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June 2020

BUREAU OF INDIAN STANDARDS

Preliminary Draft for

FLEXIBLE POLYVINYL CHLORIDE LAY FLAT HOSE FOR AGRICULTURAL USE – SPECIFICATION

FOREWORD

(*Formal clauses to be added later*)

Flexible polyvinyl chloride (PVC) lay flat hose is a multipurpose hose for industrial and agricultural use, made by an advance continuous manufacturing technique using a special formulation of PVC and high tensile polyester yarn. The process ensures total penetration of PVC onto the interstices of the polyester reinforcement and inseparable fusion with the inner and outside walls of PVC. This method of production allows maximum maintaining minimum wall thickness. The hose thus produced has high hoop strength, at the same time allowing minimum longitudinal movement. It is lightweight and is rugged enough to take repeated daily rough handling. It has good corrosion resistant and abrasion resistant properties, and is available in long lengths. It assumes under pressure and returns to its flat shape after use, for easy handling and storage. It does not need drying and can be rolled immediately after use. The various applications of PVC lay flat hose pipes in various sectors, are

Agriculture	Irrigation, Sprinkling, Dewatering, Grain Chutes
Forestry	Fire Fighting, Sprinkler, Water Supply line
Mining	Dewatering, Pumping, waste water disposal, ventilation
Marine	Water supply of ships, unloading of vessels, submarine exploration
Municipalities	Emergency Sewage, flood control lines, horticulture
Construction	Concrete Chutes, Boring, Dewatering, Pile Driving, Hydrualic
Fishery	Fish farming

This standard, however, covers polyester yarn reinforced polyvinyl chloride flexible lay flats hoses for agriculture usage.

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FLEXIBLE POLYVINYL CHLORIDE LAY FLAT HOSE ─ SPECIFICATION

1 SCOPE

This standard prescribes the requirements, methods of sampling and tests for polyester yarn reinforced polyvinyl chloride flexible lay flats hoses for agriculture usage.

2 REFERENCES

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

IS No.	*Title*
686 : 1985	Methods for determination of colour fastness of textile materials to day- light
768 : 1982	Method for evaluating change in colour
2405 (Part 1): 1980	Industrial Sleeves : Part 1 Wire cloth sieves (*first revision*)
2828 : 2001	Glossary of terms used in Plastics Industry
4669 : 1968	Methods of test for polyvinyln chloride resins
4905 : 1968	Methods of random sampling
4985 : 2000	Unplasticized PVC pipes for portable water supplies
7016 (Part 4) : 1987	Methods of Test for Coated and Treated Fabrics, Part 4: Rubber - or Plastics-Coated Fabrics - Determination of Resistance to Damage by Flexing
7703 (Part 1):1990	Methods of test for continuous filament polyester and polyamide flat yarn – Linear density (first revision) (Superseding IS 1226:1957)
7703 (Part 2):1990	Methods of test for continuous filament polyester and polyamide flat yarn – Tenacity and elongation at break (*first revision*) (superseding IS 1228:1957)

7703 (Part 3):1991	Methods of test for man-made fibre continuous filament flat yarn – Commercial mass (first revision) (Superseding IS 1229:1957
7703 (Part 4):1981	Methods for test for continuous filament polyester and polyamide flat yarn : Part 4 Sampling
7703 (Part 5):1987	Methods of test for continuous filament polyester and polyamide flat yarn – Unevenness percentage
8543 (Part4/Sec 1):1984	Methods of testing plastics : Part 4 Short term mechanical properties, Section 1 Determination of tensile properties
9766:2000	Flexible PVC compounds – Specification
10148 : 1982	Positive list of constituents of polyvinyl chloride resins and its copolymers for safe use in contact with foodstuffs, pharmaceuticals and drinking water.
10151 : 1992	Polyvinyl chloride (PVC) and its copolymers for its safe use in contact with food stuffs, pharmaceuticals and drinking water.
12235	Thermoplastics pipes and fittings – Methods of test
Part 1 : 2004	Measurement of dimensions.
Part 3 : 2004	Test for opacity
13360 (Part 2/Sec 1):1992	Plastics methods of testing : part 2 sampling and preparation of test specimens, sec 1 compression molding test specimens of thermoplastic materials
13360 (Part 5/Sec 11):1992	Plastics methods of testing : part 5 mechanical properties, sec 11 determination of indentation hardness of plastics by means of durometer (shore hardness)
15907:2010	High density polyethylene (hdpe) woven beds for vermiculture — specification

3 TERMINOLOGY

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

3.1 Nominal Size (DN) — The numerical designation for the size of a hose, which is a convenient round number approximately equal to the manufacturing dimension, in millimeters (mm).

3.2 Nominal Outside Diameter — The specified outside diameter, in millimeters (mm) assigned to a nominal size.

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

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

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

3.6 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.

3.7 Internal Diameter — Diameter of the bore of a hose, in mm.

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

3.9 Wall Thickness at any Point — The value of the measurement of the wall thickness at any point around the circumference of a hose, rounded off to the next higher 0.1 mm.

3.10 Minimum Wall Thickness at any Point — The minimum value for the wall thickness at any point around the circumference of a hose, rounded off to the next higher 0.1 mm.

3.11 Maximum Wall Thickness at any Point — The maximum value of the wall thickness at any point around the circumference of a hose, rounded off to the next higher 0.1 mm.

3.12 Mean Wall Thickness — The arithmetical mean of at least four measurements regularly spaced around the circumference and in the same cross-section of a hose, including the measured minimum and the measured maximum values of the wall thickness in that cross-section and rounded off to the next higher 0.1 mm.

3.13 Tolerance — The permitted variation of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum value.

3.14 Working Pressure (PN) — The numerical designation of a hose related to the mechanical characteristics of that hose used for reference purposes. For plastics piping systems, it corresponds to the allowable operating pressure, in bar, conveying water at 27°C.

3.15 Tests

3.15.1 *Type Tests* — Tests carried out whenever a change is made in the composition or in the size/series in order to establish the suitability and the performance capability of the hoses.

3.15.2 *Acceptance Test* — Acceptance testers are carried out on samples selected from a lot for the purpose of acceptance of the lot.

3.17 Virgin Material — Material in such form as granules or powder that has not been subjected to use or processing other than that required for its manufacture and to which no reprocess-able or recyclable material(s) have been added.

4 CLASSIFICATION OF HOSES

4.1 The hose shall be classified by pressure ratings (working pressures) at 27°C as follows.

Table 1 Type of Lay Flat Hose
(*Clause* 4.1)

Sl No.	Type of Hoses	Working Presseure (PN) kg/cm^2
(1)	(2)	(3)
i)	Light duty	3.0
ii)	Medium duty	5.0
iii)	Heavy duty	7.0

5 COMPOSITION

5.1 The material from which the hose is produced shall consist substantially of plasticized polyvinyl chloride to which may be added only those additives that are needed to facilitate the manufacture of the hose and the production of sound and durable hose of good surface finish, mechanical strength and opacity under conditions of use. None of these additives shall be used separately or together in quantities sufficient to constitute a toxic, organoleptic or microbial growth hazard, or materially to impair the fabrication or welding properties of the pipe, or to impair its chemical and physical or mechanical properties.

5.2 Flexible Polyvinyl Chloride Compound

Commented [I1]: Why IS 9766 has not been referred for material requirements?

A compound suitable for extrusion, injection moulding and compression moulding and consisting of polyvinyl chloride, and/or a copolymer of vinyl chloride, suitably compounded with plasticizers and other ingredients. The compound shall be in the form of random cut chips, regular cubes, regular cylindrical pellets, powder or any other convenient form.

5.3 The monomer content (VCM Content) in the resin shall be within the limits specified in **3.3.1** of IS 10151, when tested as per Annex A of IS 10151.

5.4 The composition shall be based on PVC resin having a K-value of 64 or greater when tested in accordance with IS 4669.

5.5 Physical Properties of Flexible PVC Compound

The flexible PVC compound when tested in accordance with the method of test as given in Table 2 shall fulfill the requirements given therein.

Table 2 Requirements for Flexible PVC Compounds for Hosepipe
(*Clause* 5.5)

Sl. No.	Characteristics	Unit	Requirement for		Method of Test, Reference to IS/Annex
(1)	(2)	(3)	(4)	(5)	(6)
i)	Durometer hardness, *Min*	Shore A	51-60	61-70	13360 (Part 5/ Sec 11)
ii)	Tensile strength, *Min*	N/mm^2	8	10	8543 (Part 4/ Sec 1)
iii)	Elongation at break, *Min*	%	200	175	8543 (Part 4/ Sec 1)
iv)	Volatile loss at 130°C/3 h, *Max*	%	2.0	1.5	Annex
v)	Cold bend temperature at which sample does not crack, *Min*		-20	-20	Annex G of IS 9766
vi)	Volume resistivity at 27°C, *Min*	Ohm-cm	NA	NA	Annex E of IS 9766
vii)	Ageing :				
	a) Treatment *Temperature* *Duration*	 °C Days	 80°C 7	 80°C 7	Annex D of IS 9766
	b) Tensile strength, Variation, *Max*	%	± 20 percent of the individual value before ageing	± 20 percent of the individual value before ageing	8543 (Part 4/ Sec1)
	c) Elongation at break, Variation, *Max*	%	± 20 percent of the individual value before ageing	± 20 percent of the individual value before ageing	8543 (Part 4/ Sec1)

5.6 Polyester Yarn

The thermoplastic polyester yarn used for manufacturing hoses shall have high tenacity and regular shrinkage, and when tested shall fulfill the requirements given in Table 3.

Table 3 Specification for High Tenacity Polyester Yarn
(*Clause* 5.6)

Sl No.	Characteristics	Unit	Requirement	Method of Test, Reference to IS/Annex
(1)	(2)	(3)	(4)	(5)
i)	Titer	Dtex	1 100	IS 7703 (Part 1)
		Denier	1 000	
ii)	Filaments	F	192	???
iii)	Breaking Strength	N	88	???
iv)	Tenacity	cN/dtex	8.0	IS 7703 (Part 2)
		g/d	9.1	
v)	Elongation	percent	14±2	IS 7703 (Part 2)
vi)	Hot Air Shrinkage 177°C, 2min, 0.05cn/dtex	percent	7.5±1.5	???

6 MATERIALS AND CONSTRUCTION

The hose shall be uniform in colour, opacity and other physical and chemical properties. The hose shall consist of a flexible thermoplastic material supported in its mass by a helix of thermoplastic polyester yarn material. 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.

7 DIMENSIONS

7.1 Diameter

The inside diameter of a hose and the tolerance shall be as given in Table 4.

7.2 Wall Thickness

The wall thickness of plain hose and the plain portion shall be as given in Table 4.

Table 4 Dimensions of Light/Medium/Heavy Duty Hose Pipe
(*Clauses* 7.1 and 7.2)

Light Duty Hosepipe							
Sl. No.	Nominal Bore	Inner Diameter		Wall thickness	Working Pressure	Burst Pressure	Length
	(DN)	inch	mm	mm	Bar	Bar	m
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	25	1”	25	1.5±.0.2	4	10	100
ii)	35	1-1/4”	32	1.5±.0.2	4	10	100

iii)	40	1-1/2”	38	1.5±.0.2	4	10	100
iv)	50	2”	51	1.5±.0.2	4	10	100
v)	65	2.5”	64	1.5±.0.2	4	10	100
vi)	75	3”	76	1.5±.0.2	4	10	100
vii)	100	4”	102	1.5±.0.2	4	10	100
viii)	125	5”	127	1.5±.0.2	4	10	50
ix)	150	6”	153	1.5±.0.2	4	10	50

Medium Duty Hosepipe							
Sl. No.	**Nominal Bore**	**Inner Diameter**		**Wall thickness**	**Working Pressure**	**Burst Pressure**	**Length**
	(DN)	Inch	mm	mm	Bar	Bar	m
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	25	1”	25	1.8±.0.2	6	12	100
ii)	35	1-1/4”	32	1.8±.0.2	6	12	100
iii)	40	1-1/2”	38	1.8±.0.2	6	12	100
iv)	50	2”	51	1.8±.0.2	6	12	100
v)	65	2.5”	64	1.8±.0.2	6	12	100
vi)	75	3”	76	1.8±.0.2	6	12	100
vii)	100	4”	102	1.8±.0.2	6	12	100
viii)	125	5”	127	1.8±.0.2	6	12	50
ix)	150	6”	153	1.8±.0.2	6	12	50

Heavy Duty Hosepipe							
Sl. No.	**Nominal Bore**	**Inner Diameter**		**Wall thickness**	**Working Pressure**	**Burst Pressure**	**Length**
	(DN)	Inch	mm	mm	Bar	Bar	m
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	25	1”	25	2.0±.0.2	8	16	50
ii)	35	1-1/4”	32	2.0±.0.2	8	16	50
iii)	40	1-1/2”	38	2.0±.0.2	8	16	50
iv)	50	2”	51	2.0±.0.2	8	16	50
v)	65	2.5”	64	2.0±.0.2	8	16	50
vi)	75	3”	76	2.0±.0.2	8	16	50
vii)	100	4”	102	2.0±.0.2	8	16	50
viii)	125	5”	127	2.0±.0.2	8	16	50
ix)	150	6”	153	2.0±.0.2	8	16	50

7.3 Colour

The colour of the hose shall be given as in Table 5. Slight variation in the appearance of the colour should be permitted.

Table 5 Colour
(*Clauses* 7.3 *and* 11.2)

Sl. No.	Type of Hoses	Colour
(1)	(2)	(3)
i)	Light Duty	Green
ii)	Medium Duty	Yellow
iii)	Heavy Duty	Blue

7.4 Length

The tolerance on cut length shall be in accordance with Table 6.

Table 6 Tolerance on Cut Length
(*Clause* 7.4)

Sl. No.	Length, m	Tolerances, mm
(1)	(2)	(3)
i)	50-100	± 50
ii)	100-150	± 75
iii)	150-200	± 100

7.5 Hose Ends

The ends of the hose tube shall be cleanly cut, and shall be reasonable square to the axis of the hose tube.

8 PHYSICAL AND CHEMICAL CHARACTERISTICS OF HOSE

8.1 Visual Appearance

The internal and external surfaces of the hose pipe shall be smooth, clean and free from grooving and other processing defects. The hose pipe shall be fused and free from visible crack porosity; foreign inclusion or other defects such as are liable to cause failure of the hoses in service.

8.2 Opacity

When tested accordance with IS 12235 (Part 3), the wall of the plain hose pipe shall not transit more than 0.2 % of the visible light falling on it.

8.3 Internal Mandrel Test

The diameter of test mandrel for internal mandrel test of hose tube shall be as specified in Table 7. The mandrel of 300 mm length shall pass smooth at both end of the hose pipe.

Table 7 Internal Mandrel Test
(*Clause* 8.3)

Sl No.	DN	Diameter of Test Mandrel (mm)
(1)	(2)	(3)
i)	24	24
ii)	35	34
iii)	40	39
iv)	50	49
v)	65	64
vi)	75	74
vii)	100	99
viii)	125	124
ix)	150	149

8.3 Colour Stability

8.3.1 *Fastness to Daylight Exposure*

The colour fastness shall be rated at not less than standard 4 when the pigmented compound is tested in accordance with the method described in Annex A.

8.3.2 *Colour Bleeding*

There shall be no staining or marking of the sheet or of the filter paper when the pigmented compound is tested in accordance with the method described in Annex B.

9 PERFORMANCE REQUIREMENT OF HOSES

9.1 Hydrostatic Test at Standard Atmospheric condition

When tested in accordance with method specified in Annex C at 27 ± 2 °C and relative humidity 65 ± 5 percent, the hoses shall meet the requirements given in Table 8.

Table 8 Hydrostatic Test at Standard Atmospheric Condition
(*Clause* 9.1)

Sl. No.	Type of Hose	Working Pressure (PN), kg/cm^2
(1)	(2)	(3)
i)	Light Duty	4.0
ii)	Medium Duty	6.0
iii)	Heavy Duty	8.0

9.2 Hydrostatic Test at 55 ± 2°

When tested in accordance with method specified in Annex C at 55 ± 2°C, the hoses shall meet the requirements given in Table 9 to ensure the water temperature both inside and outside test specimen. The test specimen with end plugs shall be kept in a thermostatically controlled water bath for a minimum duration of 1 h at 55 ± 2° to adjust the temperature.

Table 9 Hydrostatic Test at 55 ± 2 °C
(*Clause* 9.2)

Sl. No.	Type of Hoses	Working Pressure (PN), kg/cm^2
(1)	(2)	(3)
i)	Light Duty	4.0
ii)	Medium Duty	6.0
iii)	Heavy Duty	8.0

9.3 Burst Pressure Test at Standard Atmospheric condition

When tested in accordance with method specified in Annex C at 27 ± 2°C and relative humidity 65 ± 5 percent, the hoses shall meet the requirements given in Table 10.

Table 10 Burst Pressure Test at Standard Atmospheric Condition
(*Clause* 9.3)

Sl. No.	Type of Hoses	Burst Pressure, kg/cm^2
(1)	(2)	(3)
i)	Light Duty	10.0
ii)	Medium Duty	12.0
iii)	Heavy Duty	16.0

9.4 Loss of Mass on Heating

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

9.5 Effect of Sunlight

Two samples each 300 mm long of different lengths of hose pipe shall be prepared. One sample shall be kept covered in thick paper and kept in shade as control sample and the other in 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 conducted as type test.

9.6 Flexibility Test

The sample shall pass the flex test for minimum 50 000 cycles when tested as per IS 7016 (Part 4).

9.7 Resistance to Chemical, Change in the Mass Chemical Resistance

The sample shall withstand the chemical resistance test, when tested as per Annex E of IS 15907. The change in mass shall not increase 0.1 percent for each of the chemicals mentioned in the test.

10 SAMPLING AND CRITERIA FOR CONFORMITY

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

11 PACKAGING AND MARKING

11.1 Packing

The hose shall be packed in suitable bag (woven sacks/wooden box/carton box) as agreed between the purchaser and the supplier.

11.2 Marking

The hose shall be marked either using a contrasting indelible ink/paint or hot embossed on white base at intervals of not more than 3 m in colour as indicated in Table 5. The marking shall show the following information:

a) Manufacturer name and trade-mark;
b) Type of hose and pressure rating;
c) Nominal bore of the hose; and
d) Lot number/Batch number containing information of date of manufacture.

11.2.1 The lot number/batch number shall include the details of production in the following manner:

Year	Month	Day	Machine No.	Shift
xxxx	xx	xx	xxx	x

11.3 BIS Certification Marking

Each hose conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the pipe may be marked with the Standard Mark.

ANNEX A
(*Clause* 5.3 *and* 8.3.1)

PREPARATION OF MOULDED TEST SPECIMENS FROM FLEXIBLE PVC COMPOUNDS

The properties of a moulded article depend, amongst other things, on the composition of the moulding material, the shape and the state of anisotropy of the moulding, and on the methods of test used. Preparation of moulded sheet and blocks involves a preparation of a rough sheet from the material to be tested, using a heated two roll mill. The preliminary sheets are subsequently compression moulded to produce sheets of uniform thickness. Test specimens are prepared from these moulded sheets by machining or die-cutting.

A-1 PREPARATION OF PRELIMINARY SHEETS

A- 1.1 Apparatus

Two roll mill capable of operating satisfactorily at temperature up to and including 180 °C:

a) The rolls shall be cylindrical;
b) The surface speed of the rolls shall be approx 10 m/min ;and
c) Rolls shall have differential speed between the two rolls. The preferred ratio is 1:1-2 to1:14, the front (working) roll being the slower.

A-1.2 Milling Conditions

A-1.2.1 The surface temperature of the mill rolls and the moulding temperature used subsequently shall be based on the shore hardness of the material in accordance with the following table:

Shore Hardness	Surface Temperature, in °C (± 5 °C)	
Scale value	Rolls	Moulds
A up to 80	130 to 160	135 to 170
A 80	145 to 170	160 to 180

The temperature of the rolls shall be selected to permit the material to band on the surface of the roll between 1 and 2 min after the commencement of the milling.

A-1.2.2 The nip setting shall be determined by the desired thickness of the milled sheet. The thickness of milled sheet shall be slightly higher than the thickness of the moulded sheet or test specimen.

A-2 PROCEDURE

A-2.1 Add the material to the mill rolls. Any material falling through the nip shall be carefully and quickly collected from the tray and returned to the moving rolls. After sheet

is formed, continue milling for approximately 5 min in such a way that optimum dispersion of all material components is obtained. This normally includes cutting the sheet, allowing it to form a roll and refeeding this roll into the nip. Remove the milled sheet from the rolls without stretching.

A-2.2 Preparation of Moulded Sheet

A-2. 2.1 *Apparatus*

a) Hydraulic moulding press, capable of developing moulding pressure of at least 5 kg/cm^2. The press platen shall be equipped with means of heating and cooling such that the surface can be heated to a temperature of 180 °C and such that the maximum deviation at any point from the temperature at the centre of the platen does not exceed 5 °C within the moulding area.

b) Male/Female mould, or window frame between two metal plates. Parting foils (for IS 9766 example stainless steel plates) can be placed between the materials and the metal surfaces.

A-2.2.2 *Moulding Conditions*

The necessary mass of material to fill a mould is predetermined either by calculation from the known material density, or by making a trial moulding. The moulding temperature shall be in accordance with the requirements given in Table 3.

A-2.3 Procedure

A-2.3.1 Place the required mass of pieces cut from the milled sheet in the preheated mould.

Close the preheated platens of the press and maintain a pressure of approximately 5 to 10 kg/cm^2 for a period of 5 min followed by application of pressure of not less than 35 kg/cm^2 calculated on the area of moulding. During this time, there shall be sufficient flow of the material between the mould and the metal surfaces to result in formation of a small amount of moulding flash. Cool the mould to approximately 40Â°C or, in the case of very soft materials to a lower temperature, while maintaining constant applied pressure. Open the mould and remove the sheet.

A-2.4 Preparation of Test Specimens

Prepare the required test specimens from the moulded sheet by machining or by stamping, using a sharp die of the required shape, the cutting edges of which are free from defects such as notches and burrs.

A-3 CONDITIONING

The conditioning and all standard test determinations shall be made at 27 °C and 65 percent relative humidity in accordance with the requirements of test method unless the relevant test method specified otherwise. The minimum time between the preparation of a test specimen and the test determination shall be 16 h, except that for electrical properties, shall be 24 h.

If shore hardness values change significantly, a minimum time of 48 h is necessary.

ANNEX B
(*Clause* **)**

TEST FOR COLOUR BLEEDING

B-1 FORM OF TEST SPECIMEN

For sheet materials, the specimen shall be a piece 50 mm square, cut from the sheet under test. For extrusion compounds the specimen shall be a piece 50 mm square and 1.25 ± 0.15 mm thick cut from sheet moulded under the conditions specified in Table 3 of Annex A.

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B-2 NUMBER OF TEST SPECIMENS

B-2.1 For compounds and sheet of uniform colour one specimen shall be used for colour bleeding test.

B-2.2 For sheet in which more than one colour is present select one specimen which shall be representative of all colours present as agreed to between the purchaser and the supplier and this one specimen shall be used for colour bleeding test.

B-3 PROCEDURE

B-3.1 The specimen shall be placed on a piece of polyvinyl chloride sheet 75 mm square of the following formulation:

	Parts per Mass
Polyvinyl chloride	100
Di-(2-ethylbexyl) phthalate	66.6
Lead stearate	1.5
Cadmium stearate	1.5

B-3.2 The specimen shall then be covered with a 75 mm square of dry, white Whatman No. 44 or equivalent filter paper. In order to ensure good contact between the filter paper, the specimen and the sheet on which it rests, shall be sandwiched between two pieces of glass plate 75 mm square and 5 mm thick. The various layers shall be brought into good contact, preferably by rolling. A weight approximately 50 g shall be placed on the top to ensure good contact. The assembly shall be maintained for 72 ± 1 h at 50 ± 2 ºC in an air oven. At the end of this time, the assembly shall be removed from the oven its parts separated and the 75 mm square piece of polyvinyl chloride sheet and the filter paper examined for staining, first over a white and then over a black background; white filter paper and photoblack cover paper are suitable for this purpose. If either the filter paper or the polyvinyl chloride sheet is stained it shall be reported that colour bleeding has occurred.

B-4 REPORT

The report shall state whether or not colour bleeding has occurred.

ANNEX C
(*Clause* 9.1)

HYDROSTATIC TEST AND BURST PRESSURE TEST

C-1 APPARATUS

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

C-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 5 percent of the full scale reading.

C-2 TEST PIECES

C-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.

C-2. 2 Number of Test Pieces

At least two test pieces shall be tested.

C-2.3 For the Hose Under Test, Water shall be Used as the Test Medium

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. 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.

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We have restricted the scope

C-3 PROCEDURE

C-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* **C - 1.2**).

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

C-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 60 s and 240 s. 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.

C-4.1 Burst Pressure Test

Increase the pressure at a rate in accordance with **C-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 D
(*Clause* 9.4)

LOSS OF MASS ON HEATING

D-1 APPARATUS

D-1.1 Analytical Balance ─ The analytic balance shall have an accuracy of 0.001 g.

D-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.

D-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.

D-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.

D-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.

D-2 TEST SPECIMENS

D-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.

D-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.

D-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.

D-3 PROCEDURE

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

D-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 of carbon. Finally put the Hd on the container.

D-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.

D-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.

D-3.4 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 thermostatically bath.

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

ANNEX E
(*Clause* 10)

SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

E-1 LOT

In any consignment, all the rolls of thermo-plastic hoses of the same type, colour and finish shell be grouped together and each such group shall constitute a lot.

E-1.1 The conformity of the lot to the requirements of the specification shall be ascertained for each lot separately. The number of rolls N to be selected from a lot shall depend on the size of the lot n and shall be in accordance with Table11.

Table 11 Number of Rolls of Hose Tubes to be Selected for Sampling
(*Clause* G-1.1)

Sl. No.	Lot Size	Number of Rolls to be Selected
	N	n
(1)	(2)	(3)
i)	Up to 50	2
ii)	51 to 100	3
iii)	101 to 200	4
iv)	201 to 300	5
v)	301 and above	7

E-1.2 The rolls of hose shall be selected at random and to ensure the randomness of selection, random number tables shall be used. In case such tables are not available, the following procedure may be adopted subject to agreement between the purchaser and the supplier.

Arrange all the rolls in the lot in a systematic manner and starting from any roll, count them as 1,2, 3 etc, up to r and so on, where r being the integral part of N/n(N being the lot size and n the sample size. Every r^{th} roll thus counted shall be with-drawn till the requisite number of roils is obtained.

E-1.3 Number of Tests

E-1.3.1 From each of the rolls selected one-metre length of thermoplastic hose shall be cut, care being taken to exclude not less than 0.25 m length of the material from either end. The test specimens necessary for the various tests specified in the standard shall be cut from the length of thermoplastic hose thus obtained.

E-1.3.2 All the type tests shall be conducted on each test specimen cut from these metre

lengths as obtained in **E-1.3.1**. Only after successful type approval, acceptance tests shall be carried out,

E-1.3.3 In case each test specimen passes all the type tests as per **4.1.1**, the material in the lot shall then be tested for acceptance test as per **4.1.2**. For this purpose test specimens of suitable length may be taken.

Commented [I4]: Type tests and acceptance tests need to be highlighted in the draft

E-1.4 Criteria for Conformity

E-1.4.1 The lot shall be declared as conforming to the requirements as given in **4.1.1** if all the test specimen passes all the type tests (*see* Annex G, **A-6**).

E-1.4.2 The lot having being found satisfactory as per **G-1.4** will be declared as conforming to the requirements of the specification, if all the test specimen passes all the acceptance tests.

E-1.4.3 If the specimens taken from these lengths fail in one or more acceptance tests, each such test shall be repeated twice. For this purpose, two further metre lengths shall be cut from the same roll as the failing metre length and specimens shall be cut from each of them so that duplicate tests may be conducted in respect of each failure. If all samples pass in there-test the lot shall be declared as conforming to the specification, otherwise not.