IS 651 (2007): Glazed Stoneware Pipe and Fittings - [CED 3: Sanitary Appliances and Water Fittings]

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भारतीय मानक

कांचाभ स्टोनवेयर पाइप और फिटिंग — विशिष्टि

(छठा पुनरीक्षण)

Indian Standard

GLAZED STONEWARE PIPES AND FITTINGS — SPECIFICATION

(Sixth Revision)

ICS 23.040.50 : 81.060.20

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

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Price Group 9

FOREWORD

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

This standard was first published in 1956. First, second, third, fourth and fifth revisions of the standards were issued in 1962, 1965, 1971, 1980 and 1992 respectively.

In this revision, the following major modifications have been made:

a) Clause **5.3** has been deleted since change in colour is not relevant as it does not effect quality of pipes.

b) Pipes of diameter up to 800 mm have been included. Provision for supply of pipes in longer lengths has also been made. Tolerances on internal diameters, lengths and straightness have been modified, keeping in view the current manufacturing practices.

c) Pipes have been classified into three classes based on their crushing strength. Additional sizes of the pipes have been introduced in terms of diameter.

d) Provisions has been made for joints by using rubber seals, as agreed to between the manufacturer and the buyer.

For laying of pipes IS 4127 : 1983 'Code of practice for laying of glazed stoneware pipes' shall be followed.

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 values should be the same as that of the specified values in this standard.

Indian Standard

GLAZED STONEWARE PIPES AND FITTINGS — SPECIFICATION

(Sixth Revision)

1 SCOPE

1.1 This standard covers dimensions and performance requirements for the following stoneware or vitrified clay pipes and fittings:

a) Straight and taper pipes;

b) Bends;

c) Taper bend;

d) Junctions;

e) Half-section channels, straight and taper;

f) Channel junctions;

g) Channel bends;

h) Channel interceptors;

j) Gully traps; and

k) Inspection pipes.

1.1.1 The pipes as covered in this standard are not meant for potable water applications.

1.2 Dimensions of glazed stoneware pipes and fitting are grouped into two Sections, A and B. Section A covers dimensions of straight pipes and all such fitting which normally form part of pipe-line and which are subject to same conditions, specifications and tests as straight pipes. Section B includes dimensions of fittings which are commonly used but do not form a part of the normal pipe-line. The fittings in Section B being hand-moulded articles, their conformity to dimensional specifications is not required to be so accurate as or those in Section A.

2 REFERENCES

The standards given below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on these standards are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
808 : 1989	Dimensions for hot rolled steel, beam, column channel and angle sections (*third revision*)
2730 : 1977	Magnesium sulphate (Epsom salt) (*first revision*)
2781 : 1975	Glossary of terms relating to ceramicware (*first revision*)
4905 : 1968	Methods for random sampling

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2781 and the following shall apply.

3.1 Class of Pipe — Based on the value of crushing strength, these pipes are classified into three classes SP 1, SP 2 and SP 3.

4 RIGHT-HAND AND LEFT-HAND FITTINGS

A right-hand fitting is such that when viewed from the spigot towards the socket, the arm of a junction or the socket of a bend projects to the right (*see* Fig. 1A and 1B). A left-hand fitting is such that when viewed as above, the arm of socket projects to the left.

5 GENERAL QUALITY

5.1 All pipes and fittings shall be sound and free from visible defects which impair the strength, durability and serviceability. The glaze of pipes and fittings shall be free from crazing. The pipes and fitting shall give a sharp clear note when struck with a light hammer.

5.2 For pipes and fittings, a maximum of 10 percent shall be acceptable with any one of following blemishes which do not impair the strength, durability and serviceability provided these pipes and fittings satisfactory pass the hydraulic test specified in **7.2**:

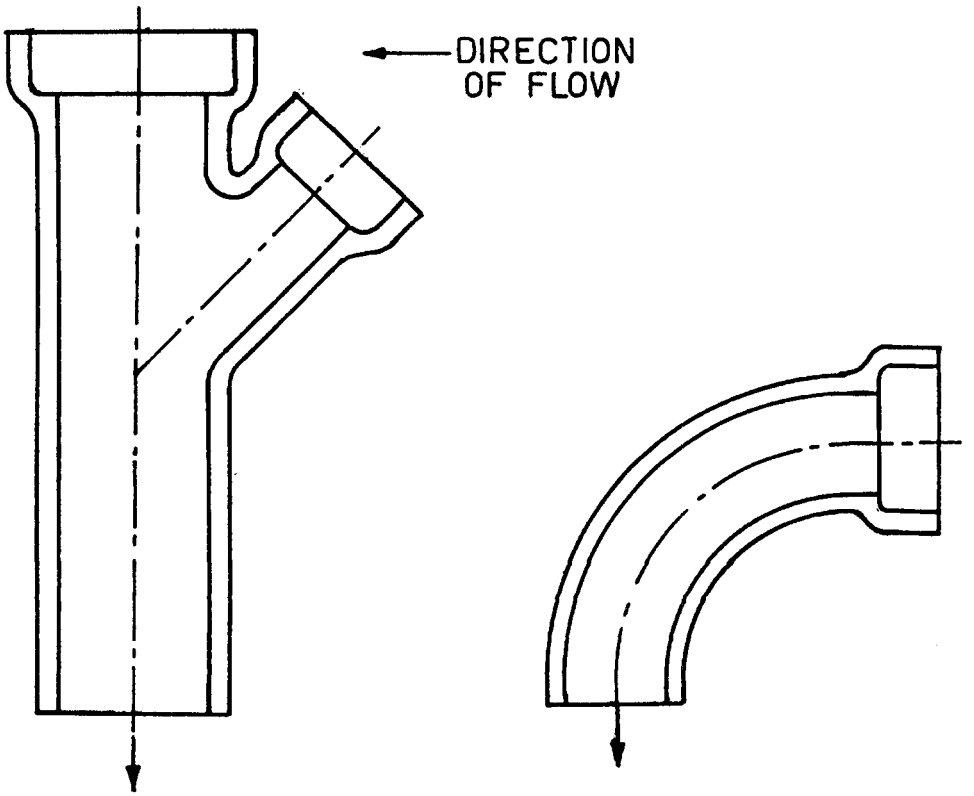
a) A thin chipping not exceeding one quarter of the thickness of the body and not exceeding 10 cm^2 on the outside of spigot or on either side of the socket;

b) One blister, unbroken, not more than 3 mm high not more than 40 mm in largest dimension inside or outside of the pipe; and

c) Hairline surface cracks.

6 GLAZING

6.1 The interior and exterior surfaces of the pipes and fittings which remain exposed after jointing, shall be glazed. The portion which remains covered



1A Channel Junction

1B Channel Bend

All dimensions in millimetres.

FIG. 1 RIGHT-HAND FITTINGS

after jointing may or may not be glazed. The glaze shall be obtained by the action of fumes of common salt on the material of pipes during the process of burning or glaze shall be ceramic glaze consisting of glazing material, applied prior to firing.

7 TESTS

7.1 Testing Facilities

The manufacturer shall, at his premises and at his own cost, provide the necessary gauges, supply and prepare all test pieces and supply all labour and apparatus for testing which may be necessary for carrying out the tests as required by this standard.

7.2 Hydraulic Test

When subjected to the hydraulic test, straight pipes shall withstand an internal hydraulic test pressure of 0.15 MPa on the barrels and fitting covered in Section A and 0.075 MPa for fittings covered in Section B, without showing signs of injury or leakage. The pressure shall be applied on pipes and fittings at a rate not exceeding 0.075 MPa in 5 s and full pressure shall be maintained for at least 5 s. Care shall be taken to ensure that all air is expelled before the test commenced.

7.3 Absorption Test

The test pieces for testing shall be taken from the body of the pipe or fitting but not from within 150 mm of the end. Each test pieces shall be of the whole thickness of the wall of the pipe or fitting and shall have two glazed surfaces each having an area of not less than 50 cm^2 and not more that 130 cm^2. The test pieces shall be cleaned by wire brush to dislodge any loose particles which may increase loss of mass during boiling. The test piece shall be dried at a temperature of not less than 150° C until no further loss of mass is noted and cooled in a desiccators to the room temperature and the specimen weighed to an accuracy of 0.1g. The test piece may be suitably suspended in cold distilled water by means of thread so that the test piece may not strike against each other or the container and incur loss in mass and the water in the container shall then be brought to the boiling point. The water shall be maintained at the boiling point. The water shall be maintained at that temperature for 1h and after it has been allowed to cool to room temperature, the test pieces shall be removed carefully wiped with a dry cloth and then the mass determined. The percentage increase in mass of each test piece by absorption of water shall not exceed

the following values:

Thickness of Pipes or Fitting mm	*Increase in Mass* Percent
Up to and including 20	6
Over 20 and up to 25	7
Over 25 and up to 32	8
Over 32 and up to 38	9
Over 38	10

7.4 Test for Acid Resistance

Pipes and fittings shall be tested for acid resistance in accordance with the procedure given in Annex A. The loss in mass shall not exceed 2.5 percent.

7.5 Test for Alkali Resistance

Pipes and fittings shall be tested to the action of magnesium sulphate in accordance with the procedure given in Annex B. There shall be no evidence of pitting, softening, spalling or cracking in the pipe or fitting after the test.

7.6 Crushing Strength Test

When tested along the full length of the pipe barrel from shoulder to spigot in accordance with Annex C, the crushing strength of each class of pipes or pipe sections shall be not less than the values given below:

Internal Diameter mm	*Class* SP 1 kN/m	SP 2 kN/m	SP 3 kN/m
(1)	(2)	(3)	(4)
Up to 150	16	18	21
200-300	16	21	24
350-450	16	26	32
500-800	16	32	60

8 SAMPLING AND CRITERIA FOR CONFORMITY

Scale of sampling and criteria for conformity of a lot shall be as prescribed in Annex D.

9 MARKING

9.1 Every pipe and fitting shall have legibly impressed upon it before firing the following:

a) Name or trade-mark of the manufacturer,

b) Size (internal dia), and

c) Class of pipe.

9.2 BIS Certification Marking

Each pipe and fitting may also be marked with the Standard Mark.

9.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of Standard Mark may be granted to the manufacturers or the producers may be obtained from the Bureau of Indian Standards.

SECTION A

PIPES AND FITTINGS FORMING PART OF PIPELINE

10 INTERNAL DIAMETER

10.1 The internal diameter of the barrels of straight pipes, junctions and bends of size 100 mm to 800 mm shall be as specified in col 2 of Table 1.

10.2 Permissible Tolerances

The internal diameters specified in **10.1** shall be within the following tolerances:

Internal Diameter of Pipes mm	*Permissible Tolerance* Percent
100 - 350	± 3
400 - 800	± 2.5

11 THICKNESS OF BARRELS, SOCKETS AND BENDS

11.1 The mean thickness of the barrel and the socket of the pipes junctions and bends shall not be less than mean thickness given in col 4 of Table 1. Such mean thickness of the barrels or sockets of any individual pipe junctions and bends shall be ascertained by making several minimum 4 measurements and adding the measured minimum thickness (not in the groove) to the maximum thickness and dividing the sum by two. The mean thickness of the barrel and socket shall be determined separately.

11.2 Permissible Variation

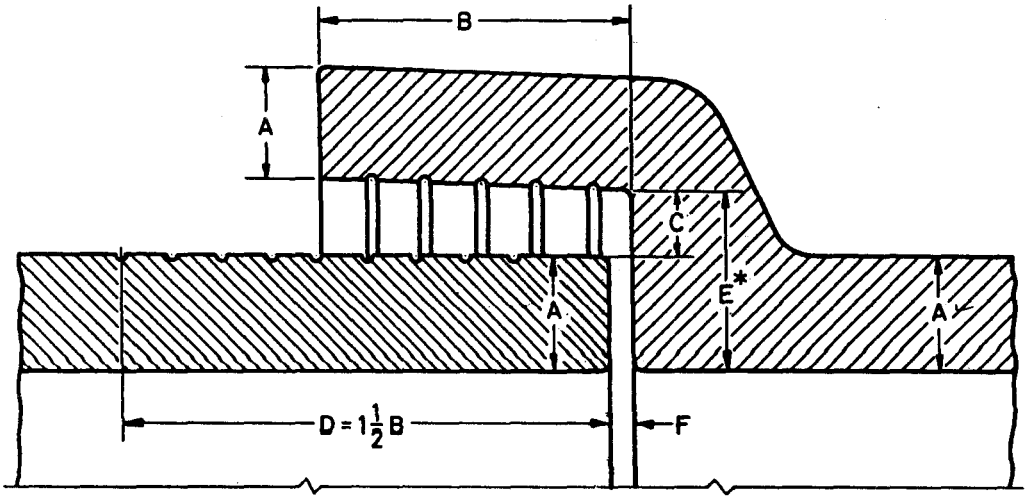
The difference between the minimum and maximum measured thicknesses mentioned in **11.1** shall not exceed the amounts given below:

Internal Diameter of Pipe mm	*Permissible Variation in Thickness of Barrel and Sockets* mm
100-350	± 3
Not exceeding 450	± 2
500 and 600	± 3
700 and 800	± 5

Table 1 Dimensions of Barrels and Sockets

(*Clauses* 10.1, 11.1, 13.1, 13.1.1, 13.2, 14 *and* 18)

All dimensions in millimetres.



Sl No.	Internal Diameter	Class	Mean Thickness of Barrel and of Socket *Min* *A*	Internal Depth of Socket *Min* *B*	Excess Shoulder Measurement *Min* *C*	Length of Grooving of Spigot *Min* *D*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	100	SP 1	12	50	10	75
		SP 2	14	55	11	82.5
		SP 3	18	60	14	90
ii)	150	SP 1	15	57	11	85.5
		SP 2	16	60	12	90
		SP 3	20	62	12	93
iii)	200	SP 1	16	63	12	94.5
		SP 2	18	65	13	97.5
		SP 3	22	68	15	102
iv)	230	SP 1	19	63	12	94.5
		SP 2	21	65	14	97.5
		SP 3	24	68	16	102
v)	250	SP 1	20	70	16	105
		SP 2	22	66	17	99
		SP 3	26	69	18	103.5
vi)	300	SP 1	25	70	16	105
		SP 2	24	72	18	108
		SP 3	28	74	19	111
vii)	350	SP 1	30	75	16	112.5
		SP 2	32	76	20	114
		SP 3	34	76	20	114
viii)	400	SP 1	35	75	16	112.5
		SP 2	36	77	20	115.5
		SP 3	38	77	20	115.5
ix)	450	SP 1	37	76	16	114
		SP 2	40	78	20	117
		SP 3	45	79	20	118.5

Table 1 (*Concluded...*)

Sl No.	Internal Diameter	Class	Mean Thickness of Barrel and of Socket *Min* *A*	Internal Depth of Socket *Min* *B*	Excess Shoulder Measurement *Min* *C*	Length of Grooving of Spigot *Min* *D*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
x)	500	SP 1	40	80	19	120
		SP 2	45	85	20	127.5
		SP 3	50	90	20	135
xi)	600	SP 1	43	90	19	135
		SP 2	50	95	22	142.5
		SP 3	55	100	22	150
xii)	700	SP 1	50	95	20	142.5
		SP 2	55	100	23	150
		SP 3	60	110	23	165
xiii)	800	SP 1	55	100	24	150
		SP 2	65	110	26	165
		SP 3	75	120	27	180

NOTES

1 *E = Width of shoulder of socket which shall exceed the mean thickness of the barrel of the pipe (ascertained as directed in **11.1**) by not less than the values of C given in col 6.

2 For pipes meant for joining with rubber ring or other flexible seals, grooving may be omitted as agreed to between the manufacturer and the buyer.

12 LENGTH AND STRAIGHTNESS OF BARRELS OR STRAIGHT AND TAPER PIPES

12.1 The length of the barrel of straight and taper pipes and half-section channels, exclusive of the internal depth of the socket shall be 600, 750, 900, 1 000 mm or other higher lengths as agreed between the manufacturer and the buyer.

12.2 Length of Junction

The length of junction shall be 600, 750 or 900 mm.

12.3 Permissible Tolerance on Length

The permissible tolerance on length shall be within −1.5 percent and +4 percent of length.

12.4 Permissible Deviation from Straightness

The maximum permissible deviation from straightness of the barrel of a pipe, measured on the inside of the curve and tested by means of a straight edge, for all diameters of pipe, shall be 1 percent of the length of pipe.

13 TAPERS, BENDS AND JUNCTIONS

13.1 Internal diameter of taper pipes (*see d* and *D* of Fig. 2), half-section straight channels (*see D* of Fig. 3.), half-section taper channels (*see d* and *D* of Fig. 4) and junctions(*see* Fig. 5 and Fig. 6), shall be selected from those given in col 2 of Table 1. Dimensions of bends shall be in accordance with Tables 2 to 6.

13.1.1 The barrels and branches of half-section channel junctions may be of any of the diameters shown in col 2 of Table 1 but the diameter of the branches shall not exceed that of the barrel diameter

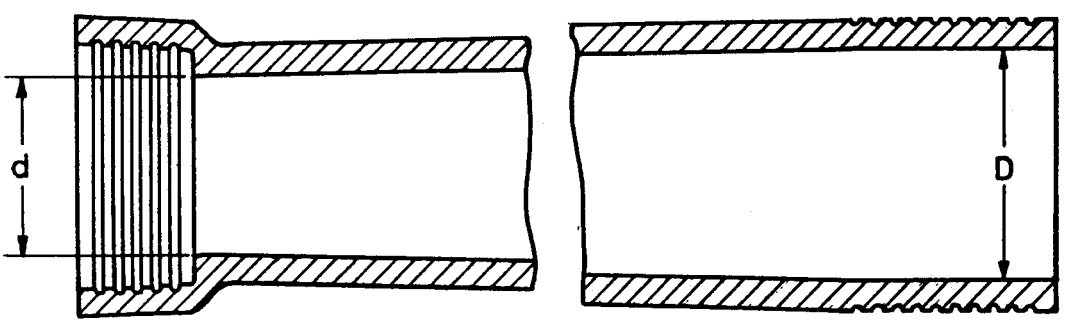


FIG. 2 CONCENTRIC TAPER PIPE

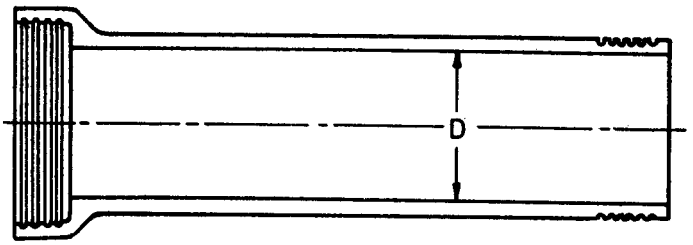


FIG. 3 HALF-SECTION STRAIGHT CHANNEL

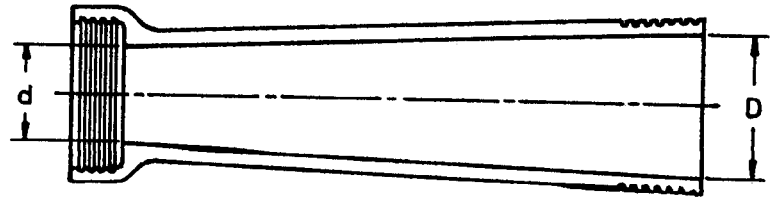
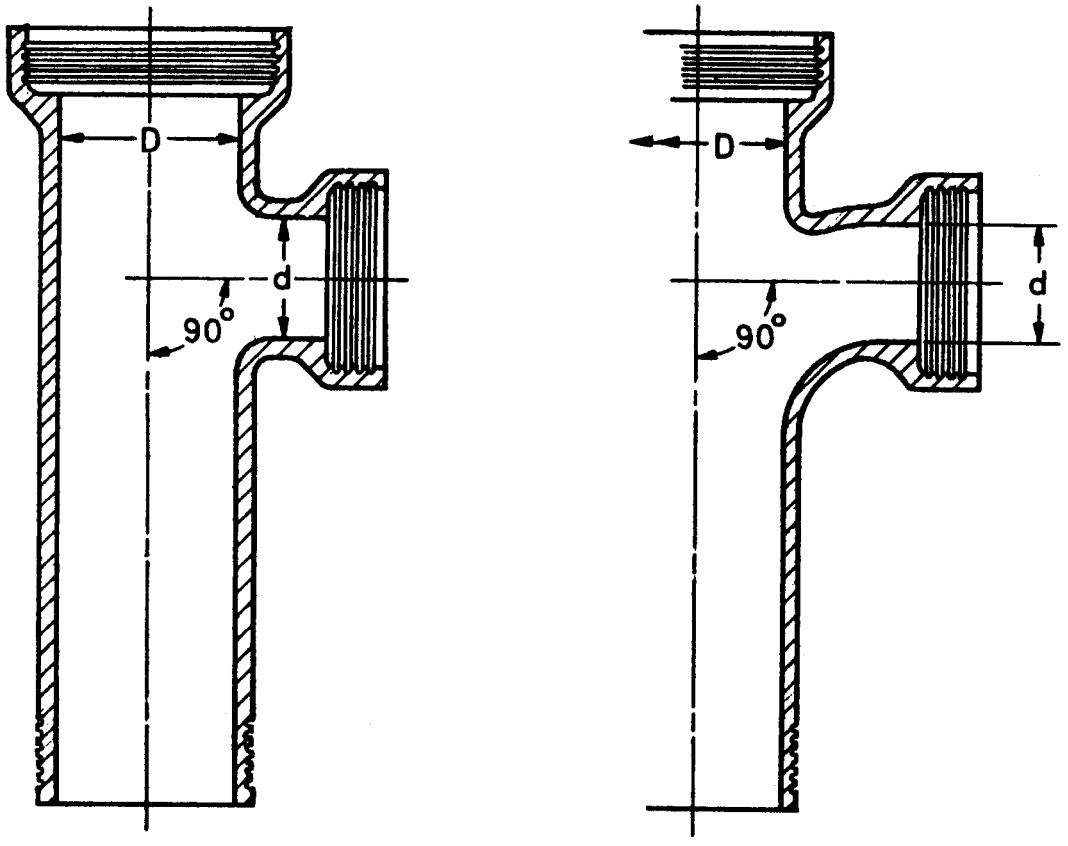


FIG. 4 HALF-SECTION TAPER CHANNEL



5A Square Type

5B Curved Square Type

NOTE — The socket of the branch arm should be as close to the main socket as possible. The barrels of junctions may be of any of the diameters shown in col 2 of Table 1 but the diameter '*d*' of the branch shall not exceed that of the barrel '*D*'. The length of the barrel may be 600 mm, 750 mm or 900 mm.

FIG. 5 JUNCTIONS WITH BRANCH AT AN ANGLE OF APPROXIMATELY 90°

(*see* Fig. 7). The angle at junction shall be 45° ± 3° or 90° ± 3°.

13.2 Taper pipes, and half-section taper channels may be ordered in any normal combination of diameters and lengths. The other dimensions shall be within the limits of pipe size given in Table 1 and under **11** and **12**.

13.3 Permissible Tolerance on Bends

13.3.1 Tolerance on angles of bends shall be within ± 3°.

13.3.2 Tolerance on dimension '*r*' and '*a*' of bends shall be as follows:

Dimensions r and a mm	*Permissible Variation* mm
Up to 100	± 3
101 – 300	± 5
301 – 600	± 7
601 – 800	± 8

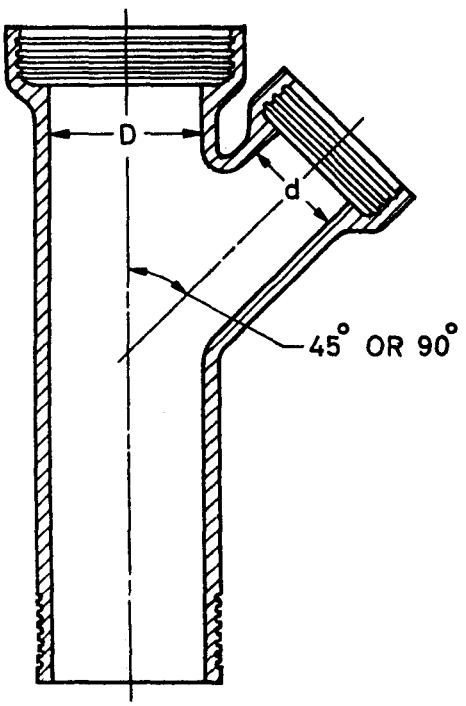
14 SOCKETS

The interior of the sockets shall be conical, having a minimum taper of 1 mm, measured on the diameter, per 15 mm length (that is, 1 to 30); thus the diameter of a socket 50 mm deep will be at least 3 mm greater at the top than at the bottom. The depth of the sockets shall be in accordance with Table 1.

The width of the shoulder of socket of any individual pipe or fitting shall exceed the mean thickness of the barrel by not less than the values given in col 5 of Table 1. If rubber ring joints are used, as agreed to between the manufacturer and the buyer, taper may not be provided.

15 GROOVING

The interior of the sockets and exterior of the spigots shall be grooved circumferentially, and such grooving on the spigot shall be for a length equal to one and half times the depth of sockets, and the depth of such grooves shall be between 1 mm to 2.5 mm. If rubber ring joints are used, as agreed to between the manufacturer and the buyer, grooving may not be provided.



NOTE — The socket of the branch arm should be as close to the main socket as possible. The barrels and branches of junctions may be of any of the diameters shown in col 2 of Table 1 but the diameter '*d*' of the branch shall not exceed that of the barrel dia '*D*'. Branches up to and including 200 mm diameter form an angle of approximately 45° and branches over 300 mm diameter form an angle of approximately 55° to 60° to the barrel, according to size.

FIG. 6 JUNCTION WITH BRANCH AT AN ACUTE ANGLE

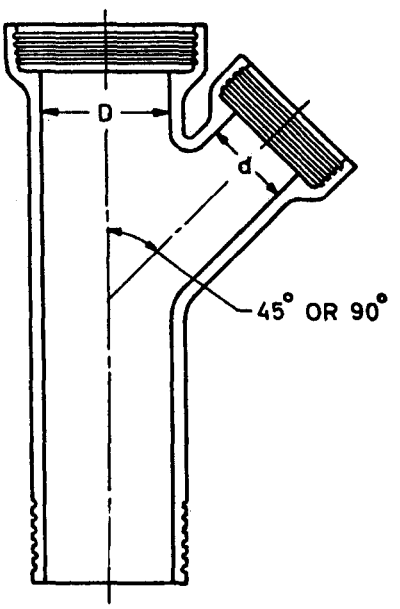
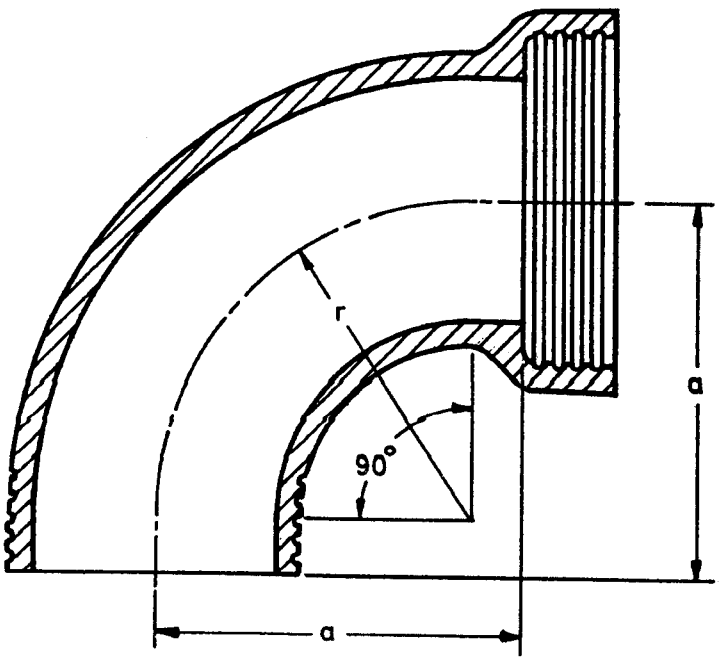


FIG. 7 HALF-SECTION CHANNEL JUNCTION

Table 2 Dimensions of One-Quarter Bends

(*Clause* 13.1)

All dimensions in millimetres.

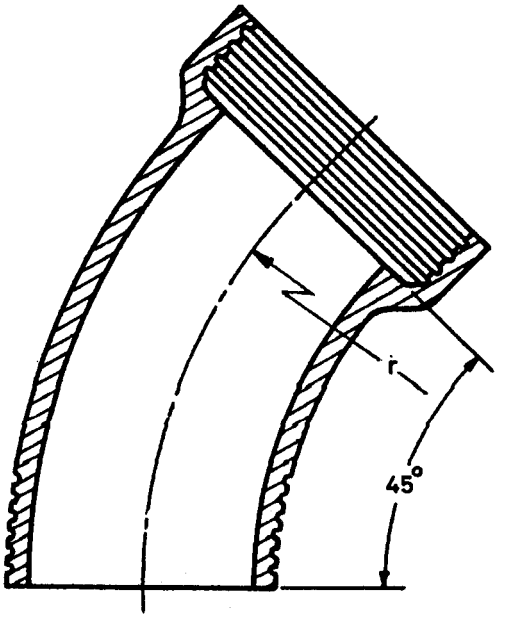


Sl No.	Internal Diameter	Short		Medium		Long	
		r	*a*	*r*	*a*	*r*	*a*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	100	90	140	150	190	215	255
ii)	150	150	190	190	230	230	265
iii)	200	–	–	215	265	–	–
iv)	230	–	–	215	265	–	–
v)	250	–	–	255	305	–	–
vi)	300	–	–	255	305	–	–
vii)	350	–	–	390	465	–	–
viii)	400	–	–	420	495	–	–
ix)	450	–	–	455	530	–	–
x)	500	–	–	490	570	–	–
xi)	600	–	–	550	640	–	–
xii)	750	–	–	600	700	–	–
xiii)	800	–	–	650	800	–	–

Table 3 Dimensions of One-Eighth Bends

(*Clause* 13.1)

All dimensions in millimetres.

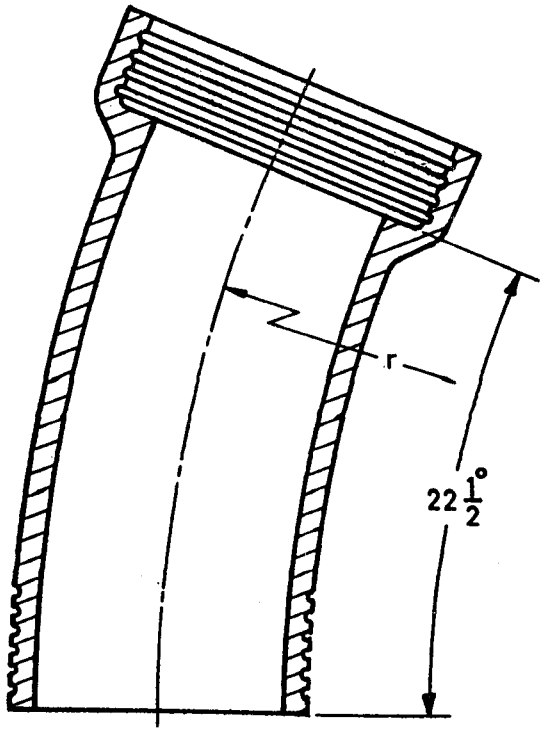


Sl No.	Internal Diameter	Short	Medium	Long
		r	*r*	*r*
(1)	(2)	(3)	(4)	(5)
i)	100	250	380	500
ii)	150	380	460	530
iii)	200	–	530	–
iv)	230	–	530	–
v)	250	–	610	–
vi)	300	–	610	–
vii)	350	–	640	–
viii)	400	–	670	–
ix)	450	–	700	–
x)	500	–	735	–
xi)	600	–	785	–
xii)	750	–	856	–
xiii)	800	–	1 000	–

Table 4 Dimension of One-Sixteenth Bends

(*Clause* 13.1)

All dimensions in millimetres.

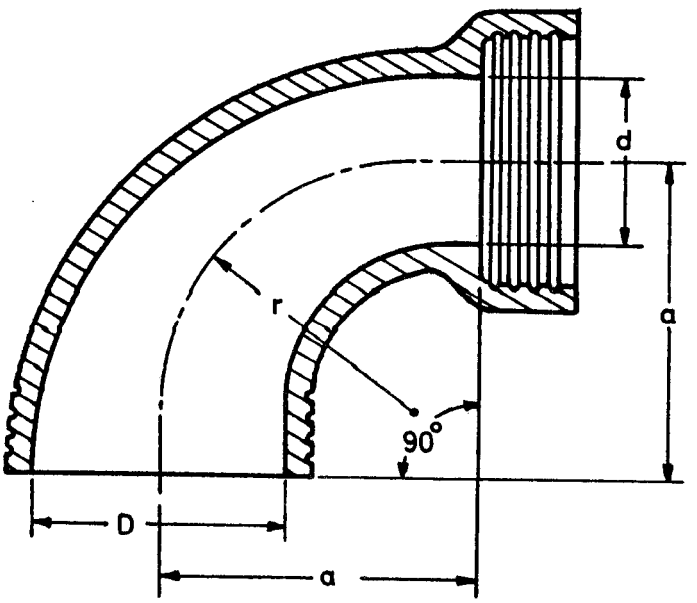


Sl No.	Internal Diameter	*r*
(1)	(2)	(3)
i)	100	750
ii)	150	900
iii)	200	1 050
iv)	230	1 050
v)	250	1 050
vi)	300	1 200
vii)	350	1 500
viii)	400	1 800
ix)	450	2 150
x)	500	2 600
xi)	600	3 050
xii)	750	3 600
xiii)	800	4 200

Table 5 Dimension of One-Quarter Taper Bends

(*Clause* 13.1)

All dimensions in millimetres.

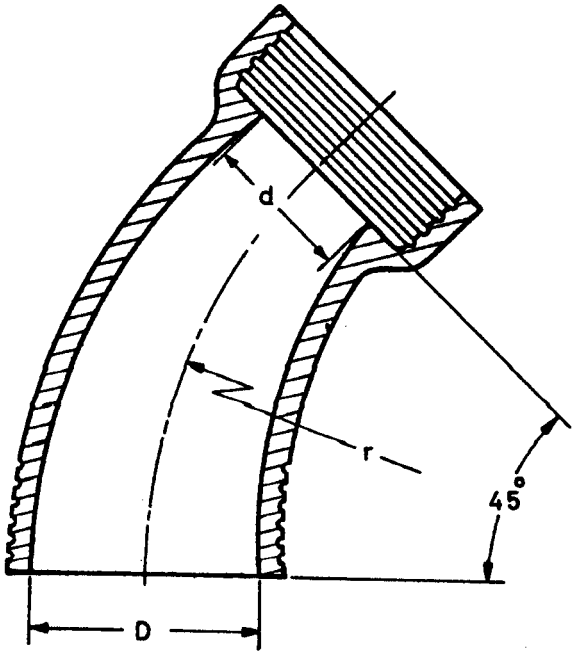


Sl No.	Internal Diameter			
	d	*D*	*r*	*a*
(1)	(2)	(3)	(4)	(5)
i)	100	150	150	190
ii)	150	250	199	250

Table 6 Dimensions of One-Eighth Taper Bends

(*Clause* 13.1)

All dimensions in millimetres.



Sl No.	Internal Diameter		
	d	*D*	*r*
(1)	(2)	(3)	(4)
i)	100	150	380
ii)	150	250	460

SECTION B

FITTINGS NOT FORMING PARTS OF NORMAL PIPELINE

16 GENERAL

This section deals only with designs and dimensions of fittings and it does not embody specification for quality. It includes inspection pipe (*see* Fig. 8) straight and taper channels, junctions and channel bends, channel, junctions and channel bends, channel interceptors and gully traps.

17 DIMENSIONS

The dimensions of fittings shall be as given in Tables 7 to 12 and Fig. 8 within practical limits without affecting the utility or serviceability of the fittings.

18 SPIGOTS AND SOCKETS OF FITTINGS

The spigots and sockets of fittings, except where otherwise provided for in this standard, shall conform to the appropriate corresponding dimensions of straight pipes and sockets given in Table 1.

19 GROOVING

The interior of the sockets and the exterior of the spigots shall be grooved circumferentially. Where applicable such grooving on the spigots shall be for a length equal to one and a half times the depth of the sockets, and the depth of such grooves shall be 1 mm to 2.5 mm.

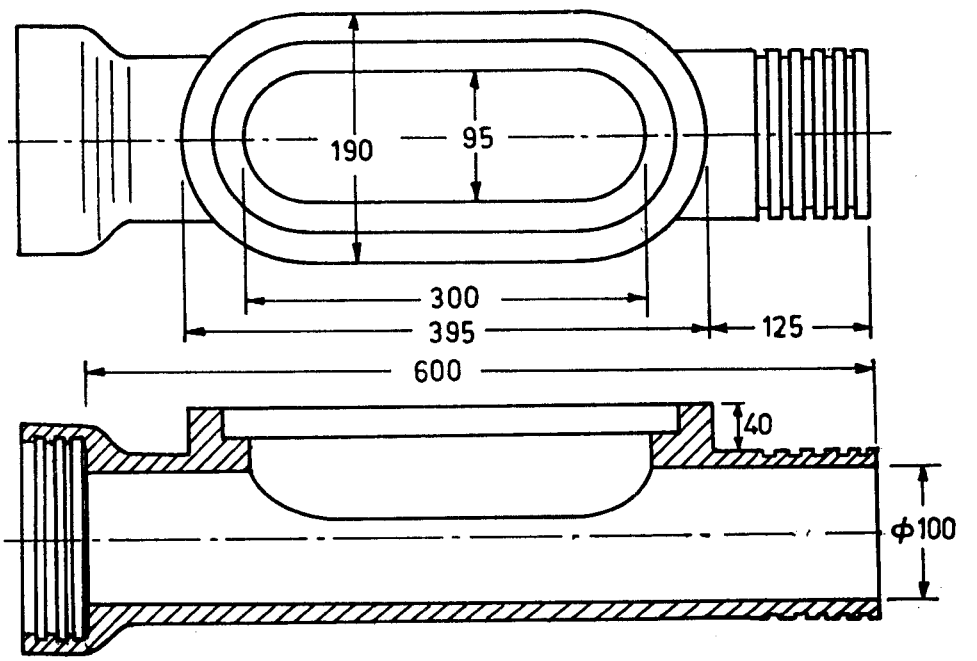
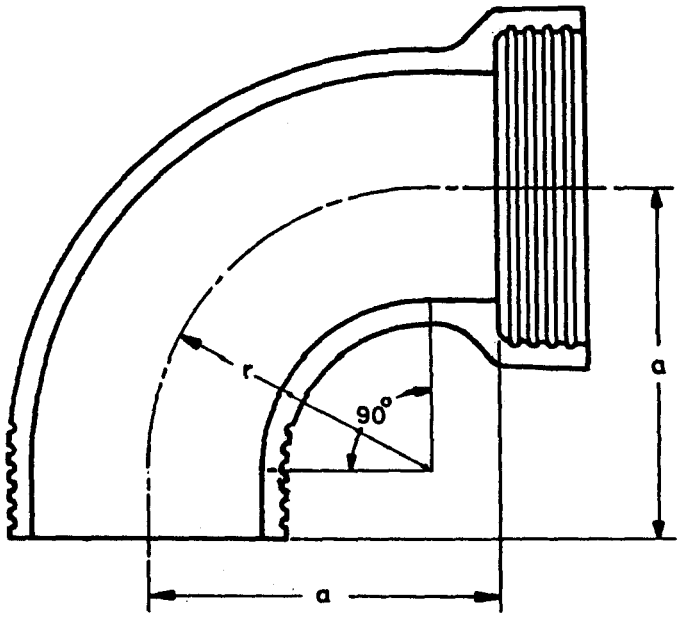


FIG. 8 INSPECTION PIPE

Table 7 Dimensions of Half-Section One-Quarter Channel Bends

(*Clause* 17)

All dimensions in millimetres.

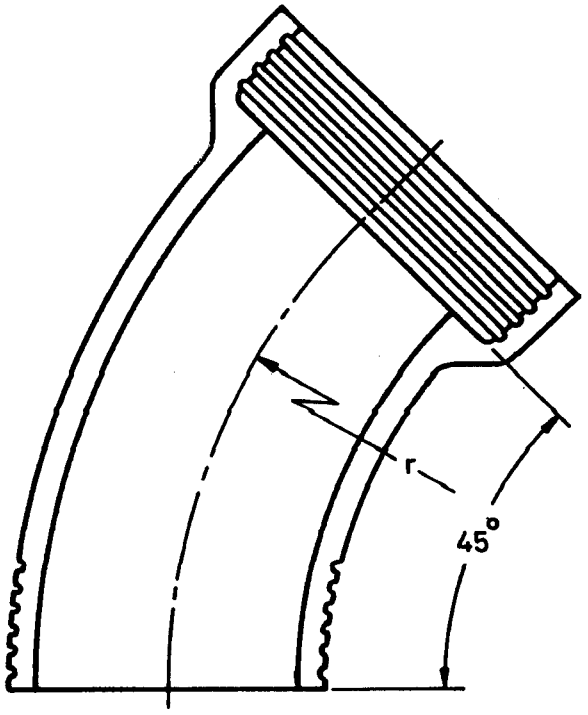


Sl No.	Internal Diameter	Short		Medium		Long	
		r	*a*	*r*	*a*	*r*	*a*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	100	90	140	150	190	215	255
ii)	150	150	190	190	230	230	265
iii)	200	–	–	215	265	–	–
iv)	230	–	–	215	265	–	–
v)	250	–	–	255	305	–	–
vi)	300	–	–	255	305	–	–
vii)	350	–	–	390	465	–	–
viii)	400	–	–	420	495	–	–
ix)	450	–	–	455	530	–	–
x)	500	–	–	490	570	–	–
xi)	600	–	–	550	640	–	–
xii)	750	–	–	600	700	–	–
xiii)	800	–	–	650	800	–	–

Table 8 Dimensions of Half-Section One-Eighth Channel Bends

(*Clause* 17)

All dimensions in millimetres.

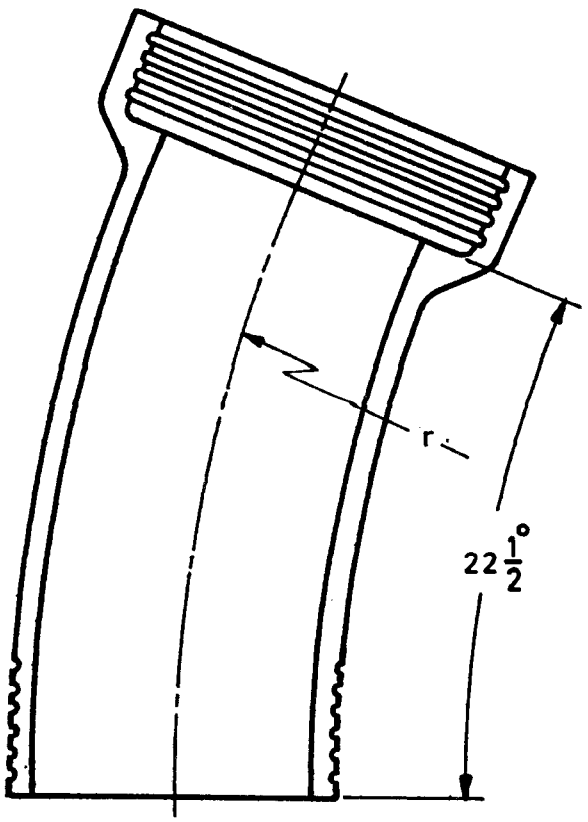


Sl No.	Internal Diameter	Short	Medium	Long
		r	*r*	*r*
(1)	(2)	(3)	(4)	(5)
i)	100	250	380	500
ii)	150	380	460	530
iii)	200	–	530	–
iv)	230	–	530	–
v)	250	–	610	–
vi)	300	–	610	–
vii)	350	–	640	–
viii)	400	–	670	–
ix)	450	–	700	–
x)	500	–	735	–
xi)	600	–	785	–
xii)	750	–	856	–
xiii)	800	–	1 000	–

Table 9 Dimensions of Half-Section One-Sixteenth Channel Bends

(*Clause* 17)

All dimensions in millimetres.

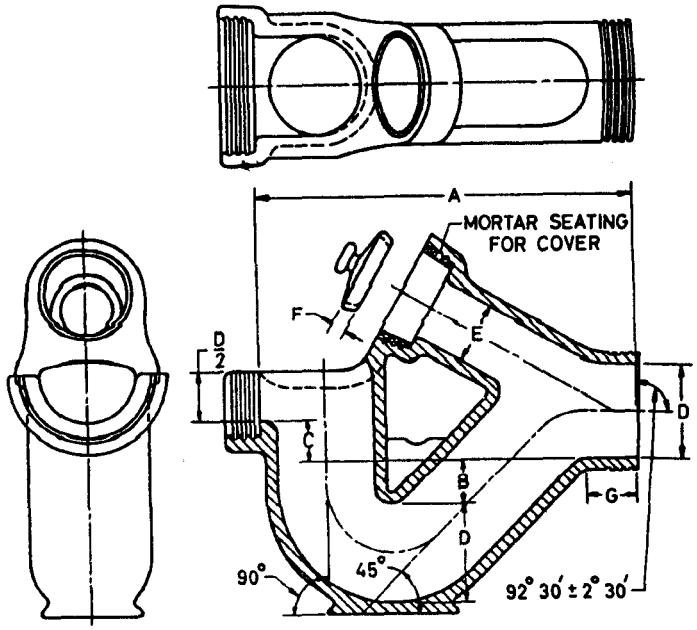


Sl No.	Internal Diameter	*r*
(1)	(2)	(3)
i)	100	750
ii)	150	900
iii)	200	1 050
iv)	230	1 050
v)	250	1 050
vi)	300	1 200
vii)	350	1 500
viii)	400	1 800
ix)	450	2 150
x)	500	2 600
xi)	600	3 050
xii)	750	3 600
xiii)	800	4 200

Table 10 Dimensions of Channel Interceptors

(*Clause* 17)

All dimensions in millimetres.

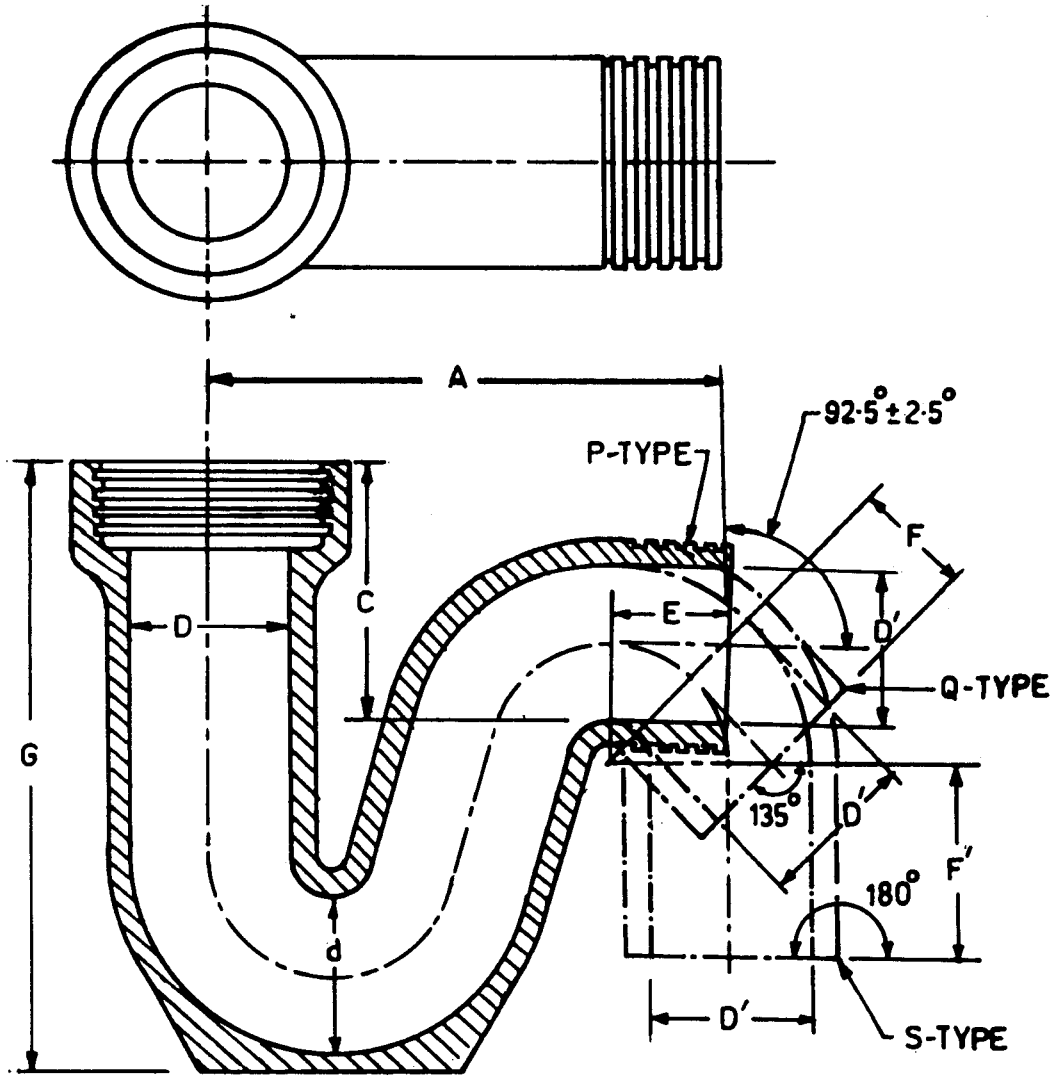


Sl No.	Internal Diameter	*A*	*B*	*C*	*E*	*F*	*G*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	100	470	65	50	100	20	75
ii)	150	620	75	65	100	20	75
iii)	230	790	75	65	100	20	90

Table 11 Dimensions of Round Mouth Gully Traps

(*Clause* 17)

All dimensions in millimetres.

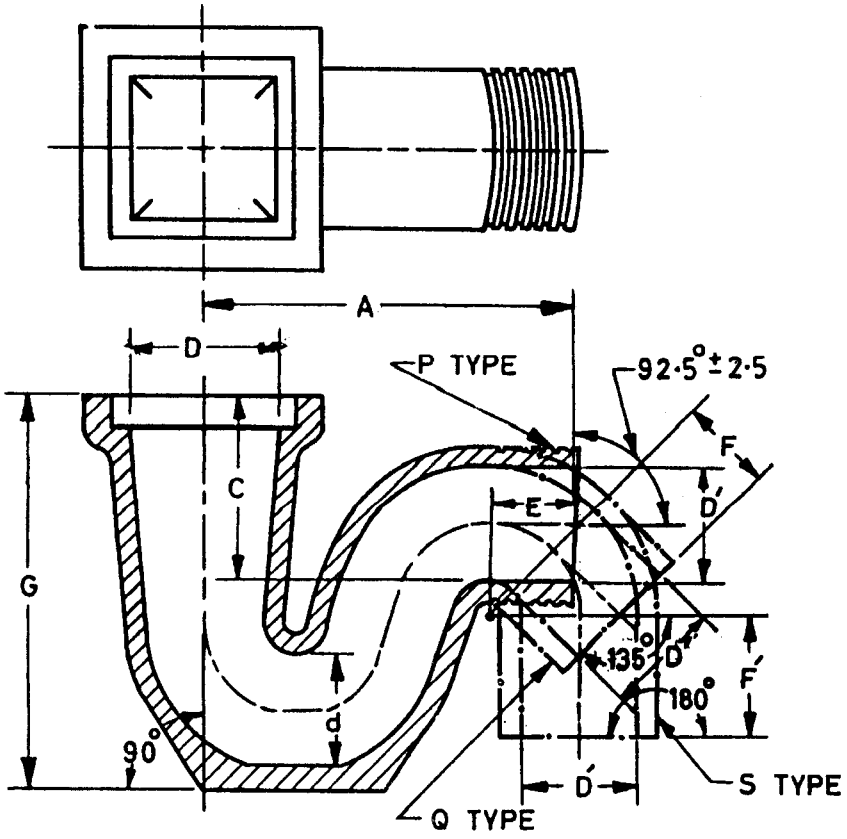


Sl No.	Type	Size	*A*	*C*	*d*	*D*	*D*	*E*	*F*	*F′*	*G*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	P	100 × 200	330	165	100	100	100	75	–	–	360
		125 × 100	355	185	100	125	100	75	–	–	340
		150 × 100	343	200	100	150	100	75	–	–	385
ii)	Q	125 × 100	330	175	100	125	100	–	75	–	340
iii)	S	100 × 100	305	165	100	100	100	–	–	120	360
		150 × 100	343	200	100	150	100	–	–	115	385
		150 × 150	405	255	150	150	150	–	–	110	460

Table 12 Dimensions of Square Mouth Gully Traps

(*Clause* 17)

All dimensions in millimetres.



Sl No.	Type	Size	*A*	*C*	*d*	*D*	*D'*	*E*	*F*	*F'*	*G*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	P	100 × 100	305	175	100	100	100	65	–	–	330
		125 × 100	265	165	100	125	100	60	–	–	345
		150 × 100	330	165	100	150	100	75	–	–	346
		180 × 100	320	200	100	180	100	65	–	–	380
		180 × 150	405	270	150	180	150	75	–	–	520
ii)	Q	125 × 100	330	165	100	125	100	–	80	–	345
iii)	S	125 × 100	290	165	100	125	100	–	–	100	345
		150 × 100	330	165	100	150	100	–	–	115	346
		180 × 150	445	275	150	180	150	–	–	125	520

ANNEX A

(*Clause* 7.4)

TEST FOR RESISTANCE TO ACIDS

A-0 PRINCIPLE

The test specimen is completely immersed in the test solution and the resistance to acid is determined as the percentage of acid soluble matter expressed as sulphate.

A-1 REAGENTS

A-1.1 Sulphuric Acid — 4.90 percent, specific gravity 1.84.

A-2 PREPARATION OF TEST SPECIMEN

Test specimen shall be sound with all edges freshly broken, free from cracks or shattered edges, about 5 cm square, not more than 200 g in mass, and shall be thoroughly cleaned with wire brush.

A-3 WEIGHING APPARATUS

The weighing shall be made on a balance accurate to 0.01 g when loaded with 200 g.

A-4 PROCEDURE

The specimens to be tested shall be dried to a constant mass (M_1) at a temperature not less than 150°C. The specimens upon reaching constant mass shall be completely immersed in the test solution at the ambient temperature for a period of 48 h. Then removed from the solution and carefully and thoroughly washed with hot distilled water, allowing the wash to run into the solution in which specimens were immersed. The solution shall be filtered and to the filtrate shall be added 5 ml of concentrated sulphuric acid. The solution shall then be evaporated (avoiding loss by ignition) and heated cautiously to dryness. It shall then be ignited to constant mass (M_2).

A-5 CALCULATION

The percentage of acid soluble matter, expressed as sulphate shall be calculated as follows:

$$\text{Loss in mass, percent} = \frac{\text{Mass of residue } (M_2)}{\text{Mass of dry specimen } (M_1)} \times 100$$

ANNEX B

(*Clause* 7.5)

TEST FOR ALKALI RESISTANCE

B-0 PRINCIPLE

The resistance of stoneware or vitrified clay pipes or fittings to alkali is determined by reacting it with magnesium sulphate solution.

B-1 PREPARATION OF SAMPLE

Test samples measuring not less than 75 cm^2 and not more than 130 cm^2 shall be broken from the pipe or fittings. The samples shall be sound, free from cracks or surface defects.

B-2 REAGENTS

B-2.1 Saturated Solution of Magnesium Sulphate — Conforming to IS 2730.

B-3 PROCEDURE

B-3.1 Heat the magnesium sulphate solution (specific gravity 1.295 to 1.308) to the boiling temperature. Place the test sample in a wire basket and submerge it into the boiling solution; continue heating for 2 h. Then remove the sample and bring it to a constant mass in a drier or oven at a temperature not less than 110°C. Subject the test sample to at least five cycles using fresh solution for each cycle. After the completion of five cycles remove the sample from the solution, wash it and bring it to constant mass in a drier or oven at a temperature not less than 110°C. Air cool the sample and observe.

B-3.2 There shall be no evidence or pitting softening spalling or cracking.

ANNEX C

(*Clause* 7.6)

CRUSHING STRENGTH TEST

C-1 CRUSHING STRENGTH TESTING MACHINE

C-1.1 While the pipe to be tested is supported in a horizontal position on two bearings parallel to axis, the load shall be applied to it along the length of the barrel through a third bearing on top of the barrel (*see* Fig. 9).

C-1.2 Any testing machine having a device that will apply the load at a uniform rate of about 30 (kN/m) min, or in increments of not more than 500 N at the same rate, may be used for making the test.

C-1.3 The testing machine shall be substantial and rigid throughout, so that the distribution of the load will not be affected appreciably by the deformation or yielding of any part. The bearings shall be as specified in **C-1.4**, **C-1.5**, **C-1.6** and **C-2.1**, and shall be attached to the machine so as to receive and uniformly transmit maximum loads required in the tests without lost motion, vibrations, or sudden shock. The machine and bearings shall be designed to transmit the load in a vertical plane through the longitudinal centre lines of the bearings and pipe.

C-1.4 The three bearings shall consist of a lower member, bearing a rigid beam on which two bearings strips are symmetrically disposed parallel to a vertical plane passing through the longitudinal axis of the pipe, and an upper member also being a rigid beam, on which one bearing strip is centered and disposed so that it lies in the vertical plane passing through the longitudinal axis of the pipe (*see* Fig. 9).

C-1.5 The beam on which the bearing strips are disposed shall be structural steel beams single or of compound sections having moments of inertia about the vertical and horizontal axis of the cross section not less than those of WB 250 (*see* IS 808) and with a width of flange not less than 200 mm.

C-1.6 Mild steel, teak or similar hardwood shall be used to face the upper flange of the bottom beam. The facing shall be straight and free of warping or twisting and shall be centrally located on the flange of the beam by means of hardwood strips attached to its lower face and in contact with the edges of the flange. The cross-section of the facing may have either of two shapes at the discretion of the pipe manufacturer. Shape A shall be rectangular 280 × 25 mm minimum, without a joint. Shape B is shown in Fig. 10. A similar facing of Shape A may be used to face the lower flange of the upper beam, if desired.

C-2 BEARING STRIPS

C-2.1 The bearing strips shall consist of rubber cut or formed from material having sufficient hardness. The strips shall be of rectangular cross-section having a width of 50 mm and a thickness of not less than 25 mm or more than 40 mm. The two bottom strips shall be of equal thickness.

C-2.2 The single top bearing strip shall be used with the 50 mm dimension in contact with the pipe. It may be positioned on the bearing by the use of wood or metal strips along its outside edges, provided the thickness of the positioning strips does not exceed one-half the thickness of the rubber bearing stip.

C-2.3 The two lower bearing strips shall be laid on the 50 mm dimension and may be positioned on the bearing with wood or metal strips between them and adjacent to their outside edges, provided the thickness of these positioning strips does not exceed one-half the thickness of these rubber bearing strips. The two strips shall be parallel and, when used with a facing of Shape A shall be spaced a distance apart of approximately 1 mm per 12 mm of pipe diameter but in no case has than 25 mm. When used with Shape B they shall be parallel and 25 mm apart for all pipe diameters.

C-2.4 The rubber bearing strips may be attached to the facings, or in the case of the single upper strip, directly to the upper beam, by adhesive if desired, provided, such method of attachment results in the strip remaining firmly fixed in position when carrying the maximum load.

C-3 APPLICATION OF LOAD

C-3.1 The load shall be applied to the top bearing at a point distant from the spigot and of the pipe equal to one-half of the overall length of the pipe including the socket, if any. The test load shall be applied to the top bearing in such a way that the bearing is free to rotate in vertical plane through the longitudinal centre line, of the top and bottom bearings. In testing a pipe that is not straight it shall be placed between the bearings in the position that appears to give the most favorable bearing condition for fair test.

C-3.2 The loading of the pipe shall be a continuous operation, and the pipe shall not be allowed to stand under load longer than is required to apply the load and record the observations.

C-4 EVALUATION OF CRUSHING STRENGTH

C-4.1 The ultimate crushing strength in kN per linear metre shall be calculated by dividing the total applied load at fracture by the inside length of the barrel of the sample broken.

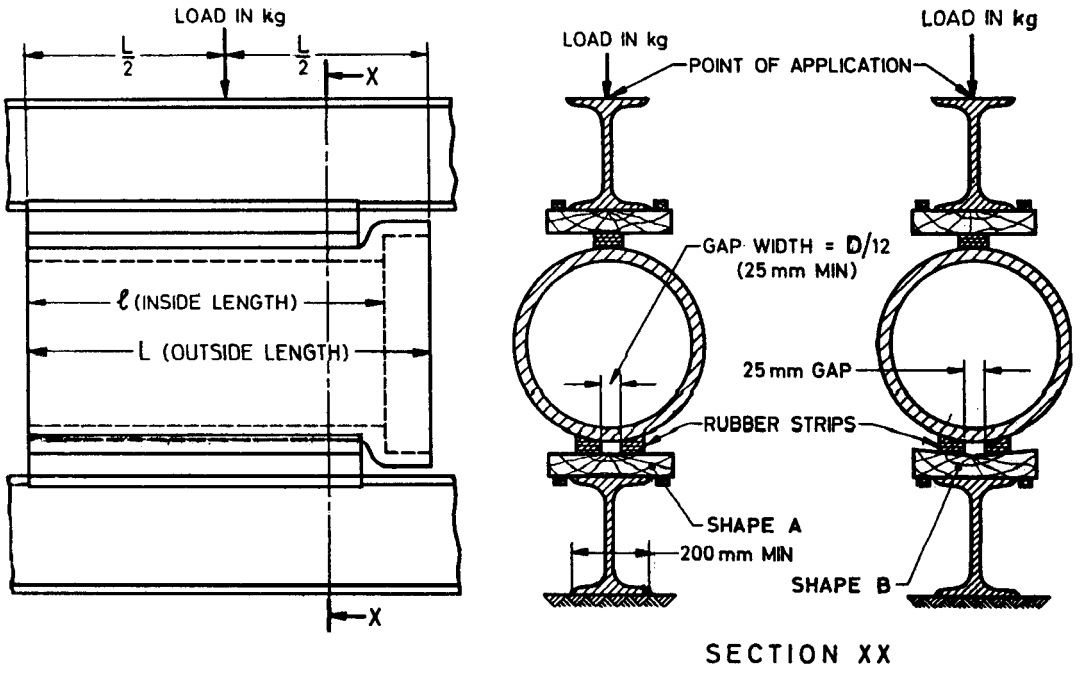


FIG. 9 CRUSHING TEST RIG

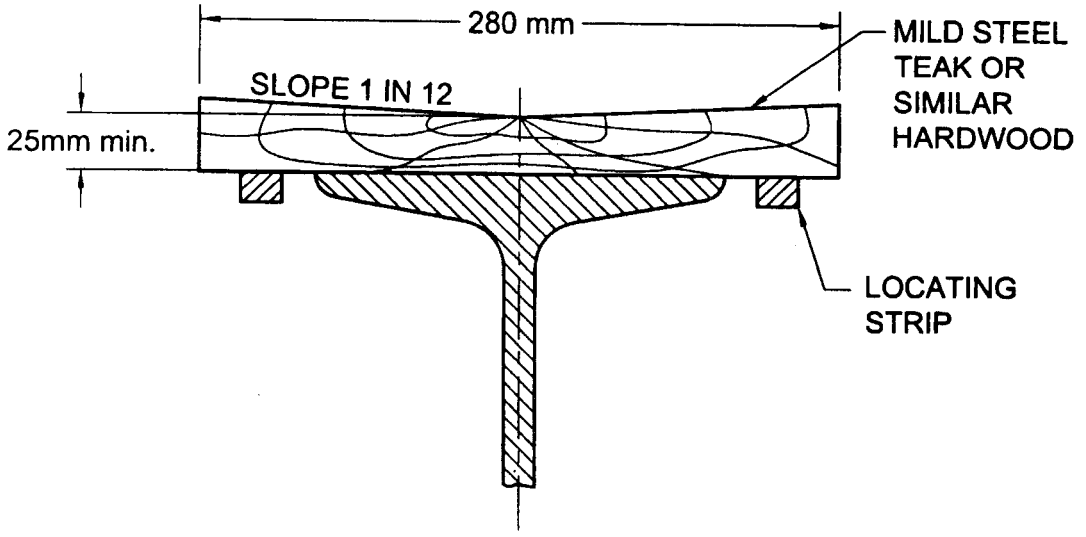


FIG. 10 DETAILS OF ALTERNATIVE FACING

ANNEX D

(*Clause* 8)

SAMPLING AND CRITERIA FOR CONFORMITY

D-1 LOT

All the pipes or fittings of the same type, size and manufactured under similar conditions of production, shall be grouped together to constitute a lot.

D-2 SCALE OF SAMPLING

The number of pipes or fittings to be selected at random (*see* IS 4905) from the lot depends upon the size of the lot and shall be in accordance with col 2 to 5 of Table 13.

D-3 NUMBER OF TESTS

D-3.1 All the pipes or fittings selected as in **D-2** shall be inspected for general quality (*see* **5**) and dimensions (*see* Section A or Section B, as relevant).

D-3.2 The number of pipes or fittings to be tested for hydraulic test (*see* **7.2**) shall be 5 percent of the lot, as prescribed in **D-1**. These pipes may be selected at random from those already selected in **D-2**.

D-3.3 The number of pipes or fittings to be tested for water absorption (*see* **7.3**), for resistance to action of acids (*see* **7.4**), for resistance to action of alkali (*see* **7.5**) and crushing strength (*see* **7.6**) shall be as given below:

Lot Size	*Number of Pipes to be Tested*
(1)	(2)
Up to 150	3
151 to 200	5
1 201 to 10 000	8

These pipes may be selected at random from those already selected in **D-2** and suitable test specimens prepared.

D-4 CRITERIA FOR CONFORMITY

D-4.1 A lot shall be considered as conforming to the requirements of the specification, if the conditions mentioned in **D-4.2** to **D-4.6** are satisfied.

D-4.2 General Quality (*see* 5) and Dimension (*see* Section A and Section B)

The number of pipes or fittings in the first sample (*see* col 3 and 4 of Table 13) shall be first selected and subjected to inspection for general quality and dimensions. If in the first sample the number of defectives, that is, those failing either for general quality or dimensions, is less than or equal to the corresponding acceptance number a_c (col 6 of Table 13), the lot shall be considered as conforming to the requirements of general quality and dimensions. If the number of defectives in the first sample is greater than or equal to the corresponding rejection number r_e (col 7 of Table 13), the lot shall be considered as not conforming. If the number of defectives in the first sample lies between the corresponding a_c and r_e, a second sample (*see* col 3 and 4 of Table 13), shall be selected and subjected to inspection. If in the combined sample, the number of defective is greater than or equal to the corresponding rejection number r_e, the lot shall be considered as not conforming.

D-4.3 For the hydraulic test, all the specimens shall satisfy the requirement as specified in **7.2**.

D-4.4 For water absorption test, the mean and the range (difference between the highest and the lowest value) of the test results obtained shall be calculated and (mean + 0.6 range) shall be less than or equal to the maximum limit specified in **7.3**.

D-4.5 For resistance to action of acid and of alkali, all test specimens shall satisfy the requirements specified in **7.4** and **7.5** respectively.

D-4.6 For crushing strength test, all the test specimens shall satisfy the requirements as specified in **7.6**.

Table 13 Sample Size and Criteria for Conformity

(*Clauses* D-2 *and* D-4.2)

Sl No.	Lot Size	Sample	Sample Size	Cumulative Sample Size	General Quality (*see* 5) and Dimensions (Sections A and B)	
					a_c	r_c
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Up to 150	First	20	20	1	4
		Second	20	40	4	5
ii)	151 - 280	First	32	32	2	5
		Second	32	64	6	7
iii)	500 - 1200	First	80	80	5	9
		Second	80	160	12	13
iv)	1 201 - 3 200	First	125	125	7	11
		Second	125	250	18	19
v)	3 201 - 10 000	First	200	200	11	16
		Second	200	400	26	27

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