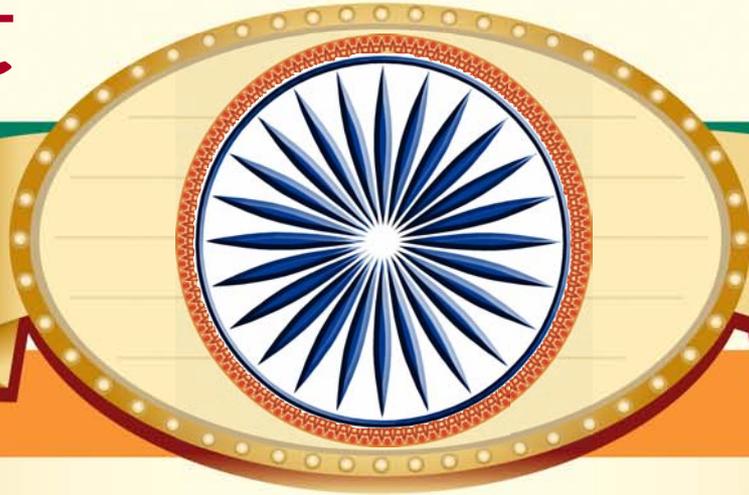


इंटरनेट

मानक



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Mazdoor Kisan Shakti Sangathan

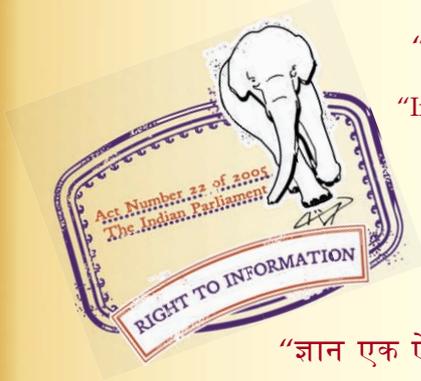
“The Right to Information, The Right to Live”

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“Step Out From the Old to the New”

IS 4984 (1995): high density polyethylene pipes for potable water supplies [CED 50: Plastic Piping System]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

पानी की आपूर्ति के लिए उच्च घनत्व वाले पॉलिएथिलीन
पाइप — विशिष्ट

(चौथा पुनरीक्षण)

Indian Standard

HIGH DENSITY POLYETHYLENE PIPES
FOR WATER SUPPLY — SPECIFICATION

(Fourth Revision)

Second Reprint JANUARY 1998

UDC 621.643 : 678.743.2 : 628.1

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Plastic Pipes and Fittings Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published in 1968 and revised in 1972, 1977 and 1987. In this fourth revision the following major changes have been affected:

- i) The scope of this standard now covers HDPE pipes for water supply only. Pipes for sewerage and industrial effluents are being covered in a separate standard.
- ii) The HDPE resin of designation PEEWA — 45-T-006 and PEEWA 45-T-012 (subject to MFR not exceeding 1.1 g/10 minutes), conforming to IS 7328 : 1992 'High density polyethylene materials for moulding and extrusion (*first revision*)' has been specified.
- iii) In addition to pipe material (HDPE) having the hydrostatic design stress as 5 MPa at 20 °C for 50 years service and the corresponding MRS (minimum required strength) as 6.3 MPa, higher grade materials with MRS of 8.0 MPa and 10.0 MPa have been introduced in line with ISO/DIS 4427 'Polyethylene (PE) pipes for water supply — Specification', issued by International Organization for Standardization.
- iv) Two more classes of pipes with pressure ratings 1.25 MPa and 1.60 MPa have been added while pressure rating of 0.2 MPa has been withdrawn.
- v) Dimensional series of pipes has been extended to cover pipes of nominal diameter (DN) up to 1 000 mm.
- vi) Additional tests such as density, MFI, ovality, carbon black content/dispersion and overall migration have been included as performance tests on the pipes.
- vii) The creep rupture tests for duration of 165 h has been modified in line with ISO/DIS 4427. However, the long term creep rupture test for 1 000 h as given in ISO/DIS 4427 has not been included as it was found not feasible at this stage. The short term creep rupture test at 80 °C for 48 h has been retained since ISO/DIS 4427 test at 20 °C for 100 h was not found acceptable as an acceptance test.
- viii) The sampling clauses for the criteria for acceptance tests have been revised in line with IS 2500 (Part I) : 1992 'Sampling inspection tables: Part I Inspection by attributes and by count of defects (*first revision*)'.

In the formulation of this standard a great deal of assistance has been derived from ISO/DIS 4427. The provisions relating to ovality are based on ISO/DIS 11922 (Part I) 'Thermo-plastic pipes for the transport of fluids — Dimensions and tolerances'.

However, provisions regarding thermal stability test and weathering test as stipulated in ISO/DIS 4427 have not been included for the time being.

Regarding guidance for laying and jointing of polyethylene pipe, including storage and handling, a reference may be made to IS 7634 (Part II) : 1975 'Code of practice for plastic pipe work for potable water supplies: Part II Laying and jointing polyethylene (PE) pipes'.

The composition of technical committees responsible for the formulation of this standard is given in Annex D.

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
**HIGH DENSITY POLYETHYLENE PIPES
 FOR WATER SUPPLY — SPECIFICATION**
(Fourth Revision)

1 SCOPE

This Indian Standard lays down requirements for high density polyethylene pipes from 16 mm to 1 000 mm nominal diameter of pressure rating from 0.25 MPa to 1.6 MPa in material grades of PE 63, PE 80, and PE 100, for use for buried water mains and services and for water supply above ground, both inside and outside buildings.

2 REFERENCES

The Indian Standards listed below are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
2530 : 1963	Methods of test for polyethylene moulding materials and polyethylene compounds
4905 : 1968	Methods for random sampling
7328 : 1992	High density polyethylene materials for moulding and extrusion (<i>first revision</i>)
9845 : 1986	Method of analysis for the determination of specific and/or overall migration of constituents of plastics materials and articles intended to come into contact with foodstuffs (<i>first revision</i>)
10141 : 1982	Positive list of constituents of polyethylene in contact with foodstuffs, pharmaceuticals and drinking water
10146 : 1982	Polyethylene for its safe use in contact with foodstuff, pharmaceuticals and drinking water

3 DESIGNATION

3.1 Pipes shall be designated according to the grade of material (*see 3.2*) followed by pressure rating (*see 3.3*) and nominal diameter (*see 3.4*). For example, PE 63 PN 10 DN 200 indicates a pipe pertaining to material grade 63, pressure rating 1.0 MPa and outside nominal diameter 200 mm.

3.2 Grade of Material

3.2.1 Pipes shall be classified according to the grade of materials as given in Table 1.

3.2.2 The maximum allowable hydrostatic design stress (σ) of a pipe is obtained by applying the design coefficient of 1.25 (*Min*) to the MRS value of the material, taking into consideration the temperature at which the pipe is to be designed for.

3.2.3 The material grading shall be given by the raw material supplier and in case of master batch, by the pipe manufacturer.

3.3 Pressure Rating

Pipes shall be classified by pressure rating (PN) corresponding to the maximum permissible working pressure at 30°C, as follows:

<i>Pressure Rating of Pipe</i>	<i>Maximum Permissible Working Pressure</i>
PN 2.5	0.25 MPa
PN 4	0.40 MPa
PN 6	0.60 MPa
PN 10	1.00 MPa
PN 12.5	1.25 MPa
PN 16	1.60 MPa

Table 1 Classification of Pipe Material
(Clause 3.2.1)

SI No.	Material Grade	MRS (Minimum Required Strength) of Material in MPa, at 20 °C, 50 Years	Maximum Allowable Hydrostatic Design Stress (σ), MPa	
			At 20 °C	At 30 °C
(1)	(2)	(3)	(4)	(5)
i)	PE 63	6.3	5.0	4.0
ii)	PE 80	8.0	6.3	5.0
iii)	PE 100	10.0	8.0	6.3

NOTE — The pipes are recommended for maximum water temperature of +45 °C. The pipes may also be used up to the ambient temperature of - 40 °C. As the creep rupture strength of the pipe varies with the change in water temperature, the maximum working pressure, therefore, should be modified by applying the pressure coefficient given in Fig. 1.

3.4 Nominal Diameter (DN)

The nominal diameter of pipes covered in this standard are:

16, 20, 25, 32, 40, 50, 63, 75, 90, 110, 125, 140, 160, 180, 200, 225, 250, 280, 315, 355, 400, 450, 500, 560, 630, 710, 800, 900 and 1 000 mm.

4 COLOUR

4.1 The colour of the pipe shall be black.

4.2 For the purpose of identification of the pipes covered in this standard, each pipe shall contain minimum three equispaced longitudinal stripes of width 3 mm (*Min*) in blue colour. These stripes shall be coextruded during pipe manufacturing and shall not be more than 0.2 mm in depth. The material of the stripes shall be of the same type of resin, as used in the base compound for the pipe.

5 MATERIAL

5.1 General

The material used for the manufacture of pipes should not constitute toxic hazard, should not support microbial growth and should 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.

5.2 High Density Polyethylene

High density polyethylene (HDPE) used for the manufacture of pipes shall conform to designation PEEWA-45-T-006 of IS 7328 : 1992. HDPE conforming to designation PEEWA-45-T-012 of IS 7328 : 1992 may also be used with the exception that melt flow rating (MFR) shall not exceed 1.10 g/10 minutes. In addition the material shall also conform to 5.6.2 of IS 7328 : 1992 (*see A-1*).

5.2.1 The specified base density shall be between 940.5 kg/m³ and 946.4 kg/m³ (both inclusive) when determined at 27 °C according to procedure prescribed in Annex A of IS 7328 : 1992. The value of the density shall also not differ from the nominal value by more than 3 kg/m³ as per 5.2.1.1 of IS 7328 : 1992.

5.2.2 The MFR of the material shall be between 0.41 and 1.10 (both inclusive) when tested at 190 °C with nominal load of 5 kgf as determined by method prescribed in 7 of IS 2530 : 1963. The MFR of the material shall also be within ± 20 percent of the value declared by the manufacturer.

5.2.3 The resin shall be compounded with carbon black. The carbon black content in the material shall be within 2.5 ± 0.5% and the dispersion of carbon black shall be satisfactory when tested according to the procedure described in IS 2530 : 1963.

5.3 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 10141 : 1982.

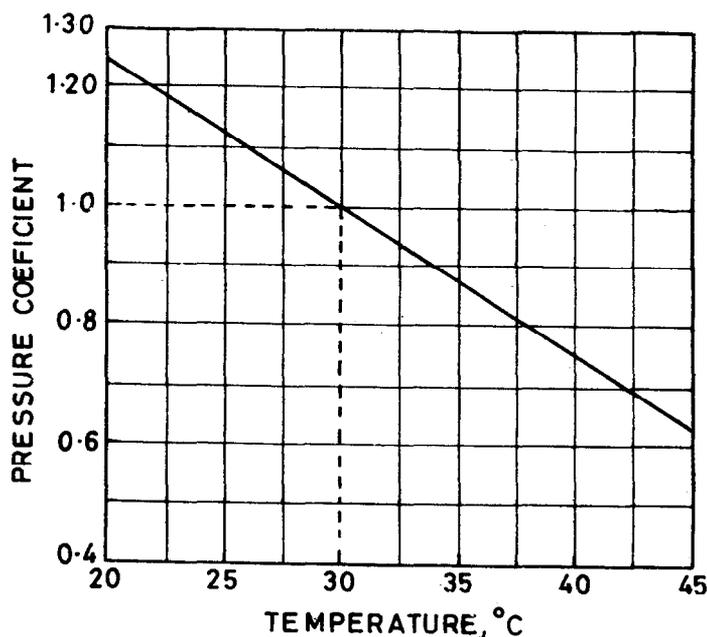


FIG. 1 PRESSURE COEFFICIENT VERSUS TEMPERATURE

5.4 Reworked Material

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

6 DIMENSIONS OF PIPES

6.1 Outside Diameter

The outside diameters of pipes, tolerance on the same and ovality of pipe shall be as given in Table 2 (see A-2).

6.2 Wall Thickness

The minimum and maximum wall thickness of pipes for the three grades of materials, namely, PE 63, PE 80 and PE 100 shall be as given in Tables 3, 4 and 5 respectively (see A-3).

Table 2 Outside Diameter, Tolerance and Ovality of Pipes
(Clause 6.1)

Nominal Diameter DN	Outside Diameter mm	Tolerance mm (only positive tolerances)	Ovality mm
(1)	(2)	(3)	(4)
16	16.0	0.3	1.2
20	20.0	0.3	1.2
25	25.0	0.3	1.2
32	32.0	0.3	1.3
40	40.0	0.4	1.4
50	50.0	0.5	1.4
63	63.0	0.6	1.5
75	75.0	0.7	1.6
90	90.0	0.9	1.8
110	110.0	1.0	2.2
125	125.0	1.2	2.5
140	140.0	1.3	2.8
160	160.0	1.5	3.2
180	180.0	1.7	3.6
200	200.0	1.8	4.0
225	225.0	2.1	4.5
250	250.0	2.3	5.0
280	280.0	2.6	9.8
315	315.0	2.9	11.1
355	355.0	3.2	12.5
400	400.0	3.6	14.0
450	450.0	4.1	15.6
500	500.0	4.5	17.5
560	560.0	5.0	19.6
630	630.0	5.7	22.1
710	710.0	6.4	24.9
800	800.0	7.2	28.0
900	900.0	8.1	31.5
1 000	1 000.0	9.0	35.0

Table 3 Wall Thickness of Pipes for Material Grade PE 63
(Clause 6.2)

All dimensions in millimetres.

Nominal Diameter	Wall Thickness of Pipes for Pressure Ratings of											
	PN 2.5		PN 4		PN 6		PN 10		PN 12.5		PN 16	
	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>
DN	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
16	—	—	—	—	—	—	—	—	2.2	2.6	2.7	3.2
20	—	—	—	—	—	—	2.3	2.8	2.7	3.2	3.4	3.9
25	—	—	—	—	2.0	2.4	2.8	3.3	3.4	4.0	4.2	4.8
32	—	—	—	—	2.3	2.7	3.6	4.2	4.4	5.0	5.4	6.1
40	—	—	2.0	2.4	2.8	3.3	4.5	5.1	5.5	6.2	6.7	7.6
50	—	—	2.4	2.9	3.5	4.1	5.6	6.4	6.8	7.7	8.4	9.4
63	2.0	2.4	3.0	3.5	4.4	5.1	7.0	7.9	8.6	9.6	10.5	11.8
75	2.3	2.7	3.6	4.2	5.3	6.0	8.4	9.4	10.2	11.4	12.5	14.0
90	2.8	3.2	4.3	5.0	6.3	7.2	10.0	11.2	12.2	13.6	15.0	16.7
110	3.4	3.9	5.3	6.0	7.7	8.7	12.3	13.7	14.9	16.6	18.4	20.4
125	3.8	4.4	6.0	6.8	8.8	9.8	13.9	15.5	16.9	18.8	20.9	23.2
140	4.3	4.9	6.7	7.6	9.8	11.0	15.6	17.4	19.0	21.1	23.4	25.9
160	4.9	5.6	7.7	8.6	11.2	12.5	17.8	19.8	21.7	24.0	26.7	29.6
180	5.5	6.2	8.6	9.7	12.6	14.1	20.0	22.2	24.4	27.0	30.0	33.2
200	6.1	6.9	9.6	10.7	14.0	15.6	22.3	24.7	27.1	30.0	33.4	36.9
225	6.9	7.7	10.8	12.0	15.7	17.5	25.0	27.7	30.5	33.7	37.5	41.5
250	7.6	8.6	11.9	13.3	17.5	19.4	27.8	30.8	33.8	37.4	41.7	46.1
280	8.5	9.6	13.4	14.9	19.6	21.7	31.2	34.5	37.9	41.9	46.7	51.6
315	9.6	10.7	15.0	16.7	22.0	24.4	35.0	38.7	42.6	47.1	52.5	58.0
355	10.8	12.1	16.9	18.8	24.8	27.5	39.5	43.6	48.0	53.0	59.2	65.3
400	12.2	14.2	19.1	22.1	28.0	32.3	44.5	51.4	54.1	62.4	—	—
450	13.7	15.9	21.5	25.0	31.4	36.3	50.0	57.7	—	—	—	—
500	15.2	17.7	23.9	27.6	34.5	40.4	55.6	64.1	—	—	—	—
560	17.0	19.8	26.7	30.9	39.1	45.2	—	—	—	—	—	—
630	19.1	22.2	30.0	34.7	44.0	50.8	—	—	—	—	—	—
710	21.6	25.0	33.9	39.1	49.6	57.2	—	—	—	—	—	—
800	24.3	28.1	38.1	44.1	55.9	64.4	—	—	—	—	—	—
900	27.3	31.6	42.9	49.5	—	—	—	—	—	—	—	—
1 000	30.3	35.1	47.7	55.0	—	—	—	—	—	—	—	—

Table 4 Wall Thickness of Pipes for Material Grade PE 80

(Clause 6.2)

All dimensions in millimetres.

Nominal Diameter	Wall Thickness of Pipes for Pressure Ratings of							
	PN 6		PN 10		PN 12.5		PN 16	
	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
16	—	—	—	—	—	—	2.3	2.7
20	—	—	1.9	2.3	2.3	2.7	2.8	3.3
25	—	—	2.3	2.7	2.8	3.3	3.5	4.0
32	1.9	2.3	3.0	3.4	3.6	4.2	4.5	5.1
40	2.3	2.7	3.7	4.3	4.5	5.1	5.6	6.3
50	2.9	3.4	4.6	5.3	5.6	6.4	6.9	7.8
63	3.6	4.2	5.8	6.6	7.0	7.9	8.7	9.8
75	4.3	4.9	6.9	7.8	8.4	9.4	10.4	11.6
90	5.1	5.8	8.2	9.3	10.0	11.2	12.5	13.9
110	6.3	7.1	10.0	11.2	12.3	13.8	15.2	16.9
125	7.1	8.0	11.4	12.8	13.9	15.5	17.3	19.2
140	8.0	9.0	12.8	14.3	15.6	17.4	19.4	21.5
160	9.1	10.2	14.6	16.3	17.8	19.8	22.1	24.5
180	10.2	11.5	16.4	18.3	20.0	22.2	24.9	27.6
200	11.4	12.7	18.2	20.3	22.3	24.7	27.6	30.6
225	12.8	14.3	20.5	22.8	25.0	27.7	31.1	34.4
250	14.2	15.8	22.8	25.3	27.8	30.8	34.5	38.2
280	15.9	17.7	25.5	28.3	31.2	34.5	38.7	42.7
315	17.9	20.0	28.7	31.8	35.0	38.7	43.5	48.0
355	20.1	22.3	32.3	35.8	39.5	43.6	49.0	54.1
400	22.7	26.3	36.4	42.1	44.5	51.4	55.2	63.7
450	25.5	29.5	41.0	47.4	50.0	57.7	—	—
500	28.3	32.8	45.5	52.5	55.6	64.1	—	—
560	31.7	36.7	51.0	58.8	—	—	—	—
630	35.7	41.3	57.3	66.1	—	—	—	—
710	40.2	46.5	—	—	—	—	—	—
800	45.3	52.3	—	—	—	—	—	—
900	50.1	58.8	—	—	—	—	—	—
1 000	56.6	65.3	—	—	—	—	—	—

Table 5 Wall Thickness of Pipes for Material Grade PE 100

(Clause 6.2)

All dimensions in millimetres.

Nominal Diameter	Wall Thickness of Pipes for Pressure Ratings of					
	PN 10		PN 12.5		PN 16	
	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>
DN	(2)	(3)	(4)	(5)	(6)	(7)
16	—	—	—	—	1.9	2.3
20	—	—	1.9	2.3	2.3	2.7
25	1.9	2.3	2.3	2.7	2.9	3.3
32	2.4	2.8	2.9	3.4	3.7	4.2
40	3.0	3.5	3.7	4.2	4.6	5.2
50	3.7	4.3	4.6	5.2	5.7	6.4
63	4.7	5.3	5.8	6.5	7.1	8.1
75	5.6	6.3	6.8	7.7	8.5	9.5
90	6.7	7.5	8.2	9.2	10.2	11.4
110	8.1	9.1	10.0	11.2	12.4	13.9
125	9.2	10.4	11.3	12.7	14.1	15.7
140	10.3	11.6	12.7	14.1	15.8	17.6
160	11.8	13.2	14.5	16.1	18.1	20.1
180	13.3	14.8	16.3	18.1	20.3	22.6
200	14.8	16.4	18.1	20.1	22.6	25.0
225	16.6	18.4	20.4	22.6	25.4	28.1
250	18.4	20.5	22.6	25.1	28.2	31.2
280	20.6	22.9	25.3	28.0	31.6	35.0
315	23.2	25.7	28.5	31.5	35.5	39.3
355	26.1	29.0	32.1	35.5	40.0	44.2
400	29.5	34.1	36.1	41.8	45.1	52.1
450	33.1	38.3	40.7	47.0	50.7	58.6
500	36.8	42.5	45.2	52.1	56.4	65.0
560	41.2	47.6	50.6	58.4	—	—
630	46.8	53.5	56.9	65.6	—	—
710	52.3	60.3	—	—	—	—
800	58.9	67.9	—	—	—	—
900	—	—	—	—	—	—
1 000	—	—	—	—	—	—

6.3 Method of Measurement

6.3.1 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. Alternatively and for higher sizes, the diameter shall be measured preferably by using a flexible Pi tape or a circometer, having an accuracy of not less than 0.1 mm. The wall thickness shall be measured by a dial vernier or ball ended micrometer. The resulting dimension shall be expressed to the nearest 0.1 mm.

NOTES

1 The outside diameter shall be measured at a distance of at least 300 mm from the end of the pipe.

2 In the case of dispute, the dimension of pipes shall be measured after conditioning at room temperature for 4 hours.

6.3.2 Ovality shall be measured as the difference between maximum outside diameter and minimum outside diameter measured at the same cross section of the pipe, at 300 mm away from the cut end. For pipes to be coiled, the ovality shall be measured prior to coiling. For coiled pipes, however, re-rounding of pipes shall be carried out prior to the measurement of ovality.

6.4 Length of Straight Pipe

The length of straight pipe shall be 5 m to 20 m, as agreed between the manufacturer and the purchaser. Short lengths of 3 metre (*Min*) up to a maximum of 10% of the total supply may be permitted.

6.5 Coiling

The pipes supplied in coils shall be coiled on drums of minimum diameter of 25 times the nominal diameter of the pipe ensuring that kinking of pipe is prevented.

7 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.

8 PERFORMANCE REQUIREMENTS

8.1 Hydraulic Characteristics

When subjected to internal pressure creep rupture test

Table 6 Requirements of Pipes for Internal Pressure Creep Rupture Test

(Clauses 8.1, 9.1.2 and B-4.3)

Sl No.	Test	Test Temp °C	Test Duration (Minimum Holding Time)	Induced Stress, σ_i in MPa for		
				PE 63	PE 80	PE 100
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Type test	80	165	3.5	4.6	5.5
ii)	Acceptance test	80	48	3.8	4.9	5.7

in accordance with procedure given in Annex B, the pipes under test shall show no signs of localized swelling, leakage or weeping, and shall not burst during the prescribed test duration. The temperatures, duration of test and induced stresses for the test shall conform to those specified in Table 6.

8.2 Reversion Test

When tested according to the procedure given at Annex C, the value of the longitudinal reversion shall not be greater than 3 percent.

8.3 Overall Migration Test

When tested from a composite sample of minimum 3 pipes as per IS 9845 : 1986, the overall migration of constituents shall be within the limits stipulated in IS 10146 : 1987.

8.4 Density

When tested from a composite sample of minimum three pipes as per Annex A of IS 7328 : 1992, it shall meet the requirement as given in 5.2.1.

8.5 Melt Flow Rate (MFR)

When tested from a composite sample of minimum three pipes as per IS 2530 : 1963, at 190 °C with nominal load of 5 kgf, MFR shall be between 0.4 to 1.1 g/10 minutes and also shall not differ by more than 30% of the MFR of the material used in manufacturing pipes (see 5.2.2).

8.6 Carbon Black Content and Dispersion

When tested from a composite sample of minimum three pipes, in accordance with IS 2530 : 1963, the carbon black content shall be within 2.5 ± 0.5 percent, and the dispersion of carbon black shall be satisfactory.

9 SAMPLING, FREQUENCY OF TESTS AND CRITERIA FOR CONFORMITY

9.1 Type Test

9.1.1 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.

9.1.2 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 type test (see 8.1 and Table 6).

9.1.3 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.

9.1.4 In case of any of the samples fails in the type 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 or the supplier may be asked to improve the design and resubmit the product for type approval.

9.1.5 At the end of the 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.

9.2 Acceptance Tests

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

9.2.2 Lot

All pipes of the same size, same pressure rating and same grade and also manufactured essentially under similar conditions of manufacture, shall constitute a lot. For ascertaining conformity of the lot to the require-

ments of this specification, samples shall be selected in accordance with the provisions as mentioned under 9.2.3 and 9.2.4 and tested for compliance.

9.2.3 Dimensional and Visual Requirements

9.2.3.1 The number of test samples shall be in accordance with Table 7.

9.2.3.2 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. For guidance and use of random number tables, IS 4905 : 1968 may be referred. In the absence of a random number table the following procedure may be adopted.

Starting from any pipe in the lot, count them as 1, 2, 3, 4, etc, up to r and so on where r is the integral part of N/n , N being the number of pipes in the lot and n is the number of pipes in the samples. Every r th pipe so counted shall be drawn so as to constitute the required sample size.

9.2.3.3 The number of pipes given for the first sample in col 3 of Table 7 shall be examined for dimensional and visual requirements given in 6.1, 6.2 and 7. 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 are less than or equal to the corresponding acceptance number given in col 5 of Table 7. 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 numbers given in col 6 of Table 7. If, however, the number of defectives found in the first sample lies between the corresponding acceptance and rejection numbers given in col 5 and 6 of Table 7, the second sample of the size given in col 3 of Table 7 shall be

Table 7 Scale of Sampling for Visual and Dimensional Requirements

(Clauses 9.2.3.1 and 9.2.3.3)

No. of Pipes in the Lot	Sample No.	Sample Size	Cumulative Sample Size	Acceptance No.	Rejection No.
(1)	(2)	(3)	(4)	(5)	(6)
Up to 150	First	13	13	0	2
	Second	13	26	1	2
151 to 280	First	20	20	0	3
	Second	20	40	3	4
281 to 500	First	32	32	1	4
	Second	32	64	4	5
501 to 1 200	First	50	50	2	5
	Second	50	100	6	7
1 201 to 3 200	First	80	80	3	7
	Second	80	160	8	9
3 201 to 10 000	First	125	125	5	9
	Second	125	250	12	13
10 001 to 35 000	First	200	200	7	11
	Second	200	400	18	19

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 5 of Table 7; otherwise not.

9.2.4 Hydraulic Characteristics, Reversion, Overall Migration, Density, MFR and Carbon Black Content/Dispersion Tests

9.2.4.1 The lot having satisfied dimensional and visual requirements shall be tested for hydraulic characteristics, reversion, overall migration, density, MFR and carbon black content/dispersion requirements.

9.2.4.2 A separate sample size for each of the test shall be taken as stipulated in Table 8 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 in the requirements for hydraulic characteristics (8.1), reversion (8.2), overall migration (8.3) density (8.4), MFR (8.5), and carbon black content/dispersion (8.6). The lot shall be considered to have met the requirements of these tests, if none of samples tested fails.

10 MARKING

10.1 Each straight length of pipe shall be clearly marked in indelible ink/paint on either end and for coil at both ends or hot embossed on white base every metre throughout the length of pipe/coil with the following

information:

- a) Manufacturer's name/Trade-mark,
- b) Designation of pipe (see 3.1), and
- c) Lot number/Batch number.

10.2 BIS Certification Marking

Each pipe may also be marked with Standard Mark.

10.2.1 The use of 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 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.

Table 8 Scale of Sampling for Tests for Hydraulic Characteristics, Reversion, Overall Migration, Density, MFR and Carbon Black Content, Dispersion
(Clause 9.2.4.2)

No. of Pipes	Sample Size
Up to 150	3
151 to 1 200	5
1 201 to 35 000	8

ANNEX A

(Clauses 5.2, 6.1 and 6.2)

EXPLANATORY NOTES

A-1 MASTER BATCH

With the advancement in technology, natural (unpigmented) resin duly stabilised with anti-oxidants (see 5.3) may be compounded/processed with the black master batch fulfilling the requirements as laid down in the standard. This will be strictly permitted only in such cases where the facilities of compounding/processing are available with the pipe manufacturer and the material thus produced shall conform to the material designation (s) given in 5.2.

A-2 TOLERANCE ON OUTSIDE DIAMETER AND MAXIMUM OVALITY

A-2.1 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.

A-2.2 The ovality specified corresponds to Grade N of ISO/DIS 11922-1 'Thermoplastic pipes for transport of fluids, dimensions and tolerances'. The basis for the values specified is:

- a) For nominal outside diameters ≤ 75 , the tolerance equals (0.008 DN + 1.0) mm, rounded to the next higher 0.1 mm, with a minimum value of 1.2 mm.
- b) For nominal outside diameters > 75 and ≤ 250 , the tolerance equals 0.02 DN rounded to the next higher 0.1 mm.
- c) For nominal outside diameters > 250 , the tolerance equals 0.035 DN rounded to the next higher 0.1 mm.

A-3 WALL THICKNESS

A-3.1 The wall thickness of pipes are based on the maximum allowable hydrostatic design stress (σ) of 4.0, 5.0 and 6.3 MPa (see Table 1) at 30°C water temperature for 50 years of life, for the three grades of materials. In case of variation in water temperature, the working pressure needs to be modified as per Fig. 1. However, occasional rise in temperature as in summer season with concurrent corresponding reduction in temperature during night has no deleterious effects on the life and working pressure of the pipes.

A-3.2 Minimum wall thicknesses in mm of the pipe has been calculated as follows and rounded off to the next higher 0.1 mm:

$$s = \frac{p \times d}{2\sigma + p}$$

where

p = maximum permissible working pressure in MPa at 30°C for 50 years of life (see 3.3);

d = nominal outside diameter in mm;

σ = specified maximum allowable hydrostatic design stress, in MPa at 30°C for 50 years of life (see Table 1).

A-3.3 Maximum wall thickness has been calculated as follows:

- a) For pipes with an outside diameter less than or equal to 355 mm, maximum wall thickness = (1.1 x minimum wall thickness + 0.2 mm), rounded off to next higher 0.1 mm.
- b) For pipes with outside diameter equal to or greater than 400 mm, maximum wall thickness = (1.15 x minimum wall thickness + 0.2 mm), rounded off to the next higher 0.1 mm.

NOTE — Considering operational problems, maximum wall thickness of pipes are considered around 63 mm.

ANNEX B (Clause 8.1)

INTERNAL PRESSURE CREEP RUPTURE TEST

B-1 GENERAL

The test shall be carried out not earlier than 24 hours after the pipes have been manufactured.

B-2 TEST SPECIMENS

A sample of pipe having free length between the end fittings equal to ten times the outside diameter but not less than 250 mm and not greater than 750 mm, shall be taken for testing from each pipe to be tested.

B-3 APPARATUS

Equipment permitting the application of a controlled internal hydraulic pressure to the specimen which are immersed in a thermostatically controlled water-bath.

B-4 PROCEDURE

B-4.1 The pipes shall be fitted with the locking plugs at both ends in such a way that the axial forces coming from the internal pressure are transmitted to the pipe. The pipe shall remain free to move in longitudinal direction.

B-4.2 Through a closable opening in one of the locking plugs, the pipe shall be filled with water at ambient temperature. It shall be then put in a water bath at the test temperature of 80°C (permissible deviation ±1°C) and kept in the bath for minimum one hour to adjust the temperature.

B-4.3 The pressure in the pipe shall then be increased to the test pressure (p) gradually and without shock preferably within 10 to 30 seconds in the bath whose temperature has been adjusted in accordance with **B-4.2**. The pressure with a permissible deviation of ±2.5 percent shall be maintained for the period laid down in Table 6.

The test pressure (p) shall be calculated as follows from the minimum dimensions given in the Table 3 or 4 or 5, as the case may be and the corresponding induced stress values given in Table 6.

$$p = \frac{2\sigma_i s}{(d - s)}$$

where

p = test pressure in MPa;

s = minimum wall thickness in mm;

σ_i = induced stress in MPa; and

d = outside diameter of pipe, in mm.

B-5 ASSESSMENT OF RESULTS

The samples shall not show signs of localized swelling or leakage and shall not burst during the prescribed test duration. The test showing failure within a distance equivalent to the length of end cap from the end shall be disregarded and the test repeated.

ANNEX C

(Clause 8.2)

LONGITUDINAL REVERSION TEST

C-1 APPARATUS

C-1.1 Air Oven — Thermostatically controlled at $110 \pm 2^\circ\text{C}$ and is capable of re-establishing this temperature within 15 minutes after the introduction of test specimen in the oven.

C-1.2 Thermometer — Graduated to 0.5°C .

C-1.3 Test Specimens — Either 3 complete sections of pipe, approximately 200 mm long, shall be taken as test pieces, or where the pipe diameter is greater than 200 mm, pieces of pipe of about 200 mm axial length and with an approximate circumferential arc length of 200 mm shall be prepared by cutting. In such cases, the entire circumference of approximately 200 mm long section of pipe shall be divided into pieces measuring approximately 200 mm square. The direction of the pipe axis shall be marked on the pieces. All pieces are required to be tested. A mark shall be scribed on the external surface approximately 50 mm from each end of the test pieces in the axial direction of pipe (in the case of complete section of pipe, the mark shall be scribed around the whole circumference). The distance between the two marks, l_0 (reference length), shall be approximately 100 mm and shall be measured to the nearest 0.25 mm at ambient temperature.

C-2 PROCEDURE

C-2.1 Place the test pieces concave side up on a glass plate previously dusted with talcum, to ensure that changes in length take place unimpeded. The test pieces

shall not touch each other.

C-2.2 Set the oven temperature at $110 \pm 2^\circ\text{C}$. The glass plate with the test pieces shall then be placed in the oven heated to test temperature and capable of maintaining continuous forced air circulation. The test pieces shall be kept in the oven at the temperatures and for the periods specified below:

<i>Wall Thickness, S</i>	<i>Test Temperature</i>	<i>Period of Stressing</i>
mm	$^\circ\text{C}$	minutes
Up to 8	110 ± 2	60 ± 1
Over 8 up to 16	110 ± 2	120 ± 2

C-2.3 Remove the test pieces from the oven and allow to cool in air, without being moved at the ambient temperature. Measure the minimum distance between the two marks.

C-3 EXPRESSION OF RESULTS

C-3.1 For each test piece, calculate the longitudinal reversion, T , as a percentage, as follows:

$$T = \frac{l_0 - l_1}{l_0} \times 100$$

where l_0 and l_1 , are the distances (reference lengths) in mm before and after the test.

C-3.2 The average value (arithmetic mean) of all the test pieces shall be obtained and reported.

ANNEX D
(Foreword)

COMMITTEE COMPOSITION

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(Continued on page 13)

(Continued from page 12)

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Amendments Issued Since Publication

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AMENDMENT NO. 1 OCTOBER 1995
TO
IS 4984 : 1995 HIGH DENSITY POLYETHYLENE
PIPES FOR WATER SUPPLY — SPECIFICATION

(Fourth Revision)

(Page 7, clause 6.3.2, line 1) — Insert the following matter between the words 'measured' and 'as':

'at the manufacturers end'.

(Page 11, Annex C, clause C-2.2) — Add the following at the end of the informal table:

<i>'Wall Thickness, S</i> mm	<i>Test</i> <i>Temperature, °C</i>	<i>Period of</i> <i>Stressing Minutes</i>
Over 16	110 ± 2	240 ± 5'

(CED 3)

AMENDMENT NO. 2 OCTOBER 2000

TO

**IS 4984 : 1995 HIGH DENSITY POLYETHYLENE PIPES FOR
WATER SUPPLY — SPECIFICATION**

(Fourth Revision)

(Page 4, Table 3) — Substitute the following table for the existing table:

Table 3 Wall Thickness of Pipes for Material Grade PE 63

(Clause 6.2)

All dimensions in millimetres.

Nominal Dia	Wall Thickness of Pipes for Pressure Ratings of													
	PN 2.5		PN 4		PN 6		PN 8		PN 10		PN 12.5		PN 16	
	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
20	—	—	—	—	—	—	—	—	2.3	2.8	2.8	3.3	3.4	4.0
25	—	—	—	—	—	—	2.3	2.8	2.8	3.3	3.4	4.0	4.2	4.9
32	—	—	—	—	2.3	2.8	3.0	3.5	3.6	4.2	4.4	5.1	5.4	6.2
40	—	—	2.0	2.4	2.8	3.3	3.7	4.3	4.5	5.2	5.5	6.3	6.7	7.6
50	—	—	2.4	2.9	3.5	4.1	4.6	5.3	5.6	6.4	6.8	7.7	8.4	9.5
63	2.0	2.4	3.0	3.5	4.4	5.1	5.8	6.6	7.0	7.9	8.6	9.7	10.5	11.8
75	2.3	2.8	3.6	4.2	5.3	6.1	6.9	7.8	8.4	9.5	10.2	11.5	12.5	14.0
90	2.8	3.3	4.3	5.0	6.3	7.2	8.2	9.3	10.0	11.2	12.2	13.7	15.0	16.7
110	3.4	4.0	5.3	6.1	7.7	8.7	10.0	11.2	12.3	13.8	14.9	16.6	18.4	20.5
125	3.8	4.4	6.0	6.8	8.8	9.9	11.4	12.8	13.9	15.5	16.9	18.8	20.9	23.2
140	4.3	5.0	6.7	7.6	9.8	11.0	12.8	14.3	15.6	17.4	19.0	21.1	23.4	26.0
160	4.9	5.6	7.7	8.7	11.2	12.6	14.6	16.3	17.8	19.8	21.7	24.1	26.7	29.6
180	5.5	6.3	8.6	9.7	12.6	14.1	16.4	18.3	20.0	22.2	24.4	27.1	30.0	33.2
200	6.1	7.0	9.6	10.8	14.0	15.6	18.2	20.3	22.3	24.8	27.1	30.1	33.4	37.0
225	6.9	7.8	10.8	12.1	15.7	17.5	20.5	22.8	25.0	27.7	30.5	33.8	37.5	41.5
250	7.6	8.6	12.0	13.4	17.5	19.5	22.8	25.3	27.8	30.8	33.8	37.4	41.7	46.1
280	8.5	9.6	13.4	15.0	19.6	21.8	25.5	28.3	31.2	34.6	37.9	41.9	46.7	51.6
315	9.6	10.8	15.0	16.7	22.0	24.4	28.7	31.8	35.0	38.7	42.6	47.1	52.5	58.0
355	10.8	12.1	17.0	18.9	24.8	27.5	32.3	35.8	39.5	43.7	48.0	53.0	59.2	65.4
400	12.2	14.3	19.1	22.2	28.0	32.4	36.4	42.1	44.5	51.4	54.1	62.5	—	—
450	13.7	16.0	21.5	25.0	31.4	36.4	41.0	47.4	50.0	57.7	—	—	—	—
500	15.2	17.7	23.9	27.7	34.9	40.4	45.5	52.6	55.6	64.2	—	—	—	—
560	17.0	19.8	26.7	31.0	39.1	45.2	51.0	58.9	—	—	—	—	—	—
630	19.1	22.2	30.0	34.7	44.0	50.8	57.3	66.1	—	—	—	—	—	—
710	21.6	25.1	33.9	39.2	49.6	57.3	—	—	—	—	—	—	—	—
800	24.3	28.2	38.1	44.1	55.9	64.5	—	—	—	—	—	—	—	—
900	27.3	31.6	42.9	49.6	—	—	—	—	—	—	—	—	—	—
1 000	30.4	35.2	47.7	55.1	—	—	—	—	—	—	—	—	—	—

(Page 5, Table 4) — Substitute the following table for the existing table:

Table 4 Wall Thickness of Pipes for Material Grade PE 80

(Clause 6.2)

All dimensions in millimetres.

Nominal Dia	Wall Thickness of Pipes for Pressure Ratings of													
	PN 2.5		PN 4		PN 6		PN 8		PN 10		PN 12.5		PN 16	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
DN (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
20	—	—	—	—	—	—	—	—	—	—	2.3	2.8	2.8	3.3
25	—	—	—	—	—	—	—	—	2.3	2.8	2.8	3.3	3.5	4.1
32	—	—	—	—	—	—	2.4	2.9	3.0	3.5	3.6	4.2	4.5	5.2
40	—	—	—	—	2.3	2.8	3.0	3.5	3.7	4.3	4.5	5.2	5.6	6.4
50	—	—	2.3	2.8	2.9	3.4	3.8	4.4	4.6	5.3	5.6	6.4	6.9	7.8
63	—	—	2.5	3.0	3.6	4.2	4.7	5.4	5.8	6.6	7.0	7.9	8.7	9.8
75	—	—	2.9	3.4	4.3	5.0	5.6	6.4	6.9	7.8	8.4	9.5	10.4	11.7
90	2.3	2.8	3.5	4.1	5.1	5.9	6.7	7.6	8.2	9.3	10.0	11.2	12.5	14.0
110	2.7	3.2	4.3	5.0	6.3	7.2	8.2	9.3	10.0	11.2	12.3	13.8	15.2	17.0
125	3.1	3.7	4.9	5.6	7.1	8.1	9.3	10.5	11.4	12.8	13.9	15.5	17.3	19.3
140	3.5	4.1	5.4	6.2	8.0	9.0	10.4	11.7	12.8	14.3	15.6	17.4	19.4	21.6
160	4.0	4.6	6.2	7.1	9.1	10.3	11.9	13.3	14.6	16.3	17.8	19.8	22.1	24.6
180	4.4	5.1	7.0	7.9	10.2	11.5	13.4	15.0	16.4	18.3	20.0	22.2	24.9	27.6
200	4.9	5.6	7.7	8.7	11.4	12.8	14.9	16.6	18.2	20.3	22.3	24.8	27.6	30.6
225	5.5	6.3	8.7	9.8	12.8	14.3	16.7	18.6	20.5	22.8	25.0	27.7	31.1	34.5
250	6.1	7.0	9.7	10.9	14.2	15.9	18.6	20.7	22.8	25.3	27.8	30.8	34.5	38.2
280	6.9	7.8	10.8	12.1	15.9	17.7	20.8	23.1	25.5	28.3	31.2	34.6	38.7	42.8
315	7.7	8.7	12.2	13.7	17.9	19.9	23.4	26.0	28.7	31.8	35.0	38.7	43.5	48.1
355	8.7	9.8	13.7	15.3	20.1	22.4	26.3	29.2	32.3	35.8	39.5	43.7	49.0	54.1
400	9.8	11.5	15.4	18.0	22.7	26.4	29.7	34.4	36.4	42.1	44.5	51.4	55.2	63.7
450	11.0	12.9	17.4	20.3	25.5	29.6	33.4	38.7	41.0	47.4	50.0	57.7	—	—
500	12.2	14.3	19.3	22.4	28.4	32.9	37.1	42.9	45.5	52.6	55.6	64.2	—	—
560	13.7	16.0	21.6	25.1	31.7	36.7	41.5	48.0	51.0	58.9	—	—	—	—
630	15.4	18.0	24.3	28.2	35.7	41.3	46.7	54.0	57.3	66.1	—	—	—	—
710	17.4	20.3	27.4	31.8	40.2	46.5	52.6	60.7	—	—	—	—	—	—
800	19.6	22.8	30.8	35.7	45.3	52.3	—	—	—	—	—	—	—	—
900	22.0	25.5	34.7	40.2	51.0	58.9	—	—	—	—	—	—	—	—
1 000	24.4	28.3	38.5	44.5	56.7	65.5	—	—	—	—	—	—	—	—

(Page 6, Table 5) — Substitute the following table for the existing table:

Table 5 Wall Thickness of Pipes for Material Grade PE 100

(Clause 6.2)

All dimensions in millimetres.

Nominal Dia	Wall Thickness of Pipes for Pressure Ratings of									
	PN 6		PN 8		PN 10		PN 12.5		PN 16	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
DN (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
20	—	—	—	—	—	—	—	—	2.3	2.8
25	—	—	—	—	—	—	2.3	2.8	2.9	3.4
32	—	—	—	—	2.4	2.9	2.9	3.4	3.7	4.3
40	—	—	2.4	2.9	3.0	3.5	3.7	4.3	4.6	5.3
50	2.3	2.8	3.0	3.5	3.7	4.3	4.6	5.3	5.7	6.5
63	2.9	3.4	3.8	4.4	4.7	5.4	5.7	6.5	7.1	8.1
75	3.5	4.1	4.5	5.2	5.6	6.4	6.8	7.7	8.5	9.6
90	4.1	4.8	5.4	6.2	6.7	7.6	8.2	9.3	10.2	11.5
110	5.0	5.7	6.6	7.5	8.1	9.2	10.0	11.2	12.4	13.9
125	5.7	6.5	7.5	8.5	9.2	10.4	11.3	12.7	14.1	15.8
140	6.4	7.3	8.4	9.5	10.3	11.6	12.7	14.2	15.8	17.6
160	7.3	8.3	9.6	10.8	11.8	13.2	14.5	16.2	18.1	20.2
180	8.2	9.3	10.8	12.1	13.3	14.9	16.3	18.2	20.3	22.6
200	9.1	10.3	12.0	13.4	14.8	16.5	18.1	20.2	22.6	25.1
225	10.3	11.6	13.5	15.1	16.6	18.5	20.4	22.7	25.4	28.2
250	11.4	12.8	15.0	16.7	18.4	20.5	22.6	25.1	28.2	31.3
280	12.8	14.3	16.8	18.7	20.6	22.9	25.3	28.1	31.6	35.0
315	14.4	16.1	18.9	21.0	23.2	25.8	28.5	31.6	35.5	39.3
355	16.2	18.1	21.2	23.6	26.2	29.1	32.1	35.6	40.0	44.2
400	18.2	21.2	23.9	27.7	29.5	34.2	36.2	41.9	45.1	52.1
450	20.5	23.8	26.9	31.2	33.1	38.3	40.7	47.1	50.8	58.7
500	22.8	26.5	29.9	34.6	36.8	42.6	45.2	52.2	56.4	65.1
560	25.5	29.6	33.5	38.8	41.2	47.6	50.6	58.4	—	—
630	28.7	33.3	37.7	43.6	46.4	53.6	56.9	65.7	—	—
710	32.3	37.4	42.4	49.0	52.3	60.4	—	—	—	—
800	36.4	42.1	47.8	55.2	58.9	68.0	—	—	—	—
900	41.0	47.4	53.8	62.1	—	—	—	—	—	—
1 000	45.5	52.6	—	—	—	—	—	—	—	—

Amendment No. 2 to IS 4984 : 1995

(Page 7, clause 7, second sentence) — Substitute the following for the existing :

‘The ends of the pipes shall be cleanly cut square with the axis to within the tolerances given below and free from deformity.’

(Page 7, clause 7) — Add the following at the end:

<i>Nominal diameter</i> DN mm	<i>Maximum out of square</i> <i>of pipe end</i> mm
16 to 75	2
90 to 125	3
140 to 180	4
200 to 280	5
Above 280	7

(Page 9, Annex A, A-1) — Substitute the following for the existing clause:

‘A-1 MASTER BATCH

With the advancement in technology natural (unpigmented) resin designation PEEAA-45-T-006 of IS 7328 : 1992 or PEEAA-45-T-012 of IS 7328 : 1992 with the exception that the melt flow rating (MFR) shall not be less than 0.40 g/10 minutes or shall not exceed 1.10 g/10 minutes, duly stabilised with anti-oxidants (see 5.3) may be compounded with suitable black master batch or processed directly after physical mixing with suitable black master batch in the pipe extruder for production of pipes, which shall conform to the performance requirements of the pipe as specified in this standard (see 8). The material of the pipe thus produced shall conform to the requirements of 5.2.’

**AMENDMENT NO. 3 SEPTEMBER 2003
TO
IS 4984 : 1995 HIGH DENSITY POLYETHYLENE PIPES
FOR WATER SUPPLY — SPECIFICATION**

(Fourth Revision)

(Page 2, clause 5.2.1, line 1 and 2) — Substitute '940.0 kg/m³ and 958.0 kg/m³' for '940.5 kg/m³ and 946.4 kg/m³'.

(Page 2, clause 5.2.2, line 1 and 2) — Substitute '0.20 and 1.10' for '0.41 and 1.10'

(CED 50)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 SEPTEMBER 2004
TO
IS 4984 : 1995 HIGH DENSITY
POLYETHYLENE PIPES FOR WATER SUPPLY —
SPECIFICATION

(Fourth Revision)

(Page 1, clause 2) — Substitute 'IS 9845 : 1998' for 'IS 9845 : 1986' and substitute the following for existing title:

'Determination of overall migration of constituents of plastics materials and articles intended to come in contact with foodstuffs — Method of analysis'

(Page 2, clause 5.2, first para) — Substitute the following for the existing:

'High density polyethylene (HDPE) used for the manufacture of pipes shall conform to designation PEEWA-45-T-003 or PEEWA-45-T-006 or PEEWA-50-T-003 or PEEWA-50-T-006 or PEEWA-57-T-003 or PEEWA-57-T-006 of IS 7328. HDPE conforming to designation PEEWA-45-T-012 or PEEWA-50-T-012 or PEEWA-57-T-012 of IS 7328 may also be used with the exception that melt flow rating (MFR) shall be between 0.20 g/10 min to 1.10 g/10 min (both inclusive). In addition the material shall also conform to 5.6.2 of IS 7328 (see A-1).'

[Page 2, clause 5.2.1, line 2 (see also Amendment No. 3)] — Substitute '958.4' for '958.0'.

[Page 2, clause 5.2.2, lines 1 and 2 (see also Amendment No. 3)] — Substitute '0.20 g/10 min and 1.10 g/10 min' for '0.20 and 1.10'.

(Page 7, clause 8.3, lines 2 and 4)] — Substitute 'IS 9845 : 1998' for 'IS 9845 : 1986' and 'IS 10146 : 1982' for '10146 : 1987'.

(Page 7, clause 8.5) — Substitute the following for the existing:

'When tested from a composite sample of minimum three pipes, as per IS 2530, at 190°C with nominal load of 5 kgf, MFR shall be between 0.20 g/10 min to 1.10 g/10 min. The MFR shall also be within ± 30 percent of the MFR of the material used in manufacturing of pipes (see 5.2.2).

Amend No. 4 to IS 4984 : 1995

[Page 9, Annex A, clause A-1 (see also Amendment No. 2)] — Substitute the following for the existing:

'With the advancement in technology natural (unpigmented) resin designation PEEAA-45-T-003 or PEEAA-45-T-006 or PEEAA-50-T-003 or PEEAA-50-T-006 or PEEAA-57-T-003 or PEEAA-57-T-006 of IS 7328 and PEEAA-45-T-012 or PEEAA-50-T-012 or PEEAA-57-T-012 of IS 7328 with the exception that melt flow rating (MFR) shall be between 0.20 g/10 min to 1.10 g/10 min (both inclusive) duly stabilized with antioxidants (see 5.3) may be compounded with suitable black master batch or processed directly after physical mixing with suitable black master batch in the pipe extruder for production of pipe which shall conform to the performance requirements of the pipes as specified in this standard (see 8). The material of pipe thus produced shall conform to requirements of 5.2.'

(CED 50)

**AMENDMENT NO. 5 AUGUST 2006
TO
IS 4984 : 1995 HIGH DENSITY POLYETHYLENE PIPES
FOR WATER SUPPLY — SPECIFICATION**

(Fourth Revision)

(Page 7, Table 6, col heading 4) — Insert 'h' at the end.

(CED 50)