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Indian Standard

**SPECIFICATION FOR
UNPLASTICIZED PVC PIPES FOR USE IN
SUCTION AND DELIVERY LINES OF
AGRICULTURAL PUMP SETS**

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**BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002**

Indian Standard

SPECIFICATION FOR UNPLASTICIZED PVC PIPES FOR USE IN SUCTION AND DELIVERY LINES OF AGRICULTURAL PUMP SETS

0. FOREWORD

0.1 This Indian Standard was adopted by the Bureau of Indian Standards on 25 November 1987, after the draft finalized by the Sanitary Appliances and Water Fittings Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Unplasticized PVC pipes are finding increasing use in piping systems with agricultural pump sets. However, commonly produced UPVC pipes conforming to IS:4985-1988* were found to be adversely affected by ultra-violet rays when exposed to sunlight. Moreover, pipes for use in piping

system for agricultural pump sets were also subjected to frequent effects of water hammer when the pump was stopped. Need was, therefore, felt to lay down specifications for such pipes separately.

0.3 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*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Specification for unplasticized PVC pipes for potable water supplies (second revision).

*Rules for rounding off numerical values (revised)

1. SCOPE

1.1 This specification covers requirements for plain end pipes made of unplasticized polyvinyl chloride for suction and delivery lines of agricultural pump sets, which may be exposed to atmosphere and sunlight.

2. TERMINOLOGY

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

2.1 Nominal Outside Diameter — The outside diameters of the pipes as stated under 'Nominal diameter of pipe' in Table 1.

TABLE 1 DIMENSIONS OF UNPLASTICIZED PVC PIPES

(Clauses 2.1 and 5.1)

All dimensions in millimetres.

NOMINAL OUTSIDE DIAMETER (NOMINAL SIZE)	MEAN OUTSIDE DIAMETER		WALL THICKNESS					
			Type 1W 0.4 MPa			Type 2W 0.6 MPa		
	Min	Max	Average value	Individual value		Average value	Individual value	
				Max	Min		Max	Max
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
63	63.0	63.3	1.9	1.5	1.9	2.7	2.2	2.7
75	75.0	75.3	2.2	1.8	2.2	3.1	2.6	3.1
90	90.0	90.3	2.6	2.1	2.6	3.7	3.1	3.7
110	110.0	110.4	3.0	2.5	3.0	4.3	3.7	4.3
140	140.0	140.5	3.8	3.2	3.8	5.5	4.8	5.5

NOTE 1 — The table is based on metric series of pipe dimensions given in ISO 161/1 in respect of pipe dimensions.

NOTE 2 — The wall thickness of pipes is based on a safe working stress of 8.6 MPa at 27°C and the working pressure gets reduced at sustained higher temperatures. Occasional rise in temperatures as in summer season with concurrent corresponding reduction in temperature during nights has no deleterious effect on the life and working pressure of the pipes considering the total life of pipes.

2.2 Outside Diameter at any Point — The measurement of any cross-section of the pipe rounded off to the next higher 0.1 mm.

2.3 Mean Outside Diameter — The quotient of the measurement of the circumference of the pipe and $3.142 (\pi)$ rounded off to the next higher 0.1 mm.

2.4 Tests

2.4.1 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 performance capability of the pipes.

2.4.2 Acceptance Tests — Tests carried out on sample taken from a lot for the purpose of acceptance of the lot.

3. CLASSIFICATION OF PIPES

3.1 The pipes shall be classified by pressure ratings (working pressure) at 27°C and colour as indicated in 3.1.1.

3.1.1 The pipes shall be snowwhite in colour and pressure ratings as follows:

Type of Pipe	Working Pressure
Type 1 w	0.4 MPa (4 kg/cm ²)
Type 2 w	0.6 MPa (6 kg/cm ²)

NOTE — The above pipes are recommended for water temperature rating from 1 to + 45°C. The recommended maximum safe working stress for these pipes is 10 MPa at 20°C. At higher temperature up to 45°C, the strength of the pipe reduces and the working pressure shall be modified in accordance with Fig. 1.

4. COMPOSITION

4.1 The material from which the pipe is produced shall consist substantially of polyvinyl chloride, to which may be added only those additives that are needed to facilitate the manufacture of sound pipe of good surface finish, mechanical strength and capacity under conditions of use. None of these additives shall be used separately or together in quantities sufficient to constitute a toxic hazard, or materially to impair the fabrication or welding

properties of the pipe or to impair its chemical and physical properties.

4.2 For producing pipes of types 1W and 2W referred to in 3.1.1, not less than 5 percent of rutile grade of titanium dioxide and not more than 2 percent of calcium carbonate shall be used to check discoloration from ultra-violet radiation.

5. DIMENSIONS OF PIPES

5.1 The mean outside diameter and wall thickness at any point and their tolerances shall be as given in Table 1.

5.2 Tolerances on Diameters and Wall Thickness — These shall be as specified in 5.1.1 and 5.2.1 respectively of IS : 4985-1988*.

5.3 The outside diameter of pipe and wall thickness shall be measured by the methods given in IS : 12235 (Part 1)-1986† and IS : 12235 (Part 2)-1986‡.

6. PHYSICAL AND CHEMICAL CHARACTERISTICS

6.1 Visual Appearance — The internal and external surfaces of the pipe shall be smooth and clean, free from groovings and other defects. The end shall be cleanly cut and shall be square with the axis of the pipe or chamfered at one or both ends. Slight shallow longitudinal grooves or irregularities in the wall thickness shall be permissible provided the wall thickness remains within the permissible limits.

*Specification for unplasticized PVC pipes for potable water supplies (second revision).

†Methods of test for unplasticized PVC pipes for potable water supplies : Part 1 Method for measurement of outside diameter.

‡Methods of test for unplasticized PVC pipes for potable water supplies : Part 2 Measurement of wall thickness.

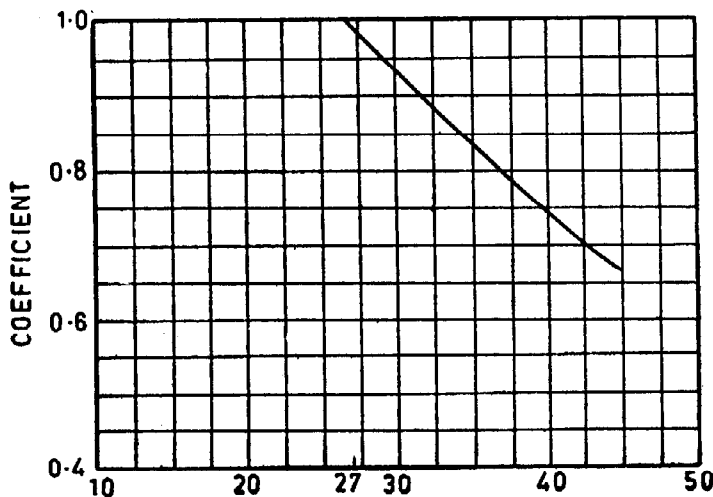


FIG. 1

6.2 Opacity — The wall of the socket portion and the wall of the plain pipe shall not transmit more than 0.2 percent of the visible light falling on them when tested in accordance with IS : 12235 (Part 3) - 1986*.

6.3 Effect on Water — The pipes shall not have any detrimental effect on the composition of the water flowing through them. When tested by the method described in IS : 12235 (Part 4) - 1986†, the quantities of lead, dialkyl tin C₄ and higher homologues (measured as tin) and any other toxic substances extracted from the internal walls of the pipes shall not exceed‡ the following concentrations in the test solution:

Lead (first extraction) 1.0 mg/litre (1.0 part per million by mass)

Lead (third extraction) 0.3 mg/litre (0.3 part per million by mass)

Dialkyl tin C₄ and higher homologues measured as tin (third extraction) 0.02 mg/litre (0.02 part per million by mass)

Cadmium — For all three extracts, the cadmium concentration shall not be greater than 0.001 mg/l

Mercury — For all three extracts, the mercury concentration shall not be greater than 0.001 mg/l

Other toxic substances (third extraction) 0.01 mg/litre (0.01 part per million by mass)

6.3.1 The manufacturer, for the purpose of these tests, shall disclose all the toxic substances present.

6.4 Reversion Test — When tested by the method described in IS : 12235 (Part 5) - 1986§ a length of pipe of approximately 300 mm shall not alter in length by more than 5 percent. In the case of bell end pipes, this test shall be carried out on the plain portion of pipe taken at least 100 mm away from the root of the socket.

6.5 Resistance to Sulphuric Acid — When tested by the method described in IS : 12235 (Part 7) - 1986||, the mass of specimen shall neither increase by more than 0.32 g nor decrease by more than 0.013 g. The effect of the acid on the surface appearance of the specimen (roughening, bleaching or blackening) shall be ignored.

*Methods of test for unplasticized PVC pipes for potable water supplies : Part 3 Test for opacity.

†Methods of test for unplasticized PVC pipes for potable water supplies : Part 4 Determining the detrimental effect on the composition of water.

‡Conformity with the requirements of 6.3 will ensure that the recommendations of the World Health Organization, 1963, concerning toxic contaminants of drinking water are not exceeded.

§Methods of test for unplasticized PVC pipes for potable water supplies : Part 5 Reversion test.

||Methods of test for unplasticized PVC pipes for potable water supplies : Part 7 Test for resistance to sulphuric acid.

6.6 Friction Test — The C-value of these pipes in Hazen-William's formula shall not be less than 150. The method of determining C-value is described in Appendix A. This test shall be taken as type test.

6.7 Vacuum Test — A sample picked up randomly from the lot will be subjected to partial vacuum for one hour. During such test, the pipe should not be deformed or collapsed. The method of such test is described in Appendix B. This test shall be taken as type test.

7. MECHANICAL PROPERTIES

7.1 Hydrostatic Characteristics — When subjected to internal hydrostatic pressure test in accordance with the procedure given in IS : 12235 (Part 8) - 1986*, the pipes shall not burst during the prescribed test duration. The temperatures, duration of test and stresses for the test shall conform to the requirements given in Table 2.

TABLE 2 REQUIREMENTS OF PIPES FOR INTERNAL HYDROSTATIC PRESSURE TEST

TEST	TEST TEMPERATURE	TEST DURATION (MINIMUM HOLDING TIME)	INDUCED STRESS
(1)	(2)	(3)	(4)
	°C	h	MPa (kg/cm ²)
Type test	60	1 000	10 (100)
Acceptance test	27	1	36 (360)

7.2 Impact Strength at 0°C — When tested by the method described in IS : 12235 (Part 9) - 1986†, the pipe samples shall not fracture or crack through its complete wall thickness meet the requirements given in IS : 4985-1988‡. In the case of bell end pipes, this test shall be carried out on the plain portion of the pipe taken at least 100 mm away from the root of the socket.

8. EFFECT OF SUNLIGHT

8.1 Two samples each 300 mm long from 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 exposed 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.

*Methods of test for unplasticized PVC pipes for potable water supplies : Part 8 Internal hydrostatic pressure test.

†Methods of test for unplasticized PVC pipes for potable water supplies : Part 9 Impact strength test.

‡Specification for unplasticized PVC pipes for potable water supplies (second revision).

9. SUPPLY OF PIPES

9.1 The pipes shall be supplied in straight lengths of 4, 5 or 6 metres with a tolerance of +10 mm and -0 mm. The pipes may be supplied in other lengths where so agreed to between the manufacturers and the purchasers.

10. SAMPLING AND CRITERIA FOR CONFORMITY

10.1 The sampling procedure and criteria for conformity shall be the same as laid down in IS : 4985-1988*. Additional type tests shall be performed for meeting the requirements of 6.6, 6.7 and 8.1.

11. MARKING

11.1 Each pipe shall be clearly and indelibly marked at intervals of not more than 3 metres in colour as indicated in 11.1.1. The marking shall show the following:

- a) Manufacturer's name or trade-mark;
- b) Outside diameter;

*Specification for unplasticized PVC pipes for potable water supplies (*second revision*).

- c) Class of pipe and pressure rating; and
- d) Batch number.

11.1.1 The information according to 11.1 shall be marked in colour as indicated below for different classes of pipes:

<i>Class of Pipe</i>	<i>Colour</i>
Type 1W	Blue
Type 2W	Green

11.2 Each pipe may also be marked with the Standard Mark.

NOTE — 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 Standard Mark on products covered by an Indian standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

APPENDIX A

(*Clause 6.6*)

MEASUREMENT OF FRICTIONAL LOSSES AND C-VALUE OF RIGID PVC PIPES

A-1. For measurement of frictional losses in unplasticized PVC pipes, the following test set up and equipment will be required:

- 1) Sump of water and discharge tank.
- 2) Arrangements for measurement of flow of water passed through the pipe under test.
- 3) Pump set having discharge capacity from 4 to 60 litres/second.
- 4) Two pressure gauges or manometers to measure drop of pressure or head in metres at two points which are 10 m apart.
- 5) Test pipes with two tapping or saddles for manometer connections.
- 6) Suction and delivery pipes of the pump.
- 7) Flexible or fixed connecting pieces for joining with the RPVC pipes to the end of delivery pipe.
- 8) Starter and switch board for electric pump.

A-2. The UPVC pipe under *hf*-test shall be connected to the delivery pipe of the pump. It

shall be kept in perfect horizontal level. The manometer tappings provided on the UPVC pipe under test shall be used to connect manometer tubes or pressure gauges. The difference in pressure or head loss in 10 m length shall be worked out from the readings taken while known quantity of water is passed through the pipe.

A-3. The relationship between *hf*, *L*, *D*, *Q* and *C*-value is as follows in the Hazen-William's formula:

$$\frac{hf}{L} = \frac{1.213 \times 10^{10} \times Q^{1.852}}{D^{4.87} \times C^{1.852}}$$

where

- hf* = head loss in m,
- Q* = rate of discharge in l/s,
- C* = Hazen-William constant,
- D* = internal diameter of pipe in mm, and
- L* = length of pipe in m.

A-4. By using the above Hazen-William's formula, the value of C shall be worked out from known values of hf , L , Q and D .

A-5. The recommended ranges of Q for hf -tests are as follows:

Nominal Diameter	Recommended Range of Q (l/s)
mm	
63	4'0 to 8'0
75	8'0 to 16'0

Nominal Diameter	Recommended Range of Q (l/s)
mm	
90	17'0 to 20'0
110	24'0 to 32'0
140	32'0 to 40'0

A-6. The required Q may be obtained by manipulating the valve fixed in the delivery line to which the test pipe is connected. For every hf -test, 6 readings should be taken at different values of Q in the range suitable for the particular size of pipe.

APPENDIX B

(Clause 6.7)

VACUUM TEST OF SPECIAL UPVC PIPES

B-1. The pipe under test shall be subjected to partial vacuum through a vacuum pump or any other device. A vacuum gauge shall be fitted in the pipe. A negative pressure of 500 mm vacuum for pipes type 1W and 600 mm vacuum for pipes type 2 W shall be applied.

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