भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG, NEW DELHI 110002
Phone: + 91 11 23230131, 23233375, 23239402 Extn 8406, 23608406; Website: www.bis.gov.in

व्यापक परिचालन मसौदा

हमारा संदर्भ : सीईडी 50/टी-76 **13 जून 2022**

तकनीकी समिति : प्लास्टिक पाईपिंग सिस्टम विषय समिति, सीईडी 50

प्राप्तकर्ता :

1 **सिविल इंजीनियरी विभाग परिषद, सीईडीसी के सभी सदस्य**
2 **प्लास्टिक पाईपिंग सिस्टम विषय समिति, सीईडी 50, पोलीओलीफिंस एवं जीआरपी पाइपिंग सिस्टम उपसमिति सीईडी 50:1, पीवीसी एवं एबीएस पाइपिंग सिस्टम उपसमिति, सीईडी 50:2 के सभी सदस्य**
3 **रूचि रखने वाले अन्य निकाय।**

महोदया/महोदय,

निम्नलिखित मसौदा संलग्न है:

प्रलेख संख्या	शीर्षक
सीईडी 50 (19776)WC	**आईएस 15328 : 2003 दाब-रहित भूमिगत जल निकास एंव भवनों के बाहर मल-जल व्यवस्था में प्रयुक्त अप्लास्टिकृत पॉलीविनायल क्लोराइड (पी. वी. सी. यू.) पाइप की विशिष्ट का भारतीय मानक मसौदा (आई सी एस संख्या 83.140.30, 93.030)**

कृपया इस मसौदे का अवलोकन करें और अपनी सम्मतियाँ यह बताते हुए भेजे कि यह मसौदा प्रकाशित हो तो इन पर अमल करने में, आपको व्यवसाय अथवा कारोबार में क्या कठिनाइयॉ आ सकती हैं।

सम्मतियॉ भेजने की अंतिम तिथि: 31 जुलाई 2022

सम्मति यदि कोई हो तो कृपया अधोहस्ताक्षरी को ई मेल द्वारा **madhurima@bis.gov.in** पर या उपरलिखित पते पर, संलग्न फोर्मेट में भेजें।

यदि कोई सम्मति प्राप्त नहीं होती है अथवा सम्मति में केवल भाषा संबंधी त्रुटि हुई तो उपरोक्त प्रलेख को यथावत अंतिम रूप दे दिया जाएगा। यदि सम्मति तकनीकी प्रकृति की हुई तो विषय समिति के अध्यक्ष के परामर्श से अथवा उनकी इच्छा पर आगे की कार्यवाही के लिए विषय समिति को भेजे जाने के बाद प्रलेख को अंतिम रूप दे दिया जाएगा।

यह प्रलेख भारतीय मानक ब्यूरो की वैबसाइट **www.bis.gov.in** पर भी उपलब्ध हैं।

धन्यवाद।

भवदीय

ह/-

(अरुण कुमार एस.)
प्रमुख (सिविल इंजीनियरिंग)

सलंग्न: उपरिलिखित

भारतीय मानक ब्यूरो
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DRAFT IN WIDE CIRCULATION

DOCUMENT DESPATCH ADVICE

Reference	Date
CED 50/T-76	**13 June 2022**

TECHNICAL COMMITTEE:

PLASTIC PIPING SYSTEMS SECTIONAL COMMITTEE, CED 50

ADDRESSED TO:

1. All Members of Civil Engineering Division Council, CEDC
2. All Members of Plastic Piping System Sectional Committee, CED 50, Polyolefins and Piping GRP System Subcommittee, CED 50:1, PVC and ABS Piping System Subcommittee, CED 50:2
3. All others interested

Dear Madam/Sir,

Please find enclosed the following draft:

Doc. No.	Title
CED 50 (19776)WC	**Draft Indian Standard Unplasticized polyvinyl chloride (PVC-U) non-pressure pipes for use in underground drainage and sewerage systems — Specification (ICS No. 83.140.30, 93.030)**

Kindly examine the draft revision and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as National Standards.

Last Date for comments: 31 July 2022

Comments if any, may please be made in the enclosed format and emailed at **madhurima@bis.gov.in** or sent at the above address.

In case no comments are received or comments received are of editorial nature, you will kindly permit us to presume your approval for the above document as finalized. However, in case comments, technical in nature are received, then it may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

The document is also hosted on BIS website **www.bis.gov.in**.

Thanking you,

Yours faithfully,

Sd/-

(Arun Kumar S.)
Head (Civil Engg.)

Encl: As above

FORMAT FOR SENDING COMMENTS ON BIS DOCUMENTS

(Please use A4 size sheet of paper only and type within fields indicated. Comments on each clause/subclause/table/fig etc. be started on a fresh box. Information in column 5 should include reasons for the comments, and those in column 4 should include suggestions for modified wording of the clauses when the existing text is found not acceptable. Adherence to this format facilitates Secretariat's work) {Please e-mail your comments to madhurima@bis.gov.in }

DOC. NO.	**Doc: CED 50 (19776)WC**
TITLE	**Draft Indian Standard Unplasticized polyvinyl chloride (PVC-U) non-pressure pipes for use in underground drainage and sewerage systems — Specification (ICS No. 83.140.30; 93.030)**
LAST DATE OF COMMENTS	**31 July 2022**
NAME OF THE COMMENTATOR/ ORGANIZATION	_____

Sl No. (1)	Clause/Sub-clause/Para No. (2)	Comments/Suggestions (3)	Modified Wording of the Clause (4)	Reasons/ Justifications for the Proposed Changes (5)

Doc: CED 43 (19776)WC
June 2022

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

Draft Indian Standard

UNPLASTICIZED POLYVINYL CHLORIDE (PVC-U) NON-PRESSURE PIPES FOR USE IN UNDERGROUND DRAINAGE AND SEWERAGE SYSTEMS — SPECIFICATION

(*first revision of* IS 15328)

Plastic Piping System Sectional Committee, CED 50	Last Date for Comments: **31 July 2022**

Plastic Piping System Sectional Committee, CED 50

FOREWORD

(*Formal clauses to be added later*)

This standard has been prepared with a view to providing guidance for the manufacture and selection of Unplasticized Polyvinyl Chloride (PVC-U) pipes no pressure type for the conveyance of domestic sewage, industrial waste and surface water (other than potable water).

This standard was first published in 2003. In this revision of the standard, due weightage has been given to bring this standard in line with International Standards as well as take into account current practices of manufacturing and use in the country. In this revision, the following major modifications have been made:

a) The title of the standard has been modified from ‘Unplasticized non-pressure polyvinyl chloride (PVC-U) pipes for use in underground drainage and sewerage systems — Specification’ to ‘Unplasticized polyvinyl chloride (PVC-U) non-pressure pipes for use in underground drainage and sewerage systems — Specification’.
b) The seven amendments issued to the previous version of the standard have been incorporated.
c) Maximum permissible limit of rework material of 5 percent has been added.
d) Pipes with integral sockets for jointing by solvent cement of sizes 250 mm to 630 mm have been added.
e) The requirement of Vicat softening temperature has been modified from 79 °C to 80 °C in line with IS 4985 : 2021 ‘Unplasticized PVC pipes for water supplies — Specification (*fourth revision*)’
f) In place of the existing test procedure given in the standard for the performance testing of elastomeric sealing ring and solvent cemented joints, concerned test methods specified in IS 12235 (Parts 1 to 19) : 2004 ‘Thermoplastic pipes and fittings — Methods of tests (*first revision*)’ have been referred. Also, the sacle of sampling and criteria for conformity for these tests have been added.

g) The colour of marking of SN 8 pipes has been changed to yellow from brown, so as to differentiate it from the colour of the pipe which is also brown.
h) Provisions on sampling and criteria for conformity for ring stiffness test and hydrostatic test have been added.

Considerable assistance has been derived from the following International Standards published by International Organization for Standardization:

ISO 4065 : 2018	Thermoplastics pipes — Universal wall thickness table
ISO 4435 : 2003	Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U)

PVC-U pipes for conveyance of potable water and for agriculture use are covered in IS 4985 : 2021 'Unplasticized PVC pipes for water supplies – Specification (*fourth revision*)'.

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 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

Draft Indian Standard

UNPLASTICIZED POLYVINYL CHLORIDE (PVC-U) NON-PRESSURE PIPES FOR USE IN UNDERGROUND DRAINAGE AND SEWERAGE SYSTEMS — SPECIFICATION

(*first revision of* IS 15328)

Plastic Piping System Sectional Committee, CED 50	Last Date for Comments: **31 July 2022**

1 SCOPE

1.1 This standard specifies the requirements of plain ended or equipped with integral sockets unplasticized polyvinyl chloride (PVC-U) pipes of nominal outside diameters ranging from 63 mm up to and including 630 mm, for either solvent-cement welding or for jointing with elastomeric sealing rings, intended for underground (buried) non-pressure gravity drain and sewer applications for transportation of soil and waste discharge of domestic origin, surface water (storm water) and industrial effluent.

1.1.1 In the case of industrial effluent, chemical and temperature resistance and resistance to suspended matter of the PVC-U material shall be taken into account for which reference may be made to IS 16268.

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.

IS No.	*Title*
4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
4985 : 2021	Unplasticized PVC pipes for water supplies – Specification (*fourth revision*)
5382 : 2018/ ISO 4633 : 2015	Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials (*second revision*)

12235 (Parts 1 to 19) : 2004	Thermoplastic pipes and fittings — Methods of tests (*first revision*)
(Part 1) : 2004	Measurement of dimensions
(Part 2) : 2004	Determination of Vicat softening temperature
(Part 4) : 2004	Determining the detrimental effect on the composition of water
(Part 5/Sec 1) : 2004	Longitudinal reversion: Section 1 Determination methods
(Part 5/Sec 2) : 2004	Longitudinal reversion, Section 2 Determination parameters
(Part 8/Sec 1) : 2004	Resistance to internal hydraulic pressure: Section 1 Resistance to internal hydrostatic pressure at constant internal water pressure
(Part 8/Sec 2) : 2004	Leak-tightness of elastomeric sealing ring type socket joints under positive internal pressure and with angular deflection
(Part 8/Sec 3) : 2004	Leak-tightness of elastomeric sealing ring type socket joints under negative internal pressure and with angular deflection
(Part 9) : 2004	Thermoplastics pipes and fittings — Method of test Part 9: Resistance to external blows (impact resistance) at 0 ˚C (round-the-clock method)
(Part 10) : 2004	Determination of organotin as tin aqueous solution (*first revision*)
(Part 18) : 2004	Determination of ring stiffness
14182 : 1994	Solvent cement for use with unplasticized polyvinyl chloride pipe and fittings — Specification
16268 : 2017/ ISO/TR 10358 : 1993	Plastics pipes and fittings — Combined chemical-resistance classification table

3 TERMINOLOGY

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

3.1 Nominal Size (DN) – The numerical designation for the size of a pipe, other than a pipe designated by thread size, which is a convenient round number approximately equal to the manufacturing dimension in millimetres.

3.2 Nominal Outside Diameter (d_n) – The specified outside diameter in millimetres assigned to the nominal size.

3.3 Outside Diameter at Any Point (d_e) – The value of the measurement of the outside diameter of a pipe through its cross-section at any point of the pipe, rounded off to the next higher 0.1 mm.

3.4 Mean Outside Diameter (d_{em}) – The quotient of the outer circumference of a pipe and 3.142 (π) in any cross-section, rounded off to the next higher 0.1 mm.

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

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

3.7 Inside Diameter of a Socket (d_s) – The value of the measurement of the inside diameter of the socket at any point in any cross–section of the socket.

3.8 Mean Inside Diameter of a Socket (d_{sm}) – The arithmetical mean of four measurements, taken at 45˚ to each other, of the inside diameter of the socket in the same cross-section of the socket.

3.9 Out-of Roundness (Ovality) – The difference between the measured maximum and the measured minimum outside diameter in the same cross-section of the pipe.

3.10 Nominal Wall Thickness (e_n) – A numerical designation of the wall thickness of a component which is a convenient round number, approximately equal to the manufacturing dimension in millimetres.

3.11 Wall Thickness at Any Point (e) – The value of the measurement of wall thickness at any point around the circumference of a pipe, rounded off to the next higher 0.1 mm.

3.12 Minimum Wall Thickness at Any Point (e_{min}) – The minimum value for the wall thickness at any point around the circumference of a pipe, rounded off to the next higher 0.1 mm.

3.13 Maximum Wall Thickness at Any Point (e_{max}) – The maximum value for the wall thickness at any point round the circumference of a pipe, rounded off to the next higher 0.1 mm.

3.14 Mean Wall Thickness (e_m) – The arithmetical mean of at least four measurements regularly spaced around the circumference and in the same cross-section of a pipe, including the measured minimum and the measured maximum values of the wall thickness in that cross-section, rounded off to the next higher 0.1 mm.

3.15 Maximum Mean Wall Thickness ($e_{m,\ max}$) – The maximum value for the mean wall thickness around the circumference of a component, as specified.

3.16 Tolerance – The permitted variation of the specified value of a quantity, expressed as the difference between the permitted maximum and the permitted minimum value.

3.17 Standard Dimension Ratio (SDR) – A numerical designation of a pipe series, which is a convenient round number approximately equal to the ratio of the minimum mean outside diameter, $d_{\mathrm{em,\ min}}$ and the minimum wall thickness at any point e_{min}.

$$SDR = \frac{d_{\mathrm{em,\ min}}}{e_{\mathrm{min}}}$$

3.18 Nominal Ring Stiffness (SN) – A numerical designation, which is a convenient round number, of the ring stiffness of a pipe or fitting, relative to the determined stiffness in kilonewtons per square metre (kN/m^2), indicating the minimum required ring stiffness of a pipe or fitting.

3.19 Socket-Ended Pipe – Unplasticized PVC pipes whose one end is expanded after heating for the purpose of jointing by solvent cement or jointing using an elastomeric sealing ring, to the plain ends of the pipes.

3.20 Virgin Material – Material in such form as granules or powder that has not been subjected to use or processing other than that required for its manufacture and to which no reprocessable or recyclable materials have been added.

3.21 Own Rework Material – Material prepared from rejected, unused pipes, including trimmings from the production of pipes that will be reprocessed in a manufacturer's plant by a process such as extrusion and for which the complete formulation is known.

3.22 Tests

3.22.1 *Type Tests* – Tests carried out whenever a change is made in the composition or in the size/series in order to establish the suitability and the performance capability of the pipes.

3.22.2 *Acceptance Tests* – Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

4 SYMBOLS

For the purpose of this standard, the following notations (symbols) shall apply:

d_{n}	:	Nominal outside diameter
d_{e}	:	Outside diameter at any point
d_{em}	:	Mean outside diameter
$d_{\mathrm{em,\ max}}$	:	Maximum mean outside diameter
$d_{\mathrm{em,\ min}}$	:	Minimum mean outside diameter
d_s	:	Inside diameter of socket
d_{sm}	:	Mean inside diameter of socket
DR	:	Dimension ratio
e	:	Wall thickness at any point

e_{m}	:	Mean wall thickness
e_{max}	:	Maximum wall thickness at any point
e_{min}	:	Minimum wall thickness at any point
$e_{\mathrm{m,\ max}}$	:	Maximum mean wall thickness
A	:	Minimum depth of engagement
B	:	Length of lip
C	:	Depth of sealing zone
e_2	:	Wall thickness of the socket
e_3	:	Wall thickness of the groove
l	:	Effective length of pipe
l_1	:	Length of spigot
l_2	:	Length of solvent cement socket
H	:	Chamfer length

NOTE — The meaning of the symbols A, B, C and H are illustrated in the respective figures.

5 COMPOSITION OF THE MATERIAL

5.1 The material from which the pipe is produced shall consist substantially of polyvinyl chloride, to which may be added only those additives that are needed to facilitate the manufacture of the compound for the production of sound and durable pipes of good surface finish, mechanical strength and opacity, for desired conditions of use. None of these additives shall be used separately or together in quantities, sufficient materially to impair the fabrication or welding properties of the pipe, or to impair its chemical and physical or mechanical properties (in particular long-term mechanical strength and impact strength) as defined in this standard.

5.2 The material shall contain a minimum of 0.3 percent of rutile grade titanium dioxide.

5.3 When sealing rings are retained by means of retaining devices (rings or caps), the devices may be made from polymers other than PVC-U, provided they conform to the same functional dimensions and test requirements as applied to sockets with either loose or fixed sealing rings.

5.4 The manufacturer's own rework material conforming to the requirements given in **3.21** is permissible up to a maximum limit of 5 percent. No other rework material shall be used.

6 DIMENSIONS

6.1 Dimension of Pipes

6.1.1 *Mean Outside Diameter*

The mean outside diameter, outside diameter at any point and tolerances shall be as given in Table 1 and shall be measured according to the method given in IS 12235 (Part 1).

6.1.2 *Wall Thickness*

The nominal wall thickness, e, and the tolerances thereon shall be in accordance with Table 2 and shall be measured according to the method given in IS 12235 (Part 1).

6.1.3 *Length of Pipe*

6.1.3.1 Effective length (L_e) of pipes with sockets is considered to be the distance between ends minus the socket depth as shown in Fig. 1.

The pipes may be supplied in lengths as agreed between the purchaser and the manufacturer.

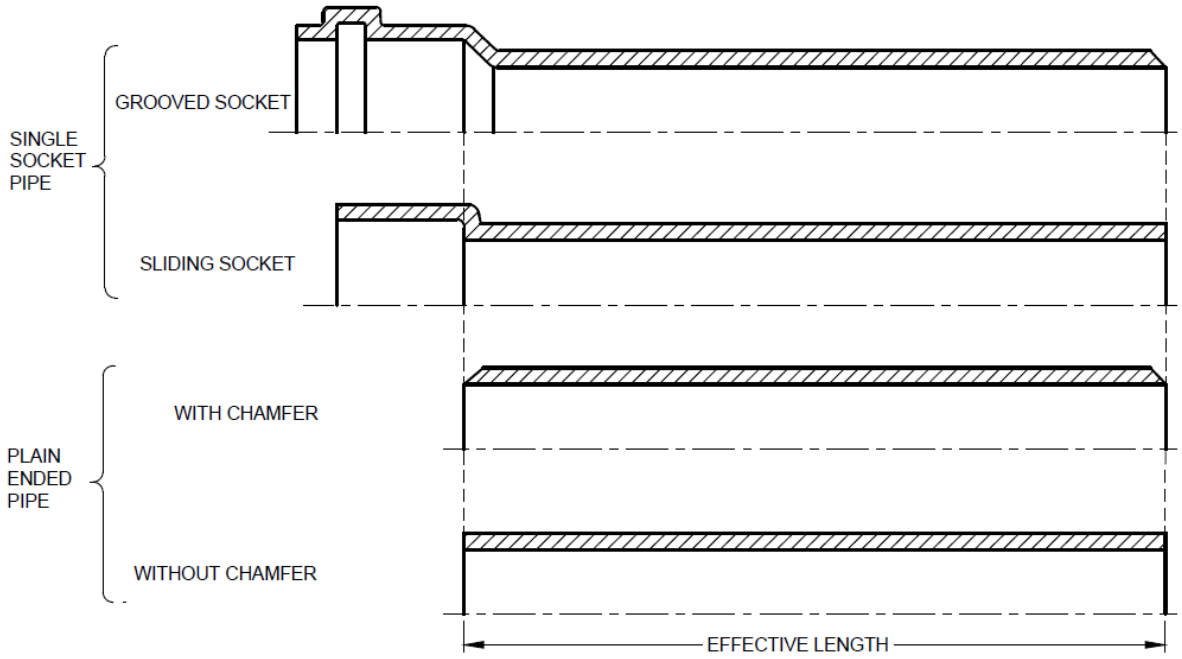


FIG. 1 EFFECTIVE LENGTH OF PIPES

6.1.4 *Dimensions of Integral Sockets and Spigots Ends*

The basic dimensions shall be in accordance with Tables 3 and 4, read along with Figs. 2, 3, 4 and 5.

6.1.4.1 *Wall Thickness of Sockets*

$$e_{2\min} = 0.9e \text{ and } e_{3\min} = 0.75e$$

$e_{3\min}$ applies only to those parts of the sealing ring zone where the fluid contained within the pipe comes into contact with the fluid, that is, beyond the designated ring seal point, walls thinner than e_3 are permitted.

If retaining caps or rings are provided, they can be made to other designs or from polymers other than unplasticized polyvinyl chloride, provided that the finished joint conforms to the same functional test requirements.

When a sealing ring is retained by means of a retaining ring or cap, the wall thickness of the area shall be calculated by addition of the wall thickness at the corresponding places of the socket and the retaining ring or cap (*see* Fig. 3). In all cases, the components shall meet the functional test requirements.

NOTE — The figures in this standard are schematic. They are meant to demonstrate relevant dimensions. They do not necessarily represent manufactured components.

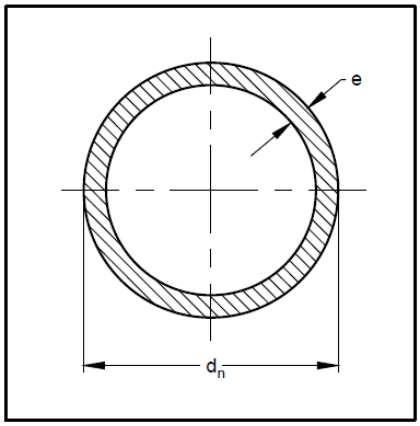
Table 1 Outside Diameters and Tolerances
(*Clause* 6.1.1)

All dimensions in millimetres.

Sl No.	Nominal Outside Diameter, d_n	Mean Outside Diameter, d_{em}		Outside Diameter at any Point, d_e	
		Min	*Max*	*Min*	*Max*
(1)	(2)	(3)	(4)	(5)	(6)
i)	63	63.0	63.3	62.2	63.8
ii)	75	75.0	75.3	74.1	75.9
iii)	90	90.0	90.3	88.9	91.1
iv)	110	110.0	110.4	108.6	111.4
v)	125	125.0	125.4	123.5	126.5
vi)	160	160.0	160.5	158.0	162.0
vii)	200	200.0	200.6	197.6	202.4
viii)	250	250.0	250.8	247.0	253.0
ix)	315	315.0	316.0	311.2	318.8
x)	400	400.0	401.2	395.2	404.8
xi)	500	500.0	501.5	494.0	506.0
xii)	630	630.0	631.9	622.4	637.6

Table 2 Wall Thickness and Tolerances

(*Clause* 6.1.2)



Sl No.	Nominal Ring Stiffness, *SN*, kN/m²	2	4	8
	Standard Dimension Ratio (*SDR*)	51	41	34
	Pipe Series	S 25	S 20	S 16.5
	Nominal outside Diameter, d_n, mm	**Wall Thickness** *e*, mm		
(1)	(2)	(3)	(4)	(5)
i)	63	–	–	2.7 + 0.4[1)]
ii)	75	–	–	2.8 + 0.5[1)]
iii)	90	–	–	2.9 + 0.5[1)]
iv)	110	–	–	3.2 + 0.5
v)	125	–	3.2 + 0.5	3.7 + 0.7
vi)	160	3.2 + 0.5	4.0 + 0.6	4.7 + 0.7
vii)	200	3.9 + 0.6	4.9 + 0.7	5.9 + 0.8
viii)	250	4.9 + 0.7	6.2 + 0.8	7.3 + 1.0
ix)	315	6.2 + 0.8	7.7 + 1.0	9.2 + 1.2
x)	400	7.9 + 1.0	9.8 + 1.2	11.7 + 1.4
xi)	500	9.8 + 1.2	12.3 + 1.4	14.6 + 1.7
xii)	630	12.3 + 1.2	15.4 + 1.7	18.4 + 1.9

[1)] In order to meet the stiffness requirement, wall thicknesses specified in these cases are more than the value calculated as per SDR.

NOTES

1 $SDR = 2S + 1$

2 The tolerances for nominal diameter and wall thickness have been calculated as per IS 4985.

Table 3 Dimensions of Elastomeric Sealing Ring Sockets and Spigot Ends

(*Clause* 6.1.4)

All dimensions in millimetres.

Sl No.	Nominal Diameter, d_n	Socket			Spigot End	
		d_{sm}, *Min*	*A*, *Min*	*C*, *Max*	l_1, *Min*	$H^{1)}$
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	63	63.3	23	18	40	4
ii)	75	75.3	25	20	45	5
iii)	90	90.3	28	23	55	5
iv)	110	110.4	32	26	60	6
v)	125	125.4	35	28	67	6
vi)	160	160.5	42	32	81	7
vii)	200	200.6	50	40	99	9
viii)	250	250.8	55	70	125	9
ix)	315	316.0	62	70	132	12
x)	400	401.2	70	80	150	15
xi)	500	501.5	80	–	160	18
xii)	630	631.9	93	–	188	23

[1)] Approximate values, when a chamfer is applied.

NOTES

1 A_{min} for $d_n \leq$ 200 mm, shall be 0.2 d_n + 10 mm.

2 A_{min} for $d_n \geq$ 250 mm, shall be 0.1 d_n + 30 mm.

3 Values for B may be smaller for constructions with sealing rings firmly fixed in the groove of the socket. Where sealing rings are firmly fixed and have multiple sealing zones, the dimensions A_{min} and C_{max} should be measured to the effective sealing point as specified by the manufacturer (*see* Fig. 4).

Table 4 Dimensions of Sockets and Spigot Ends for Solvent-Cemented Joints

(*Clause* 6.1.4)

All dimensions in millimetres.

Sl No.	Nominal Diameter	Socket			Spigot End	
	d_n	d_{sm}, *Min*	d_{sm}, *Max*	l_2, *Min*	l_1, *Min*	$H^{1)}$
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	63	63.1	63.3	37.5	45	4
ii)	75	75.1	75.3	43.5	50	5
iii)	90	90.1	90.3	51.0	60	5
iv)	110	110.1	110.4	61.0	67	6
v)	125	125.1	125.4	68.5	78	6
vi)	160	160.2	160.5	86.0	100	7
vii)	200	200.3	200.6	106.0	134	9
viii)	250	250.4	250.8	131.0	140	9
ix)	315	315.4	316.0	163.5	176	12
x)	400	400.4	401.0	206.0	221	15
xi)	500	500.4	501.0	256.0	274	18
xii)	630	630.4	631.0	321.0	344	23

[1)] Approximate values, when a chamfer is applied.

NOTE — For solvent cement sockets, the manufacturer shall declare whether the socket is designed as tapered or parallel. If they are parallel, or near parallel, the mean outside diameter of the socket, d_{sm}, shall apply over the entire length of the socket. If the socket is tapered, then the limits for d_{sm} apply at the mid-point of the socket with a maximum taper of 0˚30'.

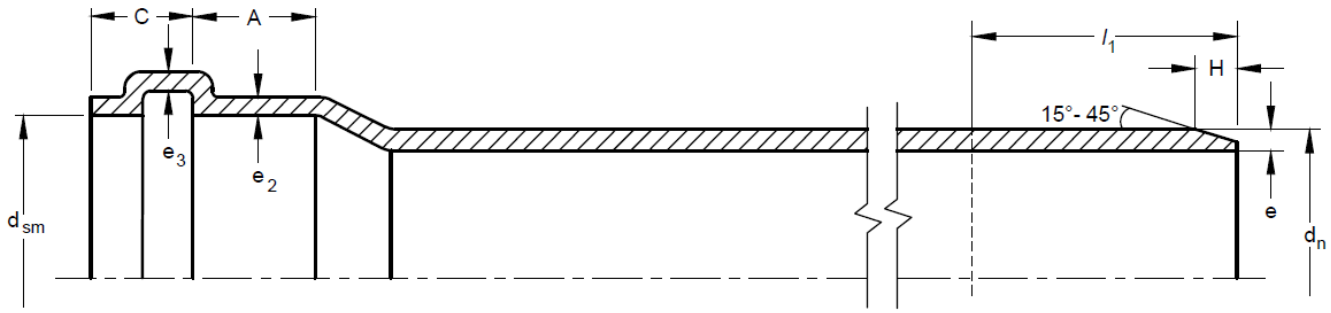


FIG. 2 BASIC DIMENSIONS OF INTERNAL SOCKETS AND SPIGOT ENDS FOR ELASTOMETRIC SEALING RING JOINTS

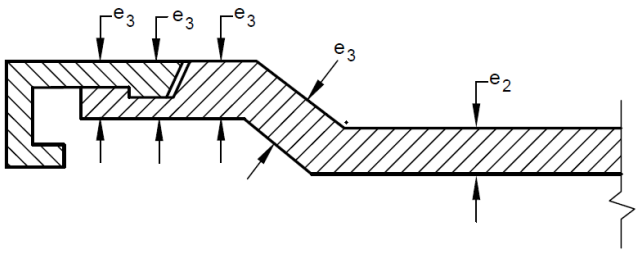


FIG. 3 EXAMPLE OF A SEAL RETAINING CAP AND CALCULATION OF THE WALL THICKNESS OF SOCKETS

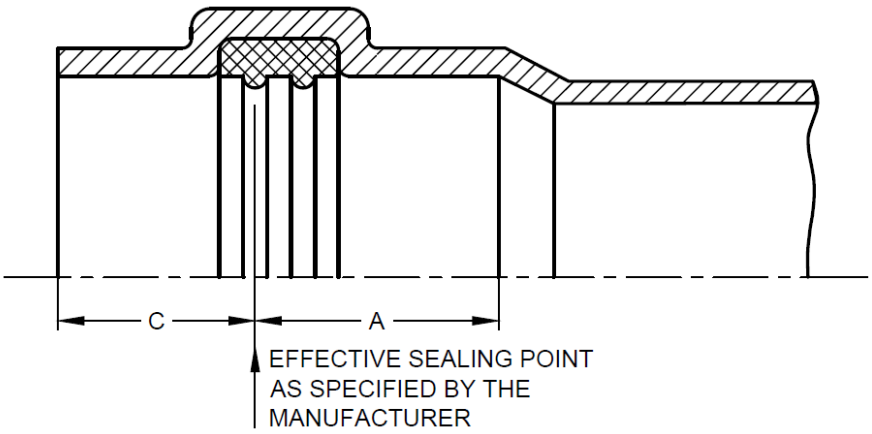


FIG. 4 EXAMPLE FOR MEASURING THE EFFECTIVE SEALING POINT

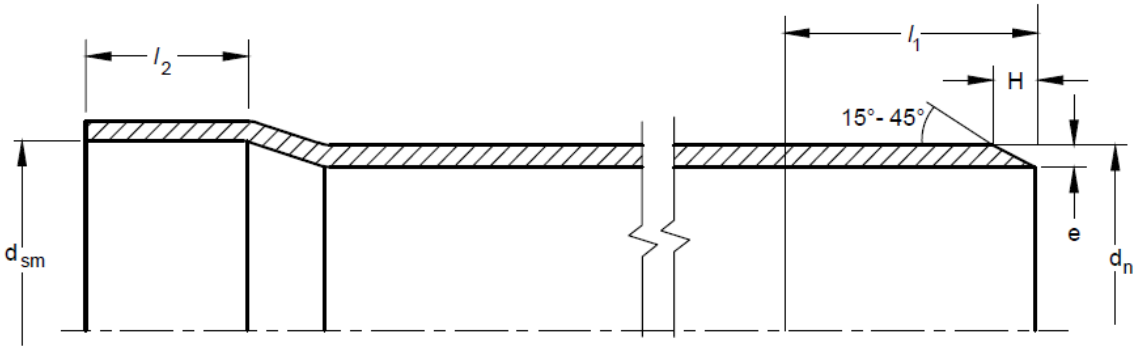


FIG. 5 BASIC DIMENSIONS FOR INTEGRAL SOCKETS AND SPIGOTS FOR SOLVENT-CEMENTED JOINTS

7 PHYSICAL AND CHEMICAL CHARACTERSTICS

7.1 Appearance

When viewed without magnification, the internal and external surfaces of the pipe shall be smooth, clean and free from grooving, blistering and any other surface irregularity, which is likely to prevent conformance of the pipe with this standard. Slight shallow longitudinal grooves or irregularities in the pipe shall be permissible, provided the wall thickness remains within permissible limits. The pipe wall shall not contain impurities or pores. The pipe ends shall be cleanly cut and square to the axis of the pipe.

7.2 Colour

The colour of the pipes shall be brown. The pipe shall be uniformly coloured throughout the entire wall. Slight variations in the appearance of the colour are permitted.

7.3 Vicat Softening Temperature

The Vicat softening temperature, when determined according to IS 12235 (Part 2) shall not be less than 80 °C.

7.4 Longitudinal Reversion

The longitudinal reversion, when tested according to the method prescribed in IS 12235 (Part 5/Sec 1) and IS 12235 (Part 5/Sec 2) shall not exceed ± 5 percent. In the case of socket ended pipe, this test shall be carried out on the plain portion of the pipe taken at least 100 mm away from the root of the socket. The pipe shall not exhibit any blisters, bubbles or cracks on completion of the test.

7.5 Effect on Water (Type Test)

The pipes shall not have any detrimental effect on the composition of water flowing through them. When tested by the method described in IS 12235 (Part 4) and IS 12235 (Part 10), the quantities of lead, dialkyl tin C4 and higher homologues (measured as tin), cadmium, mercury and any other toxic substances extracted from the internal walls of the pipes shall not exceed the concentrations as specified in **10.3** of IS 4985 and meet the other requirements given in **10.3.1** of IS 4985.

NOTE — Implementation of the lead phase out programme of the Government of India for phasing out use of lead stabilizers in PVC pipes and fittings manufacturing, shall be borne in mind.

8 MECHANICAL CHARACTERISTICS

8.1 Resistance to External Blows at 0 ˚C

When tested in accordance with the method given in IS 12235 (Part 9), the pipe shall have a true impact rate of not more than 10 percent. The total mass of the striker and height of free fall shall correspond to the values given in Table 5. In case of socket-ended pipes, this test shall be carried out on the plain portion of the pipe taken at least 100 mm away from the root of the socket.

Table 5 Mass of Striker and Height of Free Fall
(*Clause* 8.1)

Sl No.	Nominal Outside Diameter of Pipes, d_n mm	Total Mass of Striker kg	Height of Free Fall mm	Torque N.m
(1)	(2)	(3)	(4)	(5)
i)	63	0.25 ± 0.5 %	2 000 ± 10	5
ii)	75	0.25 ± 0.5 %	2 000 ± 10	5
iii)	90	0.50 ± 0.5 %	2 000 ± 10	10
iv)	110	1.6 ± 0.5 %	2 000 ± 10	32
v)	125	2.5 ± 0.5 %	2 000 ± 10	50
vi)	160	3.2 ± 0.5 %	2 000 ± 10	64
vii)	200	4.0 ± 0.5 %	2 000 ± 10	80
viii)	250	5.0 ± 0.5 %	2 000 ± 10	100
ix)	≥ 315	6.3 ± 0.5 %	2 000 ± 10	126

8.2 Ring Stiffness

When tested according to the method described in IS 12235 (Part 18), the ring stiffness of the pipe shall be as specified in Table 6. In case of socket-ended pipes, this test shall be carried out on the plain portion of the pipe, taken at least 100 mm away from the root of the socket.

Table 6 Ring Stiffness of Pipes
(*Clause* 8.2)

Sl No.	SDR/ Stiffness Class	Ring Stiffness kN/m^2
(1)	(2)	(3)
i)	51/SN 2	≥ 2
ii)	41/SN 4	≥ 4
iii)	34/SN 8	≥ 8

8.3 Resistance to Internal Hydrostatic Pressure

When tested according to the method described in IS 12235 (Part 8/Sec 1), the pipe shall not fail (seep, crack, bulge or burst) during the prescribed duration of the test and shall meet the requirements given in Table 7.

Table 7 Requirements of Pipes for Internal Hydrostatic Pressure Test
(*Clause* 8.3)

Sl No.	Test	Test Temperature	Test Duration (Minimum Holding Time)	Circumferential Hoop Stress, *Min*	Requirements
		˚C	h	MPa	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Acceptance Test	27	1	36	No seepage cracking, bursting
ii)	Type Test	60	1 000	10	

NOTE — Required internal test pressure, in MPa, can be calculated as follows from the minimum dimension given in Tables 1 and 2, as the case may be and corresponding hoop stress value given in Table 7.

$$\boldsymbol{P} = \frac{\boldsymbol{\sigma}.\mathbf{2}.\boldsymbol{e}_{\mathbf{min}}}{(\boldsymbol{d}_{\mathbf{em}} - \boldsymbol{e}_{\mathbf{min}})}$$

Where,
$\boldsymbol{P}$ = **test pressure in** MPa;
$\boldsymbol{\sigma}$ = hoop stress, in MPa;
$\boldsymbol{d}_{\mathbf{em}}$ = mean outside diameter, in mm; and
$\boldsymbol{e}_{\mathbf{min}}$ = minimum wall thickness of the free length of test specimen, in mm.

9 JOINTS

9.1 Elastomeric Sealing Rings .

Elastomeric sealing rings shall be free from substances (for example, plasticizers) that can have a detrimental effect on the polyvinyl chloride of the pipes or fittings used in conjunction with the pipes.

The design of the profile and dimensions of the sealing ring is left to the manufacturer, as long as the pipe with the sealing ring meets the requirements of this standard. Where the design of the socket is such that the sealing ring is not firmly fixed in position, the housing for the ring shall be so designed as to minimize the possibility of the ring being dislodged during insertion of the pipe (or spigot of a fitting) to complete the joint.

Elastomeric sealing rings shall be of any of the six hardness classes as specified in IS 5382. The manufacturer has to, however, specify the hardness class and application type of sealing ring that is being offered.

NOTE — A test report or conformity certificate may be obtained from the manufacturer of the sealing ring for conformity to IS 5382. The frequency of this test report/certificate shall be once in three months or whenever source of supply is changed.

9.2 Solvent Cement

The solvent cement used shall conform to the requirements laid down in IS 14182.

10 PERFORMANCE REQUIREMENTS

10.1 Elastomeric Sealing Ring Joints

10.1.1 *Leak-tightness of Elastomeric Sealing Ring Type Socket Joints under Positive Internal Pressure and with Angular Deflection.*

The joint assembled according to the manufacturer's instructions at an angular deflection, α, of minimum 2˚ as well as a diametric deflection (distortion) of 5 percent of the outer diameter, shall be tested in accordance with IS 12235 (Part 8/Sec 2). The joint shall withstand the pressure regime for the complete test duration without leakage.

10.1.2 *Leak-tightness of Elastomeric Sealing Ring Type Socket Joints under Negative Internal Pressure and with Angular Deflection*

The joint assembled according to the manufacturer's instructions at an angular deflection, α, of minimum 2˚ as well as a diametric deflection (distortion) of 5 percent of the outer diameter, shall be tested in accordance with IS 12235 (Part 8/Sec 3). The joint shall withstand the pressure regime for the complete test duration without leakage.

10.2 Solvent Cemented Joints

10.2.1 *Leak-tightness of Solvent Cemented Joints under Positive Internal Pressure*

When assembled according to the manufacturer's instructions and tested in accordance with IS 12235 (Part 8/Sec 2), the joint shall withstand the pressure regime for the complete test duration without leakage.

10.2.2 *Leak-tightness of Solvent Cemented Joints under Negative Internal Pressure*

When assembled according to the manufacturer's instructions and tested in accordance with IS 12235 (Part 8/Sec 3), the joint shall withstand the pressure regime for the complete test duration without leakage.

11 SAMPLING AND CRITERIA FOR CONFORMITY

The sampling procedure and criteria for conformity shall be as given in Annex A.

12 MARKING

12.1 Each pipe shall be clearly and indelibly marked in ink/paint at intervals of not more than 3 m in the colour indicated in **12.3** to provide the information given in **12.2**. Alternatively, inkjet printing in any colour contrasting with the colour of pipe can also be used for marking at intervals of not more than 3 m. The marking shall be legible without magnification. The marking shall not initiate cracks or other types of defects which adversely influence the performance of the pipe.

12.2 The marking shall include the following:

a) Identification of the source of manufacture;
b) Outside diameter;
c) Stiffness class; and
d) Batch or lot number.

12.2.1 The lot number/batch number shall include the details of production in the following manner:

Year	Month	Day	Machine No.	Shift
xxxx	xx	xx	xxx	x

12.3 The colour of the marking shall be as follows:

Sl No.	*Class of Pipe*	*Colour*
i)	SN 2	Blue
ii)	SN 4	Green
iii)	SN 8	Red

12.4 BIS Certification Marking

The pipes conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the Bureau of Indian Standards Act, 2016 and the Rules and Regulations framed thereunder, and the pipes may be marked with the Standard Mark.

ANNEX A
(*Clause* 11)

SAMPLING AND CRITERIA FOR CONFORMITY

A-1 ACCEPTANCE TESTS

A-1.1 Acceptance tests are carried out on samples selected from a lot for the purpose of acceptance of the lot.

A-1.2 All PVC-U pipes in a single consignment of the same stiffness class, same size and manufactured under essentially similar conditions shall constitute a lot.

A-1.3 For ascertaining the conformity of the lot to the requirements of the standard, samples shall be tested from each lot separately.

A-1.4 Visual and Dimensional Requirements

A-1.4.1 The number of test samples taken from a lot shall depend on the size of the lot and the outside diameter of the pipes, and shall be in accordance with Table 8.

A-1.4.2 These pipes shall be selected at random from the lot and in order to ensure the randomness of the selection, a random number table shall be used. For guidance and use of random number tables, IS 4905 may be referred to. In the absence of a random number table, the following procedure may be adopted:

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

A-1.4.3 The number of pipes given for the first sample in col 4 of Table 8, shall be taken from the lot and examined for visual and dimensional requirements given in **6, 7.1** and **7.2**. A pipe failing to satisfy any of these requirements shall be considered 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 8. 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 8. If, however, the number of defectives found in the first sample lies between the corresponding acceptance or rejection numbers given in col 6 and 7, a second sample of the size given in col 4 shall be taken and examined for these requirements. The lot shall be considered to have satisfied these requirements if the cumulative sample is less than or equal to the corresponding acceptance number given in col 6, otherwise not.

A-1.5 Longitudinal Reversion Test

A-1.5.1 The lot, having satisfied visual and dimensional requirements, shall be tested for longitudinal reversion as given in **7.4**.

A-1.5.2 For this purpose, the number of pipes given for the first sample in col 4 of Table 9 shall be taken from the lot. The sample pipe failing in reversion shall be considered to be defective. The lot shall be deemed to have met the requirements given in this standard for the reversion test if the number of defectives found in the first sample is less than or equal to the corresponding acceptance number given in col 6. The lot shall be deemed not to have met the 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. If, however, the number of defectives in the first sample lies between the corresponding acceptance and rejection numbers given in col 6 and 7, a second sample of the size given in col 4 shall be taken and examined for the requirement. The lot shall be deemed to have satisfied the 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, otherwise not.

Table 8 Samples for Visual Appearance and Dimensional Requirements
(*Clauses* A-1.4.1 and A-1.4.3)

Sl No.	Numbers of Pipes in the Lot	Sample Number	Sample Size	Cumulative Sample Size	Acceptance Number	Rejection Number
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Up to 1 000	First	13	13	0	2
		Second	13	26	1	2
ii)	1 001 to 3 000	First	20	20	0	2
		Second	20	40	1	2
iii)	3 001 to 10 000	First	32	32	0	3
		Second	32	64	3	4
iv)	1 0001 and above	First	50	50	1	4
		Second	50	100	4	5

Table 9 Scale of Sampling for Reversion and Vicat Softening Temperature Tests
(*Clauses* A-1.5.2 and A-1.6.2)

Sl No.	Numbers of Pipes in the Lot	Sample Number	Sample Size	Cumulative Sample Size	Acceptance Number	Rejection Number
(1)	(2)	(3)	(4)	(5)	(6)	(7)
a)	*For nominal diameters up to and including* 110 mm					
i)	Up to 1 000	First	5	5	0	2
		Second	5	10	1	2
ii)	1 001 to 3 000	First	8	8	0	2
		Second	8	16	1	2
iii)	3 001 to 10 000	First	13	13	0	2
		Second	13	26	1	2
iv)	1 0001 and above	First	20	20	0	3
		Second	20	40	3	4

b)	*For nominal diameters above* 110 mm					
i)	Up to 3 000	First	3	3	0	2
		Second	3	6	1	2
ii)	3 001 to 10 000	First	5	5	0	2
		Second	5	10	1	2
iii)	10 000 and above	First	8	8	0	2
		Second	8	16	1	2

A-1.6 Vicat Softening Temperature

A-1.6.1 The lot, having satisfied the visual and dimensional requirements, shall be tested for Vicat softening temperature as given in **7.3**.

A-1.6.2 For this purpose, the procedure adopted for sampling and criteria for conformity shall be the same as given in **A-1.5**, using Table 9.

A-1.7 Resistance to External Blows at 0 ˚C

A-1.7.1 The lot, having been found satisfactory According to **A-1.4**, **A-1.5** and **A-1.6**, shall be tested for resistance to external blows at 0 ˚C as given in **8.1**.

A-1.7.2 For this purpose, the procedure adopted for sampling and criteria for conformity shall be the same as given in **A-1.5**, however, using Table 10 in place of Table 9.

Table 10 Scale of Sampling for Resistance to External Blows
(*Clause* A-1.7.2)

Sl No.	Numbers of Pipes in the Lot	Sample Number	Sample Size	Cumulative Sample Size	Acceptance Number	Rejection Number
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	For all sizes					
i)	Up to 3 000	First	3	3	0	2
		Second	3	6	1	2
ii)	3 001 to 10 000	First	5	5	0	2
		Second	5	10	1	2
iii)	10 000 and above	First	8	8	0	2
		Second	8	16	1	2

NOTE – The numbers mentioned in col 3 to 6 in the table represent the number of times the test is to be carried out and do not represent either the number of pipe samples or the number of blows or the number of failures.

A-1.8 Ring Stiffness

A-1.8.1 The lot, having satisfied the visual and dimensional requirements, shall be tested for ring stiffness as given in **8.2**. The number of pipes (test samples) to be taken from the lot shall depend on the size of the lot and shall be according to Table 11.

A-1.8.2 The pipes shall be taken at random from the lot. In order to ensure the randomness of the selection, procedures given in IS 4905 may be followed.

A-1.8.3 The lot shall be considered to have satisfied the requirements for this test, if the number of test samples failing in this requirement is equal to the corresponding acceptance number given in col 4 of Table 11.

A-1.9 Resistance to Internal Hydrostatic Pressure Test (Acceptance Test)

A-1.9.1 The lot, having satisfied the visual and dimensional requirements, shall be tested for the acceptance test for internal hydrostatic pressure given in Table 7. The number of pipes (test samples) to be taken from the lot shall depend on the size of the lot and shall be taken in accordance with Table 11.

A-1.9.2 The pipes shall be taken at random from the lot. In order to ensure the randomness of the selection, procedures given in IS 4905 may be followed.

A-1.9.3 The lot shall be considered to have satisfied the requirements for this test, if the number of test samples failing in this requirement is equal to the corresponding acceptance number given in col 4 of Table 11.

A-1.10 Performance Test for Joints

A-1.10.1 The lot, having satisfied the visual and dimensional requirements, shall be tested for leak tightness of joints as per **10.1** or **10.2** as applicable. The number of test samples to be taken from the lot shall depend on the size of the lot and shall be taken in accordance with Table 11.

A-1.10.2 The lot shall be considered to have satisfied the requirements for this test, if the number of test samples failing in this requirement is equal to the corresponding acceptance number given in col 4 of Table 11.

Table 11 Scale of Sampling for Ring Stiffness, Resistance to Hydrostatic Pressure Test (Acceptance Test) and Performance Test for Joints
(*Clause* A-1.8, A-1.9 and A-1.10)

Sl No. (1)	**Number of Pipes in the Lot** (2)	**Sample Size** (3)	**Acceptance Number** (4)
i)	Up to 3 000	2	0
ii)	3 001 to 10 000	3	0
iii)	10 001 and above	5	0

A-2 TYPE TESTS

A-2.1 Type tests are intended to prove the suitability and performance of a new composition or a new size of pipe. Such tests, therefore, need to be applied only when a change is made in polymer composition or when a new size is to be introduced.

A-2.1.1 *Resistance to Internal Hydrostatic Pressure Test (Type Test)*

A-2.1.1.1 For this test, the manufacturer or the supplier shall furnish to the testing authority, three samples of pipes of different diameters and different stiffness classes, selected preferably from a regular production lot.

A-2.1.1.2 Three samples so selected shall be tested for compliance with the requirements of the type test given in Table 7.

A-2.1.1.3 If all the three samples pass the requirements of the quality test, the type of pipe under consideration shall be considered to be eligible for type approval, which shall be normally valid for a period of one year.

A-2.1.1.4 In case any of the samples fail in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number and subject them to the type test. If, in the repeat test, no single failure occurs, type of pipe shall be considered 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.

A-2.1.1.5 At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for fresh samples for type test for the purpose of type approval.

A-2.2.2 *Effect on Water Test*

A-2.2.2.1 For this test, the manufacturer or the supplier shall furnish to the testing authority three samples of the smallest size of pipe taken from each machine (selected preferably from a regular production lot).

A-2.2.2.2 Three samples so selected shall be tested for compliance with the requirements for effect on water as given in **7.5**.

A-2.2.2.3 If all three samples pass the requirements for effect on water, the type test of the pipe under consideration shall be considered to be eligible for approval, which shall be normally valid for a period of one year.

A-2.2.2.4 In case any of the samples fails in this test, the testing authority, at its discretion, may call for fresh samples not exceeding the original number, and subject them to the test for effect on water. If, in the 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 test, 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.

A-2.2.2.5 At the end of the validity period (normally one year) or earlier, if necessary, the testing authority may call for fresh samples for effect on water test for the purpose of type approval.