इंटरनेट मानक

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Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
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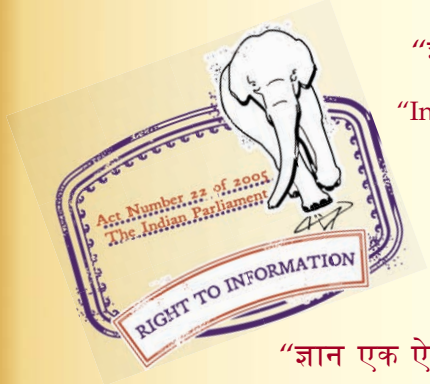
IS 15265 (2003): Flexible PVC Pipes or Polymer Reinforced Thermoplastic Hoses for Suction and Delivery Lines of Agricultural Pumps - Specification [CED 50: Plastic Piping System]



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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

कृषि पंपों की चूषण और वितरण लाइनों के लिए पौलिमर प्रबलित ताप सुघट्य अथवा नम्य पी वी सी पाईप — विशिष्टि

Indian Standard

FLEXIBLE PVC PIPES OR POLYMER REINFORCED THERMOPLASTIC HOSES FOR SUCTION AND DELIVERY LINES OF AGRICULTURAL PUMPS — SPECIFICATION

ICS 23.040.70; 65.060.35

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

April 2003

Price Group 6

FOREWORD

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

Irrigation practice in agriculture in India depends upon drawing water from open wells, rivers, canals, streams, etc. and distributing this water to the crops through pipes or open trenches. Initially, this was done by using galvanized iron (GI) pipes which were very difficult to handle or dismantle. A boom came in the form of rubber hoses reinforced with steel wire. Later on, a thermoplastic version of this evolved facilitating great flexibility, recyclability and low cost.

IS 4985 : 1988 'Specification for unplasticized PVC pipes for potable water supply (*fourth revision*)' being intended to cover unplasticized (rigid) PVC pipes, a need was felt to formulate standard for flexible thermoplastic hoses. Considerable assistance has been derived in formulating this standard, from ISO 3994 : 1998 'Plastic hoses-helical-thermoplastic-reinforced thermoplastics for suction and discharge aqueous materials — Specification'.

It should be kept in mind that unlike the UPVC pipes, which are outside diameter based pipes, the flexible hose have well defined internal diameters. The termination and jointing of these hoses is with internally fitting accessories.

The composition of the Committee responsible for 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.

AMENDMENT NO. 1 NOVEMBER 2009
TO
IS 15265 : 2003 FLEXIBLE PVC PIPES OR POLYMER REINFORCED THERMOPLASTIC HOSES FOR SUCTION AND DELIVERY LINES OF AGRICULTURAL PUMPS — SPECIFICATION

(*Foreword*, *para* 5) **—** Substitute 'Annex G' *for* 'Annex F'.

(*Page* 1, *clause* **2**) **—** Delete '12656 : 1989 Rubber or plastic hoses and tubing **—** Bending test' and insert the following:

12235 (Part 1) : 2004	Thermoplastics pipes and fittings **—** Methods of tests : Part 1 Measurement of dimensions (*first revision*)

(*Page* 3, *clause* **6.6**, *lines* 1 *and* 2) **—** Substitute 'Annex E' *for* 'method A given in IS 12656'.

(*Page* 3, *clause* **6.7**, *lines* 1 *to* 6) **—** Substitute the following for the existing:

'Requisite length of sample shall be conditioned in a cold chamber at a temperature of -10 ± 2°C for 5 hours. After conditioning for 5 hours the sample shall be removed from the cold chamber. The test must be started within 60 seconds from the time of removal of sample from the cold chamber and completed within 120 seconds from the time of removal of sample from the cold chamber. The test shall be carried out in accordance with method specified in Annex E and using a minimum radius of curvature(c) of 10 times the nominal bore. During the test hose shall not crack or fold or exhibit a kink and shall pass the proof test (*see* **6.1**).'

(*Page* 4, *clause* **6.8**, *line* 1) **—** Substitute 'Annex F' *for* 'Annex E'.

(*Page* 8, *Annex* D) **—** Insert the following 'Annex E' at the end:

ANNEX E
(*Clauses* 6.6 *and* 6.7)

BEND RADIUS TEST

E-1 APPARATUS

The apparatus consists of two guide's — *A* and *B*, Guide *A* being fixed in a plane and Guide *B* being movable in that plane, parallel to, and in line with, Guide *A* (*see* Fig. 4).

E-2 TEST PIECES

E-2.1 Types and Dimensions

The test pieces shall consist either of complete manufactured lengths of hose or of suitable test lengths. If the manufactured length is shorter than the length required for the test, test pieces of adequate length (*see* **E-4**) shall be specially manufactured.

E-2.2 Number

Unless otherwise specified, two test pieces shall be tested.

E-3 CONDITION OF TEST PIECES

No test shall be carried out within 24 h of manufacture.

FIG. 1 TYPICAL APPARATUS FOR BEND RADIUS TEST

E-4 PROCEDURE

Determine the average external diameter *D* of the hose by means of a suitable measuring instrument as specified in IS 12235 (Part 1).

Draw two parallel and diametrically opposite lines along the length of hose. If the hose has natural curvature, one of the lines shall be on the outside of the curve. On each of these lines, mark a distance of 1.6 *C* + 2 *D* or 200 mm whichever is longer, where *C* is twice the minimum bend radius specified in the appropriate specification, so that the marked distances are exactly opposite. This will ensure a sufficient length for the bend test and adequate support of the hose.

Separate the Guides *A* and *B* to a distance slightly less than 1.6 *C* + 2 *D*. Place the hose between the guides so that the ends of the marked distances are parallel to the ends of the guides and remain in this position while the guides are closed to a distance of *C* + 2 *D* (*see* Fig. 4).

Check that the hose on each side is supported to a length of not less than *D*.

(*Page* 9, *Annex* E) — Substitute '*ANNEX* F' *for* '*ANNEX* E' and renumber the other clauses accordingly.

(*Page* 10, *Annex* F) — Substitute '*ANNEX* G' *for* '*ANNEX* F'.

(CED 50)

Reprography Unit, BIS, New Delhi, India

Indian Standard

FLEXIBLE PVC PIPES OR POLYMER REINFORCED THERMOPLASTIC HOSES FOR SUCTION AND DELIVERY LINES OF AGRICULTURAL PUMPS — SPECIFICATION

1 SCOPE

This standard specifies the requirements for flexible PVC pipes or polymer reinforced thermoplastics hoses for suction and delivery lines of agricultural pumps. The hoses covered in this standard are neither intended for use with flammable and combustible materials nor with aromatic solvents.

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 agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
2809 : 1972	Glossary of terms and symbols relating to soil engineering (*first revision*)
2810 : 1979	Glossary of terms and symbols relating to soil dynamics (*first revision*)
12656 : 1989	Rubber or plastic hoses and tubing — Bending test

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Bend Radius — The radius of a bent section of hose measured to the inner most surface of the curved portion.

3.2 Bending Force — Load required to induce bending around a specified radius and hence a measure of stiffness.

3.3 Bore — Inside of a hose through which the material to be conveyed passes.

3.4 Burst Pressure — Pressure at which rupture of the hose occurs.

3.5 Coupling — Fittings, usually made of metal, attached to the end of a hose to facilitate connection to equipment for another hose (A female coupling carries internal fastening while a male coupling carries external fastening).

3.6 Helix — Shape formed by spiralling a wire or other reinforcement around or within the body of a hose.

3.7 Hose — Flexible tube consisting of a lining, reinforcement and usually, an outer cover.

3.8 Hydrostatic Stability — Ability to resist, within limits, changes in length and/or diameter and/or twist at a specified pressure.

3.9 Hydrostatic Stability Test — Non-destructive test in which the change in length and/or diameter and/or twist of a hose is measured at a specified pressure.

3.10 Impulse — Pressure of short duration that may be cyclic and which produces sudden stress.

3.11 Impulse Test — Pulsating pressure test, usually applied to high pressure hydraulic hose.

3.12 Internal Diameter — Diameter of the bore of a hose in mm.

3.13 Mandrel — Rigid or flexible rod or tube of circular cross-section on which certain types of hose are manufactured.

3.14 Mandrel Built — Hose fabricated on a mandrel.

3.15 Minimum Bend Radius — Smallest specified radius to which a hose may be bent in service.

3.16 Nominal Bore — Reference number (which is dimensionless) for the bore of a hose.

3.17 Proof Pressure — Pressure applied during a non-destructive test and held for a specified period of time to prove the integrity of construction.

3.18 Proof Pressure Test — Pressure holding test to prove the structural integrity of a hose.

3.19 Reinforcement — Non-rubber strengthening member(s) of a hose.

3.20 Thermoplastic Hose — Tube of flexible plastic material reinforced with a spiral of semi-rigid plastic material encapsulated in, or external to the wall.

3.21 Vacuum Test — Test of the resistance of a hose to collapse under vacuum.

3.22 Working Pressure — Maximum pressure to which a hose is designed to be subjected, including the expected momentary surges, during service.

3.23 Working Temperature — Maximum or minimum temperature at which hose is designed to be serviceable.

NOTE — For the definitions of terms pertaining to soil mechanic and soil dynamic reference may be made to IS 2809 and IS 2810.

4 MATERIALS AND CONSTRUCTION

The hoses shall be as uniform as commercially practicable in colour, opacity and other physical properties. They shall consist of a flexible thermoplastic material supported in its mass by a helix of thermoplastic material of a similar molecular structure. The reinforcing and flexible components of the wall shall be fused and free from visible cracks, porosity, foreign inclusion or other defects such as are liable to cause failure of the hoses in service.

5 DIMENSIONS AND TOLERANCES

5.1 Nominal Bore, Internal Diameter and Tolerances

The nominal bore, internal diameter and tolerances of the hoses shall meet the requirements given in Table 1.

5.1.1 *Measurement of Internal Diameter*

No measurement of test shall be carried out within 24 h of manufacture. The measurements shall be carried out with a varnier caliper with a minimum required precision of 0.05 mm. Determination of minimum and maximum inside diameters requires several measurements on the same cross-section of the specimen to be taken until maximum and minimum values are found. After the minimum and maximum values are found, it should be ascertained that these values are at 90° to each other. A mean of these two values rounded off to the next higher 0.1 mm shall be termed as the 'Mean Inside Diameter'.

5.2 Length Tolerances

The tolerances on cut lengths shall be in accordance with Table 2.

6 PERFORMANCE REQUIREMENTS OF HOSES

6.1 Hydrostatic Test at Standard Atmospheric Condition

When tested in accordance with method specified in Annex A at 27 ± 2°C and relative humidity 65 ± 5 percent, the hoses shall meet the requirements given in Table 3.

Table 1 Nominal Bore, Internal Diameter and Tolerances

(*Clause* 5.1)

Sl No.	Nominal Bore	Internal Diameter mm	Tolerances mm
(1)	(2)	(3)	(4)
i)	12.5	12.5	± 0.75
ii)	16	16.0	± 0.75
iii)	20	20.0	± 0.75
iv)	25	25.0	± 1.25
v)	32	32.0	± 1.25
vi)	38	38.0	± 1.50
vii)	40	40.0	± 1.50
viii)	50	50.0	± 1.50
ix)	63	63.0	± 1.50
x)	75	75.0	± 2.00
xi)	80	80.0	± 2.00
xii)	100	100.0	± 2.00
xiii)	125	125.0	± 2.00
xiv)	150	150.0	± 2.00
xv)	160	160.0	± 2.00
xvi)	200	200.0	± 2.00
xvii)	250	250.0	± 3.00
xviii)	315	315.0	± 3.00

NOTE — Sizes other than those covered in this standard shall be subject to the agreement between the supplier and the purchaser.

Table 2 Tolerances on Length

(*Clause* 5.2)

Sl No.	Length mm		Tolerances mm
(1)	(2)		(3)
i)		≤300	± 3.0
ii)	> 300	≤ 600	± 4.5
iii)	> 600	≤ 900	± 6.0
iv)	> 900	≤ 1 200	± 9.0
v)	> 1 200	≤ 1 800	± 12.0
vi)	>1 800		

At proof pressure (that is, 50 percent of minimum burst pressure) the hoses shall be examined for evidence of leakage, cracking, abrupt distortion indicating irregularity in materials or manufacture, or other signs of failure.

6.2 Hydrostatic Test at 55 ± 2°C

When tested in accordance with method specified in Annex A at 55 ± 2°C, the hoses shall meet the

requirements given in Table 4. To ensure the water temperature both outside and inside of the test specimen, the test specimen with end plugs shall be kept in a thermostatically controlled water bath for minimum 1 h at 55 ± 2°C to adjust the temperature.

Table 3 Hydrostatic Test at Standard Atmospheric Condition

(*Clause* 6.1)

Sl No.	Nominal Bore	Maximum Working Pressure Mpa	Minimum Burst Pressure MPa
(1)	(2)	(3)	(4)
i)	12.5 up to and including 25	0.7	1.7
ii)	32 up to and including 63	0.5	1.25
iii)	75, 80	0.4	1.0
iv)	100 up to and including 125	0.3	0.75
v)	150 up to and including 250	0.25	0.6
vi)	315	0.2	0.8

Table 4 Hydrostatic Test at 55 ± 2°C

(*Clause* 6.2)

Sl No.	Nominal Bore	Minimum Burst Pressure MPa
(1)	(2)	(3)
i)	12.5 up to and including 25	0.5
ii)	32 up to and including 63	0.4
iii)	75, 80	0.3
iv)	100 up to and including 125	0.25
v)	150 up to and including 250	0.2
vi)	315	0.25

6.3 Pressure Impulse Test

When tested in accordance with the method specified in Annex B, the hoses shall withstand a minimum of 10 000 cycles. The test piece shall be considered to have failed if it develops a leak or rupture. In the event of a failure within one inside diameter distance from either coupling the test shall be disregarded and further test piece tested. The maximum pressure of a test cycle (*see* Fig. 1), shall be 120 percent of maximum working pressure, with variation of ± 5 percent.

6.4 Vacuum Test Requirement

When tested in accordance with the method specified in Annex C using the absolute pressure indicated in Table 5, the hoses shall not fail due to collapse or fracture at a point that is more than one inside diameter distance from the coupling. In the event of failure closer to the coupling, the test shall be disregarded and a further test piece tested.

6.5 Reinforcement Fracture Test Requirements

When tested in accordance, with the method specified in Annex D, the polymer reinforcement shall be capable of reverse bending without cracking after 336 h extended over the appropriate size extension block listed in Table 6.

Table 5 Pressure for the Vacuum Test

(*Clauses* 6.4 *and* C-4)

Sl No.	Nominal Bore	Absolute Pressure MPa
(1)	(2)	(3)
i)	12.5 up to and including 160	0.035
ii)	25 up to and including 315	0.02

The period of extension of 336 h is intended as a control test. For a type test a period of four months shall be used.

Table 6 Extension Block for Fracture Test

(*Clause* 6.5)

Sl No.	Nominal Bore	Block Width mm
(1)	(2)	(3)
i)	12.5	10.0
ii)	16	12.0
iii)	20	16.0
iv)	25	19.0
v)	32	23.0
vi)	38	26.0
vii)	40	27.0
viii)	50	31.0
ix)	63	34.0
x)	75	37.0
xi)	80	38.0
xii)	100	44.0
xiii)	125	49.0
xiv)	150	51.0
xv)	160	53.0
xvi)	200	59.0
xvii)	250	66.0
xviii)	315	75.0

6.6 Minimum Bend Radius Requirement

When tested in accordance with method A given in IS 12656 using a minimum radius of curvature (*c*) of five times the nominal bore, in the case of nominal bores up to 250, and eight times the nominal bore in case nominal bores above 250, the hoses shall not crack and shall pass the proof test (*see* **6.1**).

For the purpose of this test numeric value of the nominal bore shall have the designation of mm.

6.7 Cold Bend Radius Requirements

When tested at 10 ± 2°C in accordance with the requirements of IS 12656 after conditioning for 5 h at that temperature and using a minimum radius of curvature (*c*) of 20 times the nominal bore, in the case

of nominal bores up to 250, the hose shall not crack and shall pass the proof test (*see* **6.1**).

For the purpose of this test numeric value of the nominal bore shall have the designation of mm.

6.8 Loss in Mass on Heating

When tested in accordance with Annex E the flexible thermoplastic material used in the construction shall have a loss in mass not greater than 4 percent.

6.9 Effect of Sunlight

Two samples each 300 mm long of different lengths of pipe shall be prepared. One sample shall be kept covered in thick paper and kept in shade as control sample and the other to sun for not less than 1 600 h at ambient temperature of not less than 20°C. After the required period of exposure, the two samples when compared shall not show any difference in colour or physical appearance. This test shall be taken as type test.

7 JOINTING AND TERMINATION

Cast iron or plastic hose connectors (one way or two way) are available in the market of standard diameters. The hose shall be push fitted on the hose connector (hose nipple or hose coupling), in the following manner:

a) Take some water in a metal pot with depth equal to or slightly less than the effective length of hose nipple.

b) Heat the water up to 70-80°C.

c) Dip the end portion of the pipe into hot water vertically for 2-3 min. Do not expose the pipe to flame.

d) Take away the pipe from hot water. Place the hose nipple on ground and press the end of the hot pipe vertically to force it on the hose coupling.

e) Wait for a few seconds and use a suitable sized hose clamp (hose clip) and fasten it on to the pipe.

NOTE — This clause is for the general guidance for the end user.

8 MARKING

8.1 The hoses shall be marked either using a contrasting indelible ink or as agreed between the supplier and the purchaser with at least the following information:

a) Identification of source of manufacture;

b) The hose nominal bore; and

c) Batch No. with year of manufacture.

8.1.1 *BIS Certification Marking*

Each pipe may also be marked with the Standard Mark.

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

ANNEX A

(*Clauses* 6.1 *and* 6.2)

HYDROSTATIC TESTING

A-1 APPARATUS

A-1.1 Pressure source capable of applying pressure at the rate specified in **A-3.2** up to a required test pressure.

A-1.2 Calibrated pressure gauge or pressure transducers with digital read-outs chosen for each test so that the test pressure is between 15 and 85 percent of the full scale reading.

A-2 TEST PIECES

A-2.1 Hoses

The hydrostatic pressure and burst tests shall be carried out on a hose test piece with a minimum free length of 300 mm, excluding end fittings and end reinforcements.

A-2.2 Number of Test Pieces

At least two test pieces shall be tested.

A-2.3 For the hose under test, water shall be used as the test medium.

WARNING — Hoses and hose assemblies pressurized by liquids can fail in a potentially dangerous manner. For this reason, the test shall be performed in a suitable enclosure. Also the use of air and other gases as test media shall be avoided because of the risk to operators. In special cases, where such media are required for the tests, strict safety measures are imperative. Furthermore, it is stressed that, even when a liquid is used as the test medium, it is essential that all air is expelled from the test piece because of the risk of injury to the operator due to the sudden expansion of trapped air released when the hose bursts.

A-3 PROCEDURE

A-3.1 Fill the test piece with test liquid, expelling all air, and connect to the test equipment. Close the valve and apply the hydrostatic pressure at a uniform rate of increase. Measure the pressure using a calibrated pressure gauge or pressure transducer with digital read out (*see* **A-1.2**).

NOTE — It is important to allow unrestricted movement of the free or plugged end of the test piece during test.

A-3.2 The rate of pressure increase shall be constant and chosen to reach the final pressure after between 30s and 60s for hoses with nominal inside diameter up to 50 mm. For hoses with nominal inside diameter greater than 50 mm and less than or equal to 250 mm, the time needed to reach the final pressure shall be between 60s and 240s. For hoses with nominal inside diameter larger than 250 mm, the time limit to reach the final pressure shall be decided between the manufacturer and the user.

A-4 PROOF PRESSURE HOLD TEST

When proof pressure tests are used to determine leakage of hoses or hose assemblies, apply the specified proof pressure in accordance with **A-3.2** and hold it for 60s, examining the test pieces during this period for evidence of leakage, cracking, abrupt distortions, indicating irregularity in material or manufacture or other signs of failure.

NOTE — The test is not applicable to curved hose.

A-4.1 Burst Pressure Test

Increase the pressure at a rate in accordance with **A-3.2** until the hose or hose assembly fails. The position and mode of failure shall be recorded in the test report.

Any failure caused by blowing off fittings, leakage or burst within 25 mm of a fitting or within a distance equal to the outside diameter of a hose whichever is greater shall not be interpreted as a true hose burst.

ANNEX B

(*Clause* 6.3)

PRESSURE IMPULSE TEST

B-1 APPARATUS

A circuit capable of applying an internal hydraulic pressure which can be released at a predetermined level, delayed by a fixed period of time and the cycles repeated. The cycle shall comply with the pressure/ time requirements shown in Fig. 1.

A suitable circuit is shown in Fig. 2.

B-2 TEST FLUID

The test fluid shall be water, which may be suitably dyed.

NOTE — Other fluids may be used by agreement between the customer and the supplier.

B-3 TEST PIECES

A minimum of three test pieces of hose with end fittings shall be tested. The clear distance between fittings shall be at least 5 times the nominal bore.

B-4 CONDITIONING

No test shall be carried out within 24 h of manufacture. The test pieces shall be conditioned at 27 ± 2°C and relative humidity of 65 ± 5 percent for at least 3 h before testing which may be part of 24 h.

B-5 PROCEDURE

Connect the test pieces in straight condition to the apparatus and ensure that the temperature of both the test fluid and the ambient temperatures are standard laboratory temperature at which conditioning was carried out. Purge all air from the test piece. Apply 10 000 impulse cycles.

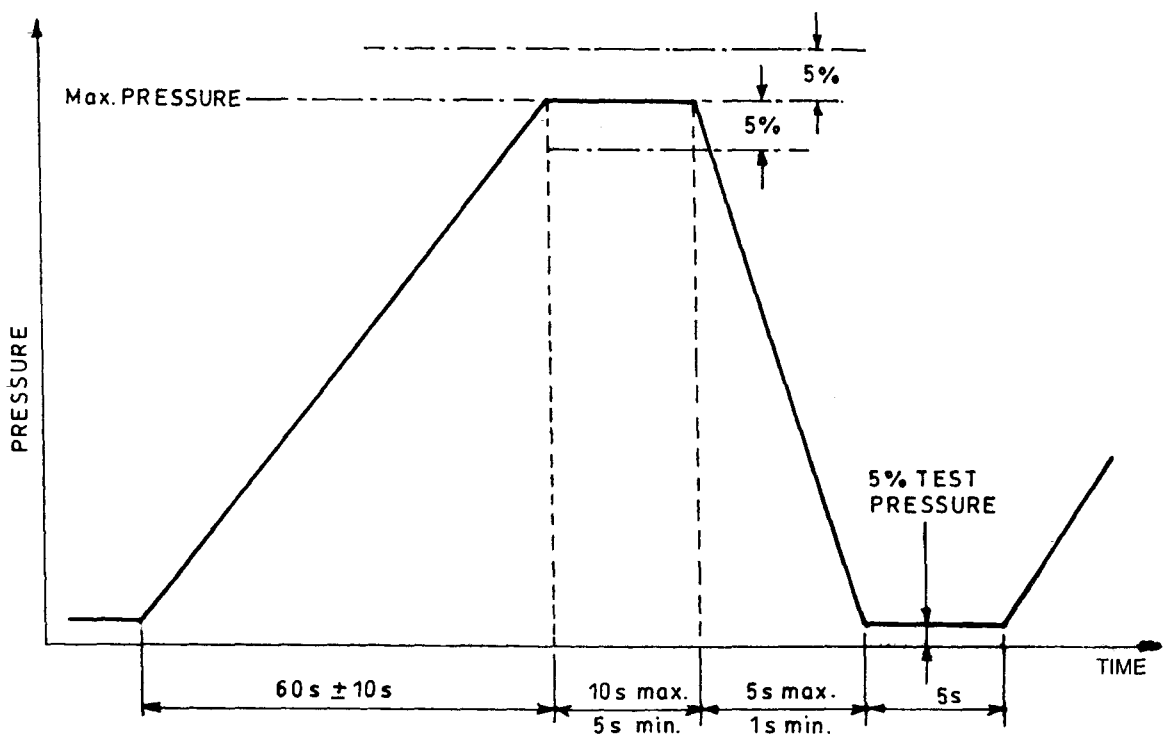

FIG. 1 PRESSURE IMPULSE CYCLE

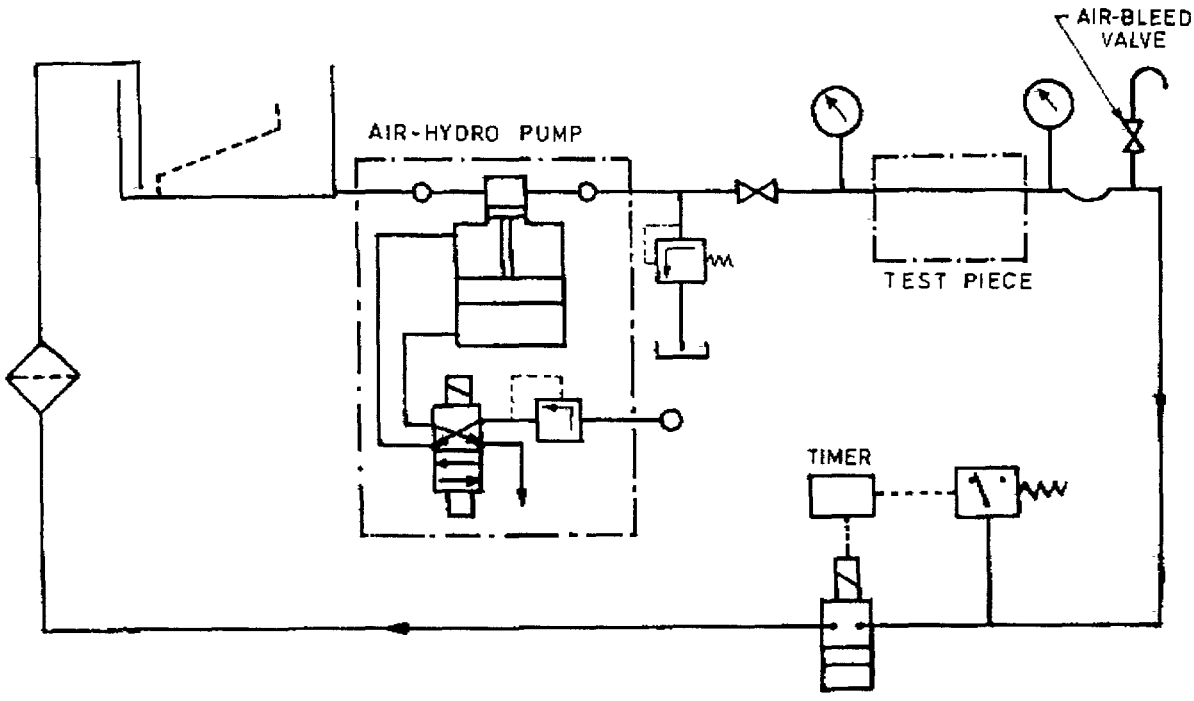

FIG. 2 SUITABLE DIAGRAMMATIC IMPULSE TEST CIRCUIT

ANNEX C

(*Clause* 6.4)

VACUUM TEST

C-1 APPARATUS

A vacuum pump capable of achieving an absolute pressure of 0.02 MPa, the evacuation rate should be uniform and be such that the vacuum is achieved in less than 1 min.

C-2 TEST PIECES

A minimum test length clear of the fittings of five times the bore of the test hose shall be used.

C-3 CONDITIONING

No test shall be carried out within 24 h of manufacture. Test pieces shall be conditioned at 27 ± 2°C for at least 3 h before testing, which may be part of the 24 h.

C-4 PROCEDURE

Attach end fittings to the test piece without causing damage to the hose.

Ensure that the ambient temperature is standard laboratory temperature at which conditioning was carried out. Apply appropriate vacuum listed in Table 5 within 1 min maintained for 10 min.

Repeat the test on additional samples but at a temperature of 55 ± 2°C. To ensure the temperature of 55 ± 2°C the sealed test specimen shall be immersed and kept in a thermostatically controlled water bath for at least 1 h.

ANNEX D

(*Clause* 6.5)

REINFORCEMENT FRACTURE TEST

D-1 APPARATUS

Extension pieces of hardwood or metal of rectangular section with one cross-section dimension of appropriate value given in Table 6.

D-2 TEST PIECES

The test piece shall contain three helices of reinforcement. This shall be split with clean cut along with its length. 3 test pieces shall be tested.

D-3 CONDITIONING

No test shall be carried out within 24 h of manufacture. Test pieces shall be conditioned at 27 ± 2°C and relative humidity of 65 ± 5 percent for at least 3 h before testing, which may be part of the 24 h.

D-4 PROCEDURE

Open up the test piece and place it on the block extension appropriate to its nominal bore (*see* Table 6) as indicated in Fig. 3.

Leave in this condition for either 336 h (for a control test) or for 4 months (for a type test) as appropriate at the same standard laboratory temperature at which the test pieces were conditioned.

Reverse bend the test piece until the outside surface touch and examine for cracking of the helix (*see* Fig. 3).

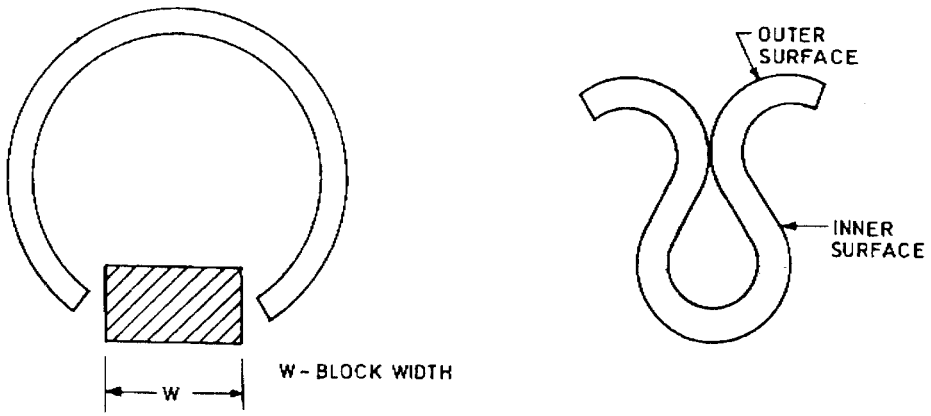

FIG. 3 DIAGRAMMATIC REPRESENTATION OF REINFORCEMENT FRACTURE TEST

ANNEX E

(*Clause* 6.8)

LOSS IN MASS ON HEATING

E-1 APPARATUS

E-1.1 Analytical Balance — The analytic balance shall have an accuracy of 0.001g.

E-1.2 Micrometer — Accurate to 0.01 mm thermostatically bath or oven capable of maintaining the temperature to within ± 2°C of the test temperature in the range of 50 to 150°C.

E-1.3 Containers — Metal cans of cylindrical forms about 100 mm in diameter and 120 mm in height provided with non-airtight cover; a lid with a small vent hole of 3 mm diameter may be suitable.

E-1.4 Metal Cages — Cylindrical metal cages constructed from bronze gauze having apertures of approximately 500 microns, with a diameter of 60 mm and height of 6 mm, formed by soldering a strip of gauze at right angles to the periphery of disk of the gauze; a similar but slightly larger cylinder acts as a lid.

E-1.5 Activated carbon with a grain size of 4 to 6 mm, free from powder. The carbon shall be of well determined type and grade, in order to obtain concordant results.

Before use, the carbon should be sieved and dried to constant mass at 70°C preferably under vacuum, and then stored in an air-tight container. Use fresh material for each test.

E-2 TEST SPECIMENS

E-2.1 The test specimens shall be in the form of disks 50 ± 1 mm diameter and 1 ± 0.1 mm in thickness cut from compression moulded sheet of the appropriate thickness.

E-2.2 If the test is carried out for the determination of characteristics of specific plasticizers, standard compounds of a given composition, as agreed to between the vendor and the purchaser shall be used.

E-2.3 At least 3 test specimens shall be tested for each material.

NOTE — For special purposes the use of specimens of different shapes and thickness may be necessary. However, comparison of the values obtained is possible only for specimens of the same thickness. Coated fabrics and other supported plastic films may be tested by this method using specimens cut directly from the sample as received.

E-3 PROCEDURE

E-3.1 Weigh each test specimen to the nearest 0.001 g and determine its mean thickness to the nearest 0.01 mm.

E-3.2 On the bottom of metal container (1.4) spread about 120 cm of activated carbon (1.6). Place the specimen in wire-mesh cage (1.4) and place the cage on top of the carbon and cover it with the further 120 cm^3 of carbon. Finally put the lid on the container.

E-3.3 Place the container in the oven or thermostatic bath controlled at a temperature of 100 ± 2°C. After 24 h, remove the container from the oven or bath and allow it to cool at room temperature. Remove the wire cage from the container and remove the specimen from the wire cage, carefully brush them free from any trace of carbon particles.

E-3.4 Reweigh each specimen to the nearest 0.001 g.

NOTE — For different materials, different temperature and durations of test may be agreed to between the interested parties, maintaining the same test procedure.

E-4 EXPRESSION OF RESULTS

The change in mass, M, expressed as a percentage, is given by the formula:

$$M = \frac{m_0 - m_1}{m_0} \times 100$$

where

m_0 = mass in grams of the test specimen before the test, and

m_1 = mass in grams of the test specimen after treatment in the over or thermostatical bath.

NOTE — The arithmetic mean of values obtained from the three test specimens is the loss of plasticizers from the material under test.

ANNEX F

(Foreword)

COMMITTEE COMPOSITION

Plastic Piping System Sectional Committee, CED 50

Organization	*Representative(s)*
Engineer-in-Chief's Branch, Army Headquarters, New Delhi	SHRI K. PRABHAKAR RAO (***Chairman***)
Ahmedabad Municipal Corporation, Ahmedabad	SHRI N. P. PATEL SHRI V. B. PARMAR (*Alternate*)
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(*Continued from page* 11)

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