

भारतीय मानक
Indian Standard

IS 458 : 2021

पूर्वढलित कंक्रीट पाइप
(प्रबलन सहित और रहित) — विशिष्टि
(पाँचवाँ पुनरीक्षण)

Precast Concrete Pipes
(with and without Reinforcement) —
Specification
(Fifth Revision)

ICS 23.040.50; 91.100.30

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Cement Matrix Products Sectional Committee, CED 53

FOREWORD

This Indian Standard (Fifth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cement Matrix Products Sectional Committee had been approved by the Civil Engineering Division Council.

Precast concrete pipes are widely used for water mains, sewers, culverts and in irrigation. This standard lays down the requirements of quality and dimensions for concrete pipes cast by spinning process or vertical vibration casting process. To serve as guidance to the manufacturers and users in producing and obtaining concrete pipes of suitable quality. Guidance regarding laying of concrete pipes is given in IS 783 : 1985 'Code of practice for laying of concrete pipes (*first revision*)'.

In case liquid conveyed by the pipeline is likely to be harmful to concrete, necessary precautions should be taken.

This standard was first published in 1956 and subsequently revised in 1961, 1971, 1988 and 2003. The fifth revision has been brought out with a view to incorporating the modifications found necessary as a result of experience gained with the use of this standard since its last revision.

The major modifications incorporated in this revision are:

- a) Separate detailed classification for unreinforced and reinforced pipes has been given.
- b) Requirement of cover to reinforcement has been modified from durability consideration.
- c) Range of pipe sizes has been expanded as per the current practice.
- d) Separate tables have been provided for pipes made by spun and vertical cast process, for the design and strength test requirement.
- e) Requirement of quantity of steel reinforcement has been modified in the above tables as required.
- f) Marking requirements have been elaborated.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960. 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

**PRECAST CONCRETE PIPES
(WITH AND WITHOUT REINFORCEMENT) —
SPECIFICATION**

(Fifth Revision)

1 SCOPE

This standard covers the requirements for reinforced and unreinforced precast cement concrete pipes, of both pressure and non-pressure varieties used for water mains, sewers, culverts and irrigation. The requirements for collars are also covered by this standard.

NOTES

- 1 This standard covers the requirements for pressure and non-pressure pipes manufactured by spinning process and vibration casting process.
- 2 In addition to the requirements specified specifically for the collars, the requirements given in the following clauses shall also apply for the collars: 5.2, 5.3, 5.4, 5.5.1, 5.5.3, 5.5.4, 5.7, 5.8, 7.1, 7.2, 7.2.1, 7.2.2, 7.3, 7.3.1, 7.4, 8.2, 9.1, 9.1.1, 9.1.2, 9.1.3, 9.1.4, 12.1 and 12.2.

1.2 Prestressed concrete pipes and pipes with non-circular section are not covered by this standard.

2 REFERENCES

The standards given in Annex A 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 this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

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

3.1 Working Pressure — The maximum sustained internal pressure excluding surge, to which each portion of the pipeline may be subjected when installed.

3.2 Site Test Pressure — 1.5 times working pressure pertaining to the section or 1.1 times static pressure, whichever is more (surge pressure is to be controlled within 25 percent of pump head in case of pumping mains).

3.3 Hydrostatic Test Pressure — It is the maximum pressure which the pipe can withstand without any leakage when tested for hydrostatic pressure in accordance with this standard and IS 3597.

3.4 Surge (Water Hammer) Pressure — It is a pressure which is produced by a change of velocity of the moving stream and becomes maximum when there is a sudden stoppage which may be caused by the closing of a valve or by shutting down a pump station. Surge pressure is to be controlled within 25 percent of pump head.

4 CLASSIFICATION

4.1 For the purpose of this standard, concrete pipes shall be classified as under (*see also* Note):

a) *Unreinforced Concrete Pipes:*

<i>Class</i>	<i>Description</i>	<i>Conditions where Normally Used</i>
NP1	Unreinforced concrete non-pressure spun pipes	For drainage and irrigation use, above ground or in shallow trenches
NP3	Unreinforced spun/vibrated cast concrete non-pressure pipes	For drainage and irrigation use for cross drains/culverts carrying light traffic
NP4	Unreinforced spun/vibrated cast concrete non-pressure pipes	For drainage and irrigation use, for cross drains/culverts carrying medium traffic

b) *Reinforced Concrete Pipes:*

<i>Class</i>	<i>Description</i>	<i>Conditions where Normally Used</i>
NP 2	Reinforced concrete light duty, non-pressure spun/vibrated pipes	For drainage and irrigation use, for cross drains/culverts carrying light traffic
NP 3	Reinforced concrete medium duty, non-pressure pipes	For drainage and irrigation use, for cross drains/culverts carrying medium traffic

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<i>Class</i>	<i>Description</i>	<i>Conditions where Normally Used</i>
NP 4	Reinforced concrete heavy duty, non-pressure pipes	For drainage and irrigation use, for cross drains/culverts carrying heavy traffic
P-1	Reinforced concrete pressure pipes tested to a hydrostatic pressure of 0.2 MPa (20 m head)	For use on gravity mains, the site test pressure not exceeding two-thirds of the hydrostatic test pressure
P-2	Reinforced concrete pressure pipes tested to a hydrostatic pressure of 0.4 MPa (40 m head)	For use on pumping mains, the site test pressure not exceeding half of the hydrostatic test pressure
P-3	Reinforced concrete pressure pipes tested to a hydrostatic pressure of 0.6 MPa (60 m head)	For use on pumping mains, the site test pressure not exceeding half of the hydrostatic test pressure.

NOTE — The uses are only by way of recommendations as a general guidance and the exact usage shall be decided by the engineer-in-charge.

4.2 Unreinforced and reinforced concrete non-pressure pipes shall be capable of withstanding a test pressure of 0.07 MPa (7 m head).

5 MATERIALS

5.1 For precast concrete pipes, materials complying with the requirements given in 5.2 to 5.8 shall be used.

5.2 Cement

Cement used for the manufacture of unreinforced and reinforced concrete pipes shall conform to the following Indian standards:

- a) Ordinary Portland cement conforming to IS 269,
- b) Portland slag cement conforming to IS 455,
- c) Portland pozzolana cement, fly ash based conforming to IS 1489 (Part 1),
- d) Portland pozzolana cement, calcined clay based conforming to IS 1489 (Part 2),
- e) Rapid hardening Portland cement conforming to IS 8041,
- f) Hydrophobic Portland cement conforming to IS 8043, and

- g) Sulphate resisting Portland cement conforming to IS 12330.

NOTES — Sulphate resisting Portland cement shall be used, where sulphate is predominant.

5.3 Aggregates

Aggregates used for the manufacture of unreinforced and reinforced concrete pipes shall conform to 5 of IS 383. The maximum nominal size of aggregate should not exceed one third thickness of the pipe or 20 mm, whichever is smaller for pipes above 250 mm internal diameter. But for pipes of internal diameter 80 to 250 mm the maximum size of aggregate should be 10 mm.

5.4 Reinforcement

Reinforcement used for the manufacture of the reinforced concrete pipes shall conform to mild steel Grade I or medium tensile steel bars conforming to IS 432 (Part 1) or hard-drawn steel wire conforming to IS 432 (Part 2) or structural steel (standard quality) bars conforming to IS 2062.

NOTE — Wire fabric conforming to IS 1566 or deformed bars and wires conforming to IS 1786 or plain hard-drawn steel wire for prestressed concrete conforming to IS 1785 (Part 1) or IS 1785 (Part 2) or its equivalent conforming to relevant Indian standards may also be used. For such reinforcement maximum tensile stress shall be as given in 6.1.

5.5 Concrete or Mortar

5.5.1 The concrete used for manufacturing of pipes and collar shall conform to IS 456 for at least very severe environment exposure condition. The concrete shall have a minimum compressive strength of 35 N/mm² or as specified in respective Tables given in this standard, whichever is higher. Higher cement content, more fines aggregates and higher water-cement ratio may be required for manufacturing of pipes by spinning process, as per process requirement.

For non-pressure pipes, if mortar is used, it shall have minimum cement content of 450 kg/m³ and compressive strength not less than 35 N/mm² at 28 days. For pressure pipes, if mortar is used, it shall have minimum cement content of 600 kg/m³ and compressive strength not less than 35 N/mm² at 28 days.

5.5.2 For pipes manufactured by the manufacturing process where compressive strength of cubes and compressive strength of concrete in pipes/collars differs, the manufacturer shall declare relation between these two compressive strengths. For spun pipes, conversion factor of 1.25 may be taken for conversion of compressive strength of concrete in cubes to compressive strength of concrete in pipes, in the absence of data provided by the manufacturer. This value shall be used to check the conformity against

the compressive strength requirement in case of spun pipes, given in **5.5.1**.

5.5.3 For pressure pipes, splitting tensile strength of concrete cylinders at 28 days, when tested in accordance with IS 5816, shall not be less than 2.5 N/mm².

5.5.4 Compressive strength tests shall be conducted on 150 mm cubes in accordance with the relevant requirements of IS 456 and IS 516.

5.5.5 The manufacturer shall give a certificate indicating the quantity of cement in the concrete mix.

5.6 Rubber Ring

Rubber ring chords and profile gaskets used in pipe joints shall conform to Type 2 of IS 5382.

5.7 Water

Water used for mixing of concrete and curing of pipes shall conform to **5.4** of IS 456.

5.8 Chemical Admixtures

The admixtures, where used, shall conform to IS 9103.

6 DESIGN

6.1 General

Reinforced concrete pipes either spun or vibrated cast shall be designed such that the maximum tensile stress in the circumferential steel due to specified hydrostatic test pressure does not exceed the limit of 125 N/mm² in the case of mild steel rods, 140 N/mm² in the case of hard-drawn steel wires and high strength deformed steel bars and wires.

6.1.1 The barrel thickness shall be such that under the specified hydrostatic test pressure, the maximum tensile stress in concrete, when considered as effective to take stress along with the tensile reinforcement, shall not exceed 2 N/mm² for pressure pipes and 1.5 N/mm² for non-pressure pipes. But the barrel wall thickness shall be not less than those given in Tables 1, 2, 3, 6, 9, 10 and 11 subject to **8.2** (iii) for pipes manufactured by spun process. For pipes manufactured by vibrated casting process, the barrel wall thickness shall be as given in Tables 2A, 4, 5, 7, 8, 9A, 10A and 11A.

6.1.2 Pipes of length above 3 m and up to 4 m may be supplied by agreement between the user and the supplier and for such pipes, the quantity of reinforcement shall be modified as per **6.1.2.1**.

6.1.2.1 Longitudinal reinforcement

Reinforced cement concrete pipes of lengths up to 4 m may be accepted, if the longitudinal reinforcement is increased in proportion to the square of length compared with what is used for 3 m length as specified in Tables 2 to 11A, except for Table 4 and Table 7.

For length '*L*' (in metre) of pipe, longitudinal reinforcement shall be $L^2/3^2$ times the longitudinal reinforcement used for 3 m long pipes.

6.1.3 Longitudinal reinforcement shall be provided to ensure rigidity and correct location of cages (grids) longitudinally and to limit the effects of transverse cracking. Minimum longitudinal reinforcement shall be as given in Tables 2, 3, 6, 9, 10 and 11 for pipes manufactured by spinning process. For reinforced pipes manufactured by vibrated casting process, the minimum longitudinal reinforcement shall be as given in Tables 2A, 5, 8, 9A, 10A and 11A.

6.2 Reinforcement

The reinforcement in the reinforced concrete pipe shall extend throughout the length of the pipe and shall be so designed that it may be readily placed and maintained to designed shape and in the proper position within the pipe mould during the manufacturing process. The circumferential and longitudinal reinforcement shall be adequate to satisfy the requirements specified under **6.1**.

For non-welded cages spiral reinforcement of the same diameter shall be closely spaced at the end of the pipe for a length of 150 mm to minimize damage during handling. The spacing of such end spirals shall not exceed 50 mm or half the pitch whichever is less. Such spiral reinforcement at ends shall be part of the total spiral reinforcement specified in different tables.

6.2.1 The pitch of circumferential reinforcement shall not be more than following:

- a) 200 mm for pipes of nominal internal diameter 80 to 150 mm,
- b) 150 mm for pipes of nominal internal diameter 200 to 350 mm, and
- c) 100 mm for pipes of nominal internal diameter 400 mm and above.

The pitch shall also be not less than maximum size of aggregate plus diameter of the reinforcement bar used.

6.2.2 The quantity and disposition of steel in pipes may be decided by mutual agreement between the purchaser and the supplier. However, it shall be proved by calculations and tests that the quantity of the reinforcement conforms to all the requirements specified in the standard. In the absence of calculations and tests, the reinforcement given in Tables 2, 3, 6, 9, 10 and 11 for pipes manufactured by spinning process and in Tables 2A, 5, 8, 9A, 10A and 11A for pipes manufactured by vibrated casting process shall be used as minimum reinforcement subject to the requirements of **6.2.2.1**.

6.2.2.1 Tolerances given in IS 432 (Part 1), IS 432 (Part 2) and IS 2062 shall be applied to the minimum

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mass of longitudinal reinforcement specified in different tables. Total mass of longitudinal reinforcement shall be calculated taking into account the clear cover provided at each end of the pipe.

NOTE — For longitudinal reinforcement conforming to IS 432 (Part 2), tolerance on mass shall be calculated from the diameter tolerance.

6.2.3 If so required by the purchaser, the manufacturer shall give a certificate indicating the details relating to quality, quantity and dispersion of steel in the pipes as well as the clear cover to the steel provided in the pipe.

6.3 Ends of Pipes

Spigot and socket ended pipes shall be used for water mains, sewer, irrigation and culverts/cross drains. Flush jointed (NP3 and NP4) and collar jointed (NP2) pipes shall be used for culverts/cross drains only (*see* Fig. 1 and Fig. 2). However, as agreed to between manufacturer and purchaser, collar jointed (NP3 and NP4) pipes may also be used for culverts/cross drains. The ends of concrete pipes used for water mains, sewer, and irrigation shall be suitable for spigot and socket, roll on or confined gasket joints. Dimensions of spigot and socket for various classes of spun pipes shall be as given in Tables 12, 13, 14, 16, 17, 18 and 19. However, dimensions of spigot and socket shall be as given in Tables 13A, 15A, 15B, 15C, 16, 18A and 19A in case of pipes manufactured by vibration casting process. Reinforcement in socket of rubber ring jointed pipes may be as given in Table 20. In case of flush joints, for pipes of internal diameters up to 700 mm, external flush joint (*see* Fig. 1B) and for pipe of internal diameter above 700 mm, internal flush joint (*see* Fig. 1A) is recommended. Dimension of collars for NP1 and NP2 class spun pipes shall be according to details given in Table 1 and Table 21, respectively. Dimensions of collars for NP3 and NP4 class pipes, when used shall be in according to details given in Table 22. Reinforcement in collars shall be as given in Table 21 (NP2 class) and Table 22 (NP3 and NP4 class). The end of collar reinforcement shall have a full ring at both ends.

NOTES

- 1 Bends, junctions and specials for concrete pipes covered under this standard shall conform to the requirements of IS 7322.
- 2 Some typical arrangement of reinforcement in socket are illustrated in Fig. 3 and Fig. 4.
- 3 Table 20 for reinforcement in socket of rubber ring jointed pipes is for guidance only.

6.3.1 Only flexible rubber ring joints shall be used for the joints in,

- a) all pressure pipes; and
- b) all nonpressure pipes except when used for road culverts/cross drains.

The pipe joints shall be capable of withstanding the same pressures as the pipe.

NOTE — The requirements of 6.3.1 does not imply that the collar shall also be tested for the test pressure for pipes specified in 4.1, 4.2 and 10.2.

6.4 Cover

The minimum clear covers for reinforcement in pipes and collars shall be as given below:

Sl No.	Precast Concrete Pipe/Collar	Minimum Clear Cover mm
(1)	(2)	(3)
i)	Barrel wall thickness:	
	a) Up to and including 30 mm	8
	b) Over 30 mm and up to 40 mm	10
	c) Over 40 mm and up to 60 mm	15
	d) Over 60 mm	18
ii)	At spigot steps	5
iii)	At end of longitudinals	5

NOTE — An effective means shall be provided for maintaining the reinforcement in position and for ensuring correct cover during manufacture of the unit. Spacers for this purpose shall be of rust proof material or of steel protected against corrosion.

7 MANUFACTURE

7.1 General

The method of manufacture shall be such that the forms and dimensions of the finished pipe are accurate within the limits specified in this standard. The surfaces and edges of the pipes shall be well defined and true, and their ends shall be square with the longitudinal axis.

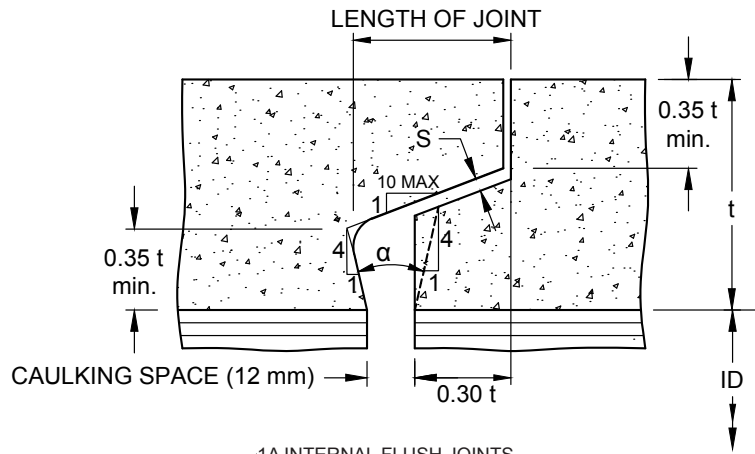
7.2 Concrete Mixing and Placing

7.2.1 Concrete shall be mixed in a mechanical mixer. Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency, but in no case shall the mixing be done for less than 2 min.

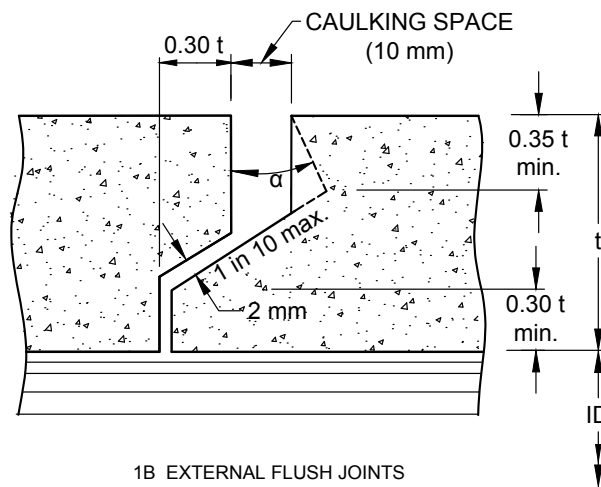
7.2.2 Concrete shall be placed before setting has commenced. It should be ensured that the concrete is not dropped freely so as to cause segregation. The concrete shall be consolidated by spinning, vibrating, spinning combined with vibrations, or other appropriate mechanical means.

7.3 Reinforcement Cages

Reinforcement cages for pipes shall extend throughout the pipes barrel. The cages shall consist of spirals or circular rings and straights of hard drawn steel wire or mild steel rod. Reinforcement cages shall be placed symmetrically with respect to thickness of the pipe wall. The spirals shall end in a complete ring at both the ends of a pipe.



1A INTERNAL FLUSH JOINTS



1B EXTERNAL FLUSH JOINTS

KEY

- t - WALL THICKNESS
- s - 0.002 OF INTERNAL DIA. OR 2 mm min.
- ID - INTERNAL DIAMETER
- α - INCLUDED ANGLE NOT MORE THAN 25° (ONLY FOR DESIGN PURPOSE NOT TO BE MEASURED)

FIG. 1 DETAILS OF FLUSH JOINTS

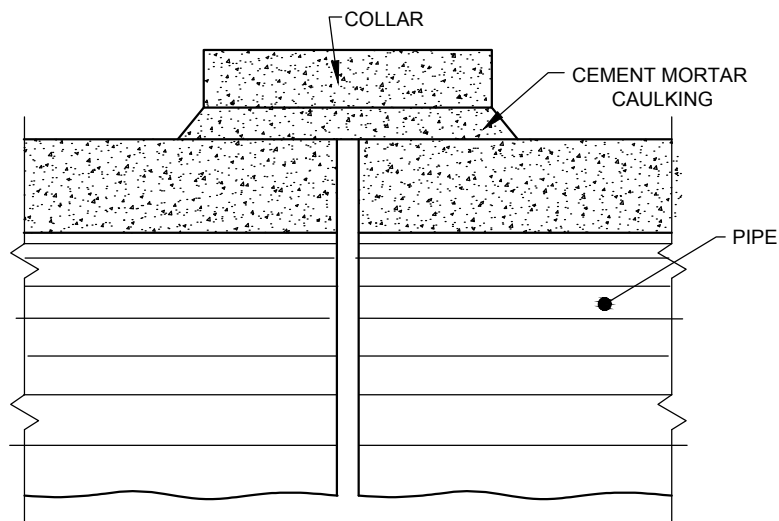
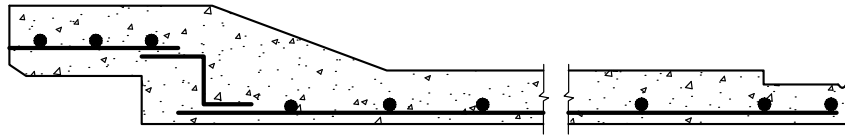


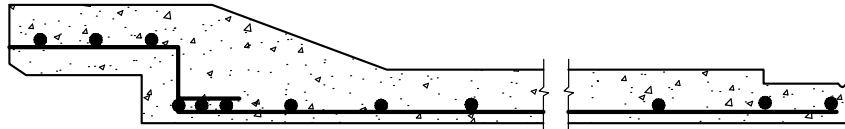
FIG. 2 COLLAR JOINTS (RIGID)

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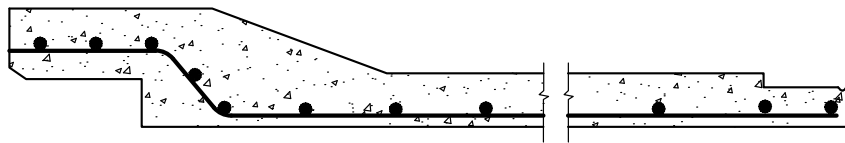


NOTE - NO OF Z BARS: MINIMUM HALF THE NUMBER OF LONGITUDINALS
MAXIMUM EQUAL TO NUMBER OF LONGITUDINALS

3A SOCKET CAGE CONNECTED TO BARREL CAGE BY MEANS OF Z BARS

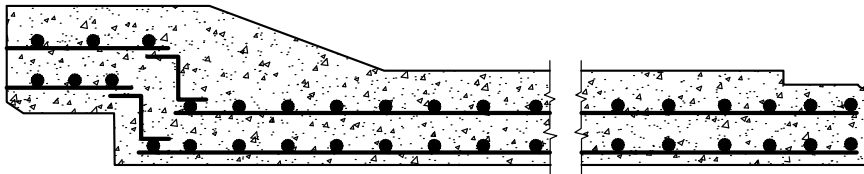


3B SOCKET CAGE LONGITUDINALS SUITABLY BENT
FOR CONNECTED TO BARREL CAGE



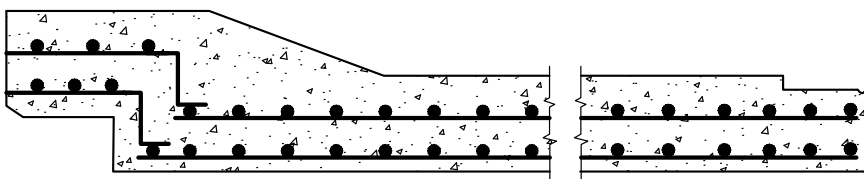
3C CAGE MADE OF CONTINUOUS LONGITUDINALS

FIG. 3 TYPICAL ARRANGEMENT OF REINFORCEMENT IN SOCKET FOR SINGLE CAGE

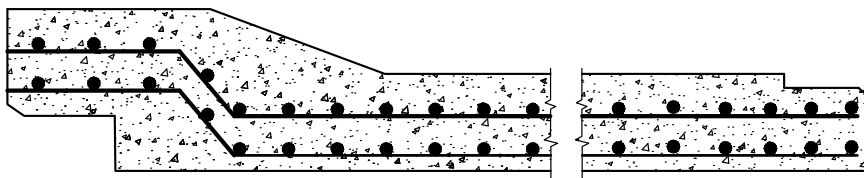


NOTE - NO OF Z BARS: MINIMUM HALF THE NUMBER OF LONGITUDINALS
MAXIMUM EQUAL TO NUMBER OF LONGITUDINALS

4A SOCKET CAGE CONNECTED TO BARREL CAGE BY MEANS OF Z BARS



4B SOCKET CAGE LONGITUDINALS SUITABLY BENT
FOR CONNECTING TO BARREL CAGE



4C CAGE MADE OF CONTINUOUS LONGITUDINALS

FIG. 4 TYPICAL ARRANGEMENT OF REINFORCEMENT IN SOCKET FOR DOUBLE CAGE

7.3.1 Pipes having barrel wall thickness 100 mm and above shall have double reinforcement cage and the amount of spirals steel in the outer cage shall be 75 percent of the mass of spiral steel in the inner cage, whilst the total shall conform to the requirements specified in the relevant tables of this standard. The mass of longitudinals in the outer cage and inner cage should be the same, that is equal to half the total mass of longitudinals specified in the relevant tables. The total longitudinal steel per pipe shall be as given in the relevant tables.

NOTE — It is preferable that single reinforcement cage should be located near the inner surface of the pipe with adequate clear cover.

7.3.2 Diagonal reinforcement may be provided in pipes, the cages for which are not welded so as to help in binding the cage securely. It shall, however, be ensured that the clear cover for any reinforcement is not below the limits specified in **6.4**. Diagonal reinforcement is a process requirement and shall not be counted against longitudinal and spiral reinforcement.

7.4 Curing

Curing shall be either by steam or by water or by a combination of steam and water or by use of approved curing compounds. If water curing is used, the pipes shall be cured for a minimum period of 7 days in case of non-pressure pipes, and 14 days in case of pressure pipes. In case of pipes where cement with fly ash or slag is used, the minimum period of water curing shall be 14 days. If steam curing is used, after that it shall be water cured for 3 days. Impermeable membrane may be used for curing as per IS 456.

8 DIMENSIONS

8.1 Pipes and Collars

The internal diameter, barrel wall thickness, length, the minimum reinforcement and strength test requirements for different classes of pipes (*see 4.1*) shall be as specified in Table 1 to Table 11A. Dimensions of collar for class NP1 shall be as per Table 1. Dimensions and reinforcement of collar for class NP2 shall be as per Table 21 and for classes NP3 and NP4 shall be as per Table 22. However, in case of pipes manufactured by vibration casting process, the internal diameter, wall thickness, the minimum reinforcement (in case of reinforced pipes) and strength test requirements for different classes of pipes shall be as given in Tables 2A, 4, 5, 7, 8, 9A, 10A and 11A. The manufacturer shall inform the purchaser of the effective length of spigot and socket and flush jointed pipes that he is able to supply. For collar jointed pipes, effective length shall be 2 m or 2.5 m up to 250 mm nominal diameter pipes and 2.5 m, 3.0 m, 3.5 m or 4.0 m for pipes above 250 mm nominal diameter. Class NP3 and NP4 pipes of nominal internal diameter 900 mm and above, the effective length may also be 1.25 m.

NOTE — Pipes of internal diameter, barrel wall thickness and length of barrel and collar other than those specified in **8.1** may be supplied by mutual agreement between the purchaser and the supplier. In such case, the design of pipes submitted to the purchaser shall include all standard details as covered in Tables 1 to Table 11A.

**Table 1 Design and Strength Test Requirements of Concrete Pipes of Class NP1 —
Unreinforced, Non-pressure Pipes**
(Clauses 6.1.1, 6.3 and 8.1)

Internal Diameter of Pipe	Barrel Wall Thickness	Collar Dimensions		Minimum Length of Collar	Strength Test Requirements for Three Edge Bearing Test Ultimate Load Test
		Minimum Caulking Space	Minimum Thickness		
mm	mm	mm	mm	mm	kN/linear metre
(1)	(2)	(3)	(4)	(5)	(6)
80	25	13	25	150	15.3
100	25	13	25	150	15.3
150	25	13	25	150	15.3
200	25	13	25	150	16.4
225	25	13	25	150	16.4
250	25	13	25	150	16.4
300	30	16	30	150	17.6
350	32	16	32	150	18.4
400	32	16	32	150	18.8
450	35	19	35	200	21.9

NOTE — Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days.

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**Table 2 Design and Strength Test Requirements of Concrete Pipes of Class NP2 —
Reinforced Concrete, Light Duty, Non-pressure Pipes Made by Spinning Process**

(Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce 0.25 mm Crack	Ultimate load
		Minimum Number	kg/linear metre	kg/linear metre	kN/linear metre	kN/linear metre
mm	mm					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
80	25	6	0.59	0.16	10.05	15.08
100	25	6	0.59	0.18	10.05	15.08
150	25	6	0.59	0.24	10.79	16.19
200	25	6	0.59	0.38	11.77	17.66
225	25	6	0.59	0.46	12.26	18.39
250	25	6	0.59	0.58	12.55	18.83
300	30	8	0.78	0.79	13.48	20.22
350	32	8	0.78	1.14	14.46	21.69
400	32	8	0.78	1.55	15.45	23.18
450	35	8	0.78	1.97	16.18	24.27
500	35	8	0.78	2.46	17.16	25.74
600	45	8	0.78	3.47	18.88	28.32
700	50	8	1.22	4.60	20.35	30.53
800	50	8	1.22	6.71	21.57	32.36
900	55	8	1.22	9.25	22.80	34.20
1 000	60	8	1.76	10.69	24.27	36.41
1 100	65	8	1.76	12.74	25.50	38.25
1 200	70	8	1.76	15.47	26.97	40.46
1 400	75	12	2.64	20.57	29.42	44.13
1 600	80	12 or 8 + 8	3.52	25.40	32.12	48.18
1 800	90	12 or 8 + 8	3.52	32.74	35.06	52.59
2 000	100	12 + 12	5.28	45.14	37.76	56.64
2 200	110	12 + 12	5.28	56.37	40.21	60.32

NOTES

- 1 Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days.
- 2 If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.
- 3 Soft grade mild steel wire for spirals may be used for pipes of internal diameters 80 mm, 100 mm and 150 mm only, by increasing mass to 140/84.
- 4 The longitudinal reinforcement given in this table is valid for pipes up to 2.5 m effective length for internal diameter of pipe up to 250 mm and up to 3 m effective length for higher diameter pipes.
- 5 Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

**Table 2A Design and Strength Test Requirements of Concrete Pipes of Class NP2 —
Reinforced Concrete, Light Duty, Non-pressure Pipes Made by Vibration Casting Process**

(Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce 0.25 mm Crack	Ultimate load
		Minimum Number	kg/linear metre	kg/linear metre		
mm	mm	(3)	(4)	(5)	kN/linear metre	kN/linear metre
(1)	(2)	(3)	(4)	(5)	(6)	(7)
700	50	8	1.22	4.60	20.35	30.53
800	50	8	1.22	6.71	21.57	32.36
900	55	8	1.22	9.25	22.80	34.20
1 000	60	8	1.76	10.69	24.27	36.41
1 100	65	8	1.76	12.74	25.50	38.25
1 200	70	8	1.76	15.47	26.97	40.46
1 400	75	12	2.64	20.57	29.42	44.13
1 600	80	12 or 8+8	3.52	25.40	32.12	48.18
1 800	90	12 or 8+8	3.52	32.74	35.06	52.59
2 000	100	12+12	5.28	45.14	37.76	56.64
2 200	110	12+12	5.28	56.37	40.21	60.32

NOTES

1 Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days.

2 If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.

3 The longitudinal reinforcement given in this table is valid for pipes up to 3 m effective length.

4 Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

**Table 3 Design and Strength Test Requirements of Concrete Pipes of Class NP3 –
Reinforced Concrete, Medium Duty, Non-pressure Pipes Made by Spinning Process**

(Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce 0.25 mm Crack	Ultimate Load
		Minimum Number	kg/linear metre	kg/linear metre		
mm	mm	(3)	(4)	(5)	kN/linear metre	kN/linear metre
(1)	(2)	(3)	(4)	(5)	(6)	(7)
80	25	6	0.59	0.17	13.00	19.50
100	25	6	0.59	0.24	13.00	19.50
150	25	6	0.59	0.49	13.70	20.55
200	30	6	0.59	0.68	14.50	21.75
225	30	6	0.59	0.86	14.80	22.20
250	30	6	0.59	1.05	15.00	22.50
300	40	8	0.78	1.53	15.50	23.25
350	75	8	0.78	1.58	16.77	25.16
400	75	8	0.78	1.60	19.16	28.74
450	75	8	0.78	1.90	21.56	32.34
500	75	8	0.78	1.97	23.95	35.93

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Table 3 (Concluded)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce 0.25 mm Crack	Ultimate Load
		Minimum Number	kg/linear metre	kg/linear metre	kN/linear metre	kN/linear metre
mm	mm					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
600	85	8 or 6+6	1.18	2.82	28.74	43.11
700	85	8 or 6+6	1.18	4.87	33.53	50.30
800	95	8 or 6+6	2.66	6.87	38.32	57.48
900	100	6 + 6	2.66	11.55	43.11	64.67
1 000	115	6 + 6	2.66	15.70	47.90	71.85
1 100	115	6 + 6	2.66	20.42	52.69	79.00
1 200	120	8 + 8	3.55	24.74	57.48	86.22
1 400	135	8 + 8	3.55	46.21	67.06	100.60
1 600	140	8 + 8	3.55	65.40	76.64	114.96
1 800	150	12 + 12	9.36	87.10	86.22	129.33
2 000	170	12 + 12	9.36	97.90	95.80	143.70
2 200	185	12 + 12	9.36	133.30	105.38	158.07
2 400	200	12 + 12	14.88	146.61	114.96	172.44
2 600	215	12 + 12	14.88	175.76	124.54	186.81

NOTES

- Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days.
- If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.
- The longitudinal reinforcement given in this table is valid for pipes up to 2.5 m effective length for Internal diameter of pipe up to 250 mm and up to 3 m effective length for higher diameter pipes.
- Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

**Table 4 Design and Strength Test Requirements of Concrete Pipes of Class NP3 — Unreinforced
Concrete, Medium-Duty, Non-pressure Pipes Made by Spinning/Vibration Casting Process**
(Clauses 5.5.1, 6.1.1, 6.3, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Strength Test Requirement for Three Edge Bearing Test, Ultimate Load
mm	mm	kN/linear metre
(1)	(2)	(3)
100	24	13.00
150	28	13.70
200	32	14.50
250	37	15.00
300	50	15.50
350	55	16.77
400	60	19.16
450	65	21.56
500	70	23.95
600	75	28.74
700	85	33.53

Table 4 (Concluded)

Internal Diameter of Pipes	Barrel Wall Thickness	Strength Test Requirement for Three Edge Bearing Test, Ultimate Load
mm	mm	kN/linear metre
(1)	(2)	(3)
800	95	38.32
900	100	43.11
1 000	115	47.90
1 100	120	52.69
1 200	125	57.48
1 400	140	67.06
1 600	165	76.64
1 800	180	86.22

NOTES

1 Concrete for pipes shall have a minimum compressive strength of 45 N/mm² at 28 days.

2 The pipes up to 250 mm dia shall be manufactured in standard length of 1.25 m.

Table 5 Design and Strength Test Requirements of Concrete Pipes of Class NP3 — Reinforced Concrete, Medium-Duty, Non-pressure Pipes Made by Vibration Casting Process

(Clauses 5.5.1, 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce 0.25 mm Crack	Ultimate Load
		Minimum Number	kg/linear metre	kg/linear metre	kN/linear metre	kN/linear metre
mm	mm					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	50	8	0.78	1.53	15.50	23.25
350	55	8	0.78	1.58	16.77	25.16
400	60	8	0.78	1.60	19.16	28.74
450	65	8	0.78	1.90	21.56	32.34
500	70	8	0.78	2.0	23.95	35.93
600	75	8 or 6 + 6	1.18	2.20	28.74	43.11
700	85	8 or 6 + 6	1.18	4.87	33.53	50.30
800	95	8 or 6 + 6	2.66	6.87	38.32	57.48
900	100	6 + 6	2.66	11.55	43.11	64.67
1 000	115	6 + 6	2.66	15.70	47.90	71.85
1 100	120	6 + 6	2.66	19.61	52.69	79.00
1 200	125	8 + 8	3.55	21.25	57.48	86.22
1 400	140	8 + 8	3.55	30.00	67.06	100.60
1 600	165	8 + 8	3.55	50.63	76.64	114.96
1 800	180	12 + 12	9.36	64.19	86.22	129.33
2 000	190	12 + 12	9.36	83.12	95.80	143.70
2 200	210	12 + 12	9.36	105.53	105.38	158.07
2 400	225	12 + 12	14.88	133.30	114.96	172.44

NOTE — Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days.

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**Table 6 Design and Strength Test Requirements of Concrete Pipes of Class NP4 —
Reinforced Concrete, Heavy Duty, Non-pressure Pipes Made by Spinning Process**

(Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce 0.25 mm Crack	Ultimate Load
mm	mm	Minimum Number	kg/linear metre	kg/linear metre	kN/linear metre	kN/linear metre
(1)	(2)	(3)	(4)	(5)	(6)	(7)
80	25	6	0.59	0.26	22.10	33.15
100	25	6	0.59	0.37	22.10	33.15
150	25	6	0.59	0.76	23.30	34.95
200	30	6	0.59	0.88	24.60	36.90
225	30	6	0.59	1.11	25.20	37.80
250	30	6	0.59	1.35	25.50	38.25
300	40	8	0.78	1.53	26.40	39.60
350	75	8	0.78	1.61	29.80	44.70
400	75	8	0.78	1.97	33.90	50.90
450	75	8	0.78	3.36	36.90	55.30
500	75	8	0.78	5.56	40.00	61.20
600	85	8 or 6 + 6	2.34	8.50	46.30	69.40
700	85	8 or 6 + 6	3.44	12.78	52.20	78.30
800	95	8 or 6 + 6	3.44	16.72	59.30	89.10
900	100	6 + 6	3.44	20.92	66.30	99.40
1 000	115	8 + 8	6.04	26.70	72.60	108.90
1 100	115	8 + 8	6.04	38.02	80.40	120.60
1 200	120	8 + 8	6.04	46.25	88.30	132.40
1 400	135	8 + 8	9.36	59.20	99.10	148.65
1 600	140	12 + 12	9.36	86.60	109.90	164.85
1 800	150	12 + 12	14.88	103.30	120.70	181.05
2 000	170	12 + 12	14.88	125.28	131.50	197.25
2 200	185	12 + 12	14.88	154.94	142.20	213.30
2 400	200	12 + 12	14.88	181.25	155.00	232.50
2 600	215	12 + 12	14.88	208.25	166.70	250.00

NOTES

- 1 Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days.
- 2 If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.
- 3 The longitudinal reinforcement given in this table is valid for pipes up to 2.5 m effective length for internal diameter of pipe up to 250 mm and 3 m effective length for higher diameter pipes.
- 4 Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

Table 7 Design and Strength Test Requirements of Concrete Pipes of Class NP4 — Unreinforced Concrete, Heavy Duty, Non-pressure Pipes Made by Spinning/Vibration Casting process
(Clauses 5.5.1, 6.1.1, 6.3, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Strength Test Requirements for Three Edge Bearing Test, Ultimate Load
mm	mm	kN/linear metre
(1)	(2)	(3)
100	24	22.1
150	28	23.8
200	32	24.6
250	37	25.5
300	50	26.4
350	55	29.8
400	60	33.9
450	65	36.9
500	70	40.0
600	75	46.3
700	85	52.2
800	95	59.3
900	100	66.3
1 000	115	72.6
1 100	125	80.4
1 200	135	88.3
1 400	155	104.2
1 600	180	119.6
1 800	205	135.3

NOTES

- 1 Concrete for pipes shall have a minimum compressive strength of 50 N/mm² at 28 days.
- 2 The pipes up to 250 mm dia shall be manufactured in standard length of 1.25 m.

Table 8 Design and Strength Test Requirements of Concrete Pipes of Class NP4 — Reinforced Concrete, Heavy Duty, Non-pressure Pipes Made by Vibration Casting Process
(Clauses 5.5.1, 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce 0.25 mm Crack	Ultimate load
		Minimum Number	kg/linear metre	kg/linear metre	kN/linear metre	kN/linear metre
mm	mm					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	50	8	0.78	1.53	26.4	38.6
350	55	8	0.78	1.61	29.8	44.7
400	60	8	0.78	1.97	33.9	50.9
450	65	8	0.78	3.36	36.9	55.3
500	70	8	0.78	5.56	40.0	61.2
600	75	8 or 6 + 6	2.34	8.50	46.3	69.4
700	85	8 or 6 + 6	3.44	12.78	52.2	78.3

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Table 8 (Concluded)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements			Strength Test Requirements for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce 0.25 mm Crack	Ultimate load
		Minimum Number	kg/linear metre	kg/linear metre	kN/linear metre	kN/linear metre
mm	mm					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
800	95	8 or 6 + 6	3.44	16.72	59.3	89.1
900	100	6 + 6	3.44	20.92	66.3	99.4
1 000	115	8 + 8	6.04	26.70	72.6	108.9
1 100	120	8 + 8	6.04	35.60	80.4	120.6
1 200	125	8 + 8	6.04	42.42	88.3	132.4
1 400	140	8 + 8	9.36	51.39	99.10	148.65
1 600	165	12 + 12	9.36	61.81	109.90	164.85
1 800	180	12 + 12	14.88	78.03	120.70	181.05
2 000	190	12 + 12	14.88	103.50	131.50	197.25

NOTE — Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days.

Table 9 Design and Strength Test Requirements of Concrete Pipes of Class P1 — Reinforced Concrete, Pressure Pipes Safe for 0.2 MPa Pressure Test Made by Spinning Process

(Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements		
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel
		Minimum Number	kg/linear metre	kg/linear metre
mm	mm			
(1)	(2)	(3)	(4)	(5)
80	25	6	0.59	0.16
100	25	6	0.59	0.22
150	25	6	0.59	0.46
200	25	6	0.59	0.79
225	25	6	0.59	1.00
250	25	6	0.59	1.22
300	30	8	0.78	1.75
350	32	8	0.78	2.37
400	32	8	0.78	3.05
450	35	8	0.78	3.86
500	35	8	0.78	4.72
600	45	8	0.78	6.79
700	50	8	1.22	9.15
800	50	8	1.22	11.94
900	55	8	1.22	15.12
1 000	60	8	1.76	18.64
1 100	65	8	1.76	22.88
1 200	70	8	1.76	26.82

NOTES

1 Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days.

2 Strength requirements for pressure pipes shall be the same as for NP-2 class pipes.

Table 9 (Concluded)

- 3 If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.
 4 Soft grade mild steel wire for spirals may be used for pipes of internal diameters 80 mm, 100 mm and 150 mm only, by increasing mass to 140/84.
 5 The longitudinal reinforcement given in this table is valid for pipes up to 2.5 m effective length for internal diameter of pipe up to 250 and up to 3 m effective length for higher diameter pipes
 6 Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

Table 9A Design and Strength Test Requirements of Concrete Pipes of Class P1 — Reinforced Concrete, Pressure Pipes Safe for 0.2 MPa Pressure Test Made by Vibration Casting Process
 (Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements		
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel
mm	mm	Minimum Number	kg/linear metre	kg/linear metre
(1)	(2)	(3)	(4)	(5)
700	50	8	1.22	9.15
800	50	8	1.22	11.94
900	55	8	1.22	15.12
1 000	60	8	1.76	18.64
1 100	65	8	1.76	22.88
1 200	70	8	1.76	26.82

NOTES

- 1 Concrete for pipes shall have a minimum compressive strength of 35 N/mm² at 28 days.
 2 Strength requirements for pressure pipes shall be the same as for NP-2 class pipes.
 3 If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.
 4 The longitudinal reinforcement given in this table is valid for pipes up to 3 m effective length.
 5 Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

Table 10 Design and Strength Test Requirements of Concrete Pipes of Class P2 — Reinforced Concrete Pressure Pipes Safe for 0.4 MPa Pressure Test Made by Spinning Process
 (Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements		
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel
mm	mm	Minimum Number	kg/linear metre	kg/linear metre
(1)	(2)	(3)	(4)	(5)
80	25	6	0.59	0.29
100	25	6	0.59	0.45
150	25	6	0.59	0.93
200	30	6	0.59	1.63
225	30	6	0.59	2.03
250	30	6	0.59	2.47
300	40	8	0.78	3.61

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Table 10 (Concluded)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements		
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel
		Minimum Number	kg/linear metre	kg/linear metre
mm	mm			
(1)	(2)	(3)	(4)	(5)
350	45	8	0.78	4.88
400	50	8	0.78	6.36
450	50	8	0.78	7.96
500	55	8	0.78	9.80
600	65	8	1.76	14.10
700	70	8	1.76	21.90
800	80	8 or 6 + 6	2.66	28.54
900	90	8 or 6 + 6	2.66	35.92
1 000	100	6 + 6	2.66	43.48

NOTES

- 1 Strength requirements for pressure pipes shall be the same as for NP-2 class pipes.
- 2 If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.
- 3 Soft grade mild steel wire for spirals may be used for pipes of internal diameters 80 mm, 100 mm and 150 mm only, by increasing mass to 140/84,
- 4 The longitudinal reinforcement given in this table is valid for pipes up to 2.5 m effective length for internal diameter of pipe up to 250 mm and up to 3 m effective length for higher diameter pipes.
- 5 Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

Table 10A Design and Strength Test Requirements of Concrete Pipes of Class P2 — Reinforced Concrete Pressure Pipes Safe for 0.4 MPa Pressure Test Made by Vibration Casting Process

(Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements		
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel
		Minimum Number	kg/linear metre	kg/linear metre
mm	mm			
(1)	(2)	(3)	(4)	(5)
400	50	8	0.78	6.36
450	50	8	0.78	7.96
500	55	8	0.78	9.80
600	65	8	1.76	14.10
700	70	8	1.76	21.90
800	80	8 or 6 + 6	2.66	28.54
900	90	8 or 6 + 6	2.66	35.92
1000	100	6 + 6	2.66	43.48

NOTES

- 1 Strength requirements for pressure pipes shall be the same as for NP-2 class pipes.
- 2 If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.
- 3 The longitudinal reinforcement given in this table is valid for pipes up to 3 m effective length.
- 4 Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

Table 11 Design and Strength Test Requirements of Concrete Pipes of Class P3 — Reinforced Concrete Pressure Pipes Safe for 0.6 MPa Pressure Test Made by Spinning Process
(Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements		
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel
		Minimum Number	kg/linear metre	kg/linear metre
mm	mm			
(1)	(2)	(3)	(4)	(5)
80	25	6	0.59	0.45
100	25	6	0.59	0.66
150	25	6	0.59	1.39
200	35	6	0.59	2.49
225	35	6	0.59	3.10
250	35	6	0.59	3.78
300	45	8	0.78	5.49
350	55	8	0.78	7.52
400	60	8	0.78	9.78
450	70	8	0.78	13.06
500	75	8	0.78	15.96
600	90	8 or 6 + 6	2.66	22.63
700	105	6 + 6	2.66	30.82
800	120	6 + 6	2.66	39.46

NOTES

- 1 Strength requirements for pressure pipes shall be the same as for NP-2 class pipes.
- 2 If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.
- 3 Soft grade mild steel wire for spirals may be used for pipes of internal diameters 80 mm, 100 mm and 150 mm only, by increasing mass to 140/84,
- 4 The longitudinal reinforcement given in this table is valid for pipes up to 2.5 m effective length for internal diameter of pipe up to 250 mm and up to 3 m effective length for higher diameter pipes.
- 5 Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

Table 11A Design and Strength Test Requirements of Concrete Pipes of Class P3 — Reinforced Concrete Pressure Pipes Safe for 0.6 MPa Pressure Test Made by Vibration Casting Process
(Clauses 6.1.1, 6.1.2.1, 6.1.3, 6.2.2, 7.3.2, 8.1 and Table 20)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements		
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel
		Minimum Number	kg/linear metre	kg/linear metre
mm	mm			
(1)	(2)	(3)	(4)	(5)
350	55	8	0.78	7.52
400	60	8	0.78	9.78
450	70	8	0.78	13.06
500	75	8	0.78	15.96
600	90	8 or 6+6	2.66	22.63
700	105	6 + 6	2.66	30.82
800	120	6 + 6	2.66	39.46

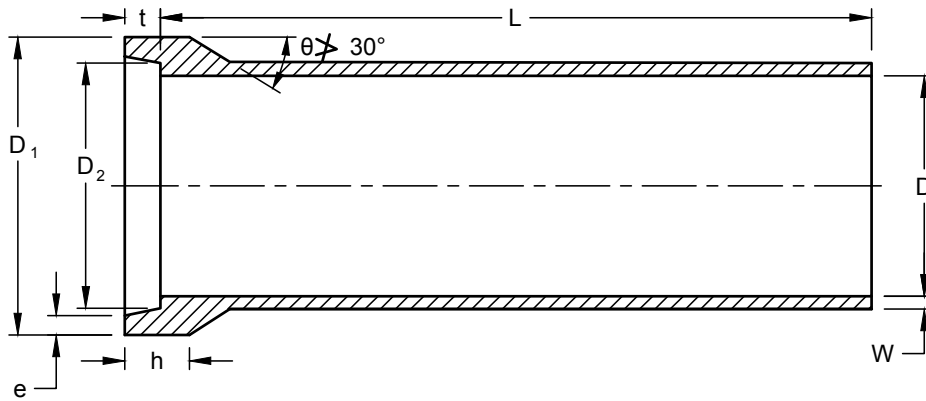
NOTES

- 1 Strength requirements for pressure pipes shall be the same as for NP-2 class pipes.
- 2 If mild steel is used for spiral reinforcement, the mass specified under col 5 shall be increased to 140/125.
- 3 The longitudinal reinforcement given in this table is valid for pipes up to 3 m effective length.
- 4 Total mass of longitudinal reinforcement shall be calculated by multiplying the values given in col 4 by the length of the pipe and then deducting for the cover length provided at the two ends.

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Table 12 Spigot and Socket Dimensions of NP-1 Class Pipes

(Clause 6.3)



All dimensions in millimetres.

D	W	D1	D2	e	h	t
(1)	(2)	(3)	(4)	(5)	(6)	(7)
80	25	206	156	22	60	45
100	25	226	176	22	60	45
150	25	276	226	22	65	50
250	25	376	326	22	70	55
300	30	452	392	26	75	60
350	32	510	446	28	80	65
400	32	560	496	28	80	65
450	35	628	558	31	85	70

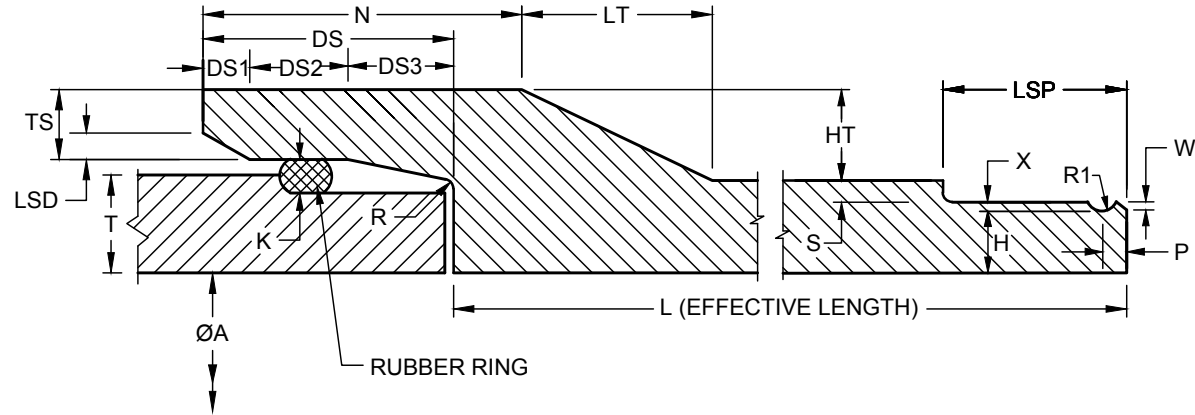
NOTE — The dimensions D_2 , h and e shall conform to the values given in this table as these are critical dimensions. The following tolerances shall apply on the critical dimensions:

$D_2 = \pm 3$ mm for pipes up to and including 300 mm diameter
 ± 4 mm for pipes over 300 mm internal diameter

$h = \pm 3$ mm for dimensions up to 60 mm
 ± 5 mm for dimensions above 60 mm

$e = \pm 2$ mm for dimensions up to 30 mm
 ± 3 mm for dimensions above 30 mm

Table 13 Spigot and Socket Dimensions of NP-2 and P-1 Class Pipes (Rubber Ring Roll on Joint) pipes made by Spinning Process
(Clauses 6.3 and 8.2)



All dimensions in millimetres

Pipe Diameter ϕA	Rubber Ring Chord Diameter	Rubber Ring Internal Diameter	T	TS	DS	DS1	DS2	DS3	R	LSD	K	N	LT	HT	LSP	P	S	H	X	W	R1
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
80	11	102	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
100	11	120	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
150	11	170	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
200	11	215	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
225	11	225	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
250	11	250	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
300	12	315	30	35	77	9	31	37	3	6	7	107	92	37	55	7.5	6	24	1	1	6
350	12	360	32	37	77	9	31	37	3	6	7	109	96	39	55	7.5	6	26	1	1	6
400	12	400	32	37	77	9	31	37	3	6	7	109	96	39	55	7.5	6	26	1	1	6
450	12	450	35	40	77	9	31	37	3	6	7	112	104	42	55	7.5	6	29	1	1	6
500	12	500	35	40	77	9	31	37	3	6	7	112	104	42	55	7.5	6	29	1	1	6
600	16	590	45	49	102	12	42	48	6	9	9.5	132	106	47	72	10	7.5	37.5	2	2	8

Table 13 (Concluded)

700	16	680	50	56	102	12	42	48	6	9	9.5	132	106	47	72	10	9.5	40.5	2	2	8
800	20	785	50	56	128	15	52	61	6	11	11.5	162	117	52	90	12.5	9.5	40.5	2	2	10
900	20	875	55	60	128	15	52	61	6	11	11.5	165	133	59	90	12.5	10.5	44.5	2	2	10
1 000	22	980	60	65	141	17	57	67	8	12	13.5	169	137	64	99	14	10.5	49.5	2	2	11
1 100	22	1070	65	71	141	17	57	67	8	12	13.5	171	148	69	99	14	10.5	54.5	2	2	11
1 200	22	1170	70	76	141	17	57	67	8	12	13.5	173	161	75	99	14	10.5	59.5	2	2	11
1 400	22	1370	75	82	141	17	57	67	8	12	13.5	179	184	86	99	14	10.5	64.5	2	2	11
1 600	25	1560	80	87	165	20	67	78	8	15	15	205	195	91	100	15	12	68	2.5	2.5	12
1 800	25	1780	90	99	165	20	67	78	8	15	15	210	221	103	100	15	12	78	2.5	2.5	12
2 000	25	1935	100	109	165	20	67	78	8	15	15	215	242	113	100	15	12	88	2.5	2.5	12
2 200	25	2130	110	119	165	20	67	78	8	15	15	220	264	123	100	15	12	98	2.5	2.5	12

NOTES

1 Important dimensions of socket and spigot to be checked in socket and spigot pipes.

- a. Socket inside diameter each pipe
- b. Spigot outside diameter each pipe

The procedure for the inspection is given in **10** of IS 3597.

2 For the dimensional checks, dimensions of few Pipes have to be checked from each mould to ensure that mould is accurate. Later on it is not necessary to check these dimensions.

3 Corners to be rounded off.

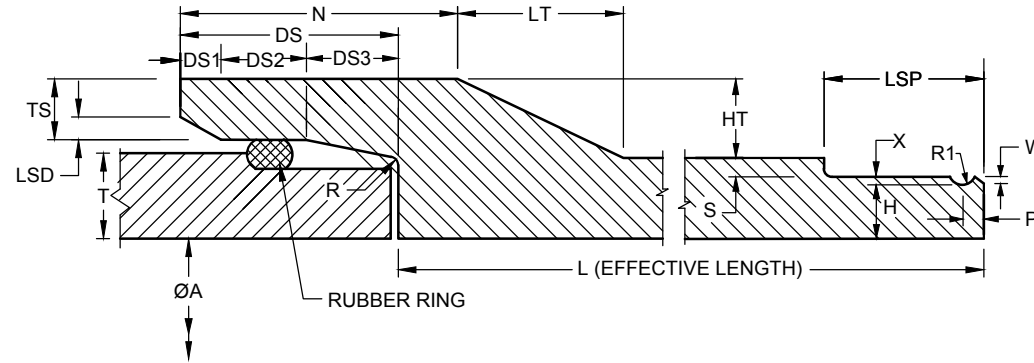
4 Tolerances:

Dimensions	Tolerances
T and HT	Same as that of barrel wall thickness given in 8.2
TS and H	Half the tolerance on barrel wall thickness given in 8.2
DS2, DS3, LSP, K & S	The tolerance, in mm, shall be given as below:

Chord Diameter	DS2	DS3	LSP	K	S
11	±2.0	±3.0	±4.00	±1.25	±0.75
12	±2.0	±3.0	±4.00	±1.25	±0.75
16	±2.5	±3.5	±5.00	±2.00	±1.25
20	±3.0	±4.0	±5.50	±2.25	±1.50
22	±3.5	±4.5	±6.25	±2.75	±1.75
25	±4.0	±5.0	±7.00	±3.25	±2.00

5 In order to ascertain the correctness of mould, 5 percent of the pipes be randomly selected from each control unit and checked for all critical dimensions.

**Table 13A Spigot and Socket Dimensions of NP-2 and P-1 Class Pipes
(Rubber Ring Roll on Joint) Pipes Made by Vibration Casting Process**
(Clauses 6.3 and 8.2)



All dimensions in millimetres

Pipe Diameter ϕA	Rubber Ring Chord Diameter	Rubber Ring Internal Diameter	T	TS	DS	DS1	DS2	DS3	R	LSD	K	N	LT	HT	LSP	P	S	H	X	W	R1
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
700	16	680	50	56	102	12	42	48	6	9	9.5	132	106	47	72	10	9.5	40.5	2	2	8
800	20	785	50	56	128	15	52	61	6	11	11.5	162	117	52	90	12.5	9.5	40.5	2	2	10
900	20	875	55	60	128	15	52	61	6	11	11.5	165	133	59	90	12.5	10.5	44.5	2	2	10
1000	22	980	60	65	141	17	57	67	8	12	13.5	169	137	64	99	14	10.5	49.5	2	2	11
1100	22	1070	65	71	141	17	57	67	8	12	13.5	171	148	69	99	14	10.5	54.5	2	2	11
1200	22	1170	70	76	141	17	57	67	8	12	13.5	173	161	75	99	14	10.5	59.5	2	2	11
1400	22	1370	75	82	141	17	57	67	8	12	13.5	179	184	86	99	14	10.5	64.5	2	2	11
1600	25	1560	80	87	165	20	67	78	8	15	15	205	195	91	100	15	12	68	2.5	2.5	12
1800	25	1780	90	99	165	20	67	78	8	15	15	210	221	103	100	15	12	78	2.5	2.5	12
2000	25	1935	100	109	165	20	67	78	8	15	15	215	242	113	100	15	12	88	2.5	2.5	12
2200	25	2130	110	119	165	20	67	78	8	15	15	220	264	123	100	15	12	98	2.5	2.5	12

Table 13A (Concluded)

NOTES

1 Important dimensions of socket and spigot to be checked in socket and spigot pipes.

- a. Socket inside diameter each pipe
- b. Spigot outside diameter each pipe

2 The procedure for the inspection is given in **10** of IS 3597.

3 Corners to be rounded off.

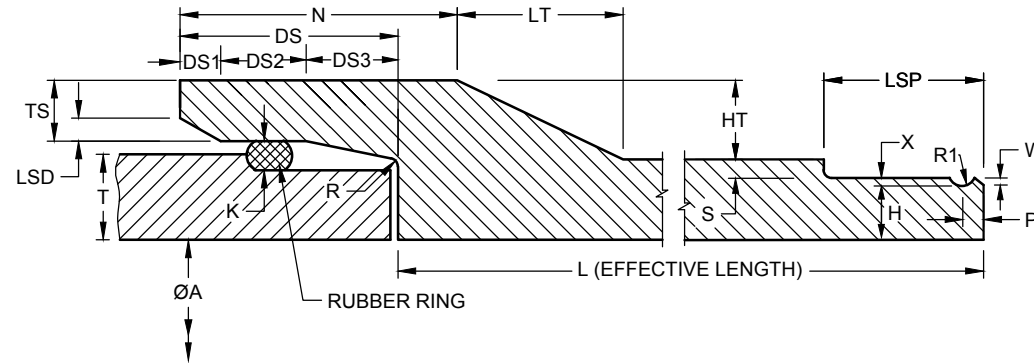
4 Tolerances:

Dimensions	Tolerances
T and HT	Same as that of barrel wall thickness given in 8.2
TS and H	Half the tolerance on barrel wall thickness given in 8.2
DS2, DS3, LSP, K and S	The tolerance, in mm, shall be given as below:

Chord Diameter	DS2	DS3	LSP	K	S
16	±2.5	±3.5	±5.00	±2.00	±1.25
20	±3.0	±4.0	±5.50	±2.25	±1.50
22	±3.5	±4.5	±6.25	±2.75	±1.75
25	±4.0	±5.0	±7.00	±3.25	±2.00

5 In order to ascertain the correctness of mould, 5 percent of the pipes be randomly selected from each control unit and checked for all critical dimensions.

**Table 14 Spigot and Socket Dimensions of NP3 and NP4 Class Pipes
(Rubber Ring Roll on Joint) from 80 to 900 mm Diameter
(Clauses 6.3 and 8.2)**



All dimensions in millimetres

Pipe Diameter ϕA	Rubber Ring Chord Diameter	Rubber Ring Internal Diameter	T	TS	DS	DS1	DS2	DS3	R	LSD	K	N	LT	HT	LSP	P	S	H	X	W	R1
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
80	11	102	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
100	11	120	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
150	11	170	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
200	11	230	30	38	83	11	38	34	5	6.5	6.5	113	97	39.5	50	7	5.5	24.5	1	1	5.5
225	11	255	30	38	83	11	38	34	5	6.5	6.5	113	97	39.5	50	7	5.5	24.5	1	1	5.5
250	11	275	30	38	83	11	38	34	5	6.5	6.5	113	97	39.5	50	7	5.5	24.5	1	1	5.5
300	12	340	40	51	90	12	42	36	6	7	7	130	130	53	55	7.5	6	34	1	1	6
350	16	435	75	75	120	16	56	48	8	10	10	158	135	78	72	10	8	67	2	2	8
400	16	480	75	75	120	16	56	48	8	10	10	158	135	78	72	10	8	67	2	2	8
450	16	525	75	75	120	16	56	48	8	10	10	158	135	78	72	10	8	67	2	2	8
500	16	570	75	75	120	16	56	48	8	10	10	158	135	78	72	10	8	67	2	2	8
600	20	675	85	85	150	20	70	60	10	12	12	193	153	88.5	90	12	10	75	2	2	10
700	20	765	85	85	150	20	70	60	10	12	12	193	153	88.5	90	12	10	75	2	2	10
800	20	875	95	95	150	20	70	60	10	12	12	197	171	98.5	90	12	10	85	2	2	10
900	20	970	100	100	150	20	70	60	10	12	12	200	180	103.5	90	12	10	90	2	2	10

Table 14 (Concluded)

NOTES

1 Important dimensions of socket and spigot to be checked in socket and spigot pipes.

- a. Socket inside diameter each pipe
- b. Spigot outside diameter each pipe

The procedure for the inspection is given in **10** of IS 3597.

2 Corners to be rounded off.

3 Tolerances

Dimensions

Tolerances

T and HT

Same as that of barrel wall thickness given in **8.2**

TS and H

Half the tolerance on barrel wall thickness given in **8.2**

DS2, DS3, LSP, K and S

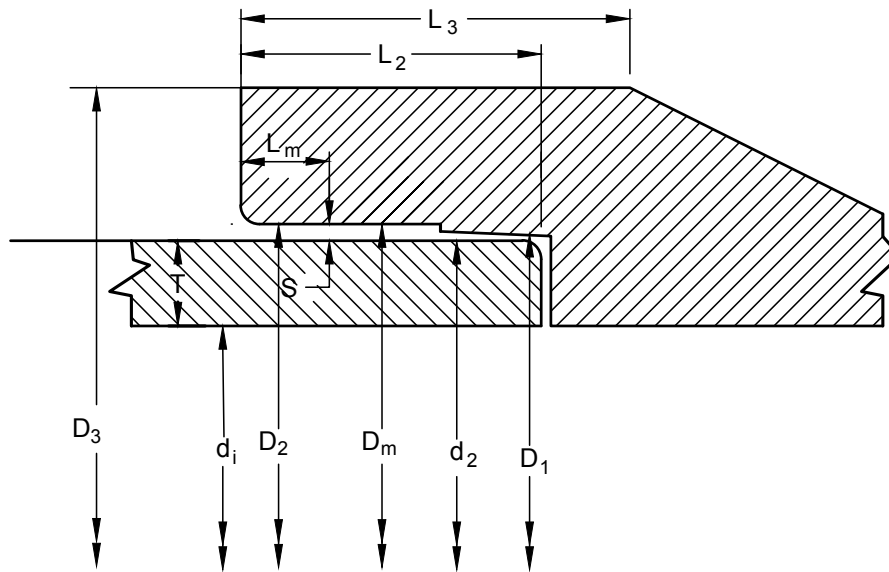
The tolerance, in mm, shall be given as below:

Chord Diameter	DS2	DS3	LSP	K	S
11	±2.0	±3.0	±4.00	±1.25	±0.75
12	±2.0	±3.0	±4.00	±1.25	±0.75
16	±2.5	±3.5	±5.00	±2.00	±1.25
20	±3.0	±4.0	±5.50	±2.25	±1.50

4 In order to ascertain the correctness of mould, 5 percent of the pipes be randomly selected from each control unit and checked for all critical dimension.

**Table 15A Spigot and Socket Dimensions for NP3 and NP4 Unreinforced Pipes
Made by Vibration Casting Process from 100 to 250 mm Diameter**

(Clauses 6.3 and 8.2)



All dimensions in millimetres

d_i	G	R	T	d_2	D_1	D_2	D_3	L_2	D_m	L_m	L_3	S
100	11	119	24	148	152	163	213	61.5	162	20.5	65	6.9 ± 1.1
150	13	172	28	206	210	224	282	68.5	222	23.5	70	8.1 ± 1.3
200	13	220	32	264	268	282	348	68.5	280	23.5	70	8.1 ± 1.3
250	13	268	37	324	328	342	418	68.5	340	23.5	70	8.1 ± 1.3

NOTES

1 G is the diameter of the un-stretched rubber chord, hardness 40 ± 5 IRHD, stretching 15 percent.

2 R is the inner diameter of the un-stretched rubber ring.

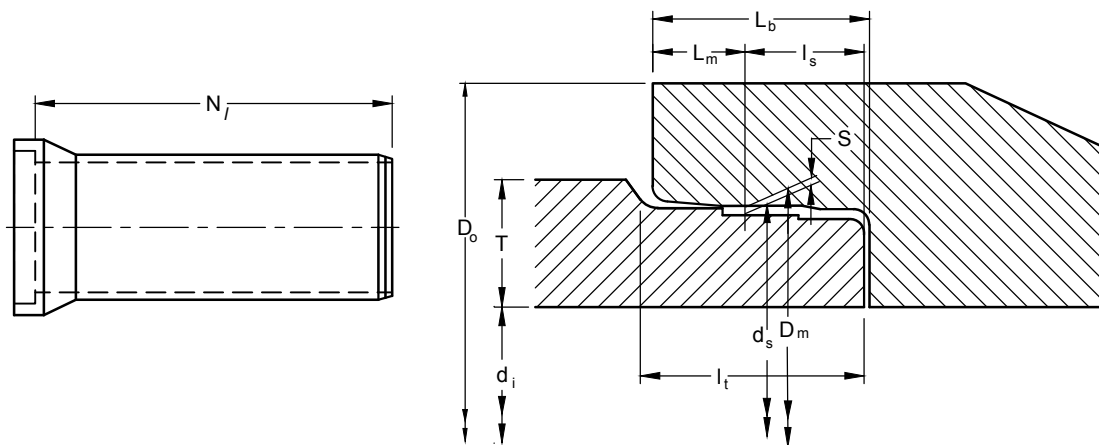
3 T is the nominal barrel wall thickness.

4 D_3, D_m, L_m and L_3 are nominal dimensions.

5 Tolerance on $D_3 \pm 4, L_2 \pm 2, S \pm 1.3$.

**Table 15B Spigot and Socket Dimensions for NP-3 Reinforced and Unreinforced + NP-4 Reinforced
Pipes Made by Vibration Casting/Spun Process from 300 to 1 800 mm Diameter**

(Clauses 6.3 and 8.2)



All dimensions in millimetres

d_i	G	R	T	D_o	I_t	L_b	d_m	D_m	L_m	I_s	S
300 ± 4	13	322	50	487 ± 4	112 ± 4	105 ± 2	370.07	386.07	49	50	8.00 ± 1.0
350 ± 5	13	370	55	555 ± 4	112 ± 4	105 ± 2	425.07	441.07	49	50	8.00 ± 1.0
400 ± 5	13	417	60	615 ± 4	112 ± 4	105 ± 2	480.07	496.07	49	50	8.00 ± 1.0
450 ± 5	13	465	65	680 ± 4	112 ± 4	105 ± 2	536.07	552.07	49	50	8.00 ± 1.0
500 ± 5	13	513	70	735 ± 4	112 ± 4	105 ± 2	590.07	606.07	49	50	8.00 ± 1.0
600 ± 5	13	609	75	850 ± 4	112 ± 4	105 ± 2	700.07	716.07	49	50	8.00 ± 1.0
700 ± 7	18	706	85	980 ± 5	141 ± 5	132 ± 3	808.00	830.00	61	65	11.00 ± 1.2
800 ± 7	18	803	95	1100 ± 5	141 ± 5	132 ± 3	924.00	946.00	61	65	11.00 ± 1.2
900 ± 7	18	901	100	1215 ± 5	141 ± 5	132 ± 3	1036.00	1058.00	61	65	11.00 ± 1.2
1000 ± 7	18	998	115	1330 ± 5	141 ± 5	132 ± 3	1148.00	1170.00	61	65	11.00 ± 1.2
1100 ± 7	24	1097	120	1520 ± 6	155 ± 6	145 ± 3	1262.00	1291.30	72	63	14.65 ± 1.5
1200 ± 7	24	1195	125	1640 ± 6	155 ± 6	145 ± 3	1372.48	1401.78	72	63	14.65 ± 1.5
1400 ± 10	24	1383	140	1870 ± 6	155 ± 6	145 ± 3	1590.91	1620.21	72	63	14.65 ± 1.5

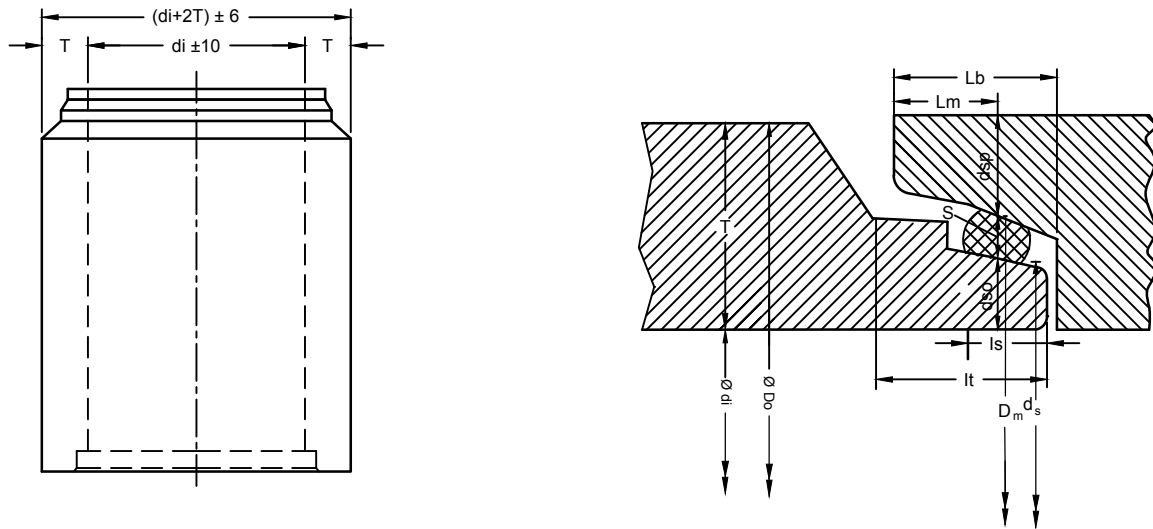
Table 15B (Concluded)

d_i	G	R	T	D_o	I_t	L_b	d_m	D_m	L_m	I_s	S
1600 ± 10	24	1578	165	2100 ± 6	155 ± 6	145 ± 3	1814.91	1844.21	72	63	14.65 ± 1.5
1800 ± 10	24	1774	180	2340 ± 6	155 ± 6	145 ± 3	2040.00	2069.30	72	63	14.65 ± 1.5
<p>NOTES</p> <p>1 G is the diameter of the un-stretched rubber chord hardness 40 ± 5 IRHD stretching 15 percent.</p> <p>2 R is the inner diameter of the un-stretched rubber ring.</p> <p>3 T is the nominal barrel wall thickness.</p> <p>4 d_s, D_m, L_{m2} and I_{s2} are nominal dimensions.</p> <p>5. Tolerance on D_o ± 4, I_b ± 2, S ± 1.3.</p>											

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Table 15C Spigot and Socket Dimensions of single offset joint (in wall joint) for NP3 and NP4 Reinforced Pipes Made by Vertical Vibrated Casting Process from 1400 to 2400 mm Diameter

(Clauses 6.3 and 8.2)



All dimensions in millimetres

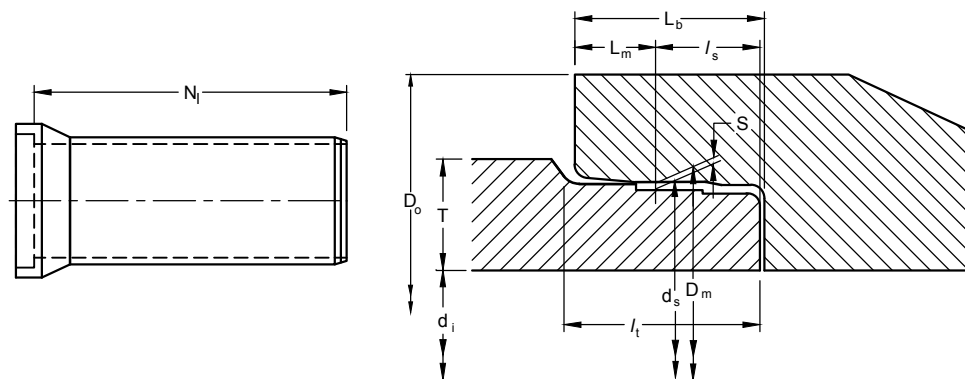
d_i	G	R	T	I_t	L_b	d_s	D_m	L_m	I_s	S	Do	dso	dsp
1 400 ± 10	24	1320	140	130	130	1516	1545	70	52	15	1680	67	58
1 600 ± 10	24	1520	165	130	130	1745	1774	70	52	15	1930	78	72
1 800 ± 10	24	1705	180	130	130	1959	1988	70	52	15	2160	86	79
2 000 ± 12	28	1890	190	130	130	2169	2204	70	52	17	2380	88	85
2 200 ± 12	28	2080	210	130	130	2389	2423	70	52	17	2620	98	95
2 400 ± 12	28	2258	225	130	130	2597	2632	70	52	17	2850	109	99

NOTES

- 1 G is the diameter of the unstretched rubber chord, hardness 40 ± 5 IRHD, stretching 15 percent.
- 2 R is the inner diameter of the unstretched rubber ring.
- 3 T is the nominal barrel wall thickness.
- 4 I_t , L_b , d_s , D_m , L_m and I_s are nominal dimensions.

**Table 16 Spigot and Socket Dimensions for NP-4 Unreinforced Pipes Made by
Vibration Casting/spun Process from 300 to 1800 mm Diameter**

(Clauses 6.3 and 8.2)



All dimensions in millimetres

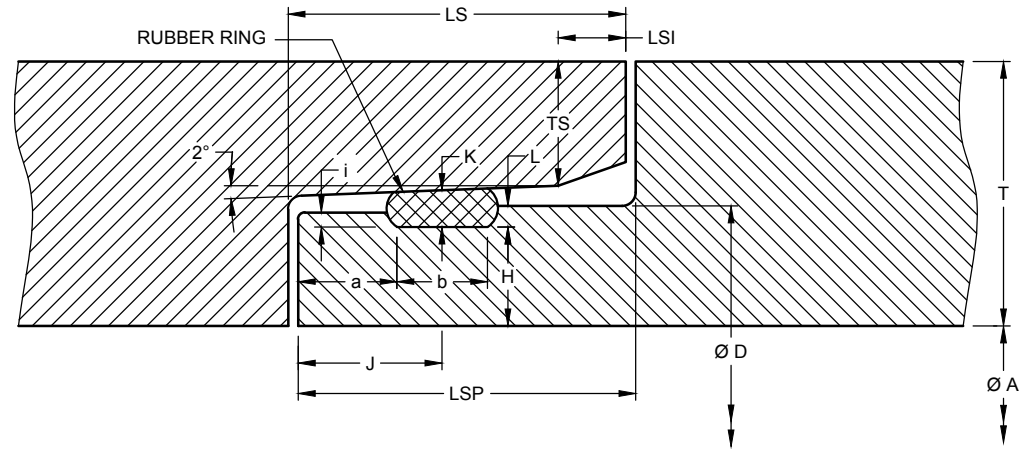
d_i	G	R	T	D_o	l_t	L_b	d_s	D_m	L_m	l_s	S
300 ± 4	13	322	50	487 ± 4	112 ± 4	105 ± 2	370.07	386.07	49	50	8.00 ± 1.0
350 ± 5	13	370	55	555 ± 4	112 ± 4	105 ± 2	425.07	441.07	49	50	8.00 ± 1.0
400 ± 5	13	417	60	615 ± 4	112 ± 4	105 ± 2	480.07	496.07	49	50	8.00 ± 1.0
450 ± 5	13	465	65	680 ± 4	112 ± 4	105 ± 2	536.07	552.07	49	50	8.00 ± 1.0
500 ± 5	13	513	70	735 ± 4	112 ± 4	105 ± 2	590.07	606.07	49	50	8.00 ± 1.0
600 ± 5	13	609	75	850 ± 4	112 ± 4	105 ± 2	700.07	716.07	49	50	8.00 ± 1.0
700 ± 7	18	706	85	980 ± 5	141 ± 5	132 ± 3	808.00	830.00	61	65	11.00 ± 1.2
800 ± 7	18	803	95	1100 ± 5	141 ± 5	132 ± 3	924.00	946.00	61	65	11.00 ± 1.2
900 ± 7	18	901	100	1215 ± 5	141 ± 5	132 ± 3	1036.00	1058.00	61	65	11.00 ± 1.2
1000 ± 7	18	998	115	1330 ± 5	141 ± 5	132 ± 3	1148.00	1170.00	61	65	11.00 ± 1.2
1100 ± 7	24	1097	120	1520 ± 6	155 ± 6	145 ± 3	1262.00	1291.30	72	63	14.65 ± 1.5
1200 ± 7	24	1195	125	1640 ± 6	155 ± 6	145 ± 3	1372.48	1401.78	72	63	14.65 ± 1.5
1400 ± 10	24	1383	140	1870 ± 6	155 ± 6	145 ± 3	1590.91	1620.21	72	63	14.65 ± 1.5

Table 16 (Concluded)

d_i	G	R	T	D_o	l_1	L_b	d_s	D_m	L_m	l_s	S
1600 ± 10	24	1578	165	2100 ± 6	155 ± 6	145 ± 3	1814.91	1844.21	72	63	14.65 ± 1.5
1800 ± 10	24	1774	180	2340 ± 6	155 ± 6	145 ± 3	2040.00	2069.30	72	63	14.65 ± 1.5
<p>NOTES</p> <p>1 G is the diameter of the un-stretched rubber chord. Hardness 40 ± 5 IRHD stretching 15 percent.</p> <p>2 R is the inner diameter of the un-stretched rubber ring.</p> <p>3 T is the nominal barrel wall thickness.</p> <p>4 d_i, D_m, L_m and l_s are nominal dimensions.</p>											

**Table 17 Spigot and Socket Dimensions of NP-3 and NP-4 Class from 1 000 to 2 600 mm Diameter
(Rubber Ring Confined Joint)**

(Clauses 6.3 and 8.2)



All dimensions in millimetres

Pipe Diameter ϕA	Rubber Ring Chord Diameter	Rubber Ring Internal Dia.	T	TS	LS	LSI	K	LSP	a	b	J	H	i	L	ϕD
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1000	20	920	115	58.0	114	20	13	114	25	28	39	42	4	9	1102
1100	20	1003	115	58.0	114	20	13	114	25	28	39	42	4	9	1202
1200	20	1095	120	60.5	114	20	13	114	25	28	39	44.5	4	9	1307
1400	25	1275	135	67.5	114	20	16	114	25	35	42.5	50	4	10	1520
1600	25	1445	140	72.5	114	25	16	114	25	35	42.5	50	4	10	1720
1800	25	1620	150	77.5	114	25	16	114	25	35	42.5	55	4	10	1930
2000	25	1810	170	87.5	114	25	16	114	25	35	42.5	65	4	10	2150
2200	25	1995	185	95.0	114	25	16	114	25	35	42.5	72.5	4	10	2365
2400	25	2180	200	102.5	114	25	16	114	25	35	42.5	80	4	10	2580
2600	25	2360	215	110.0	114	25	16	114	25	35	42.5	87.5	4	10	2795

Table 17 (Concluded)

NOTES

1 Important dimensions of socket and spigot to be checked in socket and spigot pipes.

- a. Socket inside diameter — each pipe
- b. Spigot outside diameter — each pipe

The procedure for the inspection is given in **10** of IS 3597.

2 Corners to be rounded off.

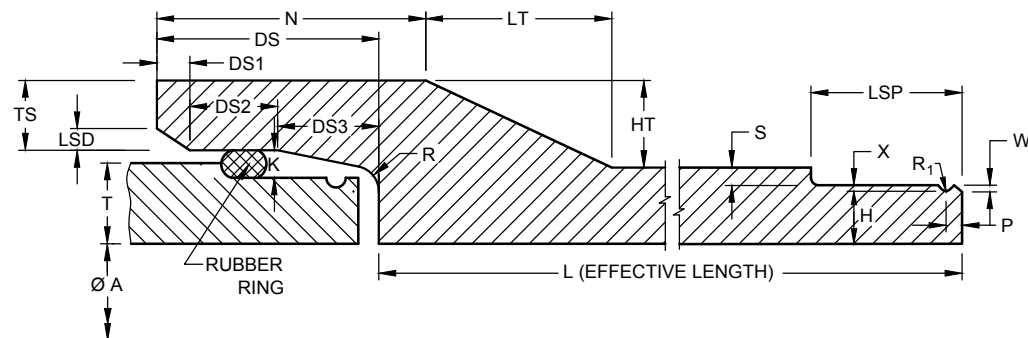
3 Tolerances on spigot and socket

Dimensions	Tolerances
<i>L_s</i> and <i>LSP</i>	± 7 mm
<i>T</i>	Same as that of barrel wall thickness given in 8.2
<i>H</i> and <i>TS</i>	Half the tolerance on barrel wall thickness given in 8.2
<i>L</i>	± 0.5 mm
<i>b</i>	± 1 mm for 28 mm and ± 1.5 mm for 35 mm
<i>k</i>	± 2.5 mm for 25 mm rubber ring chord diameter

4 In order to ascertain the correctness of mould, 5 percent of the pipes be randomly selected from each control unit and checked for all critical dimensions

Table 18 Spigot and Socket Dimensions of P2 Class Pipes (Rubber Ring Roll on Joint)

(Clauses 6.3 and 8.2)



All dimensions in millimetres

Pipe Diameter ϕA	Rubber Ring Chord Diameter	Rubber Ring Internal Diameter	T	TS	DS	DS1	DS2	DS3	R	LSD	K	N	LT	HT	LSP	P	S	H	X	W	R ₁
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
80	11	102	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
100	11	120	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
150	11	170	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
200	11	230	30	38	83	11	38	34	5	6.5	6.5	113	97	39.5	50	7	5.5	24.5	1	1	5.5
225	11	255	30	38	83	11	38	34	5	6.5	6.5	113	97	39.5	50	7	5.5	24.5	1	1	5.5
250	11	275	30	38	83	11	38	34	5	6.5	6.5	113	97	39.5	50	7	5.5	24.5	1	1	5.5
300	12	340	40	51	90	12	42	36	6	7	7	130	130	53	55	7.5	6	34	1	1	6
350	12	400	45	57	90	12	42	36	6	7	7	135	145	59	55	7.5	6	39	1	1	6
400	12	450	50	61	90	12	42	36	6	7	7	140	155	63	55	7.5	6	44	1	1	6
450	12	500	50	61	90	12	42	36	6	7	7	140	155	63	55	7.5	6	44	1	1	6
500	12	525	55	67	90	12	42	36	6	7	7	145	170	69	55	7.5	6	49	1	1	6
600	16	640	65	79	120	16	56	48	8	10	9.5	185	185	82	72	10	7.5	57.5	2	2	8
700	16	740	70	84	120	16	56	48	8	10	9.5	190	195	87	72	10	7.5	62.5	2	2	8
800	20	845	80	96	150	20	70	60	10	12	12	230	225	100	90	12.5	9.5	70.5	2	2	10
900	20	970	90	108	150	20	70	60	10	12	12	240	250	112	90	12.5	9.5	80.5	2	2	10
1000	22	1060	100	120	165	22	77	66	11	13	13	265	265	124	99	14	10.5	89.5	2	2	11

Table 18 (Concluded)

NOTES

1 Important dimensions of socket and spigot to be checked in socket and spigot pipes.

- a. Socket inside diameter — each pipe
- b. Spigot outside diameter — each pipe

The procedure for the inspection of Spigot and Socket dimensions is given in **10** of IS 3597.

2 Corners to be rounded off.

3 Tolerances

Dimensions

Tolerances

T and HT

Same as that of barrel wall thickness given in **8.2**

TS and H

Half the tolerance on barrel wall thickness given in **8.2**

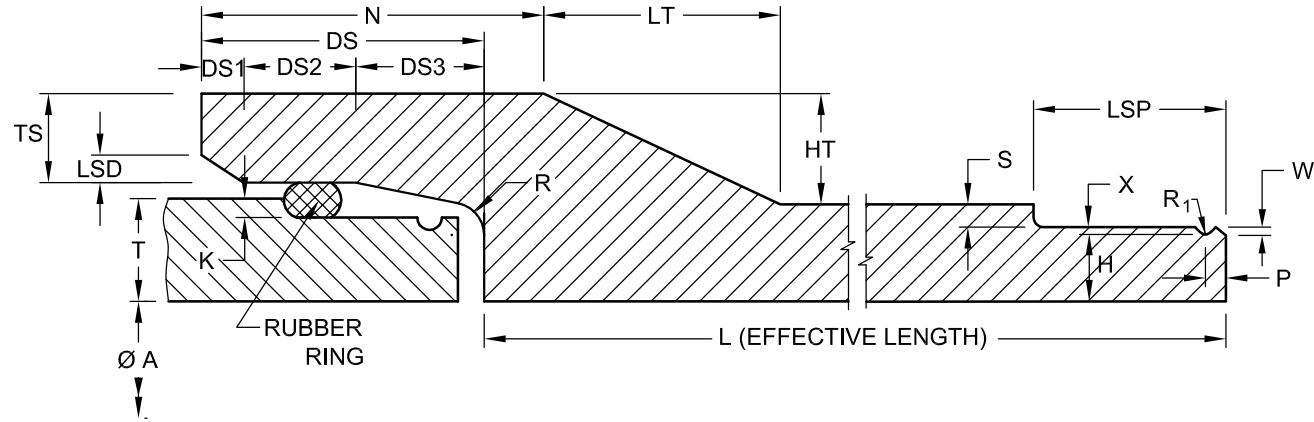
DS2, DS3, LSP, K and S

The tolerance, in mm, shall be given as below:

Chord Diameter	DS2	DS3	LSP	K	S
11	±2.0	±3.0	±4.00	±1.25	±0.75
12	±2.0	±3.0	±4.00	±1.25	±0.75
16	±2.5	±3.5	±5.00	±2.00	±1.25
20	±3.0	±4.0	±5.5	±2.25	±1.50
22	±3.5	±4.5	±6.00	±2.75	±1.50

4 In order to ascertain the correctness of mould, 5 percent of the pipes be randomly selected from each control unit and checked for all critical dimensions

Table 18A Spigot and Socket Dimensions of P2 Class Pipes (Rubber Ring Confined Joint)
Pipes Made by Vibrated Casting Process
(Clauses 6.3 and 8.2)



All dimensions in millimetres

Pipe Diameter ϕA	Rubber Ring Chord Diameter	Rubber Ring Internal Diameter	T	TS	DS	DS1	DS2	DS3	R	LSD	K	N	LT	HT	LSP	P	S	H	X	W	R ₁
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
400	12	450	50	61	90	12	42	36	6	7	7	140	155	63	55	7.5	6	44	1	1	6
450	12	500	50	61	90	12	42	36	6	7	7	140	155	63	55	7.5	6	44	1	1	6
500	12	525	55	67	90	12	42	36	6	7	7	145	170	69	55	7.5	6	49	1	1	6
600	16	640	65	79	120	16	56	48	8	10	9.5	185	185	82	72	10	7.5	57.5	2	2	8
700	16	740	70	84	120	16	56	48	8	10	9.5	190	195	87	72	10	7.5	62.5	2	2	8
800	20	845	80	96	150	20	70	60	10	12	12	230	225	100	90	12.5	9.5	70.5	2	2	10
900	20	970	90	108	150	20	70	60	10	12	12	240	250	112	90	12.5	9.5	80.5	2	2	10
1 000	22	1060	100	120	165	22	77	66	11	13	13	265	265	124	99	14	10.5	89.5	2	2	11

Table 18A (Concluded)

NOTES

1 Important dimensions of socket and spigot to be checked in socket and spigot pipes.

- a. Socket inside diameter — each pipe
- b. Spigot outside diameter — each pipe

The procedure for the inspection of spigot and socket dimensions is given in **10** of IS 3597.

2 Corners to be rounded off.

3 Tolerances

Dimensions

T and *HT*

TS and *H*

DS2, *DS3*, *LSP*, *K* and *S*

Tolerances

Same as that of barrel wall thickness given in **8.2**

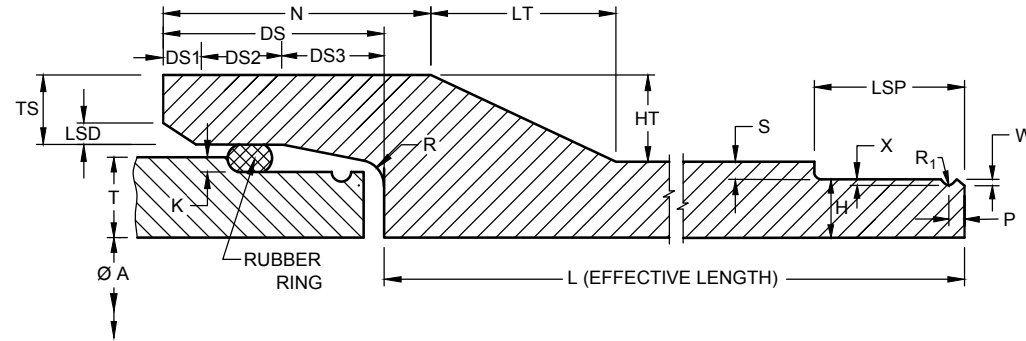
Half the tolerance on barrel wall thickness given in **8.2**

The tolerance, in mm, shall be given as below:

Chord Diameter	<i>DS2</i>	<i>DS3</i>	<i>LSP</i>	<i>K</i>	<i>S</i>
12	±2.0	±3.0	±4.0	±1.25	±0.75
16	±2.5	±3.5	±5.0	±2.00	±1.25
20	±3.0	±4.0	±5.5	±2.25	±1.50
22	±3.5	±4.5	±6.0	±2.75	±1.50
22	±3.5	±4.5	±6.0	±2.75	±1.50

4 In order to ascertain the correctness of mould, 5 percent of the pipes be randomly selected from each control unit and checked for all critical dimensions.

Table 19 Spigot and Socket Dimensions of P3 Class Pipes (Rubber Ring Roll on Joint)
(Clauses 6.3 and 8.2)



All dimensions in millimetres

Pipe Diameter ϕA	Rubber Ring Chord Diameter	Rubber Ring Internal Diameter	T	TS	DS	DS1	DS2	DS3	R	LSD	K	N	LT	HT	LSP	P	S	H	X	W	R ₁
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
80	11	102	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
100	11	120	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
150	11	170	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
200	11	230	35	45	83	11	38	34	5	5.5	6.5	120	115	46.5	50	7	5.5	29.5	1	1	5.5
225	11	255	35	45	83	11	38	34	5	5.5	6.5	120	115	46.5	50	7	5.5	29.5	1	1	5.5
250	11	275	35	45	83	11	38	34	5	5.5	6.5	120	115	46.5	50	7	5.5	29.5	1	1	5.5
300	12	340	45	60	90	12	42	36	6	7	7	135	150	62	55	7.5	6	39	1	1	6
350	12	400	55	75	90	12	42	36	6	7	7	145	190	77	55	7.5	6	49	1	1	6
400	12	450	60	80	90	12	42	36	6	7	7	150	200	82	55	7.5	6	54	1	1	6
450	12	525	70	95	90	12	42	36	6	7	7	160	240	97	55	7.5	6	64	1	1	6
500	12	570	75	100	90	12	42	36	6	7	7	165	250	102	55	7.5	6	69	1	1	6
600	16	680	90	120	120	16	56	48	8	10	9.5	190	275	123	72	10	7.5	82.5	2	2	8
700	16	805	105	140	120	16	56	48	8	10	9.5	200	320	143	72	10	7.5	97.5	2	2	8
800	20	915	120	160	150	20	70	60	10	12	11.5	240	365	164	90	12.5	9.5	110.5	2	2	10

Table 19 (Concluded)

NOTES

Important dimensions of socket and spigot to be checked in socket and spigot pipes.

- 1 a. Socket inside diameter — each pipe
- b. Spigot outside diameter — each pipe

The procedure for the inspection of spigot and socket dimensions is given in **10** of IS 3597.

2 Corners to be rounded off.

3 Tolerances

Dimensions

T and *HT*

TS and *H*

DS2, *DS3*, *LSP*, *K* and *S*

Tolerances

Same as that of barrel wall thickness given in **8.2**

Half the tolerance on barrel wall thickness given in **8.2**

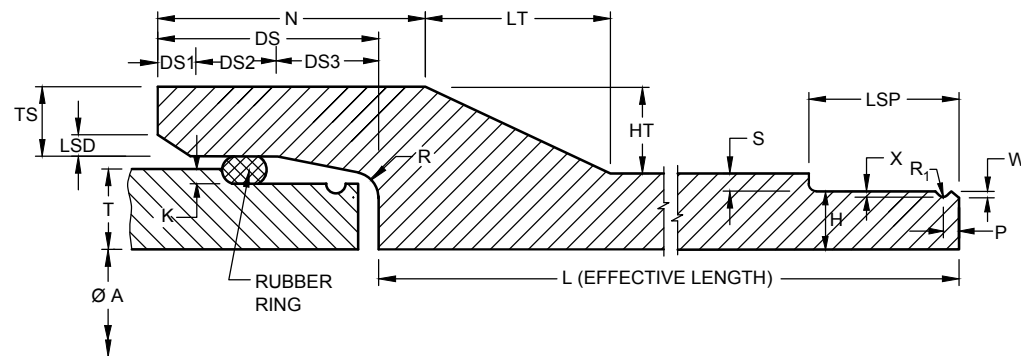
The tolerance, in mm, shall be given as below:

Chord Diameter	<i>DS2</i>	<i>DS3</i>	<i>LSP</i>	<i>K</i>	<i>S</i>
11	±2.0	±3.0	±4.0	±1.25	±0.75
12	±2.0	±3.0	±4.0	±1.25	±0.75
16	±2.5	±3.5	±5.0	±2.00	±1.25
20	±3.0	±4.0	±5.5	±2.25	±1.50

4 In order to ascertain the correctness of mould, 5% of the pipes be randomly selected from each control unit and checked for all critical dimensions.

**Table 19A Spigot and Socket Dimensions of P3 Class Pipes (Rubber Ring Roll on Joint)
Pipes Made by Vibration Casting Process**

(Clauses 6.3 and 8.2)



All dimensions in millimetres

Pipe Diameter ϕA	Rubber Ring Chord Diameter	Rubber Ring Internal Diameter	T	TS	DS	DS1	DS2	DS3	R	LSD	K	N	LT	HT	LSP	P	S	H	X	W	R ₁
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
350	12	400	55	75	90	12	42	36	6	7	7	145	190	77	55	7.5	6	49	1	1	6
400	12	450	60	80	90	12	42	36	6	7	7	150	200	82	55	7.5	6	54	1	1	6
450	12	525	70	95	90	12	42	36	6	7	7	160	240	97	55	7.5	6	64	1	1	6
500	12	570	75	100	90	12	42	36	6	7	7	165	250	102	55	7.5	6	69	1	1	6
600	16	680	90	120	120	16	56	48	8	10	9.5	190	275	123	72	10	7.5	82.5	2	2	8
700	16	805	105	140	120	16	56	48	8	10	9.5	200	320	143	72	10	7.5	97.5	2	2	8
800	20	915	120	160	150	20	70	60	10	12	11.5	240	365	164	90	12.5	9.5	110.5	2	2	10

NOTES

1 Important dimensions of socket and spigot to be checked in socket and spigot pipes.

- a. Socket inside diameter — each pipe
- b. Spigot outside diameter — each pipe

The procedure for the inspection of spigot and socket dimensions is given in **10** of IS 3597.

2 Corners to be rounded off.

Table 19A (Concluded)

3 Tolerances

Dimensions

Tolerances

T and *HT*

Same as that of barrel wall thickness given in **8.2**

TS and *H*

Half the tolerance on barrel wall thickness given in **8.2**

DS2, *DS3*, *LSP*, *K* and *S*

The tolerance, in mm, shall be given as below:

Chord Diameter	<i>DS2</i>	<i>DS3</i>	<i>LSP</i>	<i>K</i>	<i>S</i>
12	±2.0	±3.0	±4.0	±1.25	±0.75
16	±2.5	±3.5	±5.0	±2.00	±1.25
20	±3.0	±4.0	±5.5	±2.25	±1.50

4 In order to ascertain the correctness of mould, 5 percent of the pipes be randomly selected from each control unit and checked for all critical dimensions.

**Table 20 Mass of Spirals (Hard Drawn Steel) in Socket of Rubber Ring Jointed RCC Pipes
of Different Classes (kg/Number)**

(Clause 6.3)

Internal Diameter of Pipe mm	NP2 Class	NP3 Class	NP4 Class	P1 Class	P2 Class	P3 Class
(1)	(2)	(3)	(4)	(5)	(6)	(7)
80	0.08	0.08	0.08	0.08	0.08	0.08
100	0.09	0.09	0.09	0.09	0.09	0.09
150	0.12	0.12	0.12	0.12	0.12	0.15
200	0.14	0.14	0.21	0.14	0.21	0.35
225	0.15	0.15	0.26	0.15	0.26	0.43
250	0.16	0.16	0.31	0.16	0.31	0.51
300	0.45	0.45	0.53	0.45	0.53	0.84
350	0.51	0.64	0.64	0.51	0.74	1.24
400	0.56	0.71	0.71	0.56	0.99	1.66
450	0.63	0.76	0.76	0.63	1.23	2.26
500	0.68	0.87	1.08	0.68	1.57	2.85
600	0.81	1.00	2.12	1.52	2.88	4.74
700	0.92	2.16	3.02	1.79	3.96	6.79
800	1.14	2.87	4.67	2.04	6.28	9.99
900	1.50	4.06	6.03	2.63	8.29	—
1000	1.91	—	—	3.33	11.29	—
1100	2.34	—	—	4.08	—	—
1200	2.80	—	—	4.90	—	—
1400	3.82	—	—	—	—	—
1600	5.64	—	—	—	—	—
1800	7.25	—	—	—	—	—
2000	11.78	—	—	—	—	—
2200	12.88	—	—	—	—	—

NOTES

1 Longitudinal reinforcement shall be proportional to the length of socket cage as given in Tables 2 to 11A.
(except Table 4 and Table 7).

2 If mild steel is used for spiral reinforcement, the mass specified above shall be increased by a factor 140/125.

3 The above table is provided for guidance only.

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Table 21 Design Requirements of Reinforced Concrete Collar for Pipes of Class NP2
(Clauses 6.3 and 8.1)

Nominal Internal Diameter of Pipe	Collar Dimensions			Reinforcements		
	Minimum Caulking Space	Minimum Thickness	Minimum Length	Longitudinal, Mild Steel or Hard Drawn Steel		Spirals Hard Drawn Steel
				Minimum Number	Mass	
mm	mm	mm	mm		kg/collar	kg/collar
(1)	(2)	(3)	(4)	(5)	(6)	(7)
80	13	25	150	6	0.08	0.07
100	13	25	150	6	0.08	0.08
150	13	25	150	6	0.08	0.10
200	13	25	150	6	0.08	0.12
225	13	25	150	6	0.08	0.14
250	13	25	150	6	0.08	0.16
300	16	30	150	8	0.11	0.22
350	16	32	150	8	0.11	0.25
400	16	32	150	8	0.11	0.27
450	19	35	200	8	0.15	0.40
500	19	35	200	8	0.15	0.60
600	19	40	200	8	0.15	0.70
700	19	40	200	8	0.23	1.05
800	19	45	200	8	0.23	1.85
900	19	50	200	8	0.23	2.05
1 000	19	55	200	8	0.33	2.25
1 100	19	60	200	8	0.33	3.09
1 200	19	65	200	8	0.33	4.11
1 400	19	75	200	12	0.50	5.08
1 600	19	80	200	12 or 8+8	0.67	6.55
1 800	19	90	200	12 or 8+8	0.67	9.00
2 000	19	100	200	12 + 12	1.00	12.15
2 200	19	110	200	12 + 12	1.00	13.30

NOTES

- 1 If mild steel is used for spiral reinforcement, the mass specified under col 7 shall be increased by a factor 140/125.
- 2 Soft grade mild steel wire may be used for reinforcement for collars of pipes of nominal internal diameter up to 250 mm only, by increasing the mass by a factor 140/84. Where only soft grade mild steel wire is used for making collar cages, the mass of reinforcement shall be total mass of col 6 and col 7 multiplied by 140/84. This is allowed as a process requirement.
- 3 Internal diameter of collar to suit the actual diameter of pipes with minimum caulking space as given in col 2.

Table 22 Design Requirements of Reinforced Concrete Collars of Class NP3 and NP4 Suitable for Plain Ended Non-pressure Pipes

(Clauses 6.3 and 8.1)

Nominal Internal Diameter of Pipe	Collar Dimensions			Reinforcements		
	Minimum Caulking Space	Minimum Thickness	Minimum Length	Longitudinal, Mild Steel or Hard Drawn Steel		Spirals Hard Drawn Steel
				Minimum Number	Mass	
mm	mm	mm	mm		kg/collar	kg/collar
(1)	(2)	(3)	(4)	(5)	(6)	(7)
80	13	25	150	6	0.08	0.07
100	13	25	150	6	0.08	0.08
150	13	25	150	6	0.08	0.10
200	13	25	150	6	0.08	0.12
225	13	25	150	6	0.08	0.14
250	13	25	150	6	0.08	0.16
300	16	30	150	8	0.11	0.22
350	16	32	200	8	0.15	0.40
400	16	32	200	8	0.15	0.50
450	19	35	200	8	0.15	0.60
500	19	35	200	8	0.15	0.70
600	19	40	200	8	0.23	1.05
700	19	40	200	8	0.23	1.85
800	19	50	200	8	0.23	2.05
900	19	50	200	8	0.33	2.25
1 000	19	55	200	8	0.33	3.09
1 100	19	65	200	8	0.33	4.11
1 200	19	75	200	12	0.50	5.08
1 400	19	80	200	12 or 8 + 8	0.67	6.55
1 600	19	90	200	12 or 8 + 8	0.67	9.00
1 800	19	100	200	12 + 12	1.00	12.15
2000	19	110	200	12 + 12	1.00	13.30

NOTES

- 1 Collars for sizes 2 200 mm and above shall be made out of mild steel plate of 6 mm thickness, steel conforming to IS 2062 with outside painted.
- 2 If mild steel is used for spiral reinforcement, the mass specified under col 7 shall be increased by a factor 140/125.
- 3 Soft grade mild steel wire may be used for reinforcement for collars of pipes of nominal internal diameter up to 250 mm only, by increasing the mass by a factor 140/84.

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8.2 Tolerances

The following tolerances shall be permitted:

<i>Sl No.</i>	<i>Dimensions</i>	<i>Tolerances</i>
(1)	(2)	(3)
i)	Overall length	mm ±1 percent of standard length
ii)	Internal diameter of pipes:	
	a) Up to and including 300 mm	±3
	b) Over 300 mm and up to and including 600 mm	±5
	c) Over 600 mm	±10
iii)	Barrel wall thickness:	
	a) Up to and including 30 mm	+2 -1
	b) Over 30 mm up to and including 50 mm	+3 -1.5
	c) Over 50 mm up to and including 65 mm	+4 -2
	d) Over 65 mm up to and including 80 mm	+5 -2.5
	e) Over 80 mm up to and including 95 mm	+6 -3
	f) Over 95 mm	+7 -3.5

NOTE — In case of pipes with flexible rubber ring joints, the tolerance on thickness near the ends will have to be reduced. Near the rubber ring joints, the tolerance on thickness shall be as given in respective tables.

9 WORKMANSHIP AND FINISH

9.1 Finish

Pipes shall be straight and free from cracks except that craze cracks may be permitted. The ends of the pipes shall be square with their longitudinal axis so that when placed in a straight line in the trench, no opening between ends in contact shall exceed 3 mm in pipes up to 600 mm diameter (inclusive), and 6 mm in pipes larger than 600 mm diameter.

9.1.1 The outside and inside surfaces of the pipes shall be dense and hard and shall not be coated with cement wash or other preparation unless otherwise agreed to between the purchaser and the manufacturer or the supplier. The inside surface of the pipe should be smooth as far as possible. For better bond, inner surface of the collar may be finished rough.

9.1.2 The pipes shall be free from defects resulting from imperfect grading of the aggregate, mixing or moulding.

9.1.3 Pipes shall be free from local dents or bulges greater than 3.0 mm in depth and extending over a length in any direction greater than twice the barrel wall thickness.

9.1.4 Pipes may be repaired, if necessary, because of accidental injury during manufacture or handling and shall be accepted if in the opinion of the purchaser, the repairs are sound and appropriately finished and cured, and the repaired pipe conforms to the requirements of this specification.

9.2 Deviation from Straight

The deviation from straight in any pipe throughout its effective length, tested by means of a rigid straight edge as described in IS 3597 shall not exceed, for all diameters, 3 mm for every metre run.

10 TESTS

10.1 Test Specimens

All pipes for testing purposes shall be selected at random from the stock of the manufacturer and shall be such as would not otherwise be rejected under this standard.

10.1.1 During manufacture, tests on compressive strength of concrete cubes shall be done as described in IS 516. For pressure pipes, splitting tensile strength tests of concrete cylinders shall be carried out as described in IS 5816. The manufacturer shall supply, when required to do so by the purchaser or his representative, the results of compressive tests of concrete cubes (see 5.5.1) and split tensile tests of concrete cylinder (see 5.5.2) made from the concrete used for the pipes. The manufacturer shall supply cylinders or cubes for test purposes required by the purchaser, and such cylinders or cubes shall withstand the tests prescribed in 5.5.1 and 5.5.2. Every pressure pipe shall be tested by the manufacturer for the hydrostatic test pressure (see 4.1). For non-pressure pipes, 2 percent of the pipes shall be tested for hydrostatic test pressure.

10.2 The specimens of pipes selected in accordance with 10.1 shall be subjected to the following tests in accordance with IS 3597:

- a) Hydrostatic test,
- b) Three-edge bearing test, and
- c) Permeability test.

10.2.1 The permeability test when conducted in accordance with the method described in IS 3597 shall meet the requirement of final permeability, which shall not exceed 0.3 cm³.

NOTE — It is recommended that initial absorption should not exceed 2.0 cm³ and the difference in any two consecutive readings during initial absorption should not be more than 0.8 cm³.

10.2.2 The dimensions of each pipe of Spigot and Socket shall be checked as per **10** of IS 3597.

11 SAMPLING AND INSPECTION

11.1 Scale of Sampling

11.1.1 Lot

In any consignment, all the pipes of same class, same size and belonging to the same mix of concrete shall be grouped together to constitute a lot.

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

11.1.3 The number of pipes to be selected from the lot shall depend on the size of the lot and shall be according to Table 23.

11.1.3.1 These pipes shall be selected at random. In order to ensure the randomness of selection, procedures given in IS 4905 may be followed.

11.2 Number of Tests and Criteria for Conformity

11.2.1 All the pipes selected according to **11.1.3** shall be inspected for dimensional requirements (*see 8*), finish (*see 9.1*) and deviation from straight (*see 9.2*). A pipe failing to satisfy one or more of these requirements shall be considered as defective.

11.2.1.1 The lot shall be declared as conforming to these requirements if the number of defectives found in the sample does not exceed the number of defectives given in col 3 of Table 23.

11.2.2 The lot having found satisfactory shall be further subjected to the tests given under **10.2** except ultimate load test. For this purpose, the number of pipe given in

col 4 of Table 23 shall be selected from the lot. These pipes shall be selected from those that have satisfied the requirements given in **11.2.1**. For ultimate load test, the number of pipes to be checked shall be according to mutual agreement between the purchaser and the manufacturer. However, ultimate load test shall not be done for a lot size of 20 pipes or less.

11.2.2.1 The lot shall be declared as conforming to the requirements of this specification if there is no failure under **11.2.2**.

12 MARKING

12.1 The following information shall be indelibly and clearly marked on each pipe:

- Indication of the source of manufacture,
- Size of pipe,
- Class of pipe,
- The word 'reinforced' or 'unreinforced' as may be applicable,
- The words 'spun pipe' or 'vibrated cast pipe' as may be applicable, and
- Date of manufacture.

The above information shall be clearly marked on outside only for pipes up to and including 350 mm internal diameter, and both outside and inside for pipes above 350 mm internal diameter.

12.2 BIS Certification Marking

The product(s) 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 product(s) may be marked with the Standard Mark.

Table 23 Scale of Sampling and Permissible Number of Defectives

(Clauses 11.1.3, 11.2.1.1 and 11.2.2)

No of Pipes in the Lot	For Requirement under Clauses 8 and 9		Samples Size for Test Under Clause 10.2 (Excluding Ultimate Load Test)
	Sample Size	Permissible Number of Defectives	
(1)	(2)	(3)	(4)
Up to 50	8	0	2
51 to 100	13	1	3
101 to 300	20	2	5
301 to 500	32	3	7
501 and above	50	5	10

NOTE — For socket and spigot pipes refer in **10** of IS 3597.

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ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
269 : 2015	Ordinary portland cement — Specification (<i>sixth revision</i>)	(Part 2) : 1983 1786 : 1985	As drawn wire (<i>first revision</i>) High strength deformed steel bars and wires for concrete reinforcement — Specification (<i>fourth revision</i>)
383 : 2016	Coarse and fine aggregates for concrete — Specification (<i>third revision</i>)	2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (<i>seventh revision</i>)
432	Specification for mild steel and medium tensile steel bars and hard-drawn steel wires for concrete reinforcement	3597 : 1998	Concrete pipes — Methods of test (<i>second revision</i>)
(Part 1) : 1982	Mild steel and medium tensile steel bars (<i>third revision</i>)	4905 : 2015	Random sampling and randomization procedures (<i>first revision</i>)
(Part 2) : 1982	Hard-drawn steel wire (<i>third revision</i>)	5382 : 1985	Rubber sealing rings for gas mains, water mains and sewers (<i>first revision</i>)
455 : 2015	Portland slag cement — Specification (<i>fifth revision</i>)	5816 : 1999	Method of test splitting tensile strength of concrete (<i>first revision</i>)
456 : 2000	Plain and reinforced concrete code of practice (<i>fourth revision</i>)	7322 : 1985	Specials for steel cylinder reinforced concrete pipes (<i>first revision</i>)
516 : 1959	Method of test for strength of concrete	8041 : 1990	Specification for rapid hardening portland cement (<i>second revision</i>)
1489	Portland pozzolana cement — Specification	8043 : 1991	Specification for hydrophobic portland cement (<i>second revision</i>)
(Part 1) : 2015	Fly ash based (<i>fourth revision</i>)	9103 : 1999	Specification for concrete admixtures (<i>first revision</i>)
(Part 2) : 2015	Calcined clay based (<i>fourth revision</i>)	12330 : 1988	Specification for sulphate resisting Portland cement
1566 : 1982	Hard-drawn steel wire fabric for concrete reinforcement (<i>second revision</i>)		
1785	Plain hard-drawn steel wire for prestressed concrete — Specification for		
(Part 1) : 1983	Cold drawn stress relieved wire (<i>second revision</i>)		

ANNEX B

(Foreword)

COMMITTEE COMPOSITION

Cement Matrix Products Sectional Committee, CED 53

<i>Organization</i>	<i>Representative(s)</i>
National Council for Cement and Building Materials, Ballabgarh	SHRI V. V ARORA (Chairman)
Ambuja Cements Limited, Ahmedabad	SHRI J. P. DESAI SHRI B. K. JAGETIYA (<i>Alternate</i>)
Asbestos Information Centre, New Delhi	SHRI DURGESH C. SHARMA SHRI JOHN NICODEMUS (<i>Alternate</i>)
Brihanmumbai Municipal Corporation, Mumbai	SHRI VISHAL THOMBARE
Central Design Organization Nasik, Mumbai	REPRESENTATIVE
Central Pollution Control Board, Delhi	REPRESENTATIVE
Central Public Health and Environmental Engineering Organization, New Delhi	REPRESENTATIVE
Central Public Works Department, New Delhi	SHRI MANOJ KUMAR SHARMA SHRI PREM PAL SINGH (<i>Alternate</i>)
CSIR-Central Building Research Institute, Roorkee	SHRI S. K. SINGH SHRIMATI M. SURYA (<i>Alternate</i>)
CSIR-Structural Engineering Research Centre, Chennai	SHRI P. SRINIVASAN DR B. H. BHARAT KUMAR (<i>Alternate</i>)
Delhi Development Authority, New Delhi	REPRESENTATIVE
Directorate General of Factory Advise Services and Labour Institute, Mumbai	DR CHAMPAK BHATTACHARYA
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Ministry of Science & Technology, New Delhi	REPRESENTATIVE
Ministry of Environment and Forest, New Delhi	REPRESENTATIVE

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Rural Electrification Corporation Limited, New Delhi	SHRI G. S. BHATI SHRI RANJIT RANJAN (<i>Alternate</i>)
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The Indian Hume Pipe Company Limited, Mumbai	SHRI P. R. BHAT SHRI S. J. SHAH (<i>Alternate</i>)
In personal capacity, (B-806, Oberoi Exquisite Oberoi Garden City, Goregaon East, Mumbai)	SHRI A. K. JAIN
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Member Secretary

DR MANOJ KUMAR RAJAK
SCIENTIST 'D' (CIVIL ENGINEERING), BIS

SUB COMMITTEE COMPOSITION

Concrete Pipes Subcommittee, CED 53:2

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