IS 15801 (2008): Polypropylene-random copolymer pipes for hot and cold water supplies - [CED 50: Plastic Piping System]

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भारतीय मानक

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Indian Standard

POLYPROPYLENE-RANDOM COPOLYMER PIPES FOR HOT AND COLD WATER SUPPLIES — SPECIFICATION

ICS 23.040.20

BUREAU OF INDIAN STANDARDS
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TO
IS 15801 : 2008 POLYPROPYLENE-RANDOM COPOLYMER PIPES FOR HOT AND COLD WATER SUPPLIES — SPECIFICATION

(*Page* 3, *Table* 1, *col* 5, *Title*) — Substitute '**Ovality, *Max***' *for* '**Ovality**'.

(CED 50)

Reprography Unit, BIS, New Delhi, India

FOREWORD

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

This standard specifies the requirements for pipes manufactured from Polypropylene-Random Copolymer (PPR), intended to be used for conveyance of hot and cold water piping system for inside and outside buildings and solar water heating piping systems.

In the formulation of this standard, considerable assistance has been derived from ISO 15874-1 : 2003 'Plastic piping system for hot and cold water installation — Polypropylene(PP) — Part 1 : General' and ISO 15874-2 : 2003 'Plastic piping system for hot and cold water installation — Polypropylene (PP) — Part 2 : Pipes'. The sizes of pipes, however, have been kept as per manufacturing practices being followed in India and have been derived from DIN 8077 : 1999 — 07 'Polypropylene (PP) pipes'. Allowable maximum operating pressures for pipes at different temperatures have also been derived from DIN 8077 : 1999 — 07 by considering 25 years of service.

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

Indian Standard

POLYPROPYLENE-RANDOM COPOLYMER PIPES FOR HOT AND COLD WATER SUPPLIES — SPECIFICATION

1 SCOPE

This standard specifies requirements for polypropylene-random copolymer pipes from 16 to 200 mm nominal diameter of SDR 11, 7.4, 6 and 5 for:

a) wall concealed hot and cold water conveyance pipelines for inside and outside buildings (properly UV stabilized), and

b) pipelines for the solar heating system inside and outside the buildings.

2 REFERENCES

The following standards 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*
2530 : 1963	Methods of test for polyethylene moulding materials and polyethylene compounds
9845 : 1998	Method of analysis for determination of overall migration of constituents of plastic materials and articles intended to come into contact with foodstuffs
10909 : 2001	Positive list of constituents of polypropylene and its copolymers in contact with foodstuffs, pharmaceuticals and drinking water
10910 : 1984	Specification for polypropylene and its copolymers for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
10951 : 2002	Polypropylene materials for moulding and extrusion
12235	Thermoplastic pipes and fittings — Methods of tests:
(Part 3) : 2004	Test for opacity
(Part 5/Sec 1) : 2004	Longitudinal reversion, Section 1 Determination methods
(Part 8/Sec 1) : 2004	Resistance to internal hydrostatic pressure, Section 1 Resistance to internal hydrostatic pressure at constant internal water pressure
(Part 14) : 2004	Determination of density/relative density (specific gravity)
13360	Plastics methods of testing:
(Part 3/Sec 1) : 1995	Physical and dimensional properties, Section 1 Determination of density and relative density of non-cellular plastics
(Part 4/Sec 1) : 2000	Rheological properties, Section 1 Determination of melt mass flow rate (MFR) and the melt volume flow rate (MVR) of thermoplastics
(Part 5/Sec 5) : 1996	Mechanical properties, Section 5 Determination of charpy impact strength

3 DEFINITIONS, SYMBOLS AND ABBREVIATIONS

3.1 Nominal Size, DN/OD — Nominal size, related to the outside diameter, in millimetres.

3.2 Nominal Outside Diameter (d_n) — Specified outside diameter, in millimetres, assigned to a nominal size, DN/OD.

3.3 Outside Diameter at Any Point (d_e) — Value of the measurement of the outside diameter through its cross-section at any point of the pipe, rounded to the nearest 0.1 mm.

3.4 Mean Outside Diameter (d_{em}) — Value of the measurement of the outer circumference of the pipe or spigot end of a fitting in any cross section divided by π (3.142), rounded to the nearest 0.1 mm.

3.5 Minimum Mean Outside Diameter ($d_{em,\,Min}$) — Minimum value of the mean outside diameter as specified for a given nominal size.

3.6 Maximum Mean Outside Diameter ($d_{em,\,Max}$) — Maximum value of the mean outside diameter as specified for a given nominal size.

3.7 Out-of-Roundness (Ovality) — Difference between the measured maximum outside diameter and the measured minimum outside diameter in the same cross-section of the pipe or spigot end of a fitting.

3.8 Nominal Wall Thickness (e_n) — Numerical designation of the wall thickness of a component,

which is a convenient round number, approximately equal to the manufacturing dimension in millimetres.

3.9 Wall Thickness at Any Point (e) — Value of the measurement of the wall thickness at any point around the circumference of a component.

3.10 Minimum Wall Thickness at Any Point (e_{Min}) — Minimum value of the wall thickness at any point around the circumference of a component as specified.

3.11 Maximum Wall Thickness at Any Point (e_{Max}) — Maximum value of the wall thickness at any point around the circumference of a component as specified.

3.12 Mean Wall Thickness (e_m) — Arithmetic mean of a number of measurements regularly spaced around the circumference of the component in the same cross-section of the component, including the measured minimum and the measured maximum values of the wall thickness.

3.13 Standard Dimension Ratio (SDR) — Ratio of the nominal outside diameter d_n of a pipe to its nominal wall thickness e_n.

3.14 Tolerance — Permissible variation of the specified value of a quantity expressed as the difference between the permissible maximum and permissible minimum values.

3.15 Nominal Pressure (PN) — Numerical designation used for reference purposes related to the mechanical characteristics of the component of a piping system.

3.16 Maximum Operating Pressure (MOP) — Maximum effective pressure of the fluid in the piping system, expressed in MPa, which is allowed in continuous use. It takes into account the physical and the mechanical characteristics of the components of a piping system.

3.17 Hydrostatic (Hoop) Stress (σ) — The stress induced in the wall of a pipe when a pressure is applied using water as a medium. The hydrostatic stress is related to the applied pressure, P, the wall thickness at any point, e, and the mean outside diameter, d_{em}, of a pipe and calculated using the following equation:

$$\sigma = P(d_{em} - e) / 2e$$

3.18 Melt Mass-Flow Rate (MFR) — Value in grams per time unit (g/10 min) relating to the viscosity of the molten material at a specified temperature and load.

3.19 Colorants — Colorants include color pigments that are concentrated in the master batch.

3.20 Master Batch — Master batch is a homogeneous mixture of a natural polypropylene resin as the carrier resin and concentrated colorants. The master batch supplier will add sufficient quantity of colorants in the carrier resin and then recommend certain quantity of master batch to be added in the resin to get proper colour of the pipe. The master batch may also contain anti-oxidants, UV stabilizers or other such additives that are specified by the customer for specific performance requirements.

3.21 Tests

3.21.1 *Type Tests*

Tests carried out whenever a change is made in the polymer, or master batch, or colour composition or any new size is introduced in order to establish the suitability and performance capability of the pipes.

3.21.2 *Acceptance Tests*

Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

4 DESIGNATION

4.1 Pipes shall be designated according to the grade of material (*see* **4.2**) followed by SDR and nominal diameter (*see* **4.4**). For example PP-R, SDR 7.4 DN 20 indicates a pipe pertaining to material grade PP-R, SDR 7.4 and nominal outside diameter 20 mm.

4.2 Grade of Material

Material used as base resin/compound for manufacture of pipes shall be designated as Polypropylene Random copolymer Grade — PP-R-P-H-N-10-35-003/006 or PP-R-P-H-C-10-35-003/006 as per IS 10951.

The material grading shall be given by the raw material supplier and in case of compound by the compound manufacturer.

4.3 Pressure Rating

a) Pipes shall be designated with respect to SDR.

b) Annex A gives the allowable maximum operating pressure (MPa) for conveying water at various temperatures and SDRs for information.

c) PPR pipes are recommended for a maximum water temperature up to 95°C.

4.4 Nominal Diameter

The nominal diameters of pipes covered in this standard are: 16 mm, 20 mm, 25 mm, 32 mm, 40 mm, 50 mm, 63 mm, 75 mm, 90 mm, 110 mm, 125 mm, 140 mm, 160 mm, 180 mm and 200 mm.

5 COLOUR

The colour of the pipes shall be as agreed between the buyer and the seller with suitable UV stabilizer.

6 MATERIAL

6.1 General

The material used for the manufacture of pipes shall not constitute toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste or odour, cloudiness or discoloration of water. Pipe manufacturers shall obtain a certificate to this effect from the manufacturers of raw material.

6.2 Polypropylene-Random Copolymer

Polypropylene-Random copolymer (PP-R) used for the manufacture of pipes shall conform to the requirements of IS 10951 and IS 10910. MFR and density, however, shall be as per **6.2.1** and **6.2.2**.

6.2.1 The specified base density shall be between 900 kg/m^3 and 910 kg/m^3 (both inclusive) when determined at 27°C according to procedure prescribed in IS 13360 (Part 3/Sec 1).

6.2.2 The MFR of the material shall be ≤ 0.5 g/10 min when tested at 230°C with nominal load of 2.16 kg as determined by method prescribed in IS 13360 (Part 4/ Sec 1). The MFR of the material shall also be within ±20 percent of the value declared by the manufacturer.

6.2.3 The resin shall be mixed with sufficient quantity of colour master batches. The colour master batch dispersion shall be uniform throughout the pipe surface.

6.3 Outer Layer (Optional)

The base resin used for outer layer compounds shall be a base resin certified by the supplier to be compatible to the PPR resin/master batch that is used to produce the pipes.

Coloured outer layer compound shall be UV stabilized with minimum of 0.2 percent of a hindered amine light stabilizer (HALS). Alternatively, the outer layer compound shall meet the requirement of **6.2.1** and **6.2.2**.

6.4 Anti-oxidant

The percentage of anti-oxidant used shall not be more than 0.3 percent by mass of finished resin. The anti-oxidant used shall be physiologically harmless and shall be selected from the list given in IS 10909.

6.5 Reworked Material

The addition of not more than 10 percent of the manufacturer's own rework material from the manufacture of pipes is permissible. No other reworked or recycled material shall be used.

6.6 Influence on Water Intended for Human Consumption

The PPR pipes, when in permanent or temporary contact with water, which is intended for human consumption, shall not adversely affect the quality of drinking water. When tested from a composite sample of minimum 3 pipes as per IS 9845, the overall migration of constituents shall be within the limits stipulated in IS 10910.

7 DIMENSIONS OF PIPES

7.1 Outside Diameter

The outside diameters of pipes, tolerance on the same and ovality of pipes shall be as given in Table 1.

Table 1 Outside Diameter, Tolerance and Ovality of Pipes

Sl No.	Nominal Size	Outside Diameter	Tolerance (Only Positive Tolerance)	Ovality
	DN	mm	mm	mm
(1)	(2)	(3)	(4)	(5)
i)	16	16.0	0.3	1.2
ii)	20	20.0	0.3	1.2
iii)	25	25.0	0.3	1.2
iv)	32	32.0	0.3	1.3
v)	40	40.0	0.4	1.4
vi)	50	50.0	0.5	1.4
vii)	63	63.0	0.6	1.6
viii)	75	75.0	0.7	1.6
ix)	90	90.0	0.9	1.8
x)	110	110.0	0.9	2.2
xi)	125	125.0	1.2	2.5
xii)	140	140.0	1.3	2.8
xiii)	160	160.0	1.5	3.2
xiv)	180	180.0	1.7	3.6
xv)	200	200.0	1.8	4.0

NOTES

1 The values specified for tolerance on outside diameter have been calculated as 0.009 DN, rounded off to the next higher 0.1 mm subject to minimum of 0.3 mm. No negative tolerances are allowed.

2 The basis for the values specified for ovality is

a) For nominal outside diameters < 75 mm, the tolerance equals (0.008 DN + 1.0) mm, rounded to the next higher 0.1 mm, with a maximum value of 1.2 mm.

b) For nominal outside diameters > 75 mm and ≤ 250 mm, the tolerance equals 0.02 DN, rounded to the next higher 0.1 mm.

c) For nominal outside diameters > 250 mm, the tolerance equals 0.35 DN, rounded to the next higher 0.1 mm.

7.2 Wall Thickness

The minimum and maximum wall thickness of pipes shall be as given in Table 2.

7.3 Method of Measurements

7.3.1 The outside diameter of the pipe shall be taken as the average of two measurements taken at right angles for pipes up to 110 mm diameter. Above 110 mm diameter measurement has to be taken by circometer. The wall thickness shall be measured by a dial vernier or ball ended micrometer. The measurements shall be at a minimum of 300 mm away from the cut end of pipe. The resulting dimensions shall

Table 2 Wall Thickness (e) for Pipes

(*Clause* 7.2)

Sl No.	Nominal Size DN	SDR 11 mm		SDR 7.4 mm		SDR 6 mm		SDR 5 mm	
		Min	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
i)	16			2.20	2.70	2.70	3.20	3.30	3.90
ii)	20	1.90	2.30	2.80	3.30	3.40	4.00	4.10	4.80
iii)	25	2.30	2.80	3.50	4.10	4.20	4.90	5.10	5.90
iv)	32	2.90	3.40	4.40	5.10	5.40	6.20	6.50	7.40
v)	40	3.70	4.30	5.50	6.30	6.70	7.60	8.10	9.20
vi)	50	4.60	5.30	6.90	7.80	8.30	9.40	10.10	11.40
vii)	63	5.80	6.60	8.60	9.70	10.50	11.80	12.70	14.20
viii)	75	6.80	7.70	10.30	11.60	12.50	14.00	15.10	16.90
ix)	90	8.20	9.30	12.30	13.80	15.00	16.70	18.10	20.20
x)	110	10.00	11.20	15.10	16.90	18.30	20.40	22.10	24.60
xi)	125	11.40	12.80	17.10	19.10	20.80	23.10	25.10	27.90
xii)	140	12.70	14.20	19.20	21.40	23.30	25.90	28.10	31.20
xiii)	160	14.60	16.30	21.90	24.30	26.60	29.50	32.10	35.60
xiv)	180	16.40	18.30	24.60	27.30	29.00	32.10	36.10	40.00
xv)	200	18.20	20.30	27.40	30.40	33.20	36.80	—	—

NOTE — The wall thickness tolerances have been calculated on the following basis:

a) Limit deviation = $0.1e + 0.2$ mm, rounded up to the nearest 0.1 mm.

b) A local increase in wall thickness of up to $+0.2e$ is permissible for e up to 10 mm, and up to $0.15e$ for e greater than 10 mm. The mean of the measurement shall, however, still be within the given limit deviations.

be expressed to the nearest 0.1 mm. In case of dispute conditioning should be done at 27°C for 4 h.

7.3.2 Ovality shall be measured as the difference between maximum outside diameter and minimum outside diameter measured at the same cross-section of the pipe. The measurement should be taken minimum 300 mm away from the cut end.

7.4 Length of Straight Pipe

The length of the straight pipe shall be 3 to 6 m or as agreed between the manufacturer and the purchaser and a tolerance of +10 mm is allowed on total length of the pipe.

8 VISUAL APPEARANCE

The internal and external surfaces of the pipes shall be smooth, clean and free from grooving and other defects. The ends shall be cleanly cut and shall be square with axis of the pipes. Slight shallow longitudinal grooves or irregularities in the wall thickness shall be permissible provided that the wall thickness remains within the permissible limits.

9 PERFORMANCE REQUIREMENTS

9.1 Hydraulic Characteristics (Internal Creep Rupture)

When subjected to internal hydrostatic pressure test in accordance with the procedure given in IS 12235 (Part 8/Sec 1), the pipes under test shall show no signs of localized swelling, leakage or weeping and shall not burst during the prescribed test duration. The temperature, duration of test and hydrostatic stresses for the test shall conform to Table 3.

Table 3 Requirements of Pipes for Internal Hydrostatic Pressure Test

Sl No.	Test	Exposure Medium	Test Temperature °C	Test Duration h (Min Holding Time)	Hydrostatic (Hoop) Stress MPa
(1)	(2)	(3)	(4)	(5)	(6)
i)	Acceptance test	Water	20	1	16.0
ii)	Acceptance test	Water	95	22	4.3
iii)	Type test	Water	95	165	3.8
iv)	Type test	Air or water	95	1 000	3.5

9.2 Fusion Compatibility

The manufacturer shall demonstrate that the pipe and the fittings are fusible by testing strength of a socket fusion joint of pipes for hydraulic characteristics in accordance with **9.1**, and Table 3, Sl No. (iii).

9.3 Reversion Test

When tested in accordance with the procedure given in IS 12235 (Part 5/Sec 1) at 135 ± 2°C for 120 ± 2 min in an air oven, the value of the longitudinal reversion shall not be > 2 percent.

9.4 Impact Strength

When tested in accordance with the procedure given in Annex B, the total number of failures shall not exceed 10 percent of the specimens tested.

9.5 Density

When tested from composite sample of minimum three pipes according to IS 12235 (Part 14), it shall meet the requirements as given in **6.2.1** for the pipes used in hot and cold water supply pipes (except black pipes), whereas in case of black pipes the density of the pipes shall be 900-925 kg/m^3.

9.6 Melt Flow Rate (MFR)

When tested from a composite sample of minimum three pipes according to IS 13360 (Part 4/Sec 1) at 230°C with nominal load of 2.16 kgf, MFR shall be ≤ 0.5 g/10 min, and also shall not differ by more than 30 percent of the MFR of the material used in manufacturing of pipes (*see* **6.2.2**).

9.7 Carbon Black Content and Dispersion

This test is applicable only to the black pipes. When tested in accordance with IS 2530, the carbon black content shall be within 2.5 ± 0.5 percent and the dispersion of carbon black shall be satisfactory.

9.8 Thermal Stability by Hydrostatic Pressure Testing

The pipe, when subjected to internal hydrostatic pressure test according to IS 12235 (Part 8/Sec 1), at 110°C for 8 760 h by applying a hoop stress of 1.9 MPa with water as the pressurizing fluid and air as the outer medium shall not burst during the test period.

9.9 Opacity

When tested according to IS 12235 (Part 3) the wall of the plain pipe shall not transmit more than 0.2 percent of the visible light.

10 SAMPLING, FREQUENCY OF TESTS AND CRITERIA FOR CONFORMITY

10.1 Type Tests

10.1.1 Type tests are intended to prove the suitability and performance of a new composition, a new technique or a new size of a pipe. Such tests, therefore, need be applied only when a change is made in polymer composition or method of manufacture, or when a new size of pipe is to be introduced. Even if no change is envisaged, type test shall be done at least once in two years on each pressure rating and grade of pipe of the highest size manufactured during the period.

10.1.2 Three samples of the same size, same pressure rating and same grade selected at random shall be tested for compliance with the requirements of the test.

10.1.3 If all the samples pass the requirements of the type test, the type of the pipe under consideration shall be considered eligible for type approval.

10.1.4 In case if any of the samples fails in the test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number and subject them to the type test again. If in repeat test, no single failure occurs, the type of pipe under consideration shall be considered eligible for type approval. If any of the samples fails in the repeat tests, the type of pipe shall not be approved. The manufacturer may be asked to resubmit the product for type approval.

10.1.5 At the end of validity period (normally two years) or earlier as may be necessary, the testing authority may call for fresh samples for type test for the purpose of type approval.

10.1.6 The records of the type tests shall be made available during external inspection of lots for the acceptance tests.

10.2 Acceptance Tests

10.2.1 Acceptance tests are carried out on samples selected from a lot for the purpose of acceptance of the lot.

10.2.2 *Lot*

All pipes of the same size, same pressure rating and same grade and also manufactured essentially under similar conditions of manufacturer, shall constitute a lot. For ascertaining conformity of the lot to the requirements of this specification, samples shall be selected in accordance with the provisions as mentioned under **10.2.3** and **10.2.4** and tested for compliance.

10.2.3 *Dimensional and Visual Requirements*

10.2.3.1 The number of test samples shall be in accordance with Table 4.

10.2.3.2 These pipes shall be selected at random from the lot and in order to ensure the randomness of selection, a random number table shall be used.

10.2.3.3 The number of pipes given for the first sample in col 4 of Table 4 shall be examined for dimensional and visual requirements given in **7** and **8**. A pipe failing to satisfy any of these requirements shall be considered as defective. The lot shall be deemed to have satisfied these requirements, if the number of defectives found in the first sample is less than or equal to the corresponding acceptance number given in col 6 of

Table 4. The lot shall be deemed not to have met these requirements, if the number of defectives found in the first sample is greater than or equal to the corresponding rejection number given in col 7 of Table 4. If, however, the number of defectives found in the first sample lies between the corresponding acceptance and rejection numbers given in col 6 and 7 of Table 4, the second sample of the size given in col 4 of Table 4 shall be taken and examined for these requirements. The lot shall be considered to have satisfied these requirements, if the number of defectives found in the cumulative sample is less than or equal to the corresponding acceptance number given in col 6 of the Table 4; otherwise not.

10.2.4 *Hydraulic Characteristics, Fusion Compatibility, Reversion, Density, MFR and Carbon Black Content/Dispersion Test, Influence on Water Intended for Human Consumption (Overall Migration), Thermal Stability, Opacity*

10.2.4.1 The lot having satisfied dimensional and visual requirements shall be tested for hydraulic characteristics, reversion, density and MFR and opacity. In case of solar heating systems and other prolonged outdoor applications, the carbon black content/ dispersion requirements are also to be considered.

10.2.4.2 A separate sample size for each of the tests shall be taken as stipulated in Table 5 and selected at random from the sample already examined for dimensional and visual inspection. All the pipes in each of the sample size shall be tested for compliance to the requirements for Hydraulic characteristics (**9.1**), Fusion compatibility (**9.2**), Reversion (**9.3**), Impact strength (**9.4**), Density (**9.5**), MFR (**9.6**), Opacity (**9.9**), Carbon black content/dispersion (**9.7**), Influence on water intended for human consumption (overall migration) (**6.6**), and Thermal stability (**9.8**). The lot shall be considered to have met the requirements of these tests, if none of the samples tested fails.

Table 5 Scale of Sampling for Requirements of Hydraulic Characteristics, Reversion, Carbon Black Content and Dispersion, Density, Influence on Water Intended for Human Consumption (Overall Migration), Thermal Stability, Fusion Compatibility and MFR

Sl No.	No. of Pipes in the Lot	Sample Size for Tests
(1)	(2)	(3)
i)	Up to 150	3
ii)	151 to 500	3
iii)	501 to 3 200	5
iv)	> 3 200	8

11 FREQUENCY OF TESTING

Hydraulic characteristics [Table 3, Sl No. (iii) and (iv)], fusion compatibility, influence on water intended for human consumption (overall migration) and thermal stability tests are type tests. Rest of all are acceptance tests, for the acceptance of the lot.

12 MARKING

12.1 Each straight length of pipe shall be clearly marked with any one of the following methods.

12.1.1 Straight length pipe at one end with indelible ink/paint in black/white colour.

12.1.2 Hot embossed on black/white base on every meter throughout the length of pipe in black/white colour.

12.1.3 Indelible inkjet print on every meter throughout the length of pipe in black/white colour.

Table 4 Scale of Sampling for Visual and Dimensional Requirements

(*Clauses* 10.2.3.1 *and* 10.2.3.3)

Sl No.	No. of Pipes in the Lot	Sample No.	Sample Size	Cumulative Sample Size	Acceptance No.	Rejection No.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Up to 150	First	13	13	0	2
		Second	13	26	1	2
ii)	151 to 280	First	20	20	0	3
		Second	20	40	3	4
iii)	281 to 500	First	32	32	1	4
		Second	32	64	4	5
iv)	501 to 1 200	First	50	50	2	5
		Second	50	100	6	7
v)	1 201 to 3 200	First	80	80	3	7
		Second	80	160	8	9
vi)	3 201 to 10 000	First	125	125	5	9
		Second	125	250	12	13
vii)	10 001 and above	First	200	200	7	11
		Second	200	400	18	19

12.2 The marking on the pipe shall carry the following information:

a) Manufacturer's name/trade-mark;
b) PPR pipe;
c) SDR;
d) Outside diameter and minimum wall thickness; and
e) Lot number/Batch number, containing information of date of manufacture and machine number.

12.3 BIS Certification Marking

Each pipe may also be marked with the Standard Mark.

12.3.1 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 licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

[*Clause* 4.3(b)]

PPR PIPES — TEMPERATURE AND CORRESPONDING PRESSURE DETAILS (For information purposes)

A-1 When a PPR piping system is to be operated at a varying degree of temperatures and pressures, maximum operating pressures as given in Table 6 may be applicable.

Table 6 Allowable Maximum Operating Pressures for Pipes

Sl No.	SDR 11		SDR 7.4		SDR 6		SDR 5	
	Temp °C	Pressure MPa	Temp °C	Pressure MPa	Temp °C	Pressure MPa	Temp °C	Pressure MPa
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	10	1.91	10	3.02	10	3.8	10	4.78
ii)	20	1.63	20	2.58	20	3.24	20	4.09
iii)	30	1.37	30	2.17	30	2.73	30	3.44
iv)	40	1.15	40	1.84	40	2.3	40	2.9
v)	50	0.98	50	1.55	50	1.95	50	2.46
vi)	60	0.82	60	1.28	60	1.62	60	2.04
vii)	70	0.62	70	0.98	70	1.23	70	1.55
viii)	80	0.39	80	0.62	80	0.77	80	0.98
ix)	95	0.27	95	0.41	95	0.52	95	0.65

ANNEX B

(*Clause* 9.4)

TEST FOR IMPACT STRENGTH

B-1 In accordance with the requirements given in Table 7, specimens shall be prepared from the pipes either in the form of pipe sections or of bars taken along the pipe axis (*see* Fig. 1). The test is to be carried out on 'un-notched' sample. The latter shall be taken from sections of pipe in lengths of 50 ± 1 mm or 120 ± 2 mm at points spaced as evenly as possible around the circumference. The specimen width specified in Table 7 corresponds to dimension *b* in Fig. 1.

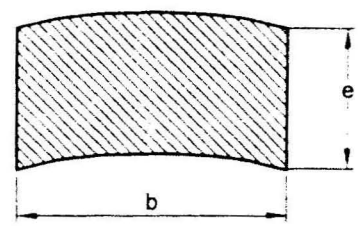

FIG. 1 DIMENSION OF SPECIMEN

Table 7 Dimensions of Specimen

(*Clause* B-1)

Sl No.	Type of Specimen	Pipe		Specimen			Distance Between Supports mm + 0.5 − 0
		Outside Diameter *d* mm	Wall Thickness *e* mm	Length mm	Width mm	Height mm	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1	≥ 25	= *e*	Pipe section 100 ± 2 mm long			70
ii)	2	≥ 25	≤ 4.2	50 ± 1	6 ± 0.2	= *e*	40
iii)	3	≥ 25	> 4.2	120 ± 2	15 ± 0.5	10.5 *Max*	70

The internal and external surfaces of the specimens shall not be machined if the wall thickness, *e*, does not exceed 10.5 mm. Otherwise, the external surfaces shall be machined until the specimen thickness is 10 ± 0.5 mm. The machined surfaces shall then be smoothed lengthwise with fine emery paper (of grain size No. 220 or finer).

Testing shall be carried out on ten specimens using a charpy impact testing machine in accordance with IS 13360 (Part 5/Sec 5), by using hammer having energy of 15 J and striking the specimen flatwise with a velocity of 3.8 m/s, with the impact applied either to the external surface or the machined face of the specimen. Testing shall be carried out at 0 ± 2°C.

It shall be established whether the specimens fails. If more than one specimen fails in this test, the test shall be repeated on further 20 specimens taken from the same pipe. In this case, the total number of failures from the first and second tests shall be evaluated together.

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