For Comments only

Draft Indian Standards

CAST IRON SPECIALS FOR ASBESTOS CEMENT PRESSURE PIPES FOR WATER, AND SEWAGE - SPECIFICATION

(Third Revision of IS 5531)

ICS 23.040.04; 91.100.40

Last date for receipt of comments is 31 July 2010

FOREWORD

(Formal Clause will be added later)

This standard was first published in 1969 and subsequently revised in 1977 and 1988. In this revision, following major modifications have been effected:

a) Alternative jointing system other than details given in this specification have been allowed as per current practice for different types of pipe materials..

b) Type test of joint to prove the efficacy of the joint design has been included corresponding to the class of joint.

c) All CI Fittings for Asbestos Cement Pipes are to be machined. The outside diameter of these plain ended fittings should be compatible with Class of Asbestos Cement Pipes with which they are to be used. There are five pressure classes of pipes with five machined outside diameters. To reduce the number of patterns and core boxes only two outside diameters of the plain ends have been proposed. There is a provision to machine the plain ends as required to fit the particular Class of pipes to be used.

d) As per standard practice of cast iron fittings specifications for other types of pipes, the weight of each castings have been omitted. The tolerance of weight has also been omitted.

e) For smoother hydraulic flow and prevention of tuberculation and corrosion, inside lining by cement mortar has been added as an optional requirement. Other types of linings such as Epoxy, ceramic Epoxy and Polyurethane have been allowed as optional.

f) In the earlier version all socket fittings were introduced, but since none of the manufacturers wanted to produce such fittings, this type was withdrawn in later revisions.

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.

1 SCOPE

1.1 This standard covers the requirements for cast iron specials to be used with asbestos cement pressure pipes for water, and sewage.

1.1.1 This standard is applicable to cast iron specials for use with asbestos cement pressure pipes suitable for connection with cast iron detachable joints or asbestos cement couplings.

1.2 Cast iron specials to be used with asbestos cement pressure pipes may have plain ends or flanged ends. In case of plain ends, cast iron detachable joints or asbestos cement couplings may be used with them.

1.2.1 Joint design other than the design given in that standard are outside the scope of this standard. The standard does not restrict the future developments of joints as long as critical dimensions are maintained to match the outside diameter of the plain end of the pipe of the same class, for which it is designed.

1.3 The fittings covered by this standard are normally supplied with externally and internally coated to protect against corrosion.

1.4 The fittings are to be suitable for fluid temperatures between 0 deg C and 50 deg C, excluding frost.

1.5 Whereas requirements of cast iron specials for use with AC pressure pipes conforming to IS 1592 have been covered in this Standard.

2 REFERNCES

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

IS NO.	*Title*
210:2009	Grey iron castings (fifth revision)
1387:1993	General requirements for the supply of metallurgical materials (second revision)
1500:2005/ ISO 6506-1:1999	Method for Brinell hardness test for metallic materials (third revision)
1592:2003	Asbestos cement pressure pipes and joints (fourth revision)

3 SUPPLY OF MATERIAL

The general requirements relating to the supply of the materials shall be as laid down in IS 1387.

4 MANUFACTURE

4.1 The metal used for the manufacture of the specials shall be of requisite quality conforming to any of the grade specified in IS 210.

4.2 The castings shall be stripped with all precautions necessary to avoid warping or shrinking defects. The castings shall be free from defects other than any unavoidable surface imperfections which result from the method of manufacture and which do not affect the use of the specials. By agreement between the purchaser and the manufacturer, minor defects may be rectified.

4.3 In the case of flanged joints, the flanges shall be at right angle to the axis of the joint. The bolt holes shall be drilled.

4.4 The casting shall be such that they could be cut, drilled or machined with the tools normally used for installation. In case of dispute, the castings may be accepted provided (the hardness of the external un-machined surface does not exceed 215 HBW

4.5 Where castings required to withstand pressure higher than those specified in this standard, the castings may be strengthened by means of increased wall thickness, if necessary, at the expense of the internal diameter or by suitable ribbing or as may be mutually agreed between manufacturer and the purchaser, to suit the pressure specified by the purchaser.

5 WALL THICKNESS AND CLASSIFICATION

The wall thickness of the fittings given in this standard are suitable for maximum working pressure of 2.5 MPa. The minimum thickness of of the fittings has been limited to 8.6mm. The specified thickness of each casting has been specified in the Tables 3 to 10.

6 MECHANICAL TESTS

6.1 Mechanical test shall be carried out during manufacture by batch sampling system. Samples shall be taken, at the manufacturer's option, either from a sample attached to the casting or from a sample cast separately. In the later case case, it shall be cast from the same metal as that used for the casting. The mechanical properties of samples being representative of finished products are tested for tensile strength and hardness to verify mechanical properties. Two tests per 24 hours of casting shall be adequate. The results obtained are taken lo represent all the castings of all sizes made during that period.

6.2 Tensile Test - Two tensile tests shall be made on bars cast from the same metal as specified in Annex A. The, results of the tests shall snow a minimum tensile strength of 150 MPa.

6.3 Brinell Hardness Test - For checking the Brinell hardness specified in 3.4, tests shall be carried out on the test bars used for the tests in 4.1 in accordance with IS 1500

6.4 Retest — If any test piece representing a lot fails to pass the test in the first instance, two additional tests shall be made on test pieces made from the same metal used for the same lot. Should any of these additional test pieces fail to pass the test; the lot shall be deemed as not complying with the standard.

6.5 All spigot ends are to be machined to a length of 90 mm with fine grade machining so that the joints do not leak in the performance test.

7. HYDROSTATIC TEST

7.1 For hydrostatic test, the specials shall be kept under pressure (*see* 7.1.1) for a period of minimum 15 seconds and, may be struck moderately with a 700-g hammer. They shall withstand the pressure test without showing any leakage, sweating or other defects of any kind. The hydrostatic test' shall be conducted before coating the castings.

7.1.1 The specials shall withstand test pressure specified in Table 1

Table I Hydrostatic Test Pressure for Castings

(Clause 6.1)

Nominal Diameter DN (mm)	Hydrostatic Test Pressure at Works (MPa)
Up to and including 300	2.5
Over 300 and up to and including 600	1.6

7.1.2 When the specials are required for higher pressures, the test pressure are subject to agreement between the purchaser and the manufacturer.

8. SIZES

8.1 The standard of nominal size DN of the fittings covered in this standard are 80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500 and 600mm.

NOTE - Nominal size is a number used to classify fittings/joints/castings and corresponds approximately to their internal diameter.

9. DIMENSIONS

9.1 The dimensions of the fittings shall be as specified in Tables 2 to 10.

NOTE 1 —Nominal diameter of cast iron fittings shall refer to the corresponding nominal diameter of the AC pressure pipe of IS 1592.

NOTE 2 — Cast Iron fittings for nominal dia more than 600 mm may also be manufactured. In such case, detailed dimensions may be as mutually agreed between the purchaser and the supplier.

9.2 The outside diameter of the engagement end of a special **shall be machined and should match** the corresponding outside diameter of the asbestos cement pressure pipe of different classes conforming to IS : 1592.

9.3 The engagement length shall be not less than 90 mm.

10. TOLERANCES ON DIMENSIONS

10.1 Thickness — Tolerances on the wall thickness and flange thickness of the specials shall be as follows :

Dimension	*Tolerance*
Wall Thickness, *e*	-(2.00 mm + 0.05*e*) (*see* note)
Flange Thickness, *b*	±(3.00 mm + 0.05 *b*)

where

e = standard thickness of the wall in mm, and

b = standard thickness of the flange in ram.

NOTE — No limit for the plus tolerances is specified.

10.2 Other Dimensions — Tolerances on other dimensions shall be as under:

Dimension	*Tolerance, mm*
Machined outside diameters	+1.5
(02 and d_2)	-1.0
Length (*l*) and	+15
Height (h)	10

11. COATING

11.1 After inspection and hydrostatic test, each casting shall be coated with bitumen as specified in 10.1 to 10.6.

11.2 Bituman oir similar coating shall not be applied to any castings, unless its surface is clean, dry and free from rust.

11.3 Unless otherwise agreed to between the purchaser and the manufacturer, all castings shall be coated externally and internally with the same material, the castings being preheated" prior to total immersion in a bath containing a uniformly heated composition, having a bituminous tar or other suitable base,

NOTE — For specials used for carrying water. coal tar should not be used.

11.4 Alternatively, the coating on the castings may be done without preheating with approved coating mutually agreed between the manufacturer and the purchaser, if agreed to at the time of enquiry and order.

11.5 The bitumen coating material shall set rapidly with good adherence and shall not scale off.

11.6 In all instances, where the coating material has a bituminous or similar base, it shall be smooth and tenacious, and hard enough not to flow.

11.7 Then the specials arc to be used for conveying potable water, the inside coating shall not contain any constituent soluble in such water or any ingredient which could impart any taste or odour whatsoever to the potable water after sterilization and suitably washing of the mains.

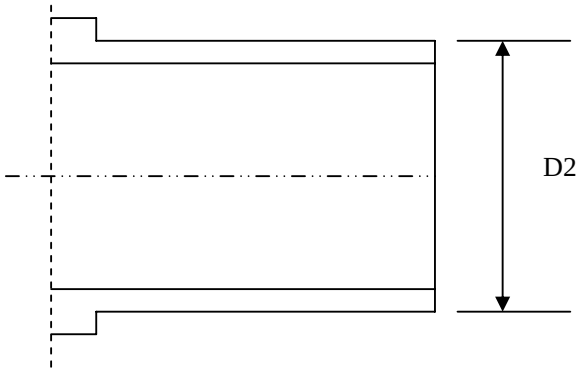


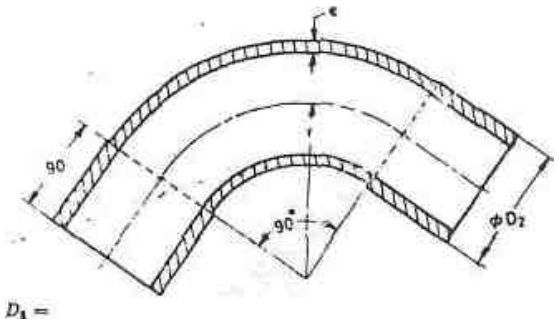
Table 2 Machined Plain Ends of the CI Fittings
(Clause 9.1)

Nominal Diameter	Class	Barrel Wall Thickness 'e'	Machined Outside Dia of the CI Fitting'D2'
DN	Bar	mm	mm
80	5,10,15,	8.6	99.5
	20,25	10.0	106.5
100	5,10,15,	9.0	121.0
	20,25	10.5	132.5
125	5,10,15,	9.5	147.0
	20,25	11.1	159.5
150	5,10,15,	10.0	176.5
	20,25	11.7	191.0
200	5,10,15,	11.0	233.5
	20,25	12.8	253.5
250	5,10,15,	12.0	284.5
	20,25	14.0	305.5.
300	5,10,15,	13.0	340.5
	20,25	15.2	366.5
350	5,10,15,	14.0	392.0
	20,25	17.9	419.0
400	5,10,15,	15.0	448.0
	20,25	19.3	478.0
450	5,10,15,	16.0	498.0
	20,25	20.6	532.0
500	5,10,15,	17.0	554.5
	20,25	21.8	591.5
600	5,10,15,	19.0	665.5
	20,25	24.4	710.5

Table 2 Dimensions Of Cast Iron Plain-End Bends (90°)

(*Clause* 9.1)

All dimensions in millimeters



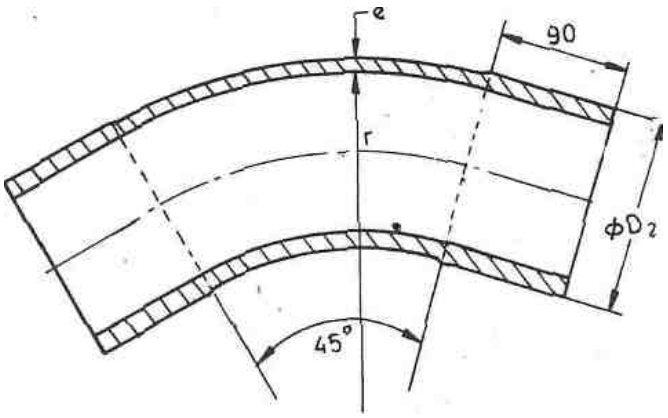
D_2 = Machined outside diameter of asbestos cement pressure pipe as given in Table 1

NOMINAL DIAMETER DN	CLASS	BARREL WALL THICKNESS 'E'	RADIUS 'r'	NOMINAL DIAMETER DN	CLASS	BARREL WALL THICKNESS 'E'	RADIUS r
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80	15	8.6	137	300	15	13.0	335
	25	10.0	137		25	15.2	335
100	15	9.0	155	350	15	14.0	380
	25	10.5	155		25	17.9	380
125	15	9.5	177.5	400	15	15.0	425
	25	11.1	177.5		25	19.3	425
150	15	10.0	200	450	15	16.0	470
	25	11.7	200		25	20.6	470
200	15	11.0	245	500	15	17.0	515
	25	12.8	245		25	21.8	515
250	15	12.0	290	600	15	19.0	605
	25	14.0	290		25	24.4	605

Table 2 Dimensions Of Cast Iron Plain-End Bends (45°)

(*Clause* 9.1)

All dimensions in millimeters



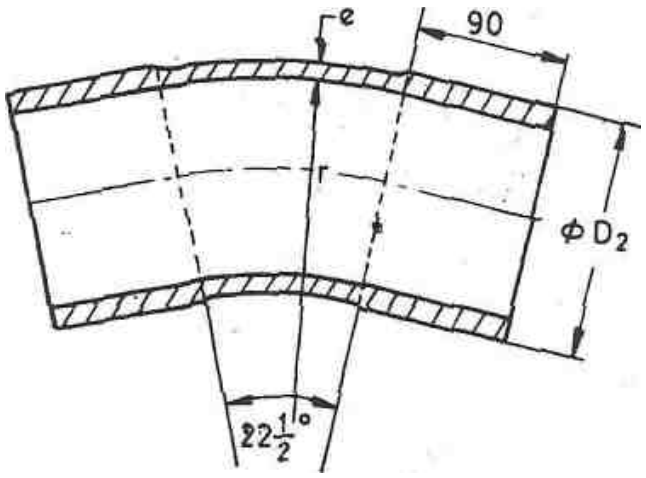
D_2 = Machined outside diameter of asbestos cement pressure pipe as given in Table 1

NOMINAL DIAMETER DN	CLASS	BARREL WALL THICKNESS 'E'	RADIUS 'r'	NOMINAL DIA DN	CLASS	BARREL WALL THICKNESS 'E'	RADIUS r
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80	15	8.6	280	300	15	13.0	500
	25	10 0	280		25	15.2	500
				350	15	14.0	550
100	15	9.0	300		25	17.9	550
	25	10.5	300				
				400	15	15.0	600
125	15	9.5	325		25	19.3	600
	25	11.1	325				600
				450	15	16.0	650
150	15	10.0	350		25	20.6	650
	25	11.7	350	500	15	17.0	700
					25	21.8	700
200	15	11.0	400				
	25	12.8	400	600	15	19.0	800
					25	24.4	800
250	15	12.0	450				
	25	14.0	450				

Table 3 Dimensions Of Cast Iron Plain-End Bends (22½°)

(*Clause* 9.1)

All dimensions in millimeters



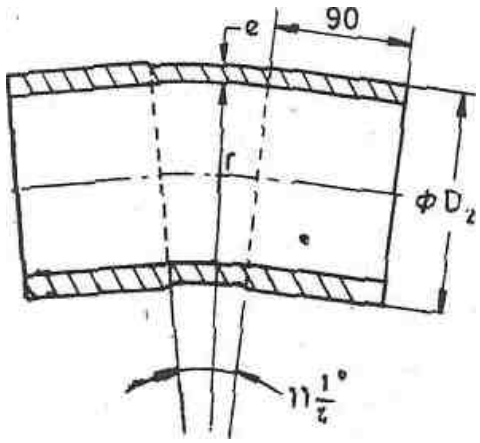
D_2 = Machined outside diameter of asbestos cement pressure pipe as given in Table 1

NOMINAL DIAMETER DN	CLASS	BARREL WALL THICKNESS 'E'	RADIUS 'r'	NOMINAL DIA	CLASS	BARREL WALL THICKNESS 'E'	RADIUS r
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80	15	8.6	280	300	15	13.0	500
	25	10 0	280		25	15.2	500
				350	15	14.0	550
100	15	9.0	300		25	17.9	550
	25	10.5	300	400	15	15.0	600
125	15	9.5	325		25	19.3	600
	25	11.1 1	325	450	15	16.0	650
					25	20.6	650
150	15	10.0	350				
	25	11.7	350	500	15	17.0	700
					25	21.8	700
200	15	11.0	400				
	25	12.8	400	600	15	19.0	800
					25	24.4	800
250	15	12.0	450				
	25	14.0	450				

Table 4 Dimensions Of Cast Iron Plain-End Bends (11¼°)

(*Clause* 9.1)

All dimensions in millimeters



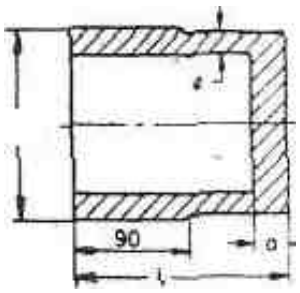
D_2 = Machined outside diameter of asbestos cement pressure pipe as given in Table 1

NOMINAL DIAMETER DN	CLASS	BARREL WALL THICKNESS 'E'	RADIUS 'r'	NOMINAL DIA DN	CLASS	BARREL WALL THICKNESS 'E'	RADIUS r
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80	15	8.6	280	300	15	13.0	500
	25	10.0	280		25	15.2	500
100	15	9.0	300	350	15	14.0	550
	25	10.5	300		25	17.9	550
125	15	9.5	325	400	15	15.0	600
	25	11.1	325		25	19.3	600
150	15	10.0	350	450	15	16.0	650
	25	11.7	350		25	20.6	650
200	15	11.0	400	500	15	17.0	700
	25	12.8	400		25	21.8	700
250	15	12.0	450	600	15	19.0	800
	25	14.0	450		25	24.4	800

Table 5 Dimensions Of Cast Iron Plain-End Plugs

(*Clause* 9.1)

All dimensions in millimeters



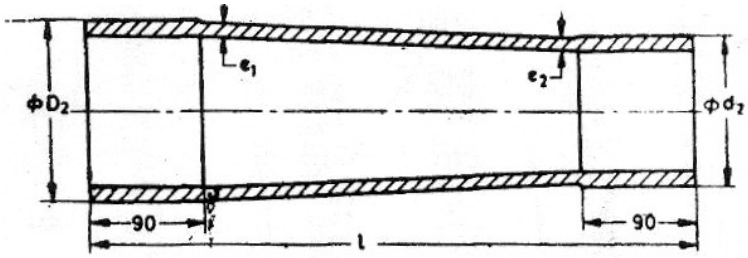
D_2 = Machined outside diameter of asbestos cement pressure pipe as given in Table 1

NOMINAL DIAMETER DN	CLASS	WALL THICKNESS 'E'	END THICKNESS 'a'	LENGTH 'l'	NOMINAL DIA DN	CLASS	WALL THICKNESS DN	END THICKNESS 'e'	LENGTH l
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
80	5,10,	8.6	21	125	300	5	13.0	27.5	160
	15	8.6	21	125		10	13.0	27.5	160
	20	10 0	21	125		15	13.0	27.5	160
	25	10.0	21	125		20	15.2	27.5	160
						25	15.2	27.5	160
100	5,.10	9.0	22	130	350	5.10	14.0	29.0	165
	15	9.0	22	130		15	14.0	29.0	165
	20	10.5	22	130		20	16.3	29.0	165
	25	10.5	22	130		25	17.9	29.0	165
125	5,10	9.5	22.5	135	400	5,10	15.0	30.0	170
	15	9.5	22.5	135		15	15.0	30.0	170
	20	11.1	22.5	135		20.	17.5	30.0	170
	25	11.1	22.5	135		25	19.3	30.0	170
150	5,10	10.0	23.0	140	450	5,10	16.0	31.5	175
	15	10.0	23.0	140		15	16.0	31.5	175
	20	11.7	23.0	140		20	18.7	31.5	175
	25	11.7	23.0	140		25	20.6	31.5	175
200	5	11.0	24.5	150	500	5,10	17.0	33.0	180
	10	11.0	24.5	150		15	17.0	33.0	180
	15	11.0	24.5	150		20	19.8	33.0	180
	20	12.8	24.5	150		25	21.8	33.0	180
	25	12.8	24.5	150					
250	5	12.0	26.0	155	600	5,10	19.0	36.0	185
	10	12.0	26.0	155		15	19.0	36.0	185
	15	12.0	26.0	155		20	22.2	36.0	185
	20	14.0	26.0	155		25	24.4	36.0	185
	25	14.0	26.0	155					

Table 6 Dimensions Of Cast Iron Plain-End Reducers

(*Clause* 9.1)

All dimensions in millimeters



D_2 = Machined outside diameter of asbestos cement pressure pipe at the large end as given in Table 1.

d_2= Machined outside diameter of asbestos cement pressure pipe at the small end as given in Table 1.

NOMINAL DIAMETER DN	CLASS	BARREL WALL THICKNESS		TOTAL LENGTH l
		e_1	e_2	
(1)	(2)	(3)	(4)	(5)
100 x 80	5,10	9.0	8.6	400
	15	9.0	8.6	400
	20	10.5	10.0	400
	25	10.0	10.0	400
125 x 80	5,.10	9.5	8.6	400
	15	9.5	8.6	400
	20	11.1	10.0	400
	25	11.1	10.0	400
125 x 100	5,10	9.5	9.0	400
	15	9.5	9.0	400
	20	11.1	10.5	400
	25	11.1	10.5	400
150 x 80	5,10	10.0	8.6	400
	15	10.0	8.6	400
	20	11.7	10.0	400
	25	11.7	10.0	400
150 x 100	5, 10	10.0	9.0	400
	15	10.0	9.0	400
	20	11.7	10.5	400
	25	11.7	10.5	400
150 x 125	5, 10	10.0	9.5	400
	15	10.0	9.5	400
	20	11.7	11.1	400
	25	11.7	11.1	400
200 x 100	5	11.0	9.0	400
	10	11.0	9.0	400
	15	11.0	9.0	400
	20	12.8	10.5	400
	25	12.8	10.5	400
200 x 125	5	11.0	9.5	400
	10	11.0	9.5	400
	15	11.0	9.5	400
	20	12.8	11.1	400
	25	12.8	11.1	400

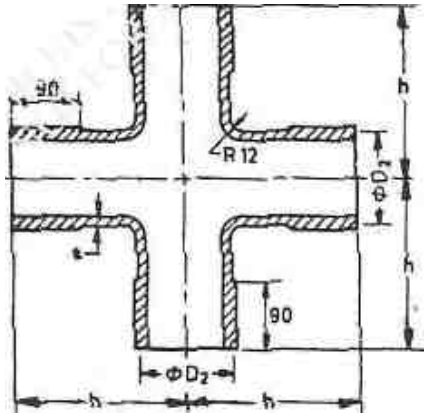
Nominal DIAMETER	Class	Barrel Wall THICKNESS		TOTAL LENGTH
DN		**e_1**	**e_2**	**l**
(1)	**(2)**	**(3)**	**(4)**	**(5)**
200 x 150	5	11.0	10.0	400
	10	11.0	10.0	400
	15	11.0	10.0	400
	20	12.8	11.7	400
	25	12.8	11.7	400
250 x 125	5	12.0	9.5	400
	10	12.0	9.5	400
	15	12.0	9.5	400
	20	14.0	11.1	400
	25	14.0	11.1	400
250 x 150	5	12.0	10.0	400
	10	12.0	10.0	400
	15	12.0	10.0	400
	20	14.0	11.7	400
	25	14.0	11.7	400
250 x 200	5	12.0	11.0	400
	10	12.0	11.0	400
	15	12.0	11.0	400
	20	14.0	12.8	400
	25	14.0	12.8	400
300 x 450	5	13.0	10.0	400
	10	13.0	10.0	400
	15	13.0	10.0	400
	20	15.2	11.7	400
	25	15.2	11.7	400
300 x 200	5	13.0	11.0	400
	10	13.0	11.0	400
	15	13.0	11.0	400
	20	15.2	12.8	400
	25	15.2	12.8	400
300 x 250	5	12.0	12.0	400
	10	13.0	12.0	400
	15	13.0	12.0	400
	20	15.2	14.0	400
	25	15.2	14.0	400
350 x 200	5	14.0	11.0	600
	10	14.0	11.0	600
	15	14.0	11.0	600
	20	16.3	12.8	600
	25	17.9	12.8	600
350 x 250	5	14.0	12.0	600
	10	14.0	12.0	600
	15	14.0	12.0	600
	20	16.3	14.0	600
	25	17.9	14.0	600
350 x 300	5	14.0	13.0	600
	10	14.0	13.0	600
	15	14.0	13.0	600
	20	16.3	15.2	600
	25	17.9	15.2	600

NOMINAL DIAMETER	CLASS	BARREL WALL THICKNESS		TOTAL LENGTH
DN		e_1	e_2	l
(1)	(2)	(3)	(4)	(5)
400 x 250	5	15.0	12.0	600
	10	15.0	12.0	600
	15	15.0	12.0	600
	20	17.5	14.0	600
	25	19.3	14.0	600
400 x 300	5	15.0	13.0	600
	10	15.0	13.0	600
	15	15.0	13.0	600
	20	17.5	15.2	600
	25	19.3	15.2	600
400 x 350	5,10	15.0	14.0	600
	15	15.0	14.0	600
	20	17.5	16.3	600
	25	19.3	17.9	600
450 x 350	5, 10	16.0	14.0	600
	15	16.0	14.0	600
	20	18.7	16.3	600
	25	20.6	17.9	600
450 x 400	5, 10	16.0	15.0	600
	15	16.0	15.0	600
	20	18.7	17.5	600
	25	20.6	19.3	600
500 x 350	5, 10	17.0	14.0	600
	15	17.0	14.0	600
	20	19.8	16.3	600
	25	21.8	17.9	600
500 x 400	5, 10	17.0	15.0	600
	15	17.0	15.0	600
	20	19.8	17.5	600
	25	21.8	19.3	600
500 x 450	5, 10	17.0	16.0	600
	15	17.0	16.0	600
	20	19.8	18.7	600
	25	21.8	20.6	600
600 x 400	5, 10	19.0	15.0	600
	15	19.0	15.0	600
	20	22.2	17.5	600
	25	24.4	19.3	600
600 x 450	5, 10	19.0	16.0	600
	15	19.0	16.0	600
	20	22.2	18.7	600
	25	24.4	20.6	600
600 x 500	5, 10	19.0	17.0	600
	15	19.0	17.0	600
	20	22.2	19.8	600
	25	24.4	21.8	600

Table 7 Dimensions Of Cast Iron Crosses

(*Clause* 9.1)

All dimensions in millimeters



D_2 = Machined outside diameter of asbestos cement pressure pipe as given in Table 1

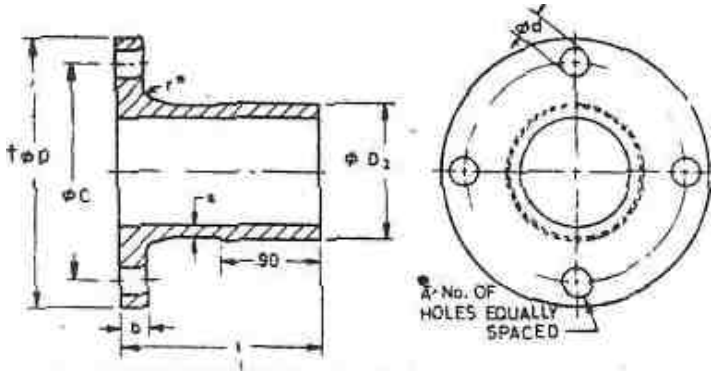
NOMINAL DIAMETER	CLASS	BARREL WALL THICKNESS	HALF LENGTH
DN		e	h
(1)	(2)	(3)	(4)
80	5,10	8.6	180
	15	8.6	180
	20	10.0	180
	25	10.0	180
100	5,.10	9.5	200
	15	9.5	200
	20	11.1	200
	25	11.1	200
125	5,10	9.5	225
	15	9.5	225
	20	11.1	225
	25	11.1	225
150	5,10	10.0	250
	15	10.0	250
	20	11.7	250
	25	11.7	250
200	5, 10	10.0	300
	15	10.0	300
	20	11.7	300
	25	11.7	300
250	5, 10	10.0	350
	15	10.0	350
	20	11.7	350
	25	11.7	350
300	5	11.0	400
	10	11.0	400
	15	11.0	400
	20	12.8	400
	25	12.8	400

NOMINAL DIAMETER	CLASS	BARREL WALL THICKNESS	HALF LENGTH
DN		e	$_h$
(1)	(2)	(3)	(4)
350	5,10	14.0	450
	15	14.0	450
	20	16.3	450
	25	17.9	450
400	5,.10	15.0	500
	15	15.0	500
	20	17.5	500
	25	19.3	500
450	5,10	16.0	550
	15	16.0	550
	20	18.7	550
	25	20.6	550
500	5,10	17.0	600
	15	17.0	600
	20	19.8	600
	25	21.8	600
600	5, 10	19.0	700
	15	19.0	700
	20	22.2	700
	25	24.4	700

Table 8 Dimensions Of Cast Iron Plain-End Flanged Spigots

(*Clause* 9.1)

All dimensions in millimeters



D_2 = Machined outside diameter of asbestos cement pressure pipe as given in Table 1

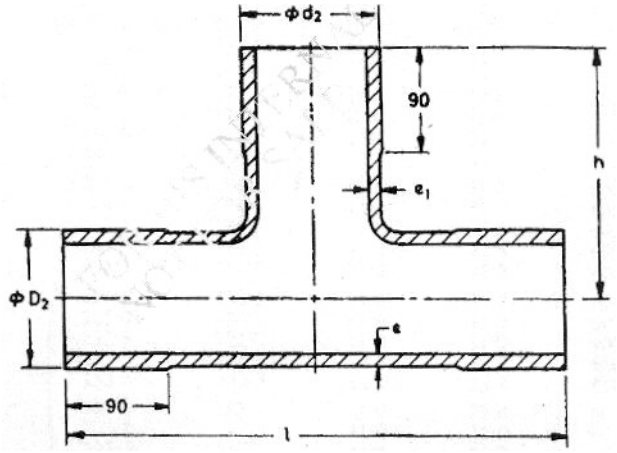
DN (MM)	CLASS	Nominal Dimensions					HOLES		Dia of Bolts	LENGTH l
		D_2	D	C	b	e	Ne	Dia		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
80	5,10	99.5	200	160	21.0	8.6	4	19	16	200
	15	99.5	200	160	21.0	8.6	4	19	16	200
	20	101.5	200	160	21.0	10.0	4	19	16	200
	25	106.5	200	160	21.0	10.0	4	19	16	200
100	5,.10	120.0	220	180	22.0	9.0	8	19	16	200
	15	121.0	220	180	22.0	9.0	8	19	16	200
	20	126.5	220	180	22.0	10.5	8	19	16	200
	25	132.5	220	180	22.0	10.5	8	19	16	200
125	5,10	145.0	250	210	22.5	9.5	8	19	16	200
	15	147.0	250	210	22.5	9.5	8	19	16	200
	20	152.5	250	210	22.5	11.1	8	19	16	200
	25	159.5	250	210	22.5	11.1	8	19	16	200
150	5,10	171.0	285	240	23.0	10.0	8	23	20	200
	15	176.5	285	240	23.0	10.0	8	23	20	200
	20	183.0	285	240	23.0	11.7	8	23	20	200
	25	191.0	285	240	23.0	11.7	8	23	20	200
200	5	221.0	340	295	24.5	11.0	8	23	20	200
	10	225.0	340	295	24.5	11.0	8	23	20	200
	15	233.5	340	295	24.5	11.0	8	23	20	200
	20	242.5	340	295	24.5	12.8	8	23	20	200
	25	253.5	340	295	24.5	12.8	8	23	20	200
250	5	271.0	395	350	26.0	12.0	12	23	20	300
	10	276.5	395	350	26.0	12.0	12	23	20	300
	15	284.5	395	350	26.0	12.0	12	23	20	300
	20	294.5	395	350	26.0	14.0	12	23	20	300
	25	305.5	395	350	26.0	14.0	12	23	20	300
300	5	322.5	445	400	27.5	13.0	12	23	20	300
	10	328.5	445	400	27.5	13.0	12	23	20	300
	15	340.5	445	400	27.5	13.0	12	23	20	300
	20	352.5	445	400	27.5	15.2	12	23	20	300
	25	366.5	445	400	27.5	15.2	12	23	20	300

DN (MM)	CLASS	Nominal Dimensions					HOLES		Dia of Bolts	LENGTH l
		D_2	D	C	b	e	Ne	Dia		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
350	5,10	379.5	505	460	29.0	14.0	16	23	20	300
	15	392.0	505	460	29.0	14.0	16	23	20	300
	20	405.0	505	460	29.0	16.3	16	23	20	300
	25	419.0	505	460	29.0	17.9	16	23	20	300
400	5,10	432.0	565	515	30.0	15.0	16	28	24	300
	15	448.0	565	515	30.0	15.0	16	28	24	300
	20	463.0	565	515	30.0	17.5	16	28	24	300
	25	478.0	565	515	30.0	19.3	16	28	24	300
450	5,10	482.0	615	564	31.5	16.0	20	28	24	300
	15	498.0	615	564	31.5	16.0	20	28	24	300
	20	515.0	615	564	31.5	18.7	20	28	24	300
	25	532.0	.615	564	31.5	20.6	20	28	24	300
500	5,10	536.5	670	620	33.0	17.0	20	28	24	300
	15	554.5	670	620	33.0	17.0	20	28	24	300
	20	572.5	670	620	33.0	19.8	20	28	24	300
	25	591.5	670	620	33.0	21.8	20	28	24	300
600	5,10	643.5	780	725	36.0	19.0	20	31	24	300
	15	665.5	780	725	36.0	19.0	20	31	24	300
	20	686.5	780	725	36.0	22.2	20	31	24	300
	25	710.5	780	725	36.0.	24.2	20	31	24	300

Table 9 Dimensions Of Cast Iron Plain-End Tees

(*Clause* 9.1)

All dimensions in millimeters



D_2 = machined outside diameter of asbestos cement pressure pipe in main line as given in Table 1.

d_2= Machined outside diameter at the reducer end in branch line as given in Table 1.

NOMINAL DIAMETER	CLASS	BARREL THICKNESS		LENGTH	
DN		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
80 x 80	5,10	8.6	8.6	360	180
	15	8.6	8.6	360	180
	20	10.0	10.0	360	180
	25	10.0	10.0	360	180
100 x 80	5,.10	9.0	9.0	400	190
	15	9.0	9.0	400	190
	20	10.5	10.5	400	190
	25	10.5	10.5	400	190
100 x 100	5,10	9	9.0	400	200
	15	9	9.0	400	200
	20	10.5	10.5	400	200
	25	10.5	10.5	400	200
125 x 80	5,10	9.5	9.5	450	202.5
	15	9.5	9.5	450	202.5
	20	11.1	11.1	450	205.5
	25	11.1	11.1	450	202.5
125 x 100	5, 10	9.5	9.5	450	212.5
	15	9.5	9.5	450	212.5
	20	11.1	11.1	450	212.5
	25	11.1	11.1	450	212.5
125 x 125	5, 10	9.5	9.5	450	225
	15	9.5	9.5	450	225
	20	11.1	11.1	450	225
	25	11.1	11.1	450	225
150 x 80	5, 10	10.0	10.0	500	215
	15	10.0	10.0	500	215
	20	11.7	11.7	500	115
	25	11.7	11.7	500	215

NOMINAL DIAMETER	CLASS	BARREL THICKNESS		LENGTH	
DN		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
150 x 100	5,10	10.0	10.0	500	225
	15	10.0	10.0	500	225
	20	11.7	11.7	500	225
	25	11.7	11.7	500	225
150 x 125	5,.10	10.0	10.0	500	237.5
	15	10.0	10.0	500	237.5
	20	11.7	11.7	500	237.5
	25	11.7	11.7	500	237.5
150 x 150	5,10	10.0	10.0	500	250
	15	10.0	10.0	500	250
	20	11.7	11.7	500	250
	25	11.7	11.7	500	250
200 x 80	5	11.0	11.0	600	240
	10	11.0	11.0	600	240
	15	11.0	11.0	600	240
	20	12.8	12.8	600	240
	25	12.8	12.8	600	240
200 x 100	5	11.0	11.0	600	250
	10	11.0	11.0	600	250
	15	11.0	11.0	600	250
	20	12.8	12.8	600	250
	25	12.8	12.8	600	250
200 x 125	5	11.0	11.0	600	262.5
	10	11.0	11.0	600	262.5
	15	11.0	11.0	600	262.5
	20	12.8	12.8	600	262.5
	25	12.8	12.8	600	262.5
200 x 150	5	11.0	11.0	600	275
	10	11.0	11.0	600	275
	15	11.0	11.0	600	275
	20	12.8	12.8	600	272
	25	12.8	12.8	600	275
200 x 200	5	11.0	11.0	600	300
	10	11.0	11.0	600	300
	15	11.0	11.0	600	300
	20	12.8	12.8	600	300
	25	12.8	12.8	600	300
250 x 80	5	12.0	11.1	700	265
	10	12.0	11.1	700	265
	15	12.0	11.1	700	265
	20	14.0	13.0	700	265
	25	14.0	13.0	700	265
250 x 100	5	12.0	11.6	700	275
	10	12.0	11.6	700	275
	15	12.0	11.6	700	275
	20	14.0	13.5	700	275
	25	14.0	13.5	700	275

DN (mm)	CLASS	BARREL THICKNESS		LENGTH	
		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
250 x 125	5	12.0	12.0	700	287.5
	10	12.0	12.0	700	287.5
	15	12.0	12.0	700	287.5
	20	14.0	14.0	700	287.5
	25	14.0	14.0	700	287.5
250 x 150	5	12.0	12.0	700	300
	10	12.0	12.0	700	300
	15	12.0	12.0	700	300
	20	14.0	14.0	700	300
	25	14.0	14.0	700	300
250 x 200	5,10	12.0	12.0	700	325
	15	12.0	12.0	700	325
	20	12.0	12.0	700	325
	25	14.0	14.0	700	325
		14.0	14.0	700	325
250 x 250	5	12.0	12.0	700	350
	10	12.0	12.0	700	350
	15	12.0	12.0	700	350
	20	14.0	14.0	700	350
	25	14.0	14.0	700	350
300 x 80	5	13.0	13.0	800	290
	10	13.0	13.0	800	290
	15	13.0	13.0	800	290
	20	15.2	15.2	800	290
	25	15.2	15.2	800	290
300 x 100	5	13.0	13.0	800	300
	10	13.0	13.0	800	300
	15	13.0	13.0	800	300
	20	15.2	15.2	800	300
	25	15.2	15.2	800	300
300 x 125	5	13.0	13.0	800	312.5
	10	13.0	13.0	800	312.5
	15	13.0	13.0	800	312.5
	20	15.2	15.2	800	312.5
	25	15.2	15.2	800	312.5
300 x 150	5	13.0	13.0	800	325
	10	13.0	13.0	800	325
	15	13.0	13.0	800	325
	20	15.2	15.2	800	325
	25	15.2	15.2	800	325
300 x 200	5	13.0	13.0	800	350
	10	13.0	13.0	800	350
	15	13.0	13.0	800	350
	20	15.2	15.2	800	350
	25	15.2	15.2	800	350
300 x 250	5	13.0	13.0	800	375
	10	13.0	13.0	800	375
	15	13.0	13.0	800	375
	20	15.2	15.2	800	375
	25	15.2	15.2	800	375

NOMINAL DIAMETER DN	CLASS	BARREL THICKNESS		LENGTH	
		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
300 x 300	5	13.0	13.0	800	400
	10	13.0	13.0	800	400
	15	13.0	13.0	800	400
	20	15.2	15.2	800	400
	25	15.2	15.2	800	400
350 x 200	5	14.0.	14.0.	900	400
	10	14.0	14.0	900	400
	15	14.0	14.0	900	400
	20	16.3	16.3	900	400
	25	17.9	17.9	900	400
350 x 250	5	14.0.	14.0.	900	400
	10	14.0	14.0	900	400
	15	14.0	14.0	900	400
	20	16.3	16.3	900	400
	25	17.9	17.9	900	400
350 x 300	5	14.0.	14.0.	900	425
	10	14.0	14.0	900	425
	15	14.0	14.0	900	425
	20	16.3	16.3	900	425
	25	17.9	17.9	900	425
350 x 350	5	14.0.	14.0	900	450
	10	14.0	14.0	900	450
	15	14.0	14.0	900	450
	20	16.3	16.3	900	450
	25	17.9	17.9	900	450
400 x 200	5	15.0	14.1	1000	400
	10	15.0	14.1	1000	400
	15	15.0	14.1	1000	400
	20	17.5	16.5	1000	400
	25	19.3	18.2	1000	400
400 x 250	5	15.0	15.0	1000	425
	10	15.0	15.0	1000	425
	15	15.0	15.0	1000	425
	20	17.5	17.5	1000	425
	25	19.3	19.3	1000	425
400 x 300	5	15.0	15.0	1000	450
	10	15.0	15.0	1000	450
	15	15.0	15.0	1000	450
	20	17.5	17.5	1000	450
	25	19.3	19.3	1000	450
400 x 350	5, 10	15.0	15.0	1000	475
	15	15.0	15.0	1000	475
	20	17.5	17.5	1000	475
	25	19.3	19.3	1000	475

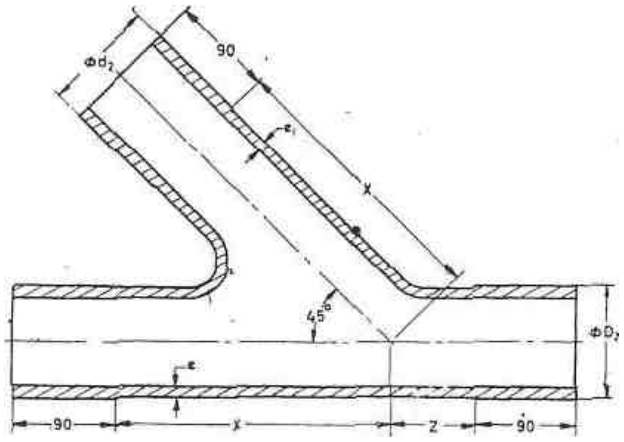
NOMINAL DIA DN	CLASS	BARREL THICKNESS		LENGTH	
		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
400 x 400	5, 10	15.0	15.0	1000	500
	15	15.0	15.0	1000	500
	20	17.5	17.5	1000	500
	25	19.3	19.3	1000	500
450 x 250	5	16.0	15.4	1100	450
	10	16.0	15.4	1100	450
	15	16.0	15.4	1100	450
	20	18.7	18.0	1100	450
	25	20.6	19.8	1100	450
450 x 300	5	16.0	16.0	1100	475
	10	16.0	16.0	1100	475
	15	16.0	16.0	1100	475
	20	18.7	18.7	1100	475
	25	20.6	20.6	1100	475
450 x 350	5,10	16.0	16.0	1100	500
	15	16.0	16.0	1100	500
	20	18.7	18.7	1100	500
	25	20.6	20.6	1100	500
450 x 400	5, 10	16.0	16.0	1100	525
	15	16.0	16.0	1100	525
	20	18.7	18.7	1100	525
	25	20.6	20.6	1100	525
450 x 450	5, 10	16.0	16.0	1100	550
	15	16.0	16.0	1100	550
	20	18.7	18.7	1100	550
	25	20.6	20.6	1100	550
500 x 250	5	17.0	15.4	1200	457
	10	17.0	15.4	1200	475
	15	17.0	15.4	1200	475
	20	19.8	18.0	1200	475
	25	21.8	19.8	1200	475
500 x 300	5	17.0	16.7	1200	500
	10	17.0	16.7	1200	500
	15	17.0	16.7	1200	500
	20	19.8	19.5	1200	500
	25	21.8	21.5	1200	500
500 x 350	5, 10	17.0	17.0	1200	525
	15	17.0	17.0	1200	525
	20	19.8	19.8	1200	525
	25	21.8	21.8	1200	525
500 x 400	5, 10	17.0	17.0	1200	550
	15	17.0	17.0	1200	550
	20	19.8	19.8	1200	550
	25	21.8	21.8	1200	550

NOMINAL DIAMETER DN	CLASS	BARREL THICKNESS		LENGTH	
		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
500 x 450	5, 10	17.0	17.0	1200	575
	15	17.0	17.0	1200	575
	20	19.8	19.8	1200	575
	25	21.8	21.8	1200	575
500 x 500	5,10	17.0	17.0	1200	600
	15	17.0	17.0	1200	600
	20	19.8	19.8	1200	600
	25	21.8	21.8	1200	600
600 x 300	5	19.0	16.7	1400	550
	10	19.0	16.7	1400	550
	15	19.0	16.7	1400	550
	20	22.2	19.5	1400	550
	25	24.4	21.5	1400	550
600 x 350	5,10	19.0	18.0	1400	575
	15	19.0	18.0	1400	575
	20	22.2	21.0	1400	575
	25	24.4	23.1	1400	575
600 x 400	5, 10	19.0	19.0	1400	600
	15	19.0	19.0	1400	600
	20	22.2	22.2	1400	600
	25	24.4	24.4	1400	600
600 x 450	5, 10	19.0	19.0	1400	625
	15	19.0	19.0	1400	625
	20	22.2	22.2	1400	625
	25	24.4	24.4	1400	625
600 x 500	5, 10	19.0	19.0	1400	650
	15	19.0	19.0	1400	650
	20	22.2	22.2	1400	650
	25	24.4	24.4	1400	650
600 x 600	5, 10	19.0	19.0	1400	700
	15	19.0	19.0	1400	700
	20	22.2	22.2	1400	700
	25	24.4	24.4	1400	700

Table 10 Dimensions Of Cast Iron Plain-End Wyes

(*Clause* 9.1)

All dimensions in millimeters



D_2 = machined outside diameter of asbestos cement pressure pipe as given in Table 1

d_2= machined outside diameter at the branch end as given in Table 1.

NOMINAL DIAMETER	CLASS	BARREL THICKNESS		LENGTH	
DN		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
80 x 80	5,10 ,15	8.6	8.6	250	75
	20	10.0	10.0	250	75
	25	10.0	10.0	250	75
100 x 80	5,.10	9.0	8.6	300	75
	15	9.0	8.6	300	75
	20	10.5	10.0	300	75
	25	10.5	10.0	300	75
100 x 100	5,10	9.0	9.0	300	75
	15	9.0	9.0	300	75
	20	10.5	10.5	300	75
	25	10.5	10.5	300	75
125 x 80	5,10	9.0	8.6	335	75
	15	9.5	8.6	335	75
	20	11.1	10.0	335	75
	25	11.1	10.0	335	75
125 x 100	5, 10	9.5	9.0	335	75
	15	9.5	9.0	335	75
	20	11.1	10.5	335	75
	25	11.1	10.5	335	75
125 x 125	5, 10	9.5	9.5	335	75
	15	9.5	9.5	335	75
	20	11.1	11.1	335	75
	25	11.1	11.1	335	75
150 x 80	5, 10	10.0	8.0	370	90
	15	10.0	8.6	370	90
	20	11.7	10.0	370	90
	25	11.7	10.0	370	90

NOMINAL DIAMETER	CLASS	BARREL THICKNESS		LENGTH	
DN		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
150 x 100	5,10	10.0	9.0	370	90
	15	10.0	9.0	370	90
	20	11.7	10.5	370	90
	25	11.7	10.5	370	90
150 x 125	5,.10	10.0	9.5	370	90
	15	10.0	9.5	370	90
	20	11.7	11.1	370	90
	25	11.7	11.1	370	90
150 x 150	5,10	10.0	10.0	370	90
	15	10.0	10.0	370	90
	20	11.7	11.7	370	90
	25	11.7	11.7	370	90
200 x 80	5	11.0	8.6	445	115
	10	11.0	8.6	445	115
	15	11.0	8.6	445	115
	20	12.8	10.0	445	115
	25	12.8	10.0	455	115
200 x 100	5	11.0	9.0	445	115
	10	11.0	9.0	445	115
	15	11.0	9.0	445	115
	20	12.8	10.5	445	115
	25	12.8	10.5	445	115
200 x 125	5	11.0	11.0	445	115
	10	11.0	11.0	445	115
	15	11.0	11.0	445	115
	20	12.8	12.8	445	115
	25	12.8	12.8	445	115
200 x 150	5	11.0	11.0	445	115
	10	11.0	11.0	445	115
	15	11.0	11.0	445	115
	20	12.8	12.8	445	115
	25	12.8	12.8	445	115
200 x 200	5	11.0	11.0	445	115
	10	11.0	11.0	445	115
	15	11.0	11.0	445	115
	20	12.8	12.8	445	115
	25	12.8	12.8	445	115
250 x 80	5	12.0	8.6	520	125
	10	12.0	8.6	520	125
	15	12.0	8.6	520	125
	20	14.0	10.0	520	125
	25	14.0	10.0	520	125
250 x 100	5	12.0	9.0	520	125
	10	12.0	9.0	520	125
	15	12.0	9.0	520	125
	20	14.0	10.5	520	125
	25	14.0	10.5	520	125

DN (mm)	CLASS	BARREL THICKNESS		LENGTH	
		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
250 x 125	5	12.0	9.5	520	125
	10	12.0	9.5	520	125
	15	12.0	9.5	520	125
	20	14.0	11.1	520	125
	25	14.0	11.1	520	125
250 x 150	5	12.0	10.0	520	125
	10	12.0	10.0	520	125
	15	12.0	10.0	520	125
	20	14.0	11.7	520	125
	25	14.0	11.7	520	125
250 x 200	5,10	12.0	11.0	520	125
	15	12.0	11.0	520	125
	20	12.0	11.0	520	125
	25	14.0	12.8	520	125
		14.0	12.8	520	125
250 x 250	5	12.0	12.0	520	125
	10	12.0	12.0	520	125
	15	12.0	12.0	520	125
	20	14.0	14.0	520	125
	25	14.0	14.0	520	125
300 x 80	5	13.0	8.6	625	140
	10	13.0	8.6	625	140
	15	13.0	8.6	625	140
	20	15.2	10.0	625	140
	25	15.2	10.0	625	140
300 x 100	5	13.0	9.0	625	140
	10	13.0	9.0	625	140
	15	13.0	9.0	625	140
	20	15.2	10.5	625	140
	25	15.2	10.5	625	140
300 x 125	5	13.0	9.5	625	140
	10	13.0	9.5	625	140
	15	13.0	9.5	625	140
	20	15.2	11.1	625	140
	25	15.2	11.1	625	140
300 x 150	5	13.0	10.0	625	140
	10	13.0	10.0	625	140
	15	13.0	10.0	625	140
	20	15.2	11.7	625	140
	25	15.2	11.7	625	140
300 x 200	5	13.0	11.0	625	140
	10	13.0	11.0	625	140
	15	13.0	11.0	625	140
	20	15.2	12.8	625	140
	25	15.2	12.8	625	140
300 x 250	5	13.0	12.0	625	140
	10	13.0	12.0	625	140
	15	13.0	12.0	625	140
	20	15.2	14.0	625	140
	25	15.2	14.0	625	140

NOMINAL DIAMETER DN	CLASS	BARREL THICKNESS		LENGTH	
		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
300 x 300	5	13.0	13.0	625	140
	10	13.0	13.0	625	140
	15	13.0	13.0	625	140
	20	15.2	15.2	625	140
	25	15.2	15.2	625	140
350 x 200	5	14.0.	11.0	670	160
	10	14.0	11.0	670	160
	15	14.0	11.0	670	160
	20	16.3	12.8	670	160
	25	17.9	12.8	670	160
350 x 250	5	14.0.	12.0	670	160
	10	14.0	12.0	670	160
	15	14.0	12.0	670	160
	20	16.3	14.0	670	160
	25	17.9	14.0	670	160
350 x 300	5	14.0.	13.0	670	160
	10	14.0	13.0	670	160
	15	14.0	13.0	670	160
	20	16.3	15.2	670	160
	25	17.9	15.2	670	160
350 x 350	5, 10	14.0	14.0	670	160
	15	14.0	14.0	670	160
	20	16.3	16.3	670	160
	25	17.9	17.9	670	160
400 x 200	5	15.0	11.0	740	175
	10	15.0	11.0	740	175
	15	15.0	11.0	740	175
	20	17.5	12.8	740	175
	25	19.3	12.8	740	175
400 x 250	5	15.0	12.0	740	175
	10	15.0	12.0	740	175
	15	15.0	12.0	740	175
	20	17.5	14.0	740	175
	25	19.3	14.0	740	175
400 x 300	5	15.0	13.0	740	175
	10	15.0	13.0	740	175
	15	15.0	13.0	740	175
	20	17.5	15.2	740	175
	25	19.3	15.2	740	175
400 x 350	5, 10	15.0	14.0	740	175
	15	15.0	14.0	740	175
	20	17.5	16.3	740	175
	25	19.3	17.9	740	175

NOMINAL DIAMETER DN	CLASS	BARREL THICKNESS		LENGTH	
		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
400 x 400	5, 10	15.0	15.0	740	175
	15	15.0	15.0	740	175
	20	17.5	17.5	740	175
	25	19.3	19.3	740	175
450 x 250	5	16.0	15.4	820	190
	10	16.0	15.4	820	190
	15	16.0	15.4	820	190
	20	18.7	18.0	820	190
	25	20.6	19.8	820	190
450 x 300	5	16.0	13.0	820	190
	10	16.0	13.0	820	190
	15	16.0	13.0	820	190
	20	18.7	15.2	820	190
	25	20.6	15.2	820	190
450 x 350	5	16.0	14.0	820	190
	10	16.0	14.0	820	190
	15	16.0	14.0	820	190
	20	18.7	16.3	820	190
	25	20.6	17.9	820	190
450 x 400	5, 10	16.0	15.0	820	190
	15	16.0	15.0	820	190
	20	18.7	17.5	820	190
	25	20.6	19.3	820	190
450 x 450	5, 10	16.0	16.0	820	190
	15	16.0	16.0	820	190
	20	18.7	18.7	820	190
	25	20.6	20.6	820	190
500 x 250	5	17.0	15.4	900	210
	10	17.0	15.4	900	210
	15	17.0	15.4	900	210
	20	19.8	18.0	900	210
	25	21.8	19.8	900	210
500 x 300	5	17.0	13.0	900	210
	10	17.0	13.0	900	210
	15	17.0	13.0	900	210
	20	19.8	15.2	900	210
	25	21.8	15.2	900	210
500 x 350	5, 10	17.0	14.0	900	210
	15	17.0	14.0	900	210
	20	19.8	16.3	900	210
	25	21.8	17.9	900	210
500 x 400	5, 10	17.0	15.0	900	210
	15	17.0	15.0	900	210
	20	19.8	17.5	900	210
	25	21.8	19.3	900	210

NOMINAL DIAMETER DN	CLASS	BARREL THICKNESS		LENGTH	
		Main e	Branch e_1	Main l	Branch h
(1)	(2)	(3)	(4)	(5)	(6)
500 x 450	5, 10	17.0	16.0	900	210
	15	17.0	16.0	900	210
	20	19.8	18.7	900	210
	25	21.8	20.6	900	210
500 x 500	5,10	17.0	17.0	900	210
	15	17.0	17.0	900	210
	20	19.8	19.8	900	210
	25	21.8	21.8	900	210
600 x 300	5	19.0	13.0	1040	240
	10	19.0	13.0	1040	240
	15	19.0	13.0	1040	240
	20	22.2	15.2	1040	240
	25	24.4	15.2	1040	240
600 x 350	5,10	19.0	14.0	1040	240
	15	19.0	14.0	1040	240
	20	22.2	16.3	1040	240
	25	24.4	17.9	1040	240
600 x 400	5, 10	19.0	15.0	1040	240
	15	19.0	15.0	1040	240
	20	22.2	17.5	1040	240
	25	24.4	19.3	1040	240
600 x 450	5, 10	19.0	16.0	1040	240
	15	19.0	16.0	1040	240
	20	22.2	18.7	1040	240
	25	24.4	20.6	1040	240
600 x 500	5, 10	19.0	17.0	1040	240
	15	19.0	17.0	1040	240
	20	22.2	19.8	1040	240
	25	24.4	21.8	1040	240
600 x 600	5, 10	19.0	19.0	1040	240
	15	19.0	19.0	1040	240
	20	22.2	22.2	1040	240
	25	24.4	22.4	1040	240

11.8 In the case of castings (wholly or partially coated) which are imperfectly coated or where the coating does not set or conform to the quality specified above, the coating shall be removed and the castings recoated.

12. MARKING

12.1 Each special shall have cast stamped or indelibly painted on it the following:

a) Manufacturer's name, initials or identification mark;

b) Nominal diameter;

c) Class reference;

d) Last two digits of the year of manufacture; and

e) Any other mark, if required by the purchaser.

12.1.1 Marking may be done on the barrels of the specials.

12.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

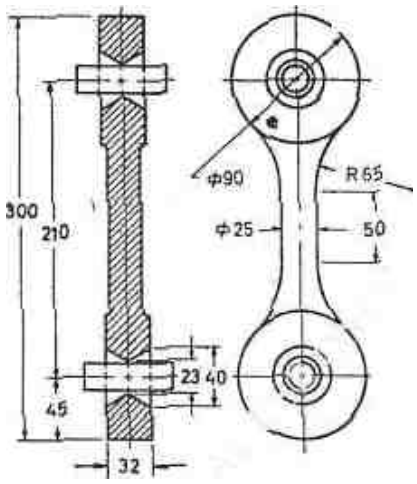
12.2.1 The use of he Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the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

ANNEXTURE A

(Clause 6.2)

TEST BARS FOR TENSILE TEST ON CAST IRON SPECIALS CAST IN SAND MOULDS

The (test bars for tensile tests shall be properly moulded free form defects. These may be either unmachined or machined to give a diameter of about 20 to 25 mm. The ends shall be selected by the manufacturer to fit the tensile testing machine. Figure 1 shows one satisfactory design.



All dimensions in millimetres.

FIG. 1 Tensile Test Specimen

ANNEXTURE B

CEMENT MORTAR LINING

(*Clause* 11)

B.1 MATERIALS

B.1.1 Cement

The cement used for the lining shall conform to the existing standards on cement. The type of cement to be used is to be mutually decided between the purchaser and manufacturer. Normal recommendation are :-

i) Portland and Portland Slag cement (as per or IS455) mortar lining perform rather well and have an expected life of approximately 50 years in soft water with moderate amount of aggressive CO_2 and when pH is within 6 to 9. Longer service life can be obtained by increasing the mortar lining thickness.

ii) Where cement mortar lining may be exposed to sulphate attack, ordinary Portland cement should be replaced by sulphate resisting Portland cement (as per IS 12330 or IS:6909)and or Blast Furnace Slag Cement. The sulphate concentration limit in water which needs sulphate resisting Portland cement is approximately 3000 mg/litre, in similar concentration blast furnace slag cements can also be used because they possess an equally good resistance to sulphate attack in addition to other better properties.

iii) The recommended type of cement used for lining are as given below:

Table B.1

Water Characteristics	Portland cement	Blast-furnace Slag Cement / Sulfate resisting Portland cements
Minimum value of pH	6	5.5
Maximum content (mg/1) of:	7	15
Aggressive CO_2	400	3000
Sulfates (SO_4-)	100	500
magnesium (Mg^{++})	30	30
ammonium (NH_4+)		

B.1.2 Sand

The sand used shall have a controlled granulometric distribution from fine to coarser elements; it shall be clean and shall be composed of inert, hard, strong and stable granular particles.

The fine fraction comprising particles passing through a sieve of aperture size 0, 125 mm shall not be more than 10 % by mass;

The fraction comprising grains up to a maximum diameter equal to one-third of the normal thickness of the mortar lining shall not be less than 50 % by mass.

The coarsest fraction (comprising particles which do not pass through a sieve of the aperture size closest to half the normal thickness of the mortar lining) shall not exceed 5% by mass.

B.1.3 Water - The water used for the preparation of the mortar shall be drinking water or water of comparable quality.

B.1.4 Mortar - The mortar of the lining shall be composed of cement, sand and water.

Additives, which shall be specified, may be used, provided that they do not prejudice the quality of the coating and that of the transported water. The mortar shall be thoroughly mixed and shall have a consistency, which results in a dense and homogeneous lining.

The mortar shall contain by mass at least one part of cement to 3.5 parts of sand.

Compressive strength of mortar shall be conducted with the actual sand, cement, water ratio available in the freshly applied lining and tested and records of each supply is maintained.

B.2 Condition of the Interior Surface of the Fittings before Application of the Lining

All foreign bodies, loose scale or any other material, which could be detrimental to good contract between the metal and the lining, shall be removed from the surface to which the lining is to be applied.

The inner surface of pipe shall also be free of any metal projections likely to protrude beyond 50% the thickness of the lining.

B.3 Application of the Lining

The mortar will be works applied by a suitable process, preferably by centrifuged sprinkler or a combination of both manual and centrifuging methods.
Apart from the inner surface of the joint, the entire inner surface of the fittings coming into contact with the transported water shall be entirely covered with mortar. The layer of mortar should be free of any cavity or air bubble and care should be taken to ensure maximum density at all points.

Once lining work is finished, the lining shall be cured at temperatures greater than 4°C. Any loss of water from the mortar by evaporation shall be sufficiently slow so that hardening is not impeded. After lining, the fittings shall be transferred to a curing area in such a manner as to prevent damage to the lining, and shall remain undisturbed for a minimum period of 24 h.

B.4 Repair of Lining

Repairs to damaged or defective areas are allowable. The damaged mortar shall first be removed from these areas. Then using, for example, a trowel with fresh mortar so that a continuous lining having a constant thickness is again obtained shall repair the defective part.

For the repair operation, the mortar shall have a suitable consistency, if necessary, additives may be included to obtain good adhesion against the side of the existing undamaged mortar.

B.5 Thickness of the Lining

The normal thickness of the lining and the minimum permissible mean and local values are given in the table-B 2. Where the fluid being conveyed is aggressive to a cement mortar, the purchaser may specify a thicker cement mortar lining.

At the pipe ends, the lining may be reduced to values below the minimum thickness. The length of the chamfer shall be as small as possible but, in any case, shall be less than 50 mm.

B.6 Determination of Lining Thickness

During manufacture the thickness of the lining shall be measured, about 200mm away from the end face, on the freshly applied lining by a spear having a diameter of 1.5mm or less and controlled on the finished hardened lining by means of a suitable gauge e.g. magnetic.

B.7 Surface Condition of the Hardened Lining

The surface of the cement mortar lining shall be uniformly smooth. Only isolated grains of sand are allowed to appear on the surface of the lining. The lining shall be such that it cannot be dislodged with pressure of hand and shall be free from corrugations or ridges that could reduce the thickness of the lining to less than the minimum value at one point, as specified in the table-B2.

Table-B2

All dimensions in mm			
DN	**Thickness**		**Maximum crack width and radial displacement**
	Nominal Value	**Tolerance**	
80 to 300	3.0	-1.5	0.8
350 to 600	5.0	-2	1.0
700 to 1200	6.0	-2.5	1.2
1400 to 2000	9.0	-3	1.5

NOTE - Cement Mortar linings at pipe ends may have a chamfer of maximum length of 50mm.

On contraction of the lining, the formation of cracks cannot be avoided. These cracks, together with other isolated cracks which may result from manufacture or may develop during transportation, are acceptable up to a width given in the above.

Fine crazing and hairline cracks associated with cement rich surface may appear in dry linings. When shrinkage cracks inherent to cement-bound materials have developed in the dry linings, the crack width and the corresponding radial displacement shall not exceed the values given in Table B 2.

Storage of pipes in a hot, dry environment can cause metal expansion and mortar shrinkage, which may result in the dry lining developing areas of disbondment, and shrinkage cracks exceeding the width given in Table B2. When the lining is re-exposed to water, it will swell by absorption of moisture and the cracks will close to conform to Table B 2 and will eventually heal by an autogenously process.

B.8 Seal Coat

B.8.1 General

When specified the cement lining shall be given a seal coat of approved ISI marked bituminous material or any other epoxy based material compatible with Cement Mortar Lining. Other seal - coat materials may be used, but they shall be agreed on at the time of purchase and shall be specified on the purchase order.

ANNEXTURE C

BITUMINOUS COATING

C.1 BITUMINOUS PAINT COATING : GENERAL

Unless otherwise agreed between the purchaser and manufacturer, all fittings shall be coated externally with Bituminous coatings either hot applied or cold applied.

C.2 Bituminous Paint Coating : General Characteristics

C.2.1 Coating shall not be applied to any fittings unless its surfaces are clean, dry and free from rust.

C.2.2 Unless otherwise agreed between the purchaser and the manufacturer all fittings shall be coated externally with the same material. The method of coating shall be as per usual practice of the manufactures. The coating material shall set rapidly with good adherence and shall not scale off.

The mean thickness of the coating shall be not less than 70 μm and the local minimum thickness shall be not less than 50 μm.

C.2.3 Where the coating material has a Bitumen base, it shall be smooth and tenacious and hard enough not to flow when exposed to a temperature of 65°C but not so brittle at a temperature of 0°C as to chip off when scribed with a penknife.

C.2.4 Fittings with or without sockets and flanges which are imperfectly coated or where the coating does not set or conform to the required quality, the coating shall be removed and the fittings /flanges re-coated.

C 3.1 Coating Application: General

The Fittings lining shall be applied in accordance with the manufacturer's recommendations. Application by airless spray equipment is preferred.

C.3.2 Surface preparation

The fittings exterior is to be thoroughly cleaned of all loose foreign matter with the help of clean, dry, oil free compressed air in a manner that does not adversely affect the cleaned surface. Alternatively, vacuum cleaning or other methods may be used in place of compressed air. Shot blasting can be used also.

C.4 Coating Repair

Accessible areas of fittings requiring coating repairs shall be cleaned to remove debris and damaged coating using grinders or other means acceptable to the purchaser. The adjacent coating shall be feathered by sanding, grinding, or other methods approved by the purchaser. Accumulated debris shall be removed by vacuum blowing or wiping with clean rags.