इंटरनेट मानक

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Mazdoor Kisan Shakti Sangathan
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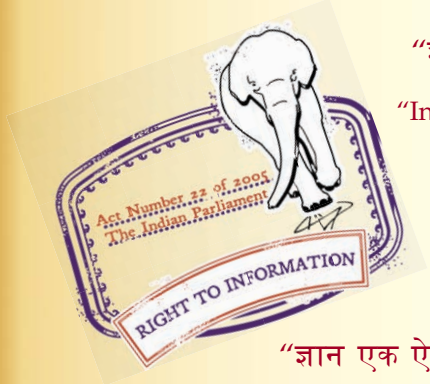
IS 14933 (2001): High Pressure Fire Fighting Hose -Specification [CED 22: Fire Fighting]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

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

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भारतीय मानक

अग्नि शमन कार्यों के लिए उच्च दाब वाले होज — विशिष्टि

Indian Standard

HIGH PRESSURE FIRE FIGHTING HOSE — SPECIFICATION

ICS 13.220.10 : 77.149

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

June 2001

Price Group 5

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Fire Fighting Sectional Committee had been approved by the Civil Engineering Division Council.

High pressure fire fighting hoses are used by the fire services to combat fire beyond the incipient stage. It is designed to convey water to handling nozzles, distributor nozzles, master stream appliances, portable hydrants, manifolds, standpipes and sprinkler systems and pumps used by the fire services.

Only the performance characteristics of hose have been dealt with in this standard. This is with a view to allowing scope for development in the manufacturing process. It may be noted that to ensure an all round quality of this type of hose, a balance has to be struck between various requirements. This has been a guiding factor in the preparation of this standard.

The composition of the technical committee responsible for the formulation of this standard is given in Annex F.

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

Indian Standard

HIGH PRESSURE FIRE FIGHTING HOSE — SPECIFICATION

1 SCOPE

This standard lays down the requirements of high pressure fire hose.

2 REFERENCES

The Indian Standards listed 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 agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards given below:

IS No.	*Title*
380 : 1978	French chalk, technical (*second revision*)
443 : 1975	Methods of sampling and test for rubber hoses (*second revision*)
715 (Part 2) : 1976	Coated abrasives: Part 2 Special and mechanical applications (*third revision*)
3400	Methods of test for vulcanized rubbers:
(Part 6) : 1983	Resistance to liquids (*first revision*)
(Part 20) : 1994	Resistance to ozone cracking (*first revision*)

3 TYPE, SIZES AND TOLERANCES

3.1 Types

Hoses shall be of the following two types.

3.1.1 *Type A*

Normal fire hoses, rubber lined or rubberized fabric lined, woven jacketed with or without elastomeric coating/covering for application under normal fire conditions.

3.1.2 *Type B*

Hose to which on elastomeric outer coating or covering has been applied or incorporated as reinforcement to give the hoses very low absorption of liquids such as oils, greases, acid and alkalis, etc, and has high resistance to abrasion and direct heat.

3.2 Sizes

The nominal internal diameter of hose shall be of 38, 50, 63 and 70 mm.

3.3 Tolerance

The tolerance on nominal diameter shall be $^{-0}_{+1}$ mm.

3.4 Internal Diameter

The internal diameter of the hose shall be measured by a suitable conical or cylindrical plug gauge and shall conform to the specified diameter with a tolerance of plus 2.0 mm and minus 0.0 mm.

4 LENGTH

Unless specified otherwise, the standard length shall be 30 metres with a tolerance of ± 2 percent.

5 MASS

The average mass of hose per metre of 5 metre length shall be not more than that prescribed in Table 1. For the determination of mass, sample of the hose shall be conditioned at 27 ± 2°C and 65 ± 5 percent relative humidity for a period of at least 48 hours and then shall be weighed under the same conditions.

Table 1 Maximum Mass of the Hose

Size/Nominal Diameter	Mass of Hose Per Metre Length, with Elastomeric Coating/Covering, *Max*
mm	g
(1)	(2)
38	350
50	450
63	550
70	650

6 COIL DIAMETER (MACHINE COILED)

The hose shall be flexible and on being machine coiled, the diameter of the coil of 30 m length of dry hose without couplings shall not exceed 52 cm. The coil diameter shall be measured at the widest part of the coil.

7 REINFORCEMENT

7.1 Hose having an outer jacket shall have a single jacket made from synthetic threads. The jacket shall be evenly and firmly woven, and free from visible defects,

dirt, thread knots, lumps and irregularities of twist. The thread shall be continuous and any knot in the filler threads shall be tucked under the warp threads.

7.2 The jacket shall be seamless and shall have the filler woven around the hose throughout its length and the warps interwoven with the fillers.

7.3 Hose having reinforcement different from the outer woven jacket specified in 7.1 and 7.2 may be accepted if the hose is found to comply with the performance tests specified in this standard.

8 LINING

8.1 The lining shall be made of rubber, plastic or rubber/plastic compounds of uniform thickness. It shall be made of either:

a) Calendered sheets, lap jointed and vulcanized into one solid body, or

b) A single ply extruded or dipped tube.

8.2 The lining may be reinforced with a fabric sheeting or other type of reinforcement.

8.3 The waterway surface of the lining shall be free from pitting, or other irregularities or imperfections.

9 COVER

A cover, if provided, shall be made of rubber, plastic or rubber/plastic compounds of uniform thickness.

A cover with intentional pricking and a cover with ribs or corrugations may be accepted.

10 HYDROSTATIC PROOF PRESSURE TEST

Each hose length shall be subjected to an internal hydraulic pressure of 3.43 MPa (35 kgf/cm^2) in accordance with 8.3 of IS 443, increasing the pressure at the rate of not exceeding 1 MPa (10.2 kg/cm^2) per min and retaining it for one min.

During this test, the hose shall not show any leakage or sweating nor any thread in the jacket shall break.

11 HYDROSTATIC BURST PRESSURE TEST

A test length of hose one metre clear of fitting when subjected to an internal hydraulic pressure in accordance with 8.2 of IS 443, increasing it at the rate not exceeding 1 MPa (10.2 kg/cm^2) per min shall not burst or show leakage before a pressure of 5.2 MPa (50 kgf/cm^2).

12 KINK TEST

Connect a 3 m length of hose to a suitable hydraulic pump. Blank the free end of hose pipe with a suitable coupling having arrangement to bleed out entrapped air with the help of suitable stop cock or pet cock. Fill the hose with water and raise the pressure to 70 KPa (0.7 kgf/cm^2). Allow the air to escape through stop cock by raising the free end of the hose and again rebuild the pressure to 70 KPa. Now kink the hose through 180° at approximately 50 cm from the free end by tying the hose back against itself as close to the fitting as practicable. Increase the pressure at a rate not exceeding 1 MPa (10.2 kgf/cm^2) per min to 2.1 MPa (21.4 kgf/cm^2). When maximum pressure is attained, retain it for 30 seconds, release the pressure, examine it for sign of leakage and damage. There shall be no sign of leakage or rupture and no thread in the jacket shall break.

13 ADHESION TEST

When tested according to the procedure laid down in Annex A, the rate of separation of the lining/cover and jacket shall not exceed 25 mm/min.

14 ABRASION RESISTANCE

When determined by the procedure laid down in Annex B, the average number of cycles completed before bursting to five test pieces shall not be less than 100 cycles.

15 ACCELERATED AGEING TEST

Four numbers of test hose pieces each of 1 metre length, shall be conditioned for 120 hours at 27 ± 2°C and 65 ± 5 percent relative humidity and shall then be aged for 336 h at 70 ± 2°C. After ageing, there shall be no tackiness on the surface of lining or the surface of the cover. Three numbers of aged test pieces each of 1 metre length shall then be subjected to burst pressure test in accordance with the method described in IS 443 and shall meet the requirements given in 11.1. The remaining length of hose shall be used for an adhesion test in accordance with the method described in Annex A using a load of 4 kg for the lining/covering. Rate of separation of the lining/covering, the rate of separation of the jacket/covering and the jacket shall not exceed 25 mm/min.

16 CHANGE IN LENGTH

16.1 The increase in length and diameter shall not exceed 6 percent when measured in accordance with 16.2.

16.2 Connect the hose to a suitable pump and raise the pressure to 70 KPa (0.7 kgf/cm^2) ensuring that all the entrapped air has been forced out. Mark two points not less than 100 cm apart, then raise the pressure to 1 MPa and maintain for minimum 2 min, and measure the distance between the two markings again. Similarly also measure the diameter at these two stages.

17 TYPE TESTS (FOR TYPE B ONLY)

17.1 Ozone Resistance

17.1.1 When tested according to the procedure laid down in Annex C, the lining/covering of the hose shall

neither develop crack nor crazing, that is fine flaws visible when seen under X_2 magnification, except at the cut edges of the hose.

17.2 Oil Resistance

17.2.1 A test piece measuring 1 m in length shall be marked around the circumference at a distance of 60 mm from each end. The test piece shall be kept immersed in an oil bath for 70 h containing oil No. 3 specified in IS 3400 (Part 6) and maintained at 50 ± 2°C in such a manner that the both ends are so clamped that the marks are in level with the surface of oil and the remaining entire length of the test piece within the marks remains completely immersed in oil. At the end of this period, the test piece shall be taken out in such a manner that the portions beyond the marks do not come in contact with the oil. The length shall be laid horizontally and the central fully immersed portion of the hose shall be visually examined for any swelling of rubber, weathering and cracking in the rubber lining.

Test pieces taken from the central (fully immersed) portion of the hose shall then be subjected to an adhesion test in accordance with the method described in Annex A and shall meet the requirement.

17.3 Heat Resistance

When tested by the method described in Annex D, none of the test samples shall burst within 20 s of the application of hot cube.

18 SAMPLING AND CRITERIA FOR CONFORMITY

The sampling and criteria for conformity shall be as given in Annex E.

19 PACKING AND MARKING

19.1 Packing

The inside of the hoses shall be dusted with french chalk (conforming to IS 380) and shall be packed and delivered in specified lengths in neat, clean and dry condition in polyethylene bags.

19.2 Marking

Beginning at a point not less than one metre from each end, each length of hose shall be marked with clear and indelible letters of at least 20 mm in height indicating:

a) Type of the hose,

b) Size of the hose,

c) Length of the hose,

d) Manufacturer's name or trade mark or both, and

e) Month and year of manufacture.

19.3 The hose may also be marked with the Standard Mark.

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

ANNEX A

(*Clauses* 13 *and* 17.2.1)

METHOD OF TEST FOR DETERMINATION OF ADHESION STRENGTH

A-1 TEST PIECE

The test piece shall be a cylindrical section of the hose, 25.0 ± 0.5 mm long, cut perpendicular to the axis of the hose with a sharp tool.

A-2 APPARATUS

A-2.1 Mandrel

It is snug fit in the test piece with a central shaft.

A-2.2 Means of Supporting the Mandrel

It may rotate in an essentially friction free manner on its shaft.

A-2.3 Means of Applying a Load to the Test Piece

These shall incorporate a grip for attachment to the lining of cover and spring for supporting weights and to serve as a cushion so as to protect the test piece from receiving jerks and impulses.

A typical layout of the test apparatus is given in Fig. 1.

A-3 PROCEDURE

A-3.1 Lining Reinforcement Adhesion

Turn the test piece inside out to expose the lining and separate the lining and reinforcement just sufficient to enable the grip to be attached. Slide the test piece on to the mandrel and insert in the apparatus. Attach the grip together with weights to give a total mass of 4 kg and then measure the length of lining separated after 1 min.

A-3.2 Cover/Reinforcement Adhesion

Repeat the procedure described in **A-3.1** using a separate test piece but test the cover adhesion without reversing the test piece and apply a total mass of 4.5 kg.

A-4 TEST REPORT

The test report shall include the following informaion:

a) The date of test,

b) All details necessary for the complete identification of the hose under test, and

c) The length of separation, if any, after 1 min.

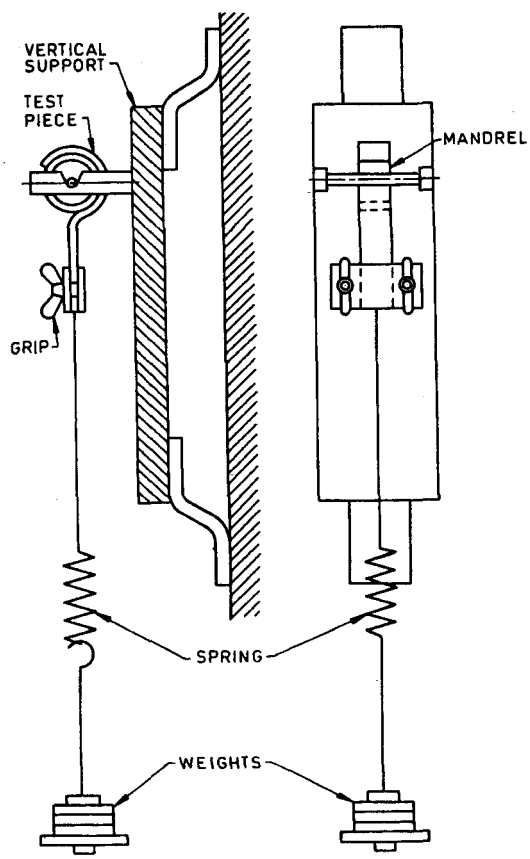


FIG. 1 TYPICAL APPARATUS FOR THE ADHESION TEST

ANNEX B

(*Clause* 14)

ABRASION RESISTANCE TEST

B-0 In this test, capability of the hose to withstand the rough usage to ground which it is bound to be subjected to during fire operation is tested. The hose may be dragged on rough surfaces or bent where it comes in contact with building corners or where the first length from the pump delivery touches the ground and is subjected to continuous chafing due to vibration of pump.

B-1 APPARATUS

B-1.1 For determining a realistic value of abrasion resistance of the hose, a special apparatus is used as described in **B-1.2**. The average number of cycles completed before the test piece bursts is to be termed as abrasion resistance cycles. Five test pieces shall be taken for such tests and the average number of cycles determined.

B-1.2 Test Apparatus

A test apparatus shall be fabricated comprising the following:

a) A constant and uninterrupted source of hydrostatic pressure with water as test medium, capable of maintaining a steady pressure of 0.7 MPa or 700 KPa (7 kgf/cm^2) in the test piece and provisions to bleed out entrapped air.

b) A machine for abrazing the test piece with a reciprocating movement. A typical layout of the test apparatus is given in Fig. 2.

c) Abrasive material fixed on the test apparatus- The abrasive material shall be a strip 25 mm wide and 300 ± 5 mm long, grit 50 'X' weight, glue bonded aluminium oxide cloth in accordance with IS 715 (Part 2). A new abrading strip shall be used for each test.

d) An electric air blower to blow away the abraded fluff.

B-2 TEST SPECIMENS

B-2.1 Test Piece

Cut pieces of 35 cms length of hose.

B-2.2 Number of Test Pieces

Three test pieces shall be subjected to abrasion resistance test.

B-3 PROCEDURE

B-3.1 The abrading strip shall be mounted in a carrier and shall be set at an angle of 45° to the horizontal axis of the test piece and at an angle of 20° to the direction of reciprocating action of the test machine. The apparatus shall be adjusted to give a frequency of 50 to 60 cycles (double strokes) of reciprocating movement per m... The length of each single stroke shall be adjusted to 230 mm. The machine shall exert a downward force of 1.58 kgf (15.5 N) on the test piece.

B-3.2 Connect the test piece to the pressure source by suitable means.

B-3.3 Fill on the test piece with water at a low pressure to expel all air. Apply a pressure of 0.7 MPa (700 KPa) raised gradually. Test piece should be horizontal as any curved fixing may lead to lower values/results.

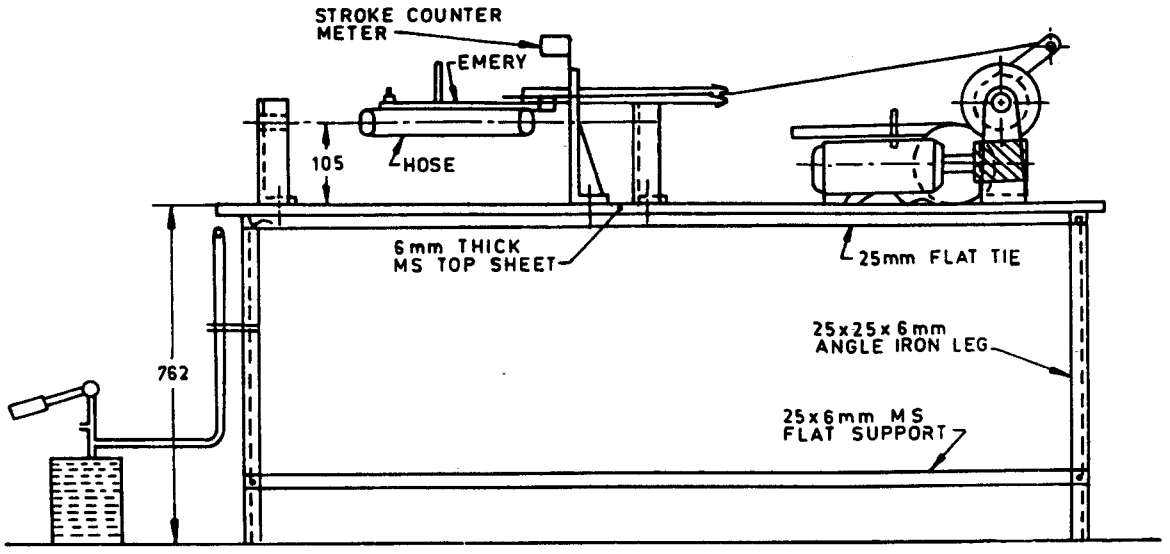
Care shall be exercised to ensure that the hose test piece is fixed on the bed of the machine in such a manner that the free end may stretch fully and maintain this pressure of 700 KPa for minimum two min before starting the abrasion. Care shall also be exercised to ensure that the abrading strip does not abrade the hose test piece at the lap joint otherwise false results will be obtained on the much higher side.

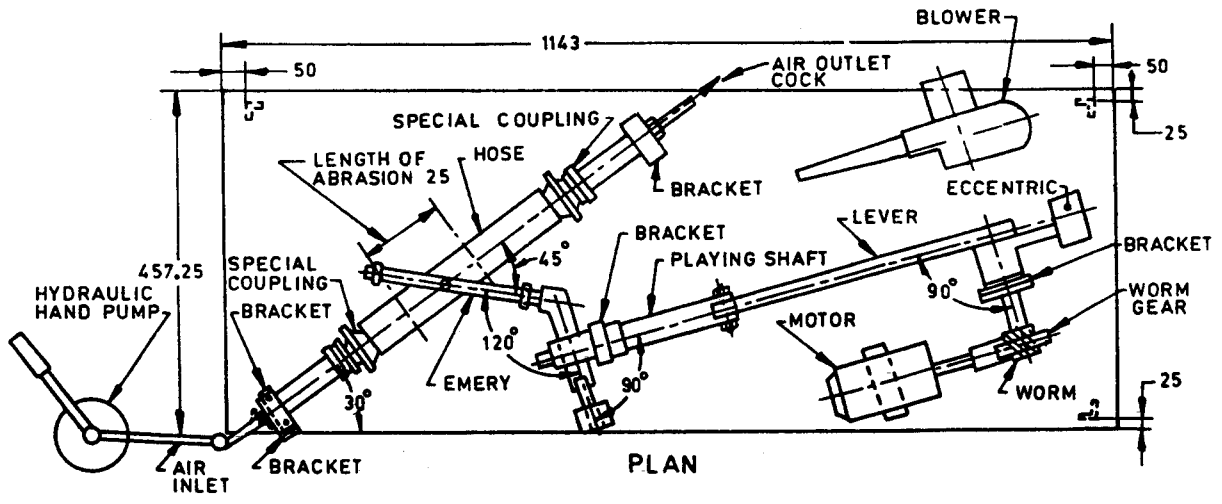
B-3.4 Switch on the air blower and start the test machine. Record the number of cycles completed until the test piece bursts. The recording of cycles should be done by a metering device such as stroke counter and it should be switched off as soon as the hose bursts.

B-3.5 Repeat the test with a new abrading strip fixed on the machine and a new test piece, three times.

B-3.6 Take the average value for three test pieces.

B-3.7 Remove any dirt or debris from the plane of abrasion by using an ordinary air blower working at a low pressure of 100 KPa and the nozzle fixed to some firm object, directing the air jet at an angle from a distance not exceeding 300 mm.





All dimensions in millimetres.

FIG. 2 GENERAL ARRANGEMENT OF ABRASION TESTING MACHINE (NTS)

ANNEX C

(*Clause* 17.1.1)

METHOD OF TEST FOR OZONE RESISTANCE

C-1 TEST PIECE

The test piece shall be a 150 mm length of hose.

C-2 APPARATUS

As described in **3** of IS 3400 (Part 20).

C-3 CONDITIONING

Condition the test piece at 27 ± 2°C in a substantially ozone free atmosphere in the dark for 38 h immediately prior to testing.

C-4 PROCEDURE

C-4.1 Lining

Turn the test piece inside out to expose the lining. If it is not possible to turn the test piece inside out, slit it length-wise and reverse it to expose the lining. Form the test piece into a securely held tight coil and then expose it in the ozone cabinet to an ozone concentration of 50 ± 5 parts per hundred million by volume (pphm) at 50 ± 2°C for 96 h. After exposure, examine the test piece with a lens of X_2 magnification for any signs of cracking or crazing.

C-4.2 Cover

Expose a separate, tightly coiled test piece which has not been reversed, in the ozone cabinet to an ozone concentration of 50 + 5 pphm at 50 ± 2°C for 96 h and then examine the test piece as described in **C-4.1**.

C-5 TEST REPORT

The test report shall include the following information:

a) The date of test,

b) All details necessary for the complete identification of hose under test, and

c) The nature and location of any cracking or crazing observed.

ANNEX D

(*Clause* 17.3)

METHOD OF TEST FOR HEAT RESISTANCE

D-1 TEST PIECE

Each test piece shall be 1 m length of hose freshly cut from the lot offered for inspection. There shall be 5 number of test pieces for this test.

D-2 APPARATUS

The following test apparatus is required:

a) Laboratory furnace capable of being controlled at $600^{+10°C}_{-0}$.

b) A number of steel cubes of uniform size each being of 13.0 ± 0.1 mm.

c) Source of steady hydrostatic pressure with water as the test medium. The pressure shall be maintained at 0.7 MPa (7 kgf/cm^2) in the test piece without any variation in the pressure.

d) A stop watch with a least count of 0.2 sec.

e) A pair of steel tongs of size 30 cm.

f) A stout guard made of steel wire mesh to protect the person(s) conducting the test against any injury.

D-3 PROCEDURE

D-3.1 Place the steel cubes in the furnace at $600^{+10°C}_{-0}$ and maintain this temperature or at least 30 min immediately before use.

D-3.2 Connect the hose test piece to the pressure source and fill the test piece with water at a low pressure not exceeding 70 KPa to expel all the air from inside the test piece with the help of a pet cock. Place the test piece horizontally on some hard smooth surface like RCC or metalled table. Put the free end of the test piece inside the guard. Apply the water pressure gradually raising it up to 0.7 MPa.

D-3.3 Take out the heated steel cube from the furnace with the help of an iron tong as quickly as possible (maximum time lapse 2 sec) and place it immediately on top of the test piece. The steel cube

shall be held in position by means of light wire support. Record the time elapsed from the time of placing the steel cube on the test piece until the test piece bursts. Repeat the test for all the 5 test pieces Burst shall not occur within 20 sec of the application of the steel cube on any of the test pieces.

Care shall be exercised to ensure that the hot cube is not placed on lap joint otherwise false results will be obtained on much higher side. For each test, only new mild steel cubes free from rust, carbon particles and loose flakes shall be used.

ANNEX E

(*Clause* 18)

SAMPLING AND CRITERIA FOR CONFORMITY

E-1 SCALE OF SAMPLING

E-1.1 Lot

In any consignment, all the lengths of hoses of the same size and length produced under essentially similar conditions of manufacture shall be separated into groups of 100 lengths or less and each such group shall consistitute a lot.

E-1.2 Tests for the determination of the conformity of a lot to the requirements of the standard shall be carried out for each lot separately. The number of lengths of hoses to be selected for this purpose shall be in accordance with col 1 and 2 of Table 2.

E-1.3 The required number of lengths of hoses shall be selected at random from among the lengths in the lot. For this purpose, suitable random number tables shall be used. In case such tables are not available, the procedure as given in **E-1.3.1** for selection may be adopted.

E-1.3.1 Starting from any hose in the lot, count them as 1, 2, 3, ... upto r and so on in one order, where r is the integral part of N/n (N being the lot size and n being the sample size). Every rth hose thus counted shall be withdrawn to give sample for inspection and testing.

E-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

E-2.1 The lengths of hoses selected according to **E-1.2** and **E-1.3** shall be inspected visually for weaving defects, dirt, knots, lumps, etc, and subjected to dimensional measurements such as diameter and length of hose. These lengths shall also be examined for weight per metre length and flexibility. Any length found to be unsatisfactory with regard to one or more of these characteristics shall be considered as a defective length.

E-2.1.1 If the number of defective lengths found is not greater than the corresponding number of defectives given in col 3 of Table 2, the lot shall be declared as conforming to the requirements of these characteristics. Only such lots shall be further examined for the other tests.

E-2.2 From each of such lots which are found to be satisfactory according to **E-2.1.1**, one length of hose shall be chosen at random to provide test pieces for the determination of various specification requirements (such as percolation, proof test, bursting pressure and alkali solubility of flax) which involve cutting up of the hoses. The test pieces required for all the determinations may be cut from either end of the chosen length of the hose.

E-2.2.1 The lot shall be declared as conforming to the requirements of these characteristics if the test results for the determination of different characteristics are all found satisfactory. In case the test result for any characteristic fails to meet the relevant requirement of the specification two more tests shall be conducted for that characteristic on two other different lengths of hoses chosen from the lot and only on finding these two satisfactory, the lot shall be considered as conforming to the requirements of that characteristic, otherwise not.

Table 2 Scale of Sampling

(*Clauses* E-1.2 *and* E-2.1.1)

Lot size (in Length)	Sample Size (in Length)	Permissible Number of Defective Lengths
(1)	(2)	(3)
Up to 15	All	0
16 to 25	15	0
26 to 50	20	0
51 to 100	32	1

ANNEX F

(Foreword)

COMMITTEE COMPOSITION

Fire Fighting Sectional Committee, CED 22

Chairman	*Representing*
SHRI OM PRAKASH	Fire Adviser, Ministry of Home Affairs, New Delhi
Members	*Representing*
SHRI D. K. SHAMI	Ministry of Home Affairs, New Delhi
DR NAVINCHANDRA JAIN FIRE ADVISER (*Alternate*)	Government of Maharashtra, Mumbai
SHRI P. N. SETHNA SHRI N. T. PANJWANI (*Alternate*)	Kooverji Devshi and Co (P) Ltd, Mumbai
SHRI SHIV NATH SHRI P. GANESHAN (*Alternate*)	Steelage Industries Ltd, Chennai/Delhi
SHRI P. K. CHATTERJEE SHRI H. S. KAPARWAN (*Alternate*)	Defence Institute of Fire Research, Ministry of Defence, Delhi
ASSISTANT SECURITY COMMISSIONER (FIRE)	Railway Board, Delhi
SHRI M. GANGARAJU SHRI V. K. VERMA (*Alternate*)	Directorate General of Supplies and Disposals, Pune
SHRI S. K. DHERI SHRI SURINDER KUMAR (*Alternate*)	Delhi Fire Service, Delhi
SHRI V. L. N. RAO LT-COL S. K. MARKENDEY (*Alternate*)	Controllerate of Quality Assurance, Pune
SHRI P. A. DUBEY	Design and Consultancy, CME Campus, Pune
SHRI M. K. BANSAL SHRI S. K. KALIA (*Alternate*)	Engineer-in-Chief's Branch, New Delhi
FIRE ADVISER SHRI S. C. RAY (*Alternate*)	Defence Research and Development Organization, Delhi
SHRI J. N. VAKIL SHRI T. R. A. KRISHNAN (*Alternate*)	Tariff Advisory Committee, Ahmedabad/Delhi
DIRECTOR DEPUTY DIRECTOR (*Alternate*)	Home Department (Fire Service), Chennai
DR T. P. SHARMA DR A. K. GUPTA (*Alternate*)	Central Building Research Institute (CSIR), Roorkee
SHRI B. PATHAK	West Bengal Fire Service, Kolkata
MANAGING DIRECTOR TECHNICAL EXECUTIVE (*Alternate*)	Avon Services Pvt Ltd, Mumbai
SHRI R. C. SHARMA SHRI S. L. NAGARKAR (*Alternate*)	Central Industrial Security Force, New Delhi
PRESIDENT GENERAL SECRETARY (*Alternate*)	The Institution of Fire Engineers (India), Delhi
SHRI S. N. KUNDU	Fire and Safety Appliances Co, Kolkata
SHRI S. K. SUREKHA	Jaya Shri Textiles, Delhi

(*Continued on page* 10)

(*Continued from page* 9)

Members	*Representing*
GENERAL MANAGER ADDITIONAL GENERAL MANAGER (*Alternate*)	National Airport Authority, New Delhi
CHIEF ENGINEER (E)-I	Central Public Works Department, New Delhi
SHRI B. J. SHAH SHRI A. M. SHAH (*Alternate*)	Newage Industries, Gujarat
CHIEF FIRE OFFICER DEPUTY CHIEF FIRE OFFICER (*Alternate*)	Bombay Fire Brigade, Mumbai
SHRI B. N. DAS SHRI B. P. DAS (*Alternate*)	Steel Authority of India Ltd, Rourkela
SHRI A. RAUTELA SHRI C. P. SINGH (*Alternate*)	Steel Authority of India Ltd, Dhanbad
SHRI R. P. SAXENA SHRI NEERAJ SHARMA (*Alternate*)	Oil and Natural Gas Commission, Dehra Dun
SHRI SWARANJIT SEN DEPUTY DIRECTOR (*Alternate*)	Home (Police Department), Government of Andhra Pradesh, Hyderabad
SHRI TARIT SUR SHRI D. NEOGI (*Alternate*)	Surex Prodution and Sales Pvt Ltd, Kolkata
SHRI HARISH SALOT	Vijay Fire Protection System Pvt Ltd, Mumbai
CHIEF FIRE OFFICER	Bhabha Atomic Research Centre, Mumbai
SHRI S. M. DESAI	Eureka Firetech Pvt Ltd, Mumbai
SHRI G. B. MENON	*In personal capacity* (House No. 33/2965A, Vennala High School Road, Cochin)
SHRI DEEPAK AGARWAL	Mather and Platt (India) Ltd, Mumbai
MANAGING DIRECTOR SHRI D. K. SARKAR (*Alternate*)	Loss Prevention Association of India, Mumbai/Delhi
SHRI P. N. PANCHAL	*In personal capacity* (B-1/64 Sector 16, Rohini, Delhi)
SHRI S. K. JAIN, Director (Civ Engg)	Director General, BIS (*Ex-Officio Member*)

Member-Secretary

SHRI SANJEEV CHATURVEDI
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