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मानक

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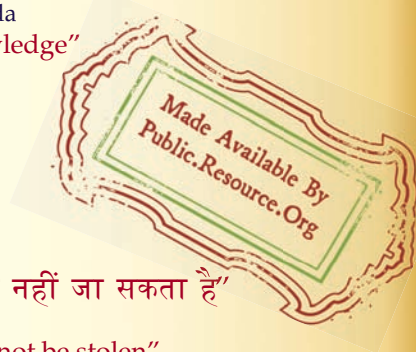
IS 14151-1 (1999): Irrigation Equipment - Sprinkler Pipes,
Part 1: Polyethylene Pipes [FAD 17: Farm Irrigation and
Drainage Systems]



“ज्ञान से एक नये भारत का निर्माण”

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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

सिंचाई उपस्कर — सिंक्रलर पाइप — विशिष्टि

भाग 1 पालीएथिलीन पाइप

(पहला पुनरीक्षण)

Indian Standard

IRRIGATION EQUIPMENT —
SPRINKLER PIPES — SPECIFICATION

PART 1 POLYETHYLENE PIPES

(First Revision)

ICS 65.060.35

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Irrigation and Farm Drainage Equipment and System Sectional Committee had been approved by the Food and Agriculture Division Council.

Sprinkler irrigation system is one of the modern techniques being used for irrigation purpose. With the extensive use of polyethylene pipes and couplers with sprinkler irrigation system, a need was felt to prepare this specification in order to have quality pipes for intended use.

This standard is published in two parts. This part covers the requirements of polyethylene pipes whereas Part 2 covers requirements of quick coupled polyethylene pipes.

This standard was first published in 1994. During implementation of the standard, number of suggestions were received. A need was therefore, felt to revise this in view of the following:

- a) To incorporate Amendments 1 to 3;
- b) To specify 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 'High density polyethylene materials for moulding and extrusion (*first revision*)' as material requirement;
- c) To specify the base density of HDPE resin between 940.4 to 946.4 when determined at 27°C;
- d) To delete density toluene extract volatile matter and average particle size requirement of carbon black due to difficulty in testing these parameters;
- e) To incorporate ovality requirement;
- f) To change temperature for internal pressure creep rupture test from 70°C to 80°C and test duration from 100 h to 165 h for quality test and 70 h to 48 h for acceptance test;
- g) To change temperature for reversion test from 100°C to 110°C;
- h) To incorporate fusion compatibility test; and
- j) To update the standard.

The principles of selection of PE pipes for Sprinkler Irrigation Systems are given in Annex C for guidance.

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

IRRIGATION EQUIPMENT — SPRINKLER PIPES — SPECIFICATION

PART 1 POLYETHYLENE PIPES

(*First Revision*)

1 SCOPE

This standard lays down requirements and method of tests for polyethylene pipes of outside diameter from 40 to 200 mm to be used for Sprinkler Irrigation Systems as mains, submains or laterals.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision 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:

<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
4984 : 1995	High density polyethylene pipes for water supply (<i>fourth revision</i>)
7328 : 1992	High density polyethylene materials for moulding and extrusion (<i>first revision</i>)

3 CLASSIFICATION OF PIPES

The pipe shall be classified by pressure ratings (working pressure) as follows:

<i>Class of Pipes</i>	<i>Maximum Permissible Working Pressure at 30°C</i>
Class 1	0.25 MPa
Class 2	0.32 MPa
Class 3	0.40 MPa
Class 4	0.60 MPa

4 MATERIAL

4.1 High density polyethylene (HDPE) used for the manufacture of pipes shall conform to designation PEEWA-45-T-006 of IS 7328. HDPE conforming to designation PEEWA-45-T-012 of IS 7328 may also be used with the exception that melt flow rating (MFR) shall not exceed 1.10 g/10 min.

4.1.1 The specified base density shall be between 940.4 kg/m³ and 946.4 kg/m³ (both inclusive) when determined at 27°C according to procedure prescribed in Annex A of IS 7328. 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.

4.1.2 The MFR of the material shall be between 0.41 and 1.10 (both inclusive) when tested at 190°C with a nominal load of 50 N as determined by method prescribed in **7** of IS 2530. The MFR of the material shall also be within ± 20 percent of the value declared by the manufacturer.

4.1.3 Polyethylene material of grade PE 63 (*see* Table 1 of IS 4984) and above shall be used for pipe manufacture.

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

NOTE — With the advancement of technology, natural (unpigmented) resin duly stabilized with anti-oxidants (*see* **4.3**) 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 **4.1**.

4.2 Carbon Black

The carbon black content in the material shall be within 2.5 ± 0.5 percent and the dispersion of carbon black shall be satisfactory when tested according to the procedure described in **10** and **16** of IS 2530 respectively. Carbon-black content and dispersion tests shall be performed on the end product (pipe).

4.3 Anti-oxidant

The percentage of anti-oxidant in the base resin shall not be more than 0.5 percent by mass.

4.4 Reworked Material

Addition of not more than 10 percent of the manufacturer's own rework material produced during the manufacture and works testing of pipes complying with this standard is permitted. No other rework material shall be used.

5 DIMENSIONS OF PIPES

5.1 The outside diameters, tolerances, ovality and wall thicknesses of pipes shall be as given in Table 1.

Table 1 Dimensions of Polyethylene Pipes for Sprinkler Irrigation
(Clauses 5.1 and A-4.3)

All dimensions in millimetres.

Nominal Diameter	Outside Diameter	Nominal Tolerance on Outside Diameter	Ovality	Wall Thickness (e)							
				Class 1 (0.25 MPa)		Class 2 (0.32 MPa)		Class 3 (0.4 MPa)		Class 4 (0.6 MPa)	
				Min	Max	Min	Max	Min	Max	Min	Max
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
40	40.0	+0.4	1.4	-	-	-	-	-	-	2.3	2.8
50	50.0	+0.5	1.4	-	-	-	-	2.0	2.4	2.9	3.4
63	63.0	+0.6	1.5	-	-	2.0	2.4	2.5	2.9	3.8	4.4
75	75.0	+0.7	1.6	2.0	2.4	2.5	2.9	3.0	3.4	4.5	5.2
90	90.0	+0.8	1.8	2.2	2.6	2.9	3.4	3.5	4.1	5.3	6.1
110	110.0	+1.0	2.2	2.7	3.2	3.4	3.9	4.2	4.8	6.5	7.4
125	125.0	+1.2	2.5	3.1	3.6	3.8	4.5	4.8	5.5	7.4	8.3
140	140.0	+1.3	2.8	3.5	4.1	4.3	5.0	5.4	6.1	8.3	9.3
160	160.0	+1.5	3.2	3.9	4.5	4.9	5.6	6.2	7.0	9.4	10.6
180	180.0	+1.7	3.6	4.4	5.0	5.5	6.3	6.9	7.8	10.6	11.9
200	200.0	+1.8	4.0	4.9	5.6	6.1	7.0	7.7	8.7	11.8	13.2

NOTES

- 1 Wall thickness of pipes are based on safe working stress of 5.0 MPa at 35°C for transport of cold water at atmospheric temperature. Occasional rise in temperature has no deleterious effects on the life and working pressure of the pipes.
- 2 Normal working conditions of pipes shall be operation of maximum 3 000 pumping hours per year at the pressure rating of pipe and at water temperature up to 35°C. If these working conditions are exceeded the next higher class of pipe with greater wall thickness should be chosen. With these working conditions the life expectancy of the pipe is 15 years.

5.1.1 The outside diameter of the pipe shall be the average of two measurements taken at right angles for pipes up to 110 mm outside diameter. For sizes greater than 110 mm the diameter shall be measured by using a flexible Pi tape or with 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 ends of the pipe.
- 2 In the case of dispute the dimension of pipes shall be measured after conditioning at room temperature for 4 hours.

5.1.2 Ovality shall be measured as the difference between maximum outside diameter and minimum outside diameter during manufacturing after extrusion but prior to coiling at the same cross section of the pipe, at 300 mm away from the cut end.

6 VISUAL APPEARANCE

6.1 The internal and external surface of the pipes shall be smooth, clean and free from grooving, pit marks and melt fractures. The ends shall be cleanly

cut and shall be square with axis of the pipe. Slight shallow longitudinal grooves or irregularities in the wall thickness shall be permissible, provided the wall thickness remains within the permissible limits.

7 PERFORMANCE REQUIREMENTS

7.1 Hydraulic Characteristics

When subjected to internal pressure creep rupture test in accordance with the procedure given in Annex A; the pipes shall show no signs of localized swelling, leakage or weeping, and shall not rupture during the prescribed test duration. The temperature, duration of test and stresses for quality and acceptance test shall be as given in Table 2.

7.1.1 Acceptance tests carried out at a temperature of 80°C allow a fast verification of the conformity to requirements of 7.1.

Table 2 Requirements for Internal Pressure Creep Rupture Test
(Clauses 7.1 and A-4.3)

Test	Test Temperature	Test Duration (Minimum Holding Time)	Induced Stresses
	°C	h	(MPa)
(1)	(2)	(3)	(4)
Quality test	80	165	3.5
Acceptance test	80	48	3.8

7.1.2 Quality tests carried out at a temperature of 80°C allow evaluation of the manufacturing process and the pipe material used and must be carried out once every year or when change is made in polymer composition or method of manufacture or when a new size of pipe is to be introduced.

7.1.3 For quality tests the manufacturer shall supply three samples of different diametres selected from a regular lot, which will be tested by testing authority. In the absence of a recognized testing laboratory, a certificate for compliance of pipe issued by the manufacturers laboratory may be accepted.

7.1.4 If all the three samples, each of different diameters pass the requirements of the quality test, the type of pipe under consideration shall be considered eligible for quality approval which will be normally valid for a period of one year.

7.1.5 In case any of the samples fails in quality test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number and subject them to quality tests. If in repeat tests no single failure occurs, the type of pipe under consideration shall be considered eligible for approval. If any of the samples fails in the repeat tests, the type of pipe shall not be approved. The manufacturers may be asked to improve the design and re-submit the pipe for quality approval.

7.2 Reversion Test

A pipe length of 200 mm shall be placed horizontally

on a support in an air-oven or a suitable liquid bath at temperature of $110 \pm 2^\circ\text{C}$ for 60 minutes in such a way that the dimensional changes in the pipe section are not impeded.

After cooling to room temperature, the dimensional change of the pipe section shall be measured in the longitudinal direction and deviation from the initial length shall be calculated and stated in percentage. The dimension shall not change by more than ± 3 percent in the longitudinal direction.

7.3 Tensile Test

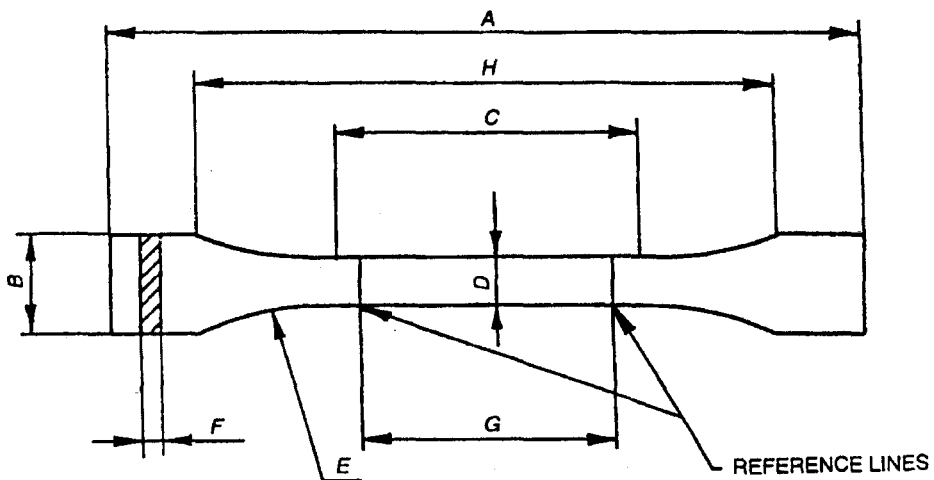
The tensile strength and elongation at break at $27 \pm 2^\circ\text{C}$ for different thicknesses of the pipes shall be as follows:

<i>Tensile Strength, Min</i>	<i>Testing Speed</i>	<i>Elongation at Break, Min</i>
16 MPa	100 mm/min ± 10 percent	350 percent

7.3.1 Test Pieces

Test Piece Type 1/2

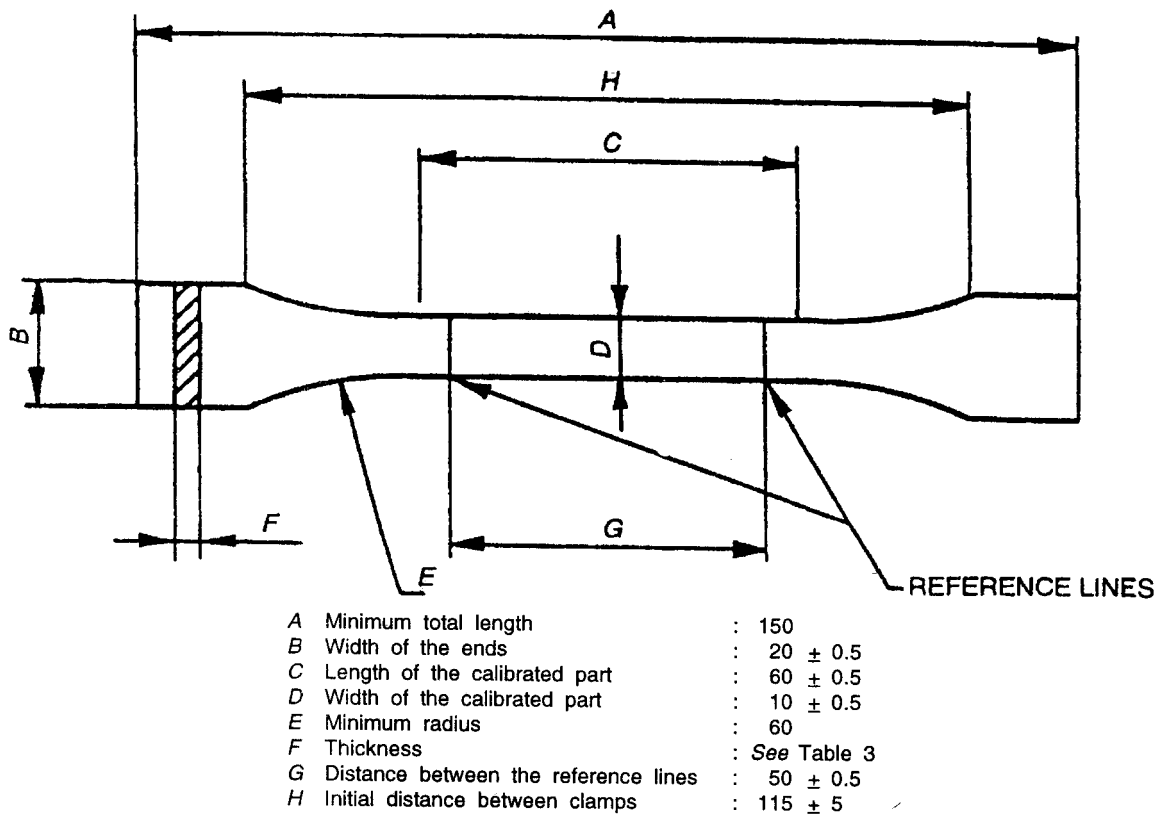
The shape and dimensions of this test piece are given in Fig. 1. This is more particularly intended for determining the tensile properties of smaller diameter pipes.



A	Minimum total length	: 75
B	Width of the ends	: 10 ± 0.5
C	Length of the calibrated part	: 30 ± 0.5
D	Width of the calibrated part	: 5 ± 0.5
E	Minimum radius	: 30
F	Thickness	: See Table 3
G	Distance between the reference lines	: 25 ± 0.5
H	Initial distance between clamps	: 60 ± 5

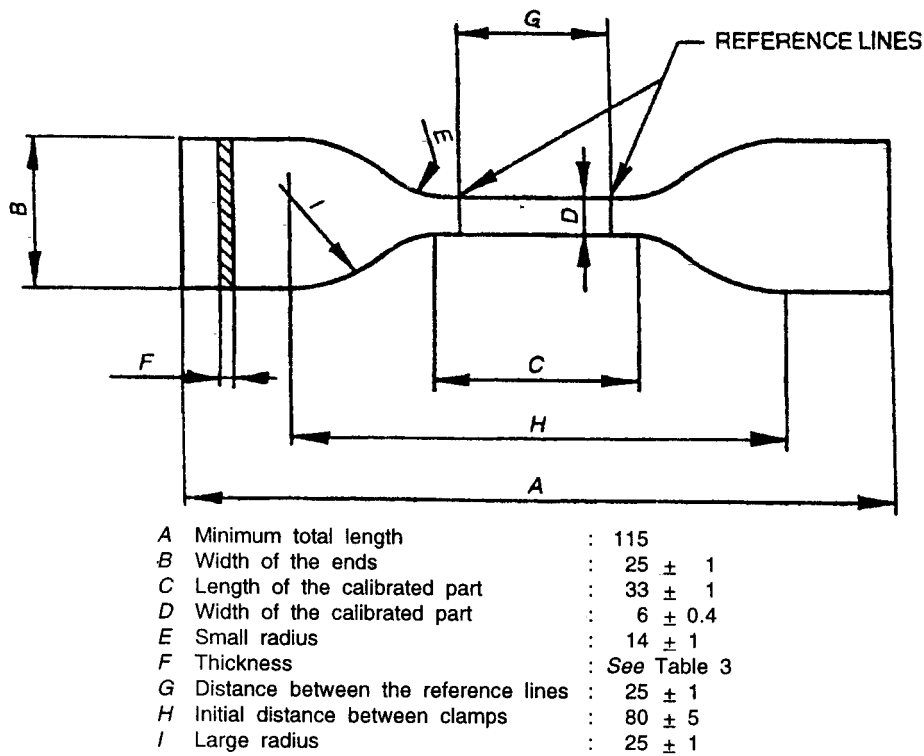
All dimensions in millimetres.

FIG. 1 TEST PIECE, TYPE 1/2



All dimensions in millimetres.

FIG. 2 TEST PIECE, TYPE 1



All dimensions in millimetres.

FIG. 3 TEST PIECE, TYPE 2

Test Piece Type 1

The shape and dimensions of this test piece is given in Fig. 2.

Test Piece Type 2

The shape and dimensions of this test piece is given in Fig. 3.

7.3.2 Number of Test Pieces

The number of test pieces to be used for determining the tensile properties of a pipe depends on the lot size (see Table 5).

7.3.3 Taking of Test Pieces

7.3.3.1 The test pieces from the pipe shall be taken in such a way that it is not flattened, that is without heating, so that the test piece axes are parallel to the axis of the pipe and in such a manner that they are regularly distributed around the circumference of the pipe.

7.3.3.2 To achieve this, use a sufficiently long piece of pipe, and divide its circumference into a certain number of sectors with an arc length of approximately 150 mm. From these divisions, mark out strips with a length equal to that of the test piece of pipe (see Fig. 4).

For example, a pipe with an external diameter of 200 mm and a circumference of approximately 630 mm will be divided into four strips.

7.3.3.3 In the middle of each of these strips, take a test piece, by means of a punch with sharp cutting edges free from burrs, and with a profile complying with one of the Fig. 1, 2 or 3 (see Table 3). Cut out the test piece by applying the punch to the inner surface of the strip and by exerting uniform pressure.

7.3.3.4 Draw two reference lines, equidistant from the ends of the waisted part of the test piece as shown

in Fig. 1, 2 and 3. Mark these lines with a wax crayon or with ink which does not affect the properties of polyethylene. The reference marks must not under any circumstances form scratches, nor shall they be stamped or printed on the test piece.

7.3.3.5 As a function of the pipe wall thickness (e), the test shall be carried out with the test pieces as given in Table 3.

7.3.4 Procedure

The test piece shall be conditioned for two hours in air or one hour in water so that it is at a temperature of $27 \pm 2^\circ\text{C}$ immediately before test. The test shall be carried out as given in 6.5 of IS 2530 at testing speed of 100 mm/min.

Table 3 Selection of Test Pieces
(Clauses 7.3.3.3 and 7.3.3.5 and Fig. 1, 2 and 3)

Sl No.	Wall Thickness (e) of the Pipe mm	Test Piece Type	Thickness of Test Piece (F) mm	Remarks
(1)	(2)	(3)	(4)	(5)
i)	$e \leq 5$	1/2 or 1	e	Non-machined ¹⁾
ii)	$5 < e < 10$	1	e	Non-machined ¹⁾
iii)	$e \geq 10$	2	10	Machined ²⁾

¹⁾ Non-machined test piece (thickness of test piece equal to the thickness of the pipe).

²⁾ Machined test piece — Two series of test pieces are prepared. The thickness of test pieces is brought down to 10 mm by suitable machining, which does not cause any heating of the machined surface, and which enables a smooth surface to be obtained. For the first series, the inside surface of the pipe is machined and for the second series the outer surface of the pipe is machined.

Only the series which has given the lowest results is taken into consideration for the test result.

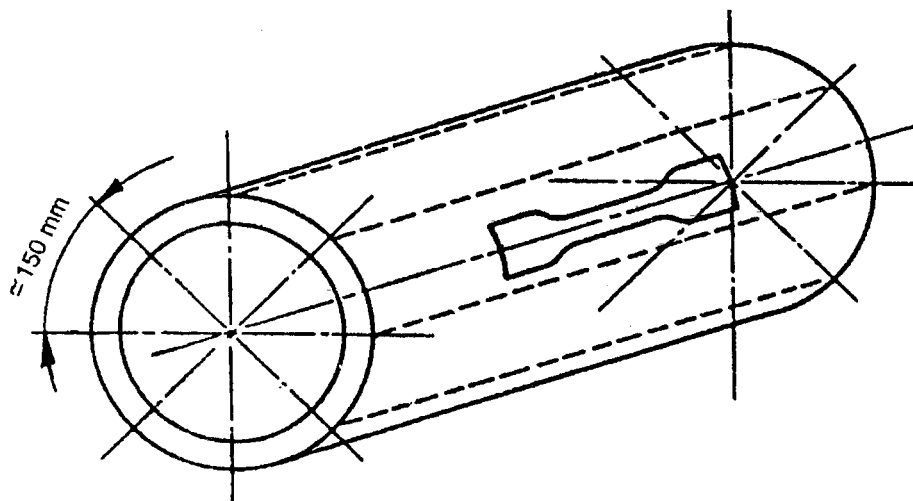


FIG. 4 TAKING OF TEST PIECES

7.4 Fusion Compatibility Test

7.4.1 If pipes manufactured are to be joined by butt fusion, socket fusion or using electrofusion fitting mixing different pipe materials, joint shall conform to the requirements specified in Table 2.

7.4.2 The total length of test piece including joint shall be as specified in A-2.1 with equal length on both the sides of joint.

8 SUPPLY OF PIPES

The pipe length excluding coupler attachment shall be either 3 m or 6 m $\pm$ 0.01 m for shiftable sprinkler systems or as coils with a minimum inner diameter of 25 times the outer diameter of the pipe. The pipes may also be supplied in other lengths where so agreed to between the manufacturer and the purchaser. The ends shall be cut at right angles to the pipe axis.

9 SAMPLING AND CRITERIA FOR CONFORMITY

The sampling procedure to be adopted and the criteria for conformity shall be as given in Annex B.

10 MARKING

10.1 Each pipe shall be indelibly marked in english at intervals of not more than 6 m by heat embossing

or in colour as indicated in 10.1.1. The marking shall show the following:

- a) Manufacturer's name or trade-mark,
- b) Outside diameter,
- c) Class of pipe, and
- d) Batch number.

10.1.1 The information specified in 10.1 shall be indelibly marked in colour or heat embossed as indicated below for different classes of pipes:

<i>Class of Pipe</i>	<i>Colour</i>
Class 1	Orange
Class 2	Red
Class 3	Blue
Class 4	Green

10.2 BIS Certification Marking

Each pipe may also be marked with the Standard Mark.

10.2.1 The use of the Standard Mark is governed by the provisions of *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 Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Clause 7.1)

INTERNAL PRESSURE CREEP RUPTURE TEST

A-1 GENERAL

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

A-2 TEST SPECIMENS

A sample of pipe having free length between the end fittings equal to ten times the outside diameter but neither less than 250 mm nor greater than 750 mm shall be taken for testing from each pipe to be tested.

A-3 APPARATUS

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

A-4 PROCEDURE

A-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.

A-4.2 Through a closable opening in one of the locking plugs, the pipe shall be fitted with water at ambient temperature. It shall be then put in a water bath at the test temperature (permissible deviation

$\pm 1^\circ\text{C}$) and kept in the bath for one hour to adjust the temperature.

A-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 A-4.2. The pressure with permissible deviation of ± 2.5 percent shall be maintained for the period laid down in Table 2. The test pressure (p) shall be calculated from the minimum dimensions given in Table 1 and induced stress values given in Table 2.

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

where

- p = test pressure in MPa,
- s = minimum wall thickness in mm,
- σ_i = induced stress in MPa, and
- d = nominal outside diameter in mm.

A-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 B

(Clause 9)

SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

B-1 LOT

B-1.1 All pipes in a single consignment of the same outside diameter, same wall thickness, same length and manufactured essentially under similar conditions of manufacture shall constitute a lot.

B-1.2 For ascertaining the conformity of the material to the requirements of this specification, samples shall be tested from each lot separately.

B-2 VISUAL AND DIMENSIONAL REQUIREMENTS

B-2.1 The number of samples to be taken from a lot shall depend on the size of the lot and shall be in accordance with Table 4.

B-2.1.1 These pipes shall be selected at random from the lot and in order to ensure randomness of selection, procedures given in IS 4905 shall be followed.

B-2.2 The number of pipes given for the first sample in column 3 of Table 4 shall be taken from the lot and examined for dimensional and visual requirements given in 5 and 6 of the specification. 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 column 5 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 6 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 5 and 6 of Table 4, the second sample of the size given in col 3 of Table 4 shall be taken and examined for these requirements.

Table 4 Scale of Sampling and Permissible Number of Defectives for Visual and Dimensional Requirements*(Clauses B-2.1, B-2.2 and B-2.3)*

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 100	First	3	3	0	2
	Second	3	6	1	2
101 to 300	First	5	5	0	2
	Second	5	10	1	2
301 " 500	First	8	8	0	2
	Second	8	16	1	2
501 and above	First	13	13	0	2
	Second	13	26	1	2

B-2.3 Criterion for Conformity

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 4, otherwise not.

B-3 REVERSION TEST

B-3.1 The lot having satisfied visual and dimensional requirements shall be tested for reversion.

B-3.1.1 For this purpose, the first sample of three pipes shall be taken from the lot. The sample pipe failing in the reversion test shall be considered as defective. If no defective is found in the first sample the lot shall be deemed to have met the requirements given in the specification for reversion test. If, however, only one defective is found in the first sample, a second sample of three pipes shall be taken from the lot and tested for reversion.

B-3.2 Criterion for Conformity

The lot shall be deemed to have met the specification requirement for reversion given in 7.2 if not more than one defective is found in cumulative sample, otherwise not.

B-4 HYDRAULIC AND TENSILE STRENGTH REQUIREMENTS

B-4.1 The lot having met the requirements given in B-2 and B-3 shall be finally tested for internal pressure creep rupture test specified in 7.1 and tensile strength tested specified in 7.3.

B-4.1.1 For this purpose, the number of pipes to be taken at random (see B-2.1.1) from the lot shall be according to Table 5.

Table 5 Scale of Sampling for Hydraulic Characteristics
(Clauses B-4.1.1 and B-5)

No. of Pipes in the Lot	Sample Size
<i>N</i>	<i>n</i>
(1)	(2)
Up to 100	2
101 to 300	4
301 and above	6

B-4.1.2 The number of pipes selected from the lot according to B-4.1.1 shall be randomly divided into two equal sets. Each of the pipes in the first set shall be tested for internal pressure rupture test according to 7.1 and each of the pipes in the second set shall be tested for tensile strength and elongation at break according to 7.3.

B-4.2 Criterion for Conformity

The lot shall be declared as conforming to the requirements of the specification if no failure occurs under B-4.1.2, otherwise not.

B-5 FUSION COMPATIBILITY

For testing the fusion compatibility (if applicable) scale of sampling and criteria for conformity shall be same as given in B-4 except that the sample size shall be half of as given in col 2 of Table 5 and only internal pressure creep rupture test shall be carried out.

ANNEX C

(Foreword)

GUIDELINES FOR SELECTION OF PE PIPES FOR SPRINKLER IRRIGATION

C-1 The pressure class of pipe should be decided after considering;

- total pressure or head in a pipe system, and
- water temperature.

C-1.1 Total pressure in a pipe system is determined by considering:

- sprinkler operating pressure,
- friction head loss in pipes and fittings, and
- static head (the difference in meter between pump and highest point on pipe system).

Select the pressure class of pipe with a working pressure equal or higher than the total pressure.

C-1.2 For water temperature up to 35°C, the class of pipe is selected as per C-1.1. For water temperature of 36 to 40°C, the next higher class is to be selected.

C-2 FRICTION HEAD LOSS CHART

Friction head loss for various diameters of pipes and at various flow rates and velocities is given in Flow Nomogram (see Fig. 5).

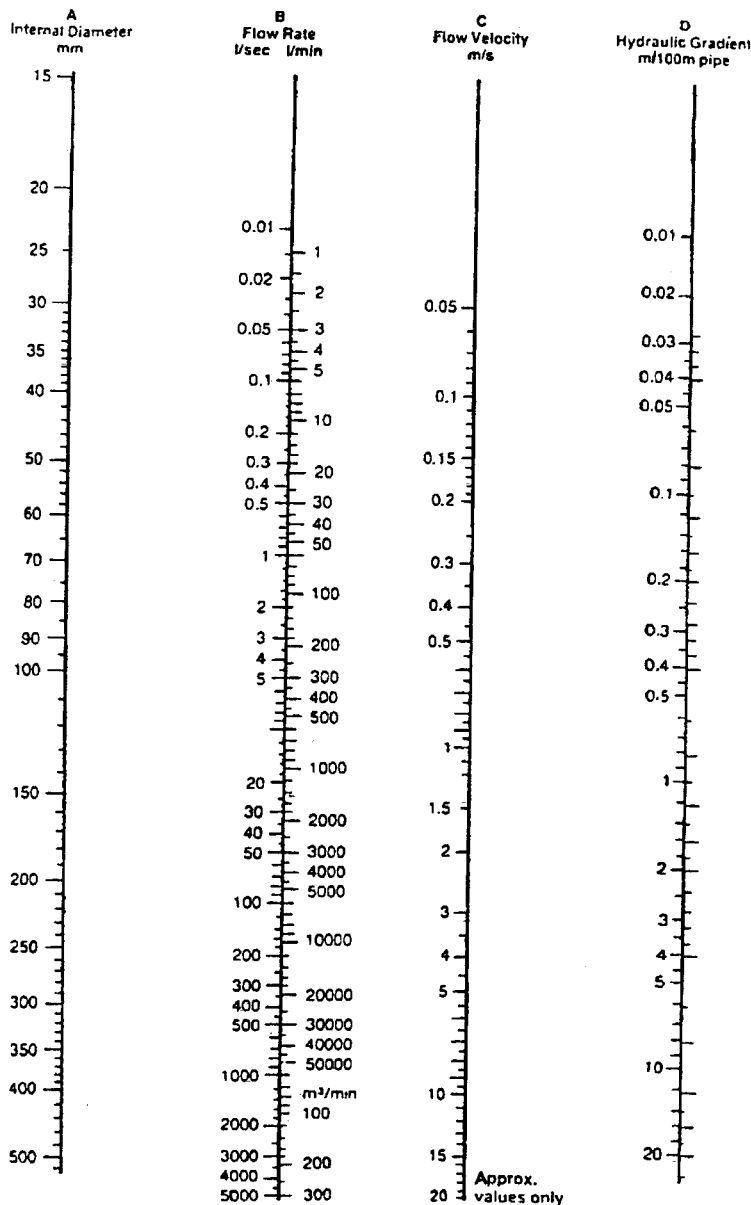


FIG. 5 FLOW NOMOGRAM

AMENDMENT NO. 1 DECEMBER 2000
TO
IS 14151 (PART 1) : 1999 IRRIGATION
EQUIPMENT — SPRINKLER PIPES —
SPECIFICATION

PART 1 POLYETHYLENE PIPES

(First Revision)

(Page 1, clause 4.1) — Insert the following text at the end:

‘In case of master batch (see note under 4.1.3.1), Polyethylene grade PEEAA-45-T006 and PEEAA-45-T-012 of IS 7328 with the exception that melt flow rating (MFR) shall not exceed 1.10 g/10 min, duly stabilized with the Anti-oxidants (see 4.3) may be compounded with carbon black master batch or processed directly with carbon black master batch in the pipe extruder.’

(Page 2, clause 6.1, second sentence) — Substitute the following for the existing sentence:

‘The ends shall be clearly cut and shall be square with the axis within tolerance of 2 mm ~~for~~ out-of-squareness of each pipe end.’

(Page 3, clause 7.3) — Substitute the following for the existing:

‘The tensile strength at yield and elongation at break at $27 \pm 2^{\circ}\text{C}$ for different wall thickness of pipes shall be as follows:

<i>Tensile strength at yield, Min</i>	<i>Test speed (mm/min)</i>	<i>Elongation at break, Min</i>
19 MPa	100 $\pm$ 10	600%

(Page 6, clause 7.4) — Substitute the following for the existing text:

‘7.4 Fusion Compatibility Test

7.4.1 If pipes manufactured are to be joined by butt fusion, socket fusion or using electrofusion fitting mixing same or different pipe materials (that is PE 63, PE 80 or PE 100), joint shall conform to the requirements specified in Table 2.

7.4.2 The length of test piece, with the joint at the middle of the test piece, shall be decided in accordance with A-2.'

(Page 6, clause 7.4.2) — Insert the following new clauses after 7.4.2:

'7.5 Density

When tested from a composite sample of minimum three pipes in accordance with Annex A of IS 7328, it shall conform to requirement given in 4.1.1.

7.6 Melt Flow Rate (MFR)

When tested from a composite sample of minimum three pipes in accordance with 7 of IS 2530 at 190°C with nominal load of 50 N, the MFR shall not differ by more than ± 30 percent of MFR of the material used in manufacturing of pipes (see 4.1.2).'

(FAD 54)

AMENDMENT NO. 2 MAY 2002
TO
IS 14151 (PART 1) : 1999 IRRIGATION
EQUIPMENT — SPRINKLER PIPES — SPECIFICATION
PART 1 POLYETHYLENE PIPES
(First Revision)

[Page 1, clause 4.1 (see also Amendment No. 1)] — Substitute the following for the existing:

‘4.1 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 PEEWA-45-T-012 or PEEWA-50-T-012 or PEEWA-57-T-012 may also be used with the exception that Melt Flow Rating (MFR) shall not exceed 1.10 g/10 min.

In case of master batch (see note under 4.1.3.1), HDPE grades 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 or PEEAA-45-T-012 or PEEAA-50-T-012 or PEEAA-57-T-012, with the exception that Melt Flow Rating (MFR) shall not exceed 1.10 g/10 min, duly stabilized with the anti-oxidants (see 4.3) may be compounded with carbon black master batch in the pipe extruder.’

(Page 1, clause 4.1.1) — Substitute the following for the existing:

‘4.1.1 The specified base density shall be between 940.4 kg/m³ and 958.4 kg/m³ (both inclusive) when tested at 190°C according to procedure given in Annex A of IS 7328. The value of density shall also not differ from the nominal value by more than 3 kg/m³ as per 5.2.2.1 of IS 7328.’

(Page 1, clause 4.1.2) — Substitute the following for the existing:

‘4.1.2 The MFR of the material shall be between 0.2 to 1.1 (both inclusive) when tested at 190 °C at a nominal load of 50 N by the method prescribed in 7 of IS 2530. The MFR of the material shall also be within 20% of the value declared by the manufacturer.’

Amend No. 2 to IS 14151(Part 1) : 1999

[Page 3, clause 7.3 (see also Amendment No. 1)] — Substitute the following for the existing:

‘7.3 Tensile strength at yield and elongation at break at $27 \pm 2^{\circ}\text{C}$ for different wall thicknesses of pipes shall be as follows:

<i>Tensile strength at yield, Min</i>	<i>Test speed (mm/min)</i>	<i>Elongation at Break, Min</i>
19 Mpa	100 ± 10	500%

(Page 6, clause 10.1.1) — Substitute the following for the existing:

‘10.1.1 The information specified in 10.1 shall indelibly marked by heat embossing or in colour as indicated below for different classes of pipes:

<i>Class of Pipe</i>	<i>Colour</i>
Class 1	Orange
Class 2	Red
Class 3	Blue
Class 4	Green’

(Page 8, Table 5, Title) — Substitute the following for the existing title:

‘Table 5 Scale of Sampling for Hydraulic Characteristics and Tensile Tests’

(FAD 54)

AMENDMENT NO. 3 MARCH 2003
TO
IS 14151(PART 1):1999 IRRIGATION EQUIPMENT
SPRINKLER PIPES —SPECIFICATION
PART 1 POLYETHYLENE PIPES
(First Revision)

(Clause 4.1.1, second sentence, amendment No. 2) — Substitute '27°C' for '190°C'.

(FAD 54)

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