(Reaffirmed 1998)

Indian Standard

SPECIFICATION FOR INJECTION MOULDED PVC SOCKET FITTINGS WITH SOLVENT CEMENT JOINTS FOR WATER SUPPLIES

PART I GENERAL REQUIREMENTS

(First Revision)

Sanitary Appliances and Water Fittings Sectional Committee, BDC 3; Plastic Pipes Subcommittee, BDC 3:8 [Ref: Doc: BDC 3 (4367)]

1. Scope — This standard (Part 1) covers general requirements regarding materials, manufacture, methods of test, inspection and marking of all types of injection moulded PVC socket fittings intended for connection, by using solvent cement, to PVC pipes covered by IS : 4985-1988 [Specification for unplasticized PVC pipes for potable water supplies (*second revision*)] for water supplies.

2. Materials — The material from which the fitting is produced shall substantially consist 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 opacity. None of those 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.

3. Size of Fitting — The sizes of the fittings shall be designated by the diameters of their sockets. The inside diameters of the sockets of the fittings shall correspond to the outside diameters of the pipes given in IS : 4985-1988.

4. Minimum Thickness — Thickness at any place in a fitting shall not be less than 3 mm.

5. Socket Length and Diameter at Mid-Point of Socket Length

5.1 The minimum socket length of any fitting (*see* Fig. 1) shall be as given by the expression $L = 0{\cdot}5\,D + 6$ mm with a minimum of 12 mm.

where

L = socket length, and

D = nominal inside diameter of fitting (corresponding to the outside diameter of the pipe covered in IS : 4985-1988).

5.1.1 The socket length is applicable to socket fittings for pipes of any diameter under pressure. The minimum socket lengths based on the formula in 5.1 for socket diameters ranging from 16 to 315 mm are given in Table 1.

5.1.2 The maximum and minimum dimensions of mean inside diameter at mid-point of socket depth shall comply with those given in Table 1.

Note 1 — The mean inside diameter of the socketed portion of the fitting is defined as being the arithmetical mean of two diameters measured at 90° to each other at the mid-point of socket length using the same cross-section. The diameter of the socket may be decreased from mouth to root; for pipe sizes 16 to 75 mm, the total included angle of taper shall not exceed 0° 40′; and for pipe sizes 90 mm and above, the total included angle of taper shall not exceed 0° 30′.

Note 2 — Only the manufacturer of injection moulded fittings is equipped to measure the socket inside diameter. Since the socket length is minimum only (no tolerance is given to this dimension), it is not practical, other than for the manufacturer, to establish the exact position of the mid-point of the socket. He can, therefore, tool up to measure his own fittings but such equipment will not necessarily give the correct figures for a fitting of other manufacturer.

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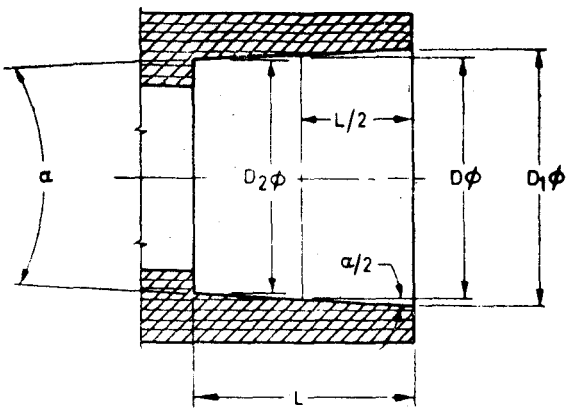

Note - This drawing is only intended to define the terms used in Table 1 and is not intended to illustrate specific design features.

It is possible to calculate the diameter D_1 and D_2 knowing D, L and α from the following equations:

$$D_2 = D - L \tan \alpha/2 \text{ , and}$$

$$D_1 = D + L \tan \alpha/2.$$

where

D = diameter at mid-point of socket length,

D_1 = diameter at mouth,

D_2 = diameter at root,

L = socket length, and

α = total included angle of taper.

FIG. 1 SOCKET DIMENSIONS

TABLE 1 SOCKET DIMENSIONS

(*Clauses* 5.1.1, 5.1.2; and *Fig.* 1)

All dimensions in millimetres.

Nominal Size	Minimum Socket Length	Mean Socket Internal Diameter at Mid-Point of Socket Length	
		Minimum	Maximum
(1)	(2)	(3)	(4)
16	14	16·1	16·3
20	16	20·1	20·3
25	19	25·1	25·3
32	22	32·1	32·3
40	26	40·1	40·3
50	31	50·1	50·3
63	38	63·1	63·3
75	44	75·1	75·3
90	51	90·1	90·3
110	61	110·1	110·4
125	69	125·1	125·4
140	76	140·1	140·5
160	86	160·2	160·5
180	96	180·2	180·5
200	106	200·3	200·6
225	118·5	225·3	225·7
250	131·0	250·4	250·8
280	146·0	280·4	280·9
315	163·5	315·4	316·0

5.1.3 *Out-of-roundness tolerances of socket inside diameter* — The maximum out-of-roundness tolerances (maximum diameter-minimum diameter) shall be:

a) less than or equal to 0·007 *D*, or

b) equal to 0·2 mm (if 0·007 *D* is less than 0·2 mm).

6. Tests and Performance Requirements

6.1 *Stress Relief Test* — When tested by the method described in Appendix A, none of the specimens tested shall show blisters, excessive delamination or cracking or signs of weldline splitting. The weldline or lines may become more pronounced during the test but this shall not be deemed to constitute failure.

6.1.1 Special care shall be taken in examining the area around the point of injection, where no cracks or delaminations shall penetrate to a depth greater than 20 percent of the wall thickness at that point. The assessment of the depth of penetration of cracks or delaminations shall be carried out by sectioning the specimen at the point of injection and measuring the depth to which these defects penetrate the wall thickness of the fitting.

6.2 *Opacity* — When tested by the method described in Appendix B, the wall of the fitting shall not transmit more than 0·2 percent of the visible light falling on it.

6.3 *Effect on Water* — The fittings shall not have any detrimental effect on the composition of the water flowing through them. When tested by the method described in Appendix C, the quantities of lead, dialkyl tin C_4 and higher homologues (measured as tin), and any other toxic substances extracted from the internal walls of the fittings 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 C_4 and higher homologues measured as tin (third extraction)	0·02 mg/litre (0·02 part per million by mass)
Other toxic substances (third extraction)	0·01 mg/litre (0·01 part per million by mass)

6.3.1 When so required by the purchaser, the manufacturer for the purpose of these tests shall disclose all the toxic substances present.

6.4 *Short-Term Hydraulic Test* — When tested by the method given in Appendix D, the fittings shall withstand a pressure of $4{\cdot}2\ ^{+0{\cdot}2}_{-0}$ times the working pressure for one hour without failure.

7. Sampling

7.1 *Type Tests* — Type tests are intended to prove the suitability and performance of a new composition, a new compounding or processing technique, or a new design or size of joint or fitting. Such tests, therefore, need be applied only when a change, if made in polymer composition or method of manufacture, or when a new size or type of fitting is to be introduced.

7.1.1 Type tests for compliance with 5 and 6.1 shall be carried out on three samples taken at random from each size, class and design of fittings. Type tests for compliance with 6.2 and 6.3 shall be carried out on three samples taken at random from the smallest size and lowest class of fitting (that is, on fittings having the thinnest wall and greatest surface area : mass ratio).

7.1.2 All the fittings tested shall comply with the requirements for which they are examined.

7.2 *Production Routine Tests* These tests are spot tests carried out during manufacture to prove the quality of a lot of fittings and shall be carried out by the method specified in 4, 5, 6.1 and 6.4.

7.2.1 *Lot* — All socket fittings of the same size, same thickness, same length and produced from an injection moulding machine, in a single consignment, shall be grouped together to constitute a lot.

7.2.2 The conformity of the lot to the requirements of this standard shall be ascertained for each lot separately. The number of socket fittings to be sampled from each lot shall depend on the size of the lot and shall be in accordance with col 1 and 2 of Table 2.

TABLE 2 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES

Number of Fittings in the Lot	Sample Size	Acceptance Number (*A*)	Acceptance Number (*B*)
(1)	(2)	(3)	(4)
Up to 150	3	0	0
151 to 300	5	0	0
301 to 500	8	0	0
501 to 1 000	13	1	0
1 001 to 3 000	20	1	0
3 001 to 10 000	32	2	1
10 001 to 35 000	50	3	2
35 001 to 150 000	80	5	3
150 001 and above	125	7	5

7.2.2.1 These sockets fittings shall be selected from the lot at random. In order to ensure the randomness of selection, procedures given in IS : 4905-1968 'Methods for random sampling' may be followed.

7.2.3 *Number of tests and criteria for conformity*

7.2.3.1 Each socket fitting so selected shall be examined for requirements given in 4.1, 5.1 and 6.1. Any socket fitting failing in one or more of these requirements shall be considered as defective. The lot shall be considered as conforming to the requirements of this standard if the number of defective socket fittings found in the sample does not exceed the corresponding acceptance number *A* given in col 3 of Table 2.

7.2.3.2 The lot rejected according to 7.2.3.1 may be retested for characteristics for which it has failed. For this purpose, number of socket fittings to be selected at random from the lot shall be according to col 1 of Table 2. A socket fitting failing to satisfy the requirements of any of these characteristics shall be considered as defective. The lot shall be deemed to satisfy the requirements of this standard if the number of defective socket fittings found in the sample does not exceed the corresponding acceptance number *B* given in col 4 of Table 2, otherwise the lot shall be rejected.

8. Marking

8.1 All fittings shall be clearly and indelibly marked at a prominent place visible even after the installation of the fitting with the following:

a) Manufacturer's identification mark, and

b) Size of the fitting (*see* 3.1) and the appropriate class (working pressure) of IS : 4985-1988 to which the pressure rating of the fitting corresponds.

8.1.1 PVC fittings also conforming to specific requirements as prescribed in the relevant parts of the standard may also be marked with the Standard Mark. For fittings for which specific requirements have not been laid in the various parts of this standard, Standard Mark may be based on the general requirements.

8.2 *Standard Marking* — Details available with the Bureau of Indian Standards.

APPENDIX A

(*Clause* 6.1)

STRESS RELIEF TEST

A-1. General

A-1.1 This test may be carried out either in an air-oven or alternatively in a bath of polyethylene glycol, glycerol or a mineral oil free from aromatic hydrocarbons.

A-2. Test Specimens

A-2.1 Three specimens of the type and size of fitting under test shall be selected at random.

A-3. Oven Method

A-3.1 *Apparatus* — An electrically heated air-oven with circulating fan, the whole interior of which is maintained automatically at a temperature of 150 ± 4°C.

A-3.2 *Procedure* — The specimens shall be placed in the oven, standing on one socket mouth. The specimens may be supported, if necessary, by a simple jig that has been preheated in the oven.

A-3.2.1 The time shall be measured from the time at which the oven regains the temperature of 150°C.

A-3.2.2 After 1 hour, the specimens shall be removed from the oven and allowed to cool naturally in air before examination.

A-4. Immersion Method

A-4.1 *Apparatus* — A thermostatically controlled bath in which the heat transfer medium is polyethylene glycol, glycerol or mineral oil free from aromatic hydrocarbons. The bath is stirred continuously and maintained automatically at a temperature of 150 ± 4°C.

A-4.2 *Procedure* — The specimens shall be placed in the bath standing on one socket mouth. The time shall be measured from the moment at which the bath regains a temperature of 150°C.

A-4.2.1 After 15 minutes, the specimens shall be removed from the bath and allowed to cool naturally in air before examination.

A-5. Assessment of Results

A-5.1 The specimens tested shall meet the requirements given in 6.1.

APPENDIX B

(*Clause* 6.2)

TEST FOR OPACITY

B-1. Apparatus

B-1.1 The following apparatus are required:

a) Source of light (electric lamp);
b) Photoelectric cell, and
c) Spot light galvanometer.

B-2. Procedure

B-2.1 The light source and photoelectric cell shall be set up at a convenient distance apart, the light from the former falling on the latter in the absence of day light. The galvanometer shall be connected to the photoelectric cell and the maximum deflection registered shall be noted.

B-2.1.1 A piece of fitting shall then be placed over the photoelectric cell so that one wall is interposed between the light source and the cell (the distance between source and cell being kept constant).

B-2.1.2 The maximum deflection of the galvanometer shall again be noted. The second deflection expressed as a percentage of the first shall give a measure of the visible light transmitted.

B-3. Assessment of Results

B-3.1 The specimen tested shall meet the requirements given in 6.2.

APPENDIX C

(*Clause* 6 3)

TEST FOR EFFECT ON WATER

C-1. Preparation of Test Specimens

C-1.1 If the total surface area of the fitting to be exposed to the extractant is less than 200 cm^2, a number of fittings of the same size and type shall be tested together so that the total surface area to be extracted exceeds 200 cm^2. The extractions may be carried out either on the internal surfaces only or on the complete fitting.

C-1.2 The fitting shall be immersed in running tap water for 6 hours and then rinsed with little distilled water complying with IS : 1070-1977 'Specification for water for general laboratory use (*second revision*)' to remove any remnants of tap water.

C-2. Procedure

C-2.1 *For Extraction of Internal Surfaces of Fittings Only* — Close the bottom and (if fitted) side sockets of each test specimen with stoppers of polythene (or some other non-interfering material), ensuring that the seals do not allow leakage.

C-2.1.1 Fill the fittings with water containing added carbonic acid equivalent to 150 mg CO_2/litre. A freshly made solution shall be used for each series of tests.

C-2.1.1.1 The water containing the desired quantity of carbon dioxide can conveniently be prepared by saturating a large bulk of water with carbon dioxide determining the carbon dioxide content by a standard method such as that given in IS : 3025-1964 'Methods of sampling and test (physical and chemical) for water used in industry' (with suitable adjustment of quantities) and then mixing with the calculated quantity of carbon dioxide free water.

C-2.1.2 Cover the open end of each specimen. Maintain the fittings and extractant at room temperature for 48 hours then empty the three lots of water into suitable containers. Retain these samples for the determination of the amount of lead present after the first extraction.

C-2.1.3 Refill the fittings with fresh extractant, cover and stand as above for 48 hours, then empty and discard the three lots of water. Again refill the fittings with fresh extractant and maintain all at room temperature for 48 hours, then empty the three lots of water into suitable containers. Retain these samples for the determination of the amounts of metal and other toxic substances present after the third extraction.

C-2.1.4 Determine the amounts of metal and other toxic substances present after the first and third extractions by one of the methods listed below and take the arithmetic averages of each set of triplicate samples. These averages shall be reported in milligrams.

Suitable methods of analysis for metals are given in the following publications:

a) IS : 3025-1964.

b) TAYLOR (E. Windle). Examination of waters and water supplies (Thresh, Beal and Suckling). 1958. Ed. 7. J. & A. Churchill Ltd, London (UK).

c) Standard methods for examination of water and waste water. 1965. Ed 12. The American Water Works Association, American Public Health Association, and Water Pollution Control Federation, U.S.A.

C-2.1.5 Determine the content of organotin by the method described in IS : 12235 (Part 10)-1986 'Methods of test for unplasticized PVC pipes for potable water supplies : Part 10 Determination of organotin as tin aqueous solution' or by a suitable polarographic method, if a polarograph is available.

C-2.2 *For Extraction of Internal and External Surfaces of Fittings*

C-2.2.1 Take three glass vessels of suitable dimensions and in each immerse a fitting in a quantity of distilled water complying with IS : 1070-1977 containing added carbonic acid equivalent to 150 mg CO_2/litre so that the fittings are only just covered. A freshly made solution shall be used for each test.

C-2.2.2 Cover the vessels and maintain the fittings and extractant at room temperature for 48 hours, then empty the three lots of water into suitable containers. Retain these samples for the determination of amount of lead present after the first extraction.

C-2.2.3 Repeat the above procedure for a second period of 48 hours, then empty and discard the three lots of water. Again repeat the above procedure for a third period of 48 hours, then empty the three lots of water into suitable containers. Retain these samples for the determination of the amounts of metals and other toxic substances present after the third extraction.

C-2.2.4 Determine the amounts of metal and other toxic substances present after the first and third extractions, and take the arithmetic averages of each set of triplicate samples. These averages shall be reported in milligrams.

C-2.2.5 The manufacturer shall, if required, provide the purchaser or user with a report on the results of these tests which have been carried out on the fitting supplied to him.

C-3. Calculation

C-3.1 The concentrations of toxic substances extracted from the fittings are calculated from the expression:

$$C = \frac{e \times S_2}{S_1 \times V}$$

where

C = concentration, in parts per million by mass, of toxic substances;

e = mass extracted, in milligrams;

S_2 = surface area of fittings that would be exposed to water in service;

S_1 = total surface area of fittings exposed to test; and

V = volume, in litres, of water contained by the area S_2 in service.

C-4. Assessment of Results

C-4.1 The specimen tested shall meet the requirements given in **6.3**.

APPENDIX D

(*Clause* 6.4)

SHORT TERM HYDRAULIC TEST

D-1. Apparatus

D-1.1 Equipment which permits the application of an internal hydraulic pressure of $4{\cdot}2 \begin{smallmatrix} +0{\cdot}2 \\ -0 \end{smallmatrix}$ times the normal pressure for at least one hour on the fitting to be tested.

D-2. Test Specimen

D-2.1 Each test specimen shall consist of a fitting, solvent welded to a section of pipe having a minimum length of 250 mm and capable of withstanding an internal pressure of at least 4·2 times the normal pressure of the fitting. A period of at least 24 hours shall be allowed to ensure satisfactory setting of the joint.

D-3. Procedure

D-3.1 The free end of the pipe section shall be connected to the hydraulic pressure equipment. The other end(s) of the test specimen shall be closed by any appropriate means.

D-3.2 The test specimen thus assembled shall be subjected for 60 minutes to an internal pressure of $4{\cdot}2 \begin{smallmatrix} +0{\cdot}2 \\ -0 \end{smallmatrix}$ times the normal pressure of the fitting, at a temperature of 27 ± 2°C.

D-3.3 Throughout the test, the specimen shall be suspended or placed in such a manner that the induced stress is not limited by external forces.

D-4. Interpretation of Results

D-4.1 A fittting shall be considered as having passed the test if it shows no sign of deterioration, leakage, fracture or other failure under specified conditions. The test shall be repeated if the pipe bursts or if the solvent-welded joints leak.

D-4.2 The specimen tested as above shall meet the requirement specified in 6.4.

Note — The fitting can be tested by the method indicated as above after a period of setting for 24 hours and, if passes the test, shall be accepted as meeting the requirements specified in 6.4. In case of failure of the joint, retest can be done taking another test specimen and allowing at least 10 days time for satisfactory setting of the joint and the final decision should be taken based on the test result obtained on this test specimen.

EXPLANATORY NOTE

The injection moulded PVC socket fittings are used for connection, by solvent cement, to PVC pipes covered by IS : 4985-1988.

The requirements of injection moulded PVC socket fittings are covered in eight parts. The other parts are as follows:

Part 2 Specific requirements for 45° elbows
Part 3 Specific requirements for 90° elbows
Part 4 Specific requirements for 90° tees
Part 5 Specific requirements for 45° tees
Part 6 Specific requirements for sockets
Part 7 Specific requirements for unions
Part 8 Specific requirements for caps.

According to the present manufacturing system the PVC socket fittings are manufactured to withstand the highest pressure rating as specified in IS : 4985-1988 for the pipes.

This standard was first published in 1975 and covered sizes of fittings up to 160 mm. The present revision has been taken up to cover additional sizes of fittings up to 315 mm.

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