ 5 percent relative humidity and 27° $\pm$ 2°C temperature for not less than 14 days before testing. In the event of either of these two samples failing to comply with the test requirements, the supply shall be rejected. If both the same samples pass the tests, the supply shall be accepted.

14. MARKING

14.1 The belting shall be marked at intervals of 5 to 10 metres on the surface with the maker's name, the trade-mark, if any and manufacturer's identification code including quarter and year of manufacture, if asked by the purchaser.

14.1.1 The belting may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act, and the Rules and Regulations made thereunder. Presence of this 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 during production. This system, which is devised and supervised by ISI and operated by the producer, has the further safeguard that the products as actually marketed are continuously checked by ISI for conformity to the standard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

15. PACKING

15.1 The belting shall be packed as mutually agreed upon between the purchaser and the manufacturer.

APPENDIX A

(*Clause* 7.3)

METHOD OF MEASURING THE THICKNESS OF COVER

A-1. Take a 50 mm long sample of the belting, cut across the full width of the belting, both edges of the sample being cut at right angles to the surface and edges of the belting.

A-2. Mark, but do not cut, the sample into five equal parts by four lines extending across the cut edges.

A-3. Measure the overall thickness of the belt 'h' on each edge at the points marked using a micrometer gauge graduated to 0·01 mm taking eight measurements in all.

A-4. Completely remove one cover, then measure the thickness 'h_1' at the same points.

A-5. Completely remove the other cover, then measure the thickness 'h_2', at the same points.

A-6. Take the average values of 'h', 'h_1' and 'h_2'. Then

Thickness of one cover $= h - h_1$

Thickness of other cover $= h_1 - h_2$

APPENDIX B

(*Clause* 8.1)

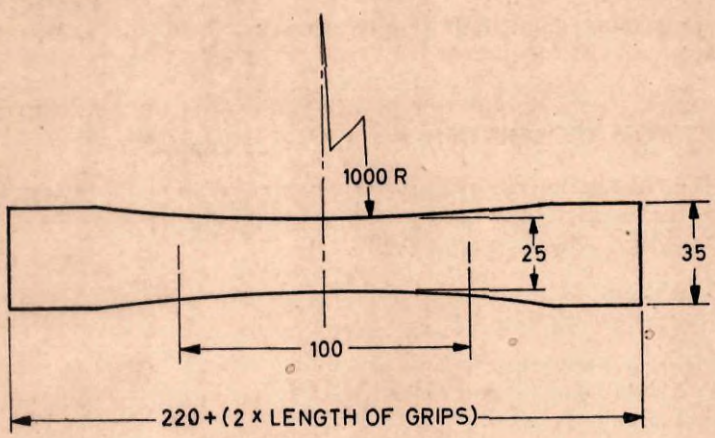
METHOD OF TESTING THE TENSILE STRENGTH AND ELONGATION

B-1. TEST PIECES

B-1.1 Cut six test pieces, three parallel to the length of the belting and three at right angles to the length of the belting. Each test piece shall conform to the shape and dimensions shown in Fig. 1

B-2. CONDITIONING OF TEST PIECES

B-2.1 Prior to evaluation, condition the test pieces in a standard atmosphere of 65 $\pm$ 5 percent relative humidity and 27° $\pm$ 2°C temperature for three days and immediately, test at that temperature and relative humidity.



All dimensions in millimetres.

FIG. 1 TEST PIECE FOR TENSILE TEST

B-3. APPARATUS

B-3.1 The accuracy of the tension testing machine shall be within ± 0·5 percent.

B-3.2 The range of the machine should be so chosen that the loads to be measured fall within the upper four-fifths of the scale.

B-3.3 The load shall be applied smoothly without any jerking or intermittent action and the power shall be sufficient to stress the test piece to the point of fracture without slowing down.

B-3.4 The rate of travel of the machine shall be 100 ± 10 mm per minute.

B-3.5 The jaws of the machine shall hold the test piece without slip and damage.

B-3.6 The jaws of the machine shall move without undue friction and in correct alignment.

B-4. PROCEDURE

B-4.1 Place the end of the test piece symmetrically in the grips of the tension testing machine and separate the grips at a constant rate of traverse at a speed of 100 ± 10 mm per minute.

B-4.2 Note the maximum load during each test. The results of breaks occurring outside the defined section shall normally be discarded and retests made.

B-4.3 Determine elongation by measuring the distance between the reference marks at the moment of break of the test piece.

B-4.4 Calculate the tensile strength per mm width from the average value for each of the two sets of three tests.

B-4.5 The elongation at break shall be expressed as a percentage and the mean value for each of the two sets of the three tests shall be the elongation at break of the belt.

APPENDIX C

(*Clause* 9.1)

METHOD OF TESTING THE TEAR STRENGTH

C-1. TEST PIECES

C-1.1 Cut two test pieces 300 mm long, 100 ± 1 mm wide and of the full thickness of the belt. The test specimens shall be taken in the longitudinal sense of the belt and at a minimum distance of 10 mm from the belt edge.

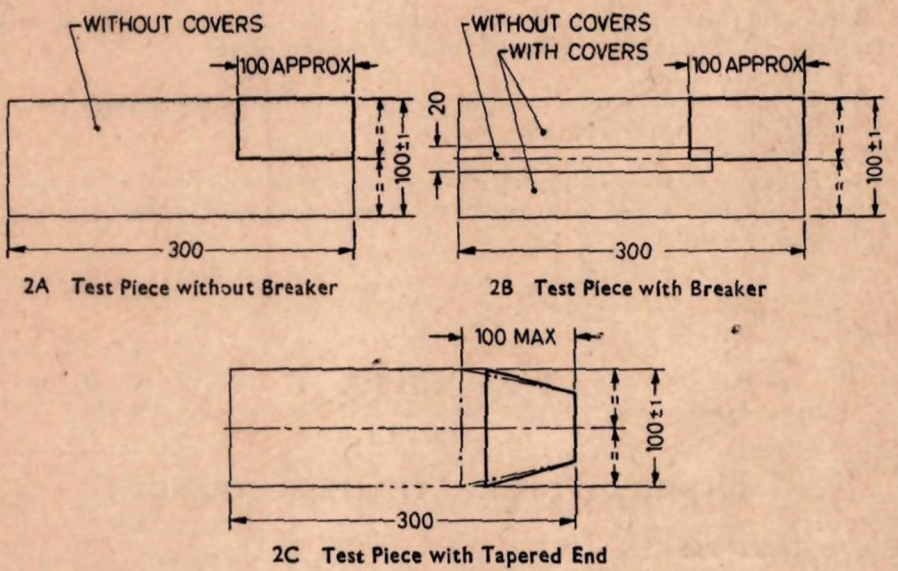
C-2. PREPARATION

C-2.1 Remove the covers of the test pieces by stripping or by buffing. If there is a breaker ply, strip the corresponding cover, without cutting the breaker ply, over a width of 20 mm only, 10 mm on each side of the longitudinal axis of the test piece with the exception of the zone held in the jaws of the test machine.

Cut each test piece from one end along the longitudinal centre line over a length of about 100 mm as shown in Fig. 2A and 2B, depending on whether there is a breaker in the cover. If necessary a portion of the test piece to be gripped may be tapered symmetrically as shown in Fig. 2C to suit the width of the jaws of the testing machine. The tapered portion shall not exceed 100 mm in length.

C-3. CONDITIONING OF THE TEST PIECE

C-3.1 Prior to evaluation, condition the test pieces in a standard atmosphere of 65 ± 5 percent relative humidity and 27° ± 2°C temperature for three days and immediately test at that temperature and relative humidity.



2A Test Piece without Breaker

2B Test Piece with Breaker

2C Test Piece with Tapered End

All dimensions in millimetres.

FIG. 2 TEST PIECES FOR TEAR STRENGTH DETERMINATION

C-4. APPARATUS

C-4.1 The apparatus consists of a dynamometric tensile testing machine with the following essential characteristics.

a) The accuracy of the machine is within $\pm$ 0·5 percent.

b) The range of the machine is so chosen that the loads to be measured fall within the upper 10 percent of the selected scale range.

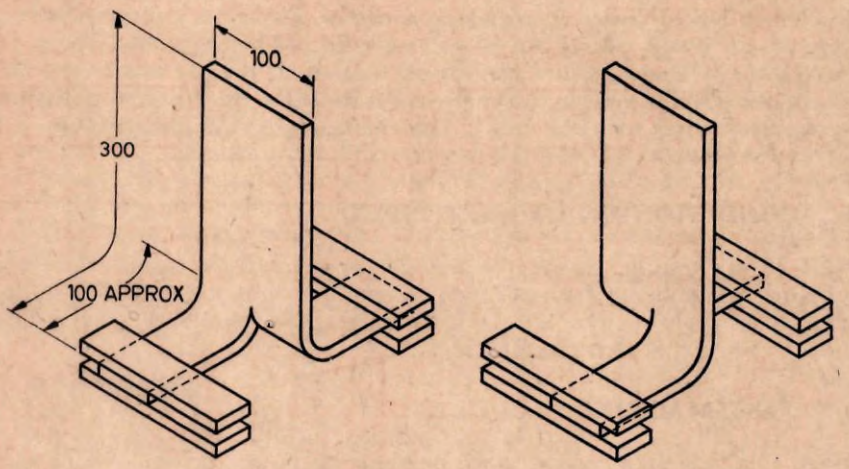
c) The load is capable of being applied smoothly and without interruption and the speed of separation of the jaws is capable of being adjusted to 100 $\pm$ 10 mm per minute.

d) The free distance between jaws is capable of being adjusted to at least 300 mm.

e) The machine is fitted with an autographic load recorder.

C-5. PROCEDURE

C-5.1 Test one test piece as shown in Sense A and the other test piece in Sense B (*see* Fig. 3).



All dimensions in millimetres.

FIG. 3 DETERMINATION OF TEAR STRENGTH

C-5.2 Mount the test piece in the jaw of the testing machine by the two edges as shown in Fig. 3, so that the inner edges of the cut are situated at the centre of each jaw.

C-5.3 Fix the speed of separation of the jaws at 100 ± 10 mm per minute and continue testing until the tear has extended for at least 100 mm.

C-5.4 Calculate the mean tearing force from the autographic record over a length of the trace corresponding to at least a 75 mm tear.

C-5.5 In addition, note the way in which tearing has occurred. If weft threads have pulled out without any characteristic tearing, consider it a tear.

APPENDIX D

(*Clause* 10.1)

METHOD OF CONDUCTING ADHESION TEST OF PLIES

D-1. TEST PIECES

D-1.1 Cut eight test pieces, each 25·0 ± 0·5 mm wide and of sufficient length, to allow a minimum test length of 100 mm, from the sample in the

direction of warp and weft (making four test pieces in each direction), using a sharp tool which leaves a clean edge. The thickness of the ply which is to be separated shall not exceed 6 mm. If the ply which is to be separated exceeds 6 mm in thickness, cut it down to the requisite thickness before proceeding with the test. The thickness of this ply shall be not greater than the thickness of the remainder of the test piece.

D-2. CONDITIONING OF TEST PIECES

D-2.1 Before testing, expose the test pieces to moisture equilibrium in a standard atmosphere of 65 ± 2 percent relative humidity and 27° ± 2°C temperature for at least 24 hours (*see also* IS : 196-1966*), and then immediately test at that temperature.

D-3. TEST MACHINE

D-3.1 The adhesion testing machine shall be power driven and of such capacity that the load required to maintain the separation of the plies is not greater that 85 percent or less than 15 percent of the maximum of the load scale. The machine shall be equipped to give a continuous indication of the load causing the separation of the plies. Because of the rapidly fluctuating loads obtained in adhesion tests, the machine shall be of a type having the shortest possible time contrast and it shall be operated so that any device for maintaining maximum load indication does not function. In pendulum type machines the weight lever arm shall swing as a free pendulum without engagement of pawls.

NOTE — A machine having a pendulum with a large moment of inertia is unsuitable for the test.

D-3.1.1 The grips shall be capable of holding the test piece and ply to be separated without slipping. Provision shall be made to maintain the test piece during the test in the approximate plane of the grips either by the attachment of sufficient weights to the free end of the test piece or by fitting a supporting plate to the non-driven grip.

D-3.1.2 The machine may be provided with mechanism for the autographic recording of the load required to cause the separation of the plies.

D-4. PROCEDURE

D-4.1 Break the bond to be tested over a distance of approximately 75 mm using sharp knife and pincers. Mount the test piece in the machine with the body of the test piece in the non-driven grip and the ply to be separated in the power driven grip so that the angle of separation is

*Atmospheric conditions for testing (*revised*).

approximately 180°. Adjust the test piece in the grips so that the tension is distributed uniformly and no twisting occurs in the ply to be separated during the test. Start the machine and maintain the rate of travel of the power driven grip from 50 to 250 mm per minute. Take the readings of the load causing separation, at intervals of 12·5 mm over a length of 100 mm. Alternatively an autographic recording of the test may be taken. Repeat the procedure on separate plies from the face ply to the centre ply. Test the second test piece in the same way commencing with the back ply and proceeding again to the centre ply. Repeat the whole test with a second pair of test pieces.

D-4.2 Two pairs of test pieces in the warp direction and two pairs in the weft direction shall be tested in the above manner.

D-5. RESULTS

D-5.1 Express the adhesion value as the average force in kgf/cm width required to cause separation of the plies at 25 mm/min to 12·5 mm/min. The results are the average for four test pieces where an autographic record is taken. Where readings are taken at 12·5 mm intervals the average of 32 readings is taken.

APPENDIX E

(*Clause* 10.2)

METHOD OF TESTING ADHESION OF EDGE TO THE BELT

E-1. TEST PIECES

E-1.1 Cut four pieces approximately 10 mm wide and 300 mm long, two from each side of the belt, and parallel to the length of the belt, using a sharp tool which leaves clean edges.

E-1.2 Separate the edge strip from the rest of the test piece carefully using a sharp tool for a distance of approximately 75 mm.

E-2. CONDITIONING OF TEST PIECES

E-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 three days and immediately test at that atmosphere.

E-3. APPARATUS

E-3.1 The accuracy of the tesion testing machine shall be within ± 0·5 percent.

E-3.2 The range of the machine will be so chosen that the loads to be measured fall within the upper four-fifths of the scale. The machine should preferably be fitted with an autographic recorder.

E-3.3 The load shall be applied smoothly without any jerking or intermittent action and the power shall be sufficient to stress the test piece to the point of fracture without slowing down.

E-3.4 The rate of travel of the machine shall be 50 ± 3 mm per minute.

E-3.5 The jaws of the machine shall hold the test piece without slip and damage.

E-3.6 The jaws of the machine shall move without undue friction and in correct alignment.

E-4. PROCEDURE

E-4.1 Conduct the test in a standard atmosphere of 65 ± 5 percent relative humidity and 27° ± 2°C temperature.

E-4.2 Measure the thickness of the test piece using a micrometer gauge graduated 0·01 mm. Take the average of two readings as the thickness of the belt.

E-4.3 Test all the four test pieces as follows:

Place the separated portion of the edge strip in one of the grips of the testing machine, and the separated portion of the test piece in the second grip. Clamp the legs so placed with the point of separation located at the centre of the grips, and the legs set parallel to the direction of traverse. Ensure that the unstripped part of the test piece is free from support during the test.

E-4.4 Ignore the initial rise of the trace on the autographic record since it is due to build up of load and note down the mean tearing force from the autographic record over a length of trace corresponding to not less than 75 mm of tearing.

E-4.5 Calculate the adhesion values for each side of the belt separately, using averages of the two values of mean tearing force from the test pieces drawn from each side of the belt. Neither of the figures expressed in kgf/mm of belt thickness shall fall below the specified adhesion value in **10.2**.

APPENDIX F

(*Clause* 11.1)

METHOD OF TESTING THE ELECTRICAL RESISTANCE

F-1. TEST PIECES

F-1.1 Cut two test pieces 300 mm square out of the full thickness of the belt including the covers.

F-2. CONDITIONING OF TEST PIECES

F-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.

F-3. APPARATUS

F-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);

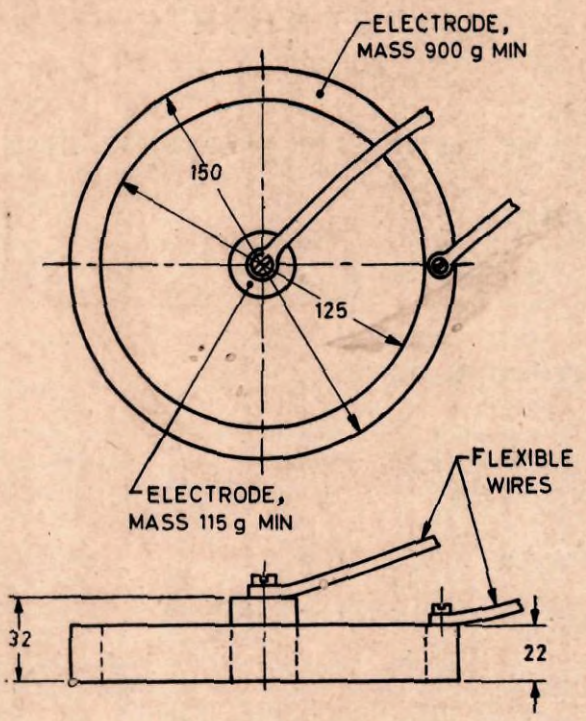
b) two cylindrical and coaxial brass electrodes, the base of one being circular and the other annular of dimensions and mass given in Fig. 4. The bases of the electrodes shall be machined and polished. A flexible insulated wire is connected to each electrode;

c) a resistance measuring instrument capable of giving readings between 10^5 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.

F-4. PROCEDURE

F-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 and dry it with a clean cloth.



All dimensions in millimetres.

FIG. 4 ASSEMBLY FOR TESTING ELECTRICAL RESISTANCE

F-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:

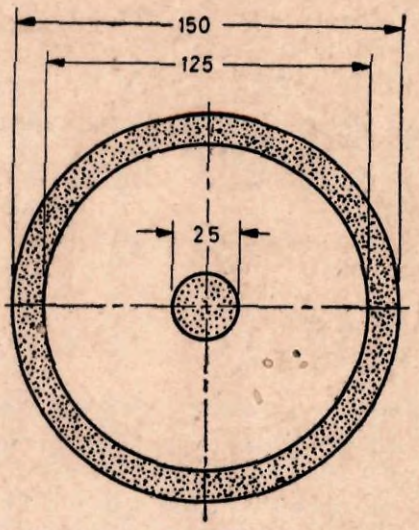
a) 800 parts by weight of anhydrous polyethylene glycol of molecular weight 600,

b) 200 parts by weight of water, and

c) 1 part by weight of soft soap

or other conducting liquid having at least the same electrical conductivity.

F-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 on one or the other of the painted rings does not exceed 10^5 ohms; otherwise discard the test piece and prepare a fresh sample.



All dimensions in millimetres.

FIG. 5 DESIGN TO BE PAINTED ON TEST PIECE

F-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.

F-4.3.1 If the sample does not have a flat surface but the cover has undulations due to the 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.

F-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.

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

F-4.6 Ensure when reading the resistance that it does not change appreciably when pressure is exerted over the electrodes. Take care not to breath on the test piece as any condensation of moisture on the surface will falsify the results. Repeat the test on the other face of the test piece.

F-4.7 For each face of the test piece the electrical resistance shall be expressed as the mean of the values noted for the two test pieces. The electrical resistance of the two faces shall be reported separately.

APPENDIX G

(*Clause* 12.1)

METHOD OF TEST FOR FIRE RESISTANCE (DRUM FRICTION TEST)

G-1. TEST PIECES

G-1.1 Cut two test pieces of the belt each 150 mm wide, and approximately 2 metres long.

G-2. APPARATUS

G-2.1 A suitable apparatus for testing is shown in Fig. 6.

NOTE — Position and size of electric motor as shown on drawing is purely diagrammatic and other power sources and methods of transmission may easily be adopted.

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

G-2.3 It is recommended that transmission of power to the rotating drum should be by means of chain and sprocket. A suitable gear ratio may be selected to give the drum a rotational speed of 190 rev/min.

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

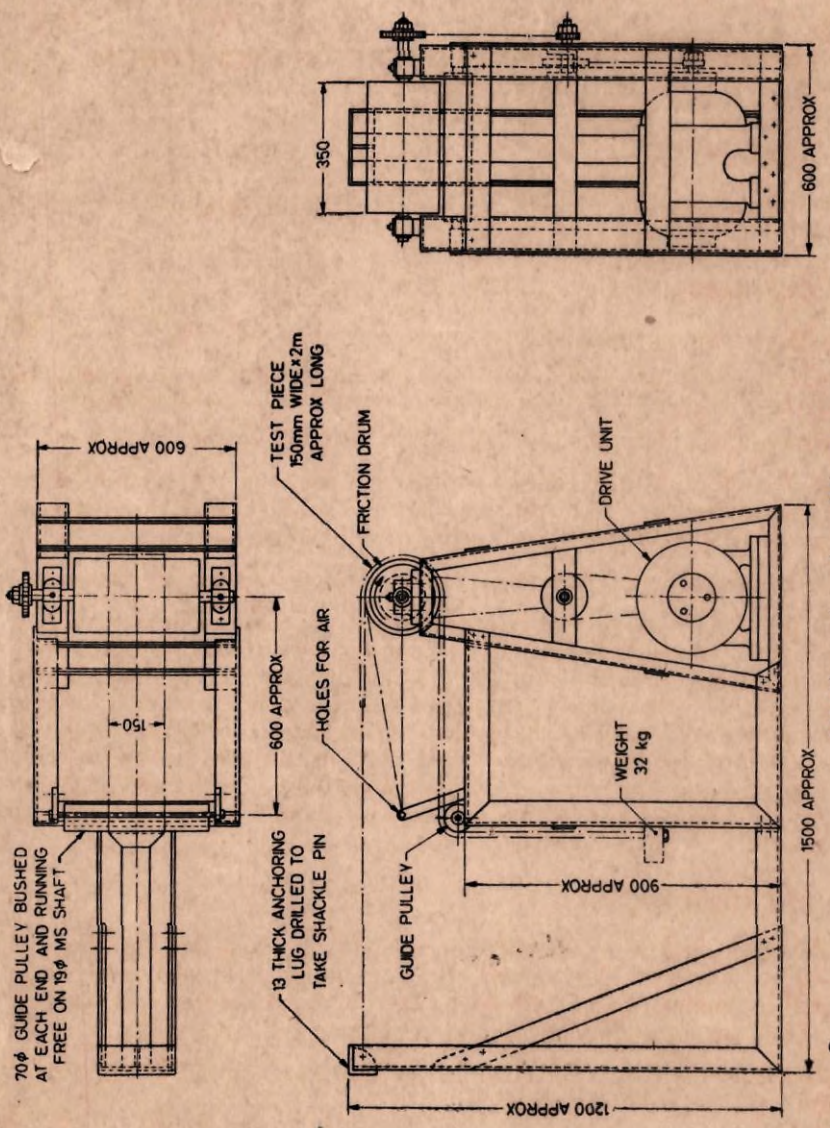
G-2.5 A standard air current required for the test may be produced by a blower fan or from a perforated pipe supplied with compressed air. In the latter case a pipe 9·5 mm to 12·5 mm in diameter and perforated along one side with holes 1·0 mm to 1·5 mm in diameter should be fixed horizontally at the back of the drum at a distance of 600 mm from the drum axis and in the same horizontal plane with the row of holes facing the drum. Air at a pressure of approximately 0·2 kg/cm^2 should be passed through the pipe. The actual air velocity should be checked with an anemometer.

G-3. PROCEDURE

G-3.1 Fix one end of the test piece on the test stand and pass the other end through an angle of 180° around the horizontally disposed steel drum 200 mm in diameter and attach a weight of 32 kg to the free end hanging vertically from a guide pulley 70 mm in diameter.

G-3.2 Rotate the drum at 190 $\pm$ 10 rev/min away from the top secured portion until the belt is destroyed.

G-3.3 Repeat the test in an air current having a velocity of 150 m/min at 200 mm from the drum surface.



All dimensions in millimetres.

FIG. 6 APPARATUS FOR DRUM FRICTION TEST

APPENDIX H

(*Clause* 12.2)

METHOD OF TEST FOR FIRE RESISTANCE (FLAME TEST)

H-1. TEST PIECES

H-1.1 Cut twelve test pieces 200 mm long and 25 mm wide, six cut parallel to the length of the belt and six cut at right angles to the length of the belt.

H-1.2 For conducting the test with outer covers intact, select three test pieces cut parallel and three test pieces cut at right angles to the length of the belt. No further preparation is required for these test pieces.

H-1.3 Remove the covers of the remaining six test pieces by buffing, care being taken to ensure that the temperature does not exceed 120°C during the buffing operation. Stop buffing when all the knuckles of the fabric become exposed.

H-2. APPARATUS

H-2.1 The apparatus for carrying out flame test shall consist of:

a) a spirit burner having a tube 20 mm in diameter with a jet 0·8 mm in diameter. A suitable apparatus is shown in Fig. 7;

b) a fuel tank and a flexible supply tube approximately 1·5 metres long;

c) a stop-watch; and

d) fuel, consisting of 95 percent ethanol and 5 percent methanol.

H-3. PROCEDURE

H-3.1 Conduct the test in an enclosure or a space fully screened to exclude draughts and in subdued light.

H-3.2 Adjust the burner to give a flame of 150 mm to 180 mm in length. To check whether the flame is satisfactory, insert a bare copper wire 0·71 mm in diameter having a free length of at least 100 mm into the flame in the position normally occupied by the lower edge of the test piece (that is 50 mm above the burner). If the wire takes more than 6 seconds to melt, the adjustment of the burner should be corrected.

H-3.3 Place the test piece horizontally in the flame with the lower edge of the strip 50 mm above the top of the burner (*see* Fig. 8).