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GOVERNMENT OF INDIA - MINISTRY OF RAILWAYS
भारत सरकार – रेल मंत्रालय

PLUMBING FITTINGS

प्लंबिंग फिटिंग

CAMTECH/2023/C/PlumbingFitting/1.0
केमटेक/2023/सि/प्लंबिंग फिटिंग/1.0

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INDIAN RAILWAYS

Centre *for* **A**dvanced **M**aintenance **Tech**nology (CAMTECH)

MAHARAJPURA, GWALIOR - 474005

प्लंबिंग फिटिंग

Plumbing Fittings

Foreword

Indian railway holds the major chunk of civil engineering assets in the country. It is looked at as a premier organization in respect of quality and workmanship. It has been observed that various fittings are used in water supply system and the requirements of such fittings are available in staggered form.

CAMTECH has made a nice attempt to provide all the information about the fittings which are used in water supply system at a glance for the field engineers. Efforts have been made to cover the codal requirements of such fittings.

I hope this handbook will certainly prove to be a valuable source of technical knowledge and will be quite helpful for civil engineering personnel of Indian Railway

CAMTECH/Gwalior ***(Jitendra Singh)***
19 January 2024 *Principal Executive Director*

Preface

Indian Railway having a lot of stations, buildings, offices and residential accommodations is vast network spread all over India. Various fittings are used in water supply system of such assets. The requirements of such fittings are available in various Indian Standards in staggered form.

Objective of this handbook is to provide all codal information about the fittings used in the water supply system at a glance for the field engineers of Indian Railways. Every effort has been made to make this handbook useful to civil engineering personnel of Indian Railways.

This hand book does not supersede any existing information from Railway Board, RDSO, IRWM and Indian standards available on the subject. This book is not statutory& contents are for the purpose of guidance only. Most of the data, sketch and information mentioned here in available in some form or the other in various books or printed matter.

This handbook is the result of sincere efforts of Shri D.K.Shrivastava, SSE/CAMTECH, who collected and compiled information, data, etc. from different sources, and went through the complete text.

We welcome valuable suggestions from our readers for further improvements.

CAMTECH/Gwalior ***(Deepak Mehra)***
19 January 2024 *Director/Civil*

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Chapter 1

Plumbing Fittings: An Introduction

1.1 Introduction

A large network of pipelines of various sizes is used in a water supply system from the source to the last point of the distribution system. A plumber must have knowledge of the various pipe fittings like elbow, union, gasket, etc., joints and valves, and where these should be used while carrying out the tasks. Not only does this help in smooth functioning, but also ensures cost-effectiveness.

For proper installation of the plumbing system in a building, various types of joints are used. Various types of fittings like elbow, gasket, union, etc., are used for making joints. It helps in changing the direction of water supply from main pipes to subsidiary pipes. Fittings are made from different types of materials.

In this handbook, Indian standard codal provisions of different types of fittings have been discussed in brief. This booklet will help to make the field engineers of Indian Railway aware of various codal provisions for acceptance of fittings.

1.2 Pipe Fittings

Any part used in connection with water supply, distribution, measurement, controlling, use and disposal of water is known as a pipe fitting. A pipe fitting is used in the plumbing system to join multiple pipes of same size or different sizes, to regulate the flow or to measure the flow.

Pipe fittings are an important component of the plumbing system. In plumbing, many types of fixtures are joined with the help of various types of material as per the requirement. Fittings are fixed in the plumbing system to join straight pipes or any section of tubes. The water-supply fittings like elbow, tee, socket, reducer, etc., are fitted to change the direction of flow, distribute the water supply from the main pipe to other pipes of equal size or lower size, etc. Proper fitting also helps in checking leakage in the plumbing lines.



Fig: 1.1 Pipe Fittings

1.3 Categories of Fittings

Broadly, fittings are classified into following categories:

1. Socket or coupler
2. Elbow
3. Tee
4. Reducer
5. Union
6. Nipple
7. Plug or cap

Also, Thread or sealing solution and Gasket are used with fittings to make the joints leak proof.

1.3.1 Socket or Coupler: A coupling connects two pipes to each other. If the size of the pipe is not the same, the fitting may be called a reducing coupling or reducer, or an adapter.

By convention, the term "expander" is not generally used for a couple that increases pipe size; instead the term "reducer" is used.



Fig 1.2 Socket or coupler

1.3.2 Elbow: It is installed at the time of joining two pipes. With the help of an elbow, the direction of liquid is changed. Normally a 45° or 90° elbow is used. When the two sides of pipes differ in size, an elbow of reducing size is used. This is called reducing type elbow or reducer type elbow. Elbows are categorized as follows:

- ***Long Radius (LR) Elbows –*** Here, the radius is 1.5 times the diameter of pipe.
- ***Short Radius (LR) Elbows –*** In this, the radius is 1.0 times the diameter of pipe.
- ***90° Elbow –*** This is used when the change in direction required is 90°.



Fig 1.3 90° Elbow

- ***45° Elbow –*** This is used when the change in direction required is 45°.

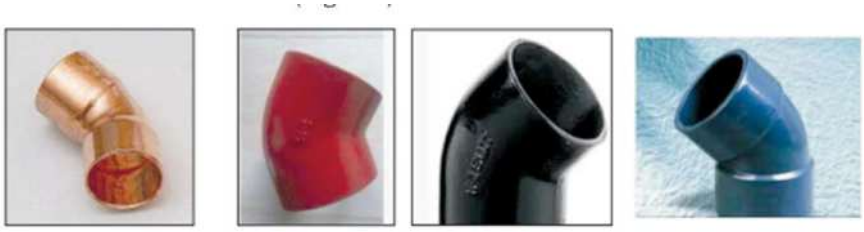


Fig 1.4 45° Elbow

1.3.3 Tee: It is an important fitting with a side outlet at 90° to the run of the pipe. Tees connect pipes of various diameters and help in changing the direction of water or material in a

pipe. Tees are made in various sizes like equal or unequal. The equal tee is most commonly used.

A tee is the most common pipe fitting. It is available with all female thread sockets, all solvent weld sockets, or with opposed solvent weld sockets and a side outlet with female threads. It is used to either combine or split a fluid flow. It is a type of pipe fitting which is T-shaped having two outlets, at 90° to the connection to the main line. It is a short piece of pipe with a lateral outlet.

A tee is used for connecting pipes of different diameters or for changing the direction of pipe runs. They are made of various materials and available in various sizes and finishes. They are extensively used in pipeline networks to transport two-phase fluid mixtures.



Fig 1.5 Tee Joint

1.3.4 Reducer: A reducer allows for a change in pipe size to meet hydraulic flow requirements of the system, or to adapt to existing piping of a different size. Reducers are usually concentric but eccentric reducers are used when required to maintain the same top- or bottom-of-pipe level.



Fig 1.6 Reducer

1.3.5 Union: A union is similar to a coupling, except it is designed to allow quick and convenient disconnection of pipes for maintenance or fixture replacement. While a coupling would require solvent welding, soldering or being able to rotate with all the

pipes adjacent as with a threaded coupling, a union provides a simple transition, allowing easy connection or disconnection at any future time.

A standard union pipe is made in three parts consisting of a nut, a female end, and a male end. When the female and male ends are joined, the nuts then provide the necessary pressure to seal the joint. Since the mating ends of the union are interchangeable, changing of a valve or other device can be achieved with a minimum loss of time. Pipe unions are essentially a type of flange connector, as discussed further below.



Fig 1.7 Union

1.3.6 Nipple: It is a piece of pipe having thread at both sides, and could be used for short extension of plumbing lines. It can also be used for connecting two fittings within small distance. A tubular pipe fitting is under 30 cm in length. If lengths are over 30 cm these are considered as cut.



Fig.1.8 Nipples

A short stub of pipe, usually threaded steel, brass, chlorinated polyvinyl chloride (CPVC) or copper; occasionally just bare copper. A nipple is defined as being a short stub of pipe which has external male pipe threads at each end, for connecting two other fittings. Nipples are commonly used for plumbing and hoses, and second as valves for funnels and pipes.

1.3.7 Plug or Cap: It is a short stub of pipe and is used to close the supply at one end. If we want to supply, simply remove the cap and connect the pipe.



Fig.1.9 Caps

1.3.8 Thread or Sealing Solution: To make the piping system leak proof thread or sealing solution may be used depend upon the material of pipe.pig lead is also used for making joint leak proof.



Fig. 1.10 Thread and Sealing Agents

1.3.9 Gasket: Gaskets are used for sealing of flange joints. Various types of gaskets are available depending upon their construction, materials, and features. The following are the type of gaskets commonly used:

(a) Non-Metallic Gaskets
(b) Spiral-Wound Gaskets
(c) Ring Joint Gaskets

1.4 Requirement of Fitting

The plumbing fixtures are to be:

a) Made of smooth and non-absorbent material.
b) Located in well ventilated enclosures.
c) Free from concealed fouling spaces.
d) Easily accessible for the intended use.
e) Able to withstand adequate pressure.
f) Connected to a drainage system with water seal traps.
g) Tested for leaks, defects, etc, and rectified promptly, where necessary.
h) Heating and storage water cisterns are to be proofed against contamination and explosions through overheating.

1.5 Type of Fittings

Depending upon the outlet and threads on fittings, they are mostly grouped in the following:

- **Equal Fittings:** Where all outlets are of the same size.
- **Unequal Fittings:** When two or more outlets are of different size irrespective of the number of outlets.
- **Male Fittings:** Fittings having only male threads.
- **Female Fittings:** Fittings having female threads on the outlet.
- **Male-Female Fittings:** Fittings having male and female threads at the outlets.

1.6 Materials for Pipe Fittings

Material selection is probably one of the methods that could solve most corrosion and erosion problems, but due to economic considerations it is not always used. For the sake of convenience the pipes are classified into three groups as given below, keeping in view the material used for manufacture:

a) Cement pipes,
b) Metallic pipes, and
c) Plastic pipes.

1.6.1 Cement Pipes: Plain and reinforced cement concrete pipes, cylinder reinforced concrete pipes, pre-stressed concrete pipes and asbestos cement pipes come in the category of cement pipes. In all these pipes the bonding material used is cement. Greatest advantage of cement pipes over metallic pipes is their corrosion resistance. Because of this property, the water carrying capacity of pipes will not change much during their life.

1.6.1.1 ***Cement Concrete Pipes*:** Concrete pipes are manufactured with or without reinforcement. Plain cement concrete pipes are used only for non-pressure purposes. All pressure pipes shall be reinforced. Cement concrete pipes are produced by centrifugal spinning or vibratory process or a combination of both. The pipes are to be cured in water or steam. RCC pipes cater to working pressures up to 0.3 MPa in case of pumping mains and 0.4 MPa in case of gravity mains. The requirements for cement concrete and reinforced cement concrete pipes are given in IS 458: 1988. Bends junction and specials conforming to IS 7322: 1985 shall be used with cement concrete pipes.

1.6.1.2 ***Steel Cylinder Reinforced Pipes:*** Steel cylinder reinforced concrete (SCRC) pipes are similar to RCC pipes; in addition to reinforcement a thin walled steel cylinder is used in the manufacture of the pipe, which increases the strength of the pipe. Ordinary RCC pipes are not suitable for carrying water at relatively high pressures. In such cases SCRC pipes are used. These pipes can be used for working pressures of 0.6 MPa to 2.0 MPa. The requirements for SCRC pipes are covered in IS 1916: 1989 and the requirements for the specials used with SCRC pipes are covered in IS 7322: 1985.

1.6.1.3 ***Pre-stressed Concrete Pipes:*** The pre-stressed concrete (PSC) pipes are manufactured by helically binding high tensile steel wire under tension around a concrete core, thereby putting the core in compression. When the pipe is pressurised, the stress induced in pipe will relieve/ reduce the compressive stress caused by pre-stressing. Thus the concrete in PSC pipes will be under compression most of the time, which is a favourable factor for impermeability. The requirements for PSC pipes and their specials are covered in IS 784: 1978.

1.6.1.4 ***Asbestos Cement Pipes:*** These pipes are made of a mixture of asbestos fibre and Portland cement compressed by steel rollers to form laminated material of great strength and density. The requirements for AC pressure pipes are covered in IS 1592: 1989. IS 9627:

1980 gives the requirements of AC pressure pipes (light duty), which cater for working pressure up to 0.5 MPa.

Note: Since there are no cement pipes in IRUSSOR & DSR, these have not been discussed further.

1.6.2 Metallic Pipes: Cast iron pipes (both sand cast and spun cast), ductile iron pipes, welded steel pipes and spiral welded steel pipes come in the category of metallic pipes.

Because of ease in production and jointing cast iron (CI) pipes are very extensively used for water supply purpose. In our country CI pipes are in use for more than a century. The development of steel pipes imparted a great significance in pipe laying, because of its light weight when compared to CI pipes. Ductile iron pipes are recent development in metallic pipes, which are basically spun cast iron pipes with improved metallurgical properties.

1.6.2.1 ***Cast Iron Pipes:*** There are three varieties in CI pipes based on their manufacturing process, Vertically Cast Pipes, Horizontally Cast Pipes & Centrifugally Cast Pipes. Vertical casting in sand moulds is an age old process. But pipes manufactured by this process are not of very good quality (properties), as internal surface of pipes is not very smooth and there is a possibility for non-uniform thickness and defects which invariably result in certain percentage of rejection which is inherent in the process. The requirements for vertically cast iron pipes are covered in IS 1537: 1976.

In our country CI pipes are manufactured by horizontal casting also. This is similar to vertical casting except that the casting is done horizontally. The properties of these two are more or less similar. Only flanged type of pipes are manufactured in this process. The requirements for the horizontally cast pipes are covered in IS 7181 : 1986.

Now a days centrifugal casting (spun casting) is more popular. In this process pipes are cast with the spinning action of sand moulds or metallic moulds. The pipes produced by this process will have uniform thickness and texture, and more compacted grains compared to vertical casting. The spun process results in faster production, longer pipes with vastly improved metal quality, a smoother inner surface and reduced thickness and consequent light weight. The requirements for centrifugally cast iron pipes are covered in IS 1536 : 1989. The requirements for centrifugally cast low pressure pipes are covered in IS 6163 : 1978.

1.6.2.2 ***Ductile Iron Pipes:*** Centrifugally cast ductile iron pipes are latest development in cast iron pipes. Molten metal treated with magnesium is used for producing these pipes. Adding magnesium based alloy to the molten metal gives a uniform distribution of nodular carbon graphites in casting, which improves the properties of the pipe to a great extent. Ductile iron pipes have got high mechanical strength and good impact resistance when compared to cast iron pipes. These pipes have high wear and tear resistance and smooth internal surface. These pipes are approximately 30 percent lighter than conventional CI pipes because of their reduced thickness due to high mechanical

properties. The requirements for ductile iron pipes are covered in IS 8329:1990. The requirements for ductile iron fittings for pressure pipes for water gas and sewage are covered in IS 9523: 1980. These pipes are suitable for hydraulic working pressures up to 4 MPa depending on diameter. These pipes can be used where high stress concentrations are anticipated.

1.6.2.3 ***Steel Pipes:*** Steel tubes are seamless or welded, made by one of the approved processes. The thickness of the steel pipe is controlled due to the need to make the pipe stiff enough to keep its circular shape during storage, transport, laying and also to take the load of trench back filling and vehicles.

The requirements for mild steel pipes up to 150 mm nominal diameter are covered in IS 1239 (Part 1) : 1990 and the requirements for mild steel and wrought steel fittings are covered in IS 1239 (Part 2) : 2011. These pipes can be jointed by means of socket and screw or by welding.

The requirements for steel pipes with diameters greater than 150 mm are covered in IS 3589: 1991. The requirements for spiral welded pipes are given in IS 5504: 1969.

Higher diameter steel pipes and spiral welded pipes are joined by welding only.

Stainless steel pipes are also now a day's being used for water supply system. At present, there are no BIS codes for manufacturing requirements for Stainless steel pipe and fittings; hence it has not been discussed further.

1.6.3 Plastic Pipes: A wide range of plastic pipes are commercially available in the country such as polyethylene (LDPE & HDPE), Rigid (unplasticised) polyvinylchloride (UPVC), CPVC, PPR , Polyethelene aluminium polyethylene(PE-AL-PE) pipes etc.

The various types of plastic pipes in use as per IR-USSOR & DSR are as follows:

i. Polyethelene aluminium polyethylene (PE-AL-PE) pipes
ii. PPR pipes
iii. CPVC Pipes

1.6.3.1 ***Polyethelene Aluminium Polyethylene(PE-AL-PE) Pipes:*** PE-AL-PE pipes conform to IS 5450, but there is no BIS code for the fittings of these pipes. However, as per Indian Railways' Unified Standard Specifications for Works & Materials, following are the requirement for connectors & fittings for PE-AL-PE pipes:

1.6.3.1.1 PE-AL-PE pipes manufactured to specification shall be capable of being jointed with suitable connectors or fittings provided that the connector or fitting alone or in assembly with PE-AL-PE pipe complies with the requirements as given in **1.6.3.1.2** and **1.6.3.1.3**.

1.6.3.1.2 ***Internal Pressure Test:*** The fitting or connector, when assembled with PE-AL-PE pipe, shall not fail or weep at the specified duration as given in Table 1. The joint shall not have any leakage during the test.

Table 1.1 Test Pressure and Duration
(Clause 1.6.3.1.2)

SN	Pipe Size (Outer dia) in mm	Test Pressure (MPa)	Duration (Hour)
(1)	**(2)**	**(3)**	**(4)**
i)	14	3.60	1
ii)	16	3.43	1
iii)	20	2.67	1
iv)	25	2.67	1
v)	32	2.30	1
vi)	40	2.23	1
vii)	50	2.20	1

1.6.3.1.3 ***Pull Out Test***

1.6.3.1.3.1 ***Apparatus:*** The apparatus shall consist of one of the following:

a) A tensile testing machine together with grips capable of subjecting the test assembly to a constant longitudinal forces; and
b) A frame with means for suspending a test piece together with stirrup at the lower end to hold sufficient weight(s) with which to apply the specified forces.

1.6.3.1.3.2 ***Test Assembly:*** The test assembly shall comprise a straight coupling or any other fitting which can join two pipe pieces assembled in accordance with the manufacturer's instructions with two pieces of pipe of the appropriate nominal size. Separate combinations shall be assembled for each type of pipe for which fitting is designed. Each pipe shall be at least 100 mm in length.

1.6.3.1.3.3 ***Procedure:*** Secure the test assembly in the apparatus and apply gradually over a period of 20s the appropriate force at ambient temperature as given in Table 2 as applicable. Hold the specimen in constant tension for the specified duration.

Table 1.2 : Test Pressure and Duration for Pull out Test (Clause 1.6.3.1.3)

SN	Pipe Size (Outer dia) in mm	Test force N	Duration(Hour)
(1)	**(2)**	**(3)**	**(4)**
i)	14	589	1
ii)	16	722	1
iii)	20	1021	1
iv)	25	1550	1
v)	32	2506	1

vi)	40	4180	1
vii)	50	5957	1

1.6.3.2 ***Polypropylene Random Pipes (PPR Pipes):*** PPR pipes conform to IS 15801, but there is no BIS code for the fittings of these pipes. However, as per Indian Railways' Unified Standard Specifications for Works & Materials, following are the requirement for fittings for PPR pipes.

The plain fittings shall be Polypropylene Random Copolymer and comply with all the requirements of the pipes. The size of fitting is specified in the schedule of quantities, corresponding to the size of the pipe. The plain fittings shall comprise of Socket, Elbow, Tee, Cross, Unions, Reducer socket, Reduction Tee, End Cap, Crossover, Omega, Threaded plug,and Wall Clamps in available sizes.

1.6.3.3 ***CPVC Pipes*****:** CPVC pipes conform to IS 15225, but there is no BIS code for the fittings of these pipes. However, as per Indian Railways' Unified Standard Specifications for Works & Materials, following are the requirement for fittings for CPVC pipes.

CPVC Fittings *(Ref: Railway specifications):* The CPVC pipe fittings should be made of material conforming to IS 15225. Fittings used shall be of the same make as that of PVC pipes.

There is no BIS code at present for any of the plastic fittings mentioned in Indian Railways' Unified Standard Specifications for Works & Materials & CPWD Delhi Schedule of Rates, plastic fittings are not discussed further.

***

Chapter-2

Cast Iron Fittings

2.0 Cast Iron Pipes

General requirement for cast iron fittings for water supply pipes are covered in IS: 1538-1993(2018). The Requirement of cast iron special castings to be used with cast iron and ductile iron water supply pipes are covered in IS: 1538-1993(2018).

Basic requirements of only those cast Iron fittings has been covered which are mentioned in IRUSSOR-2010 & DSR-2023. For details, concerned codes may be referred at.

2.1 Cast Iron Fittings for Water Supply Pipes as per IS: 1538-1993 (re-affirmed 2018): The cast iron fittings of sizes from 80 mm up to 600 mm (as per railway requirement) have only been discussed. For other sizes code may be referred at.

2.1.1 Codal Requirements for Cast Iron Fittings: The codal requirement of cast iron fittings are tabulated as follows-

SN	Test	Requirement	Remarks
(1)	(2)	(3)	(4)
1	Metal used for the manufacture of pipes	Quality not to be less than that specified for Grade FG 150 of IS 210: 1978.	
2	Requirement of Dimensional	Table 2.3 to 2.17 of respective fittings	
3	Tolerances in Dimensions	As per clause 2.1.3	
4	Requirement of mass & its tolerance	As per clause 2.1.4	
5	Mechanical tests for tensile strength	(minimum)150MPa (N/mm2)	To be carried out during manufacture
6	Brinell hardness Test	Not to exceed 210 HBS.	To be done on the external un-machined surface
7	Hydrostatic tests (Test pressure in Table 2.1)	Should withstand the pressure test without showing any leakage, sweating or other defect of any kind.	The hydrostatic test shall be conducted before coating the fittings.

Table 2.1 Hydrostatic Test Pressure for Fitting

(Ref: Table 1of IS 1538:1993 (2018))

Nominal Diameter	Test pressure	
	Fittings Without Branches or With Bunches not Greater than half the Principal Diameter (MPa (N/mm^2))	**Flanges with Branches Greater than half the Principal Diameter MPa**
(1)	**(2)**	**(3)**
Up to and including 300 mm	2.5	2.5
Over 300 mm and up to and including 600 mm	2.0	2.0
0ver 600 mm and up to and including 1500 mm	1.5	1.0

2.1.2 General Requirements for Cast Iron Fittings

- The fittings should be free from defects, other than any unavoidable surface imperfections and which do not affect the use of the fittings.
- In the case of spigot and socket ends suitable for lead joints, the socket shall be with or without the centering ring.
- In the case of Flanged joints, the flanges should be at right angles to the axis of the joint and machined in face. The bolt holes should be drilled.
- The bolt bole circle should be concentric with the bore and bolt holes shall be located off the centre lines, unless otherwise specified by the purchaser. The two Flanges of the fittings shall be correctly aligned.
- All fittings should be coated externally and internally with the same material by dipping in tar or a suitable base bath. The coating material should not scale off'.
- Where the coating material has tar or similar base, it should 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 0^0 C as to chip off when scribed lightly with it penknife.
- The inside coating should 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 suitable washing of the mains.

2.1.3 Tolerance: Tolerances on external diameter of the barrel, the internal diameter and the depth of the socket for lead joints shall be as follows:

Dimensions	Nature of Joint	Nominal Diameter DN	Tolerance in mm
(1)	**(2)**	**(3)**	**(4)**
External diameter of spigot (DE)	Lead joint	All diameter	± ½ f or ±(4.5 +0.0015DN)
Internal diameter of socket (DI)	Lead joint	All diameter	±1/3 f or ± (3+0.001DN)

Depth of socket (P)	Lead joint	Up to and including 600 mm	±5
		Over 600 mm up to and including l000mm	±10
		Over 1 000 mm up to and including 1500 mm	±15

Where, DN is the nominal diameter of the fitting in mm and f is the caulking space of the joint in mm and is equal to 9.00 + 0.003 DN.

NOTE - The jointing tolerances applicable to joints other than lead joints shall be as specified by the manufacturer and shall be within the tolerances specified above. The maximum or minimum jointing space resulting from these tolerances is such that the jointing of the pipes and fittings is not adversely affected.

2.1.3.1 ***Tolerances on Thickness****:* The tolerances on the wall thickness and Flange thickness of fittings are limited as follows:

Dimensions	Tolerance in mm
Wall thickness	- (2+0.05e)
Flange thickness	± (3+0.05 b)

Where, e= Standard thickness of the wall in mm
b= Standard thickness of flange in mm

2.1.3.2 ***Tolerances on Lengths:*** The tolerance on lengths of finings, normally manufactured, shall be as follow.

Type of Fittings	Nominal Diameter	Tolerance in mm
(1)	**(2)**	**(3)**
Socket fittings and flange and spigot pieces	Up to and including 450 mm	± 20
	Above 450 mm	+20 -30
Flanged fittings	All diameter	±10

Should smaller tolerances required, they shall be agreed to between the manufacturer and the purchaser and may not be less than ±1 mm.

2.1.4 **Mass:** The masses have been calculated by taking the density of iron as 7.15 kg/dm^3. The standard masses should conform to those given in Table 2.7-2.28. The permissible tolerances on standard mass of fittings shall be ± 8 % except for bends fittings with more than one branch and non-standard fittings, in which ease the tolerance shall be ± 12 %.

Fittings of a heavier mass than the maximum may be accepted provided they comply in every other respect with the requirement of this standard.

2.1.5 Marking: Each fitting should have cast, stamped or indelibly painted on it the following appropriate marks:

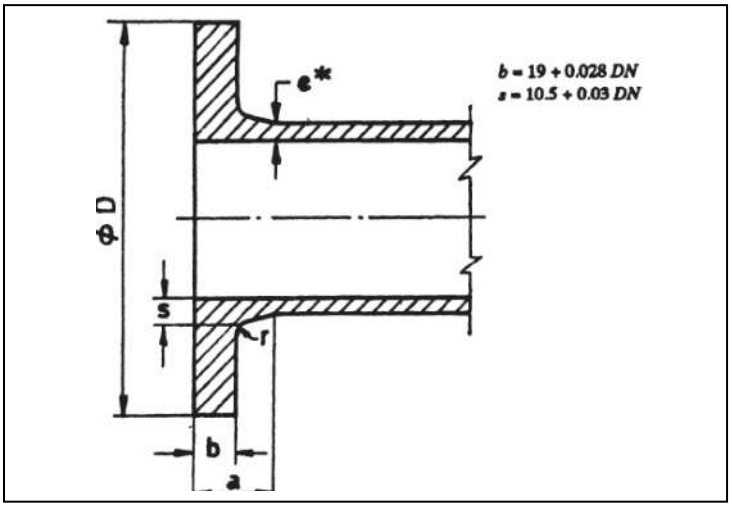
a) Manufacturer's name, initials or identification mark;
b) The nominal diameter;
c) Mass of fitting; and
d) The last two digits for the year of manufacture.

Marking may be done on the outside of the socket or on the barrel of the fitting.

2.1.6 Joints: The dimensions and designs for fittings suitable for flanged joint covered in this hand book should follow the design given in Tables 2.2.

Table 2.2 Dimensions of Flanges of Pipes and Fittings

(*Ref: Table 4 of IS 1538:1993 (2018)*)

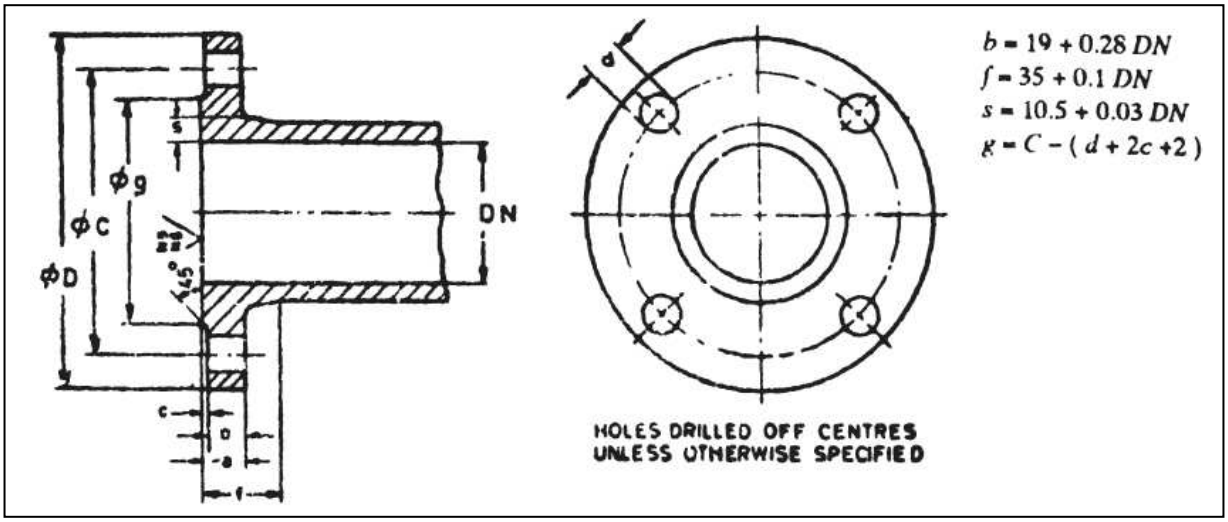


Nominal Dia (DN)	D	a	b	s	r
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
80	200	40	21	13	6
100	220	42	22	13.5	6
125	250	44.5	22.5	14.5	6
150	285	47	23	15	6
200	340	52	24.5	16.5	8
250	395	57	26	18	8
300	445	61	27.5	19.5	8
350	505	66	29	21	8
400	565	71	30	22.5	10
450	615	76	31.5	24.0	10
500	670	81	33	25.5	10
600	780	90	36	28.5	10

*Thickness e is equal to the thickness of pipe or fitting comprising the flange. Not to value of s.

Table 2.3 Dimensions of Raised Flanges

(*Ref: Table 5 of IS 1538:1993 (2018)*)

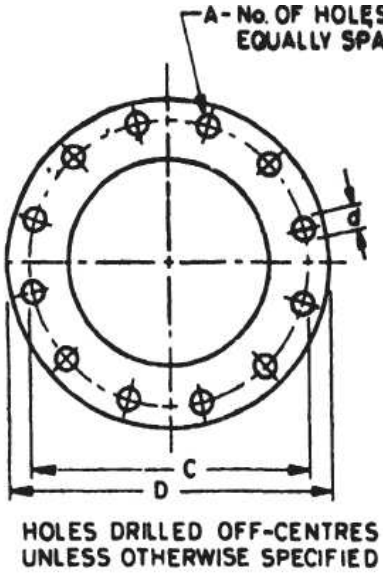


Nominal Dia (DN)	D	g	a	b	c	f	s	C	Holes		Dia of Bolts
									No.	d	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
80	200	133	24	21	3	43	13	160	4	19	16
100	220	153	25	22	3	45	13.5	180	8	19	16
125	250	183	25.5	22.5	3	47.5	14.5	210	8	19	16
150	285	209	26.0	23	3	50	15	240	8	23	20
200	340	264	27.5	24.5	3	55	16.5	295	8	23	20
250	395	319	29	26	3	60	18	350	12	23	20
300	445	367	31.5	27.5	4	65	19.5	400	12	23	20
350	505	427	33	29	4	70	21	460	16	23	20
400	565	477	34	30	4	75	22.5	513	16	28	24
450	615	527	36	32	4	80	24	565	20	28	24
500	670	582	47	33	4	85	25.5	620	20	28	24
600	780	682	41	36	5	95	28.5	725	20	31	27

Table 2.4 Standard Flange Drilling of Flanged Pipes and Fittings

(*Ref: Table 6 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	D	C	Holes		Dia of bolts
			Number A	Diameter d	
(1)	(2)	(3)	(4)	(5)	(6)
80	200	160	4	19	16
100	220	180	8	19	16
125	250	210	8	19	16
150	285	240	8	23	20
200	340	295	8	23	20
250	395	350	12	23	20
300	445	400	12	23	20
350	505	460	16	23	20
400	565	513	16	28	24
450	615	565	20	28	24
500	670	620	20	28	24
600	780	725	20	31	27

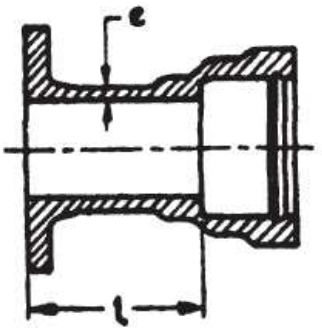


2.1.7 Special Fittings: Special fittings of the following types with their ends Flanged (for Flanged joints) should conform to the dimensions, mass and tolerances as relevant those given in Tables mentioned below against each type. Tolerances on mass shall be as per **Para 2.1.4** given above.

Table 2.5 Flanged Sockets

(*Ref: Table 7 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	e	t	Mass (Approx.) Kg.
(1)	(2)	(3)	(4)
80	10.0	150	13
100	10.5	150	16
125	11.1	150	20
150	11.7	150	26
200	12.8	150	37
250	14.0	300	62
300	15.2	300	79
350	16.3	300	100
400	17.5	300	123
450	18.7	300	142
500	19.8	300	173
600	22.5	300	234



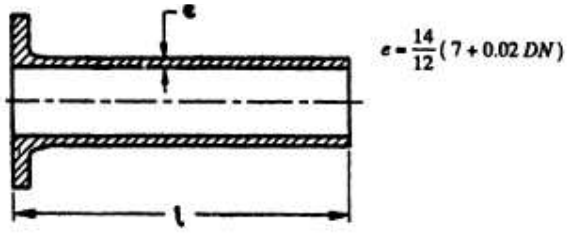
$$e = \frac{14}{12}(7 + 0.02\,DN.)$$

Note: The fitting may also be supplied with a raised flange. For details of the raised flange see **Table-2.3**.

Table 2.6 Flanged Spigots

(*Ref: Table 8 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	e	l	Mass (Approx.) Kg.
(1)	(2)	(3)	(4)
80	10.0	400	12
100	10.5	400	14
125	11.1	400	19
150	11.7	400	23
200	12.8	500	39
250	14.0	500	53
300	15.2	500	68
350	16.3	500	85
400	17.5	500	104
450	18.7	500	123
500	19.8	500	146
600	22.2	600	227

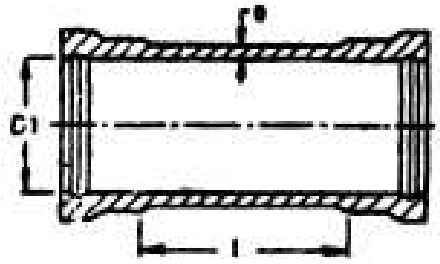


Note: The fitting may also be supplied with a raised flange. For details of the raised flange see **Table-2.3**.

Table 2.7 Collars

(*Ref: Table 9 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	e	l	Mass (Approx.) Kg.
(1)	(2)	(3)	(4)
80	10.9	158	14
100	11.4	160	17
125	12.0	163	22
150	12.6	165	28
200	13.8	170	40
250	15.0	175	55
300	16.2	180	71
350	17.5	185	90
400	18.6	190	110
450	19.8	195	133
500	21.1	200	159
600	23.5	210	216



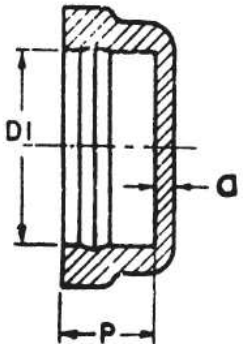
$e = \frac{14}{12}(7 + 0.02\,DN)$

$l = 150 + 0.1\,DN$

Table 2.8 Cap

(*Ref: Table 18 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	a	P	Mass (Approx.) Kg.
(1)	**(2)**	**(3)**	**(4)**
80	21	84	7
100	22	88	9
125	22.5	91	12
150	23	94	15
200	24.5	100	24
250	26	103	34
300	27.5	105	46
350	29	107	61
400	30	110	77
450	31.5	112	97
500	33	115	118
600	36	120	171



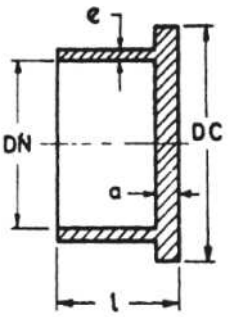
$a = 19 + 0.028\,DN$

Note: Beyond the nominal dia. 300 mm the caps may be ribbed and strengthened, if desired.

Table 2.9 Plugs

(*Ref: Table 19 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	DC	e	a	l	Mass (Approx.) Kg.
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
80	104	10.0	21	125	3
100	124	10.5	22	130	4
125	150	11.1	22.5	135	6
150	176	11.7	23	140	9
200	228	12.8	24.5	150	14
250	281	14.0	26	155	22
300	333	15.2	27.5	160	30
350	385	16.3	29	165	41
400	436	17.5	30	170	54
450	487	18.7	31.5	175	69
500	539	19.8	33	180	86
600	642	22.2	36	185	127



$e = \frac{14}{12}(7 + 0.02\,DN)$

$a = (19 + 0.028\,DN)$

Table 2.10 Bell Mouth Pieces
(*Ref: Table 20 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	Big End Dia (Dl)	h	Mass (Approx.) Kg.
(1)	(2)	(3)	(4)
80	125	100	7
100	150	150	9
125	175	150	12
150	200	150	15
200	285	200	23
250	350	200	31
300	450	250	45
350	525	250	58
400	600	300	80
450	650	300	93
500	750	350	120
600	900	410	201

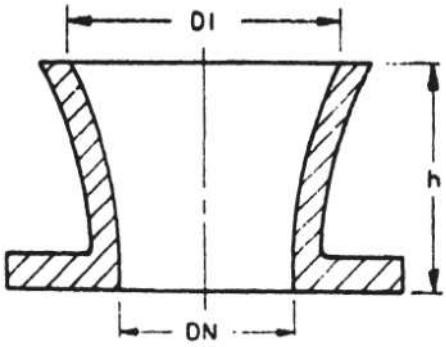
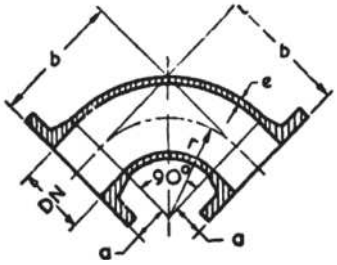


Table 2.11 Double Flanged ¼ Bends
(*Ref: Table 21of IS 1538:1993 (2018)*)

Nominal Dia (DN)	e	r	a	b	Mass (Approx.) Kg.
(1)	(2)	(3)	(4)	(5)	(6)
80	10.0	137	43	180	13
100	10.5	155	45	200	17
125	11.1	177.5	47.5	225	23
150	11.7	200	50	250	31
200	12.8	245	55	300	49
250	14.0	290	60	350	72
300	15.2	335	65	400	100
350	16.3	380	70	450	137
400	17.5	425	75	500	181
450	18.7	470	80	550	226
500	19.8	515	85	600	290
600	22.2	605	95	700	442

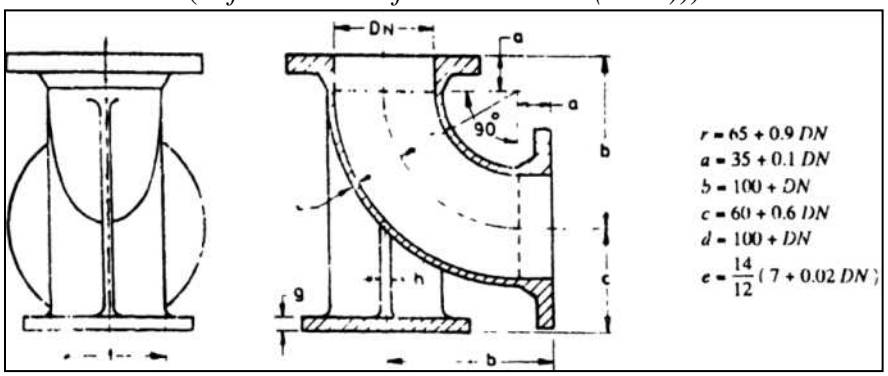


$r = 65 + 0.9\,DN$
$a = 35 + 0.1\,DN$
$b = 100 + DN$
$e = \frac{14}{12}(7 + 0.02\,DN)$

Note: The fitting may also be supplied with a raised flange. For details of the raised flange, see **Table-2.3**.

Table 2.12 Double Flanged ¼ Duckfoot Bends

(*Ref: Table 22 of IS 1538:1993 (2018)*))



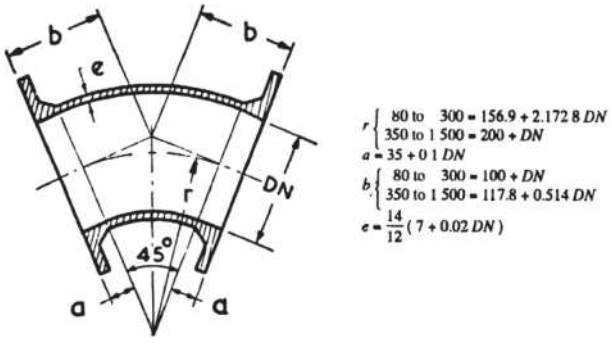
Nominal Dia (DN)	e	r	a	b	c	a	f	g	h	Mass (Approx.) Kg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
80	10.0	137	43	180	108	180	98	19	15	21
100	10.5	155	45	200	120	200	118	20	16	26
125	11.1	177.5	47.5	225	135	225	144	22	16	36
150	11.7	200	50	250	150	250	170	22	17	47
200	12.8	245	55	300	180	300	222	25	18	74
250	14.0	290	60	350	210	350	274	26	19	111
300	15.2	335	65	400	240	400	326	26	20	156
350	16.3	380	70	450	270	450	400	28	21	214
400	17.5	425	75	500	300	500	450	30	23	281
450	18.7	470	80	550	330	550	500	30	24	350
500	19.8	515	85	600	360	600	550	31	25	446
600	22.2	605	95	700	420	700	650	35	27	677

Note: The fitting may also be supplied with a raised flange. For details of the raised flange, see **Table-2.3**.

Table 2.13 Double Flanged ¼ Bends

(*Ref: Table 23 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	e	r	a	l	Mass (Approx.) Kg.
(1)	(2)	(3)	(4)	(5)	(6)
80	10.0	331	43	180	14
100	10.5	374	45	200	18
125	11.1	429	47.5	225	25
150	11.7	483	50	250	34
200	12.8	591	55	300	54
250	14.0	700	60	350	80

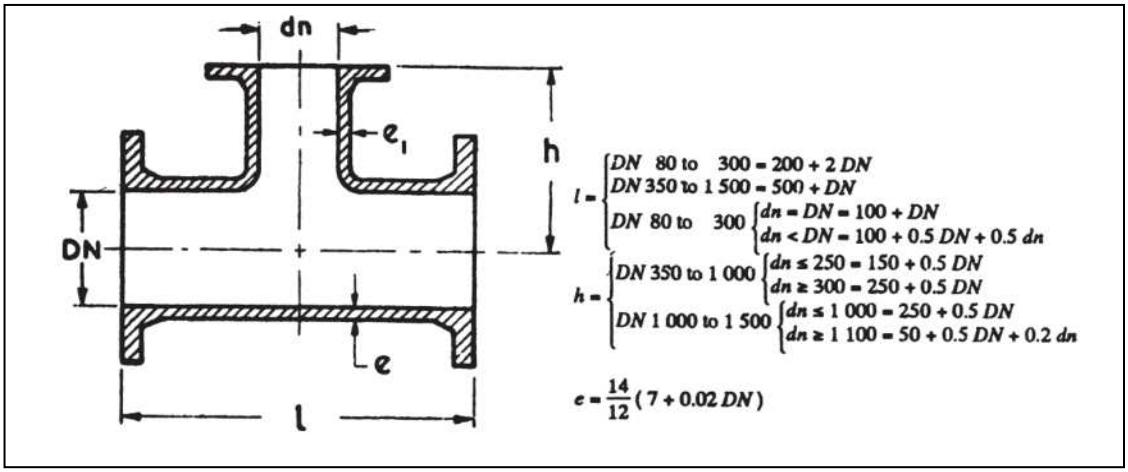


300	15.2	809	65	400	112	
350	16.3	550	70	298	115	
400	17.5	600	75	324	149	
450	18.7	650	80	349	185	
500	19.8	700	85	375	231	
600	22.2	800	95	426	342	

Note: The fitting also be supplied with a raised flange. For details of the raised flange, see **Table-2.3**

Table 2.14 All Flanged Tees

(*Ref: Table 24 of IS 1538:1993 (2018)*)



Body			Branch			Mass (Approx.) Kg.
Nominal Dia (DN)	e	l	Nominal Dia (dn)	e_1	h	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
80	10.0	360	80	10.0	180	21
100	10.5	400	80	10.5	190	25
	10.5	400	100	10.5	200	26
125	11.1	450	80	11.1	202.5	32
	11.1	450	100	11.1	212.5	34
	11.1	450	125	11.1	225	36
150	11.7	500	80	11.7	215	41
	11.7	500	100	11.7	225	42
	11.7	500	125	11.7	237.5	45
	11.7	500	150	11.7	250	47
200	12.8	600	80	12.8	240	62
	12.8	600	100	12.8	250	63
	12.8	600	125	12.8	262.5	66
	12.8	600	150	12.8	275	68
	12.8	600	200	12.8	300	74

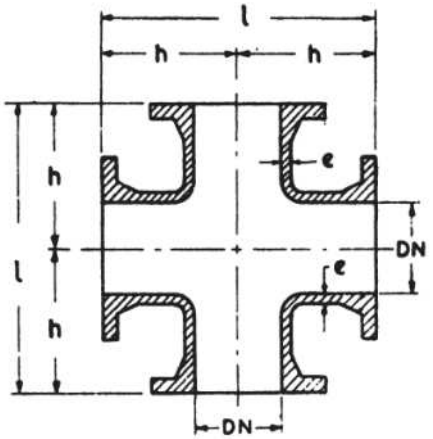
250	14.0	700	80	13.0	265	89
	14.0	700	100	13.5	275	90
	14.0	700	125	14.0	287.5	93
	14.0	700	150	14.0	300	96
	14.0	700	200	14.0	325	102
	14.0	700	250	14.0	350	109
300	15.2	800	80	13.0	290	122
	15.2	800	100	13.5	300	124
	15.2	800	125	14.5	312.5	126
	15.2	800	150	15.0	325	129
	15.2	800	200	15.2	350	136
	15.2	800	250	15.2	370	143
	15.2	800	300	15.2	400	151
350	16.3	850	200	16.3	325	169
	16.3	850	250	16.3	325	173
	16.3	850	300	16.3	425	88
	16.3	850	350	16.3	425	195
400	17.5	900	200	16.5	350	211
	17.5	900	250	17.5	350	215
	17.5	900	300	17.5	450	232
	17.5	900	350	17.5	450	239
	17.5	900	400	17.5	450	246
450	18.7	950	250	18.0	375	260
	18.7	950	300	18.7	475	277
	18.7	950	350	18.7	475	284
	18.7	950	400	18.7	475	290
	18.7	950	450	18.7	475	296
500	19.8	1000	250	18.0	400	315
	19.8	1000	300	19.5	500	334
	19.8	1000	350	19.8	500	342
	19.8	1000	400	19.8	500	349
	19.8	1000	450	19.8	500	356
	19.8	1000	500	19.8	500	363
600	22.2	1100	300	19.5	550	466
	22.2	1100	350	21.0	550	475
	22.2	1100	400	22.2	550	485
	22.2	1100	450	22.2	550	492
	22.2	1100	500	22.2	550	499
	22.2	1100	600	22.2	550	516

Note: The fitting may also be supplied with a raised flange. For details of the raised flange, see **Table-2.3**.

Table 2.15 All Flanged Crosses

(*Ref: Table 25 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	e	l	h	Mass (Approx.) Kg.
(1)	(2)	(3)	(4)	(5)
80	10.0	360	180	27
100	10.5	400	200	34
125	11.1	450	225	46
150	11.7	500	250	60
200	12.8	600	300	93
250	14.0	700	350	35
300	15.2	800	400	180



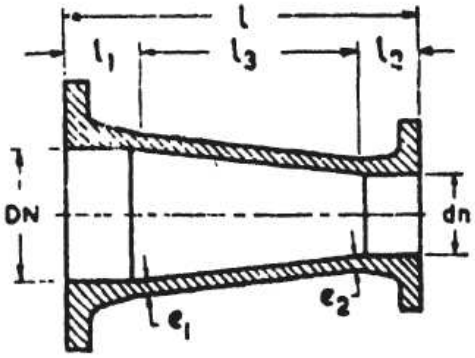
$l = 200 + 2\,DN$

$h = 100 + DN$

$e = \frac{14}{12}(7 + 0.02\,DN)$

Table 2.16 Double Flange tappers

(*Ref: Table 26 of IS 1538:1993 (2018)*)



$l_1 = 35 + 0.1\,DN$

$l_2 = 35 + 0.1\,DN$

$e_1 = \frac{14}{12}(7 + 0.02\,DN)$

$e_2 = \frac{14}{12}(7 + 0.02\,dn)$

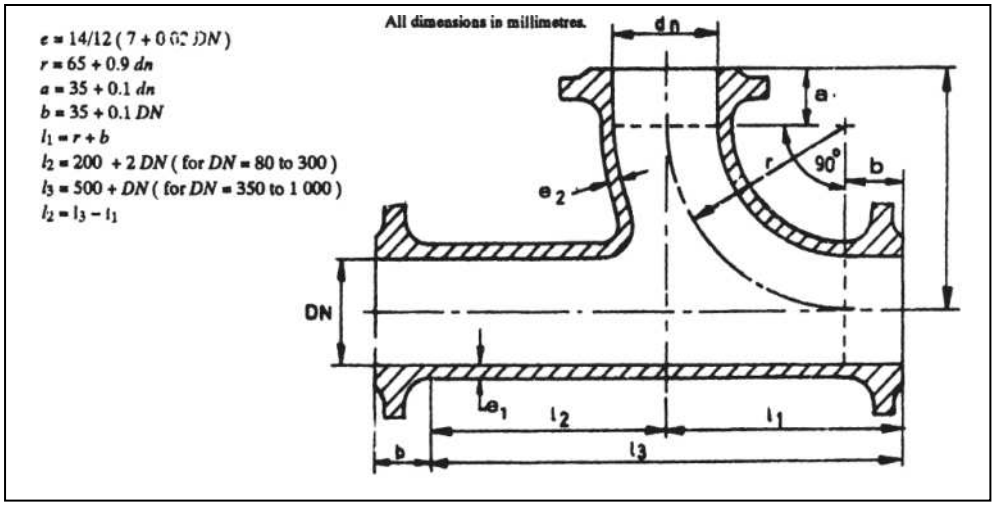
Large Diameter			Small Diameter			l_3	l	Mass (Approx.) Kg.
Nominal Dia(DN)	e_1	l_1	Nominal Dia (dn)	e_2	l_2			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
100	10.5	45	80	10.0	43	112	200	12
125	11.1	47.5	80	10.0	43	309.5	400	20
	11.1	47.5	100	10.5	45	307.5	400	22
150	11.7	50	80	10.0	43	307	400	23
	11.7	50	100	10.5	45	305	400	25
	11.7	50	125	11.1	47.5	302.5	400	27

200	12.8	55	100	10.5	45	300	400	31
	12.8	55	125	11.1	47.5	297.5	400	34
	12.8	55	150	11.7	50	295	400	37
250	14.0	60	125	11.1	47.5	292.5	400	41
	14.0	60	150	11.7	50	290	400	44
	14.0	60	200	12.8	55	285	400	50
300	15.2	65	150	11.7	50	285	400	51
	15.2	65	200	12.8	55	280	400	58
	15.2	65	250	14.0	60	275	400	65
350	16.3	70	200	12.8	55	475	600	87
	16.3	70	250	14.0	60	470	600	96
	16.3	70	300	15.2	65	465	600	106
400	17.5	75	250	14.0	60	465	600	109
	17.5	75	300	15.2	65	460	600	120
	17.5	75	350	16.3	70	455	600	132
450	18.7	80	300	15.2	65	455	600	130
	18.7	80	350	16.5	70	450	600	145
	18.7	80	400	17.5	75	445	600	158
500	19.8	85	350	16.3	70	445	600	160
	19.8	85	400	17.5	75	440	600	174
	19.8	85	450	18.7	80	435	600	186
600	22.2	95	400	17.5	75	430	600	210
	22.2	95	450	18.7	80	425	600	222
	22.2	95	500	19.8	85	420	600	239

Note: The fitting may also be supplied with a raised flange. For details of the raised flange, see **Table-2.3.**

Table 2.17 All Flanged Radial Tees

(*Ref: Table 27 of IS 1538:1993 (2018)*)

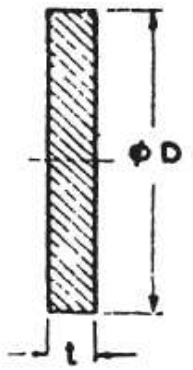


Nominal Dia		Body				Branch				Mass
(DN)	(dn)	e_1	b	l_3	l_2	e_2	r	a	l_1	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
80	80	10.0	43	360	180	10.0	137	43	180	80
100	80	10.5	45	400	218	10.5	137	43	182	80
125	100	11.1	47	450	248	11.1	155	45	202	100
150	100	11.7	50	500	295	11.7	155	45	205	100
200	100	12.8	55	600	390	12.8	155	45	210	100
250	150	14.0	60	700	440	14.0	200	50	260	150
300	150	15.2	65	800	535	15.2	200	50	265	150
350	200	16.3	70	850	535	16.3	245	55	315	200
400	200	17.5	75	900	580	16.5	245	55	320	200
450	300	18.7	80	950	535	17.5	335	65	415	300
500	400	19.8	85	1000	490	19.8	425	75	510	400
600	400	22.2	95	1100	580	22.2	425	75	520	400

Table 2.18 Blank Flanges

(*Ref: Table 28 of IS 1538:1993 (2018)*)

Nominal Dia (DN)	D	t	Mass (Approx.) Kg.
(1)	(2)	(3)	(4)
80	200	21	5
100	220	22	6
125	250	22.5	8
150	285	23	11
200	340	24.5	16
250	395	26	23
300	445	27.5	32
350	505	29	43
400	565	30	55
450	615	31.5	67
500	670	33	85
600	780	36	126



Notes:

1. Beyond the nominal dia 300 mm, the flanges may be ribbed and strengthened, if desired.
2. The fitting may also be supplied with a raised flange. For details of the raised flange, see **Table-2.3**.

2.2 Cast Iron Special castings to be used with Cast Iron/ Ductile Iron water supply pipes as per IS: 13382-2018

Requirements for cast iron special castings to be used with cast iron and ductile iron pressure pipes for carrying water, and sewage for sizes from DN 80 mm up to DN 1600 mm conforms to the Indian standard 13382:2018.

2.2.1 Codal Requirements For Cast Iron Fittings conforming to IS 13382:2018: The codal requirement of cast iron fittings are tabulated as follows-

SN	Test	Requirement	Remarks
(1)	**(2)**	**(3)**	**(4)**
1.	Metal used for the manufacture of fittings	The metal used for the manufacture of casting shall conform to the appropriate grade as specified in IS 210,	
2.	Requirement of Dimensional	Table No 2.23 to 2.44	
3.	Tolerances in Dimensions	Refer clause 2.2.2 & Table No. 2.21 &2.22	
4.	Requirement of external diameter and wall thickness	Refer table No.2.20	
5	Mechanical tests for tensile strength	(minimum)150 MPa (N/mm2)	To be carried out during manufacture
6	Brinell hardness Test	Not to exceed 210 HBS.	To be done on the external un-machined surface
7	Hydrostatic tests (Test pressure in Table 2.19	Should withstand the pressure test without showing any leakage, sweating or other defect of any kind.	The hydrostatic test shall be conducted before coating the fittings.

- The castings shall be such that they could be cut, drilled or machined. The castings may be accepted provided hardness measured on the external un-machined surface does not exceed 210 HBW.
- any one of the following coatings may be applied depending up on the external condition of use:
  a) Bituminous paint;
  b) Synthetic enamel paint /epoxy coating; and
  c) Fusion bonded epoxy coating
- When the fittings are 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 whatsoever to the potable water after sterilization and suitable washing of the mains.
- Any one of the following linings may be applied depending on the internal conditions of use:
  a) Bituminous paint;
  b) Portland cement mortar;
  c) Blast furnace slag cement mortar;
  d) Sulphate resistant cement mortar;
  e) High alumina cement mortar;
  f) Synthetic paint / epoxy coating; and
  g) Fusion bonded epoxy coating.

2.2.2 Marking:

- Each casting shall be cast, stamped or indelibly painted on it the following:
- Manufacturer's name, initials or identification mark;
- The nominal diameter;
- The last two digits of the year of manufacture; and
- Any other mark required by the purchaser.
- Marking may be done on the barrel of castings or on the outside of the sockets.

Table 2.19 Hydrostatic Test Pressure for Castings

(*Ref: Table 2 of IS 13382:2018)*

Nominal Diameter (DN)	Test Pressure	
	Castings without Branches or with Branches not Greater than Half the Principal Dia	Castings with Branches Greater than Half the Principal Diameter
mm	MPa	MPa
(1)	(2)	(3)
Up to and including 300	2.5	2.5
Over 300 and up to and including 600	2.0	2.0
Over 600 and up to and including 1600	1.5	1.0

Note: The works hydrostatic test pressure of fittings is less than the allowable pressures for operation at site because the shape of the fittings makes it difficult to provide sufficient restraint to high internal pressure during the test.

Table 2.20 External Diameter Wall Thickness and Operating Pressures of Fittings

(*Ref: Table 1 of IS 13382:2018)*

Nominal Diameter (DN)	Thickness (e)	External Diameter of Fittings (DE)	Allowable Operating Pressure in Bars	Maximum Allowable Operating Pressure with Surge in Bars	Allowable Maximum Site Test Pressure in Bars
(1)	(2)	(3)	(4)	(5)	(6)
80	10.0	98	40	48	53
100	10.5	118			
125	11.1	144			
150	11.7	170			
200	12.8	222			
250	14.0	274	30	36	41
300	15.2	326			
350	16.3	378			

400	17.5	429	25	30	35
450	18.7	480			
500	19.8	532			
600	22.2	635			

2.2.3 Tolerances

a) Tolerances for various dimensions of flanges should be as given in **Table 2.21.**

Table 2.21 Tolerances on Dimensions of Flanges

(*Ref: Table 3 of IS 13382:2018)*

SN.	Description	Nominal Diameter DN (mm)	Tolerances (mm)
(1)	**(2)**	**(3)**	**(4)**
i)	D (as cast)	Up to 250	+3.0, –1.0
ii)	D (as cast)	Above 250	+5.0, –1.5
iii)	C	Up to 250	± 1.0
iv)	C	Above 250	± 1.5

b) Tolerances on Thickness: Tolerances on wall thickness and flange thickness of fittings are limited as follows:

Parameters	Tolerances (in mm)
Wall thickness (e)	– (2 + 0.05e) [No limit for plus tolerance is specified]
Flange Thickness (b)	± (3 + 0.05b)

Where,

e = standard thickness of the wall in millimeters, and

b = standard thickness of the flanges in millimeters.

c) Tolerances on Lengths: The permissible deviations on the standard working lengths of fittings with sockets and fittings with flanges are given in **Table 2.22** below:

Table 2.22 Tolerance

(*Ref: Table 4 of IS 13382:2018)*

SN	Type of Fitting	Lengths	Deviation/Tolerance (mm)
(1)	**(2)**	**(3)**	**(4)**
i)	Flanged Socket Flanged Spigot Collar and Taper	L/L_1	DN 80 to 1200 : ± 25 DN 1400 to 1600 : ± 35
ii)	Bend 90°	L/L_1	± (15 + 0.03 DN)
iii)	Bend 45°	L/L_1	± (10 + 0.025 DN)

iv)	Bend 22½ and 11¼	L/L_1	DN 80 to DN 1000 : ± (10 + 0.02 DN) DN 1200 to 1600 : ± (10 + 0.025 DN)
v)	For Bends	R	± (10 + 0.025 DN)
vi)	Tee	L/L_1 and h/h_1	DN 80 to 1200 : + 50, –25 DN 1400 to 1600 : + 75, –35

d) Tolerance on Barrels: The external diameter of barrels of all fittings including flanged spigot (DE) will be ± (4.5 + 0.001DN).

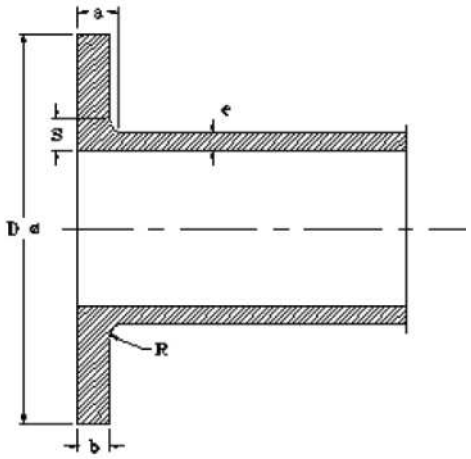
Where, DN = Nominal Diameter of fitting.

2.2.4 Special Castings: Special castings of the following types with their ends either socketed (for mechanical joints or push-on joints) or flanged shall conform to the dimensions as relevant to those given in Tables mentioned below against each type. Tolerances shall be as per 2.2.2

Table (2.23) Dimensions of Flanges of Fittings

(*Ref: Table 6 of IS 13382:2018)*

Nominal Diameter, DN		Type A			
	D	a	b	S	R
(1)	(2)	(3)	(4)	(5)	(6)
80	200	19	16	15	6
100	220	19	16	15	6
125	250	19	16	15	7
150	285	19	16	15	8
200	340	20	17	16	8
250	395	22	19	17.5	10
300	445	24.5	20.5	19.5	10
350	505	24.5	20.5	19.5	10
400	565	24.5	20.5	19.5	10
450	615	25.5	21.5	20.5	12
500	670	26.5	22.5	21	12
600	780	30	25	24	12

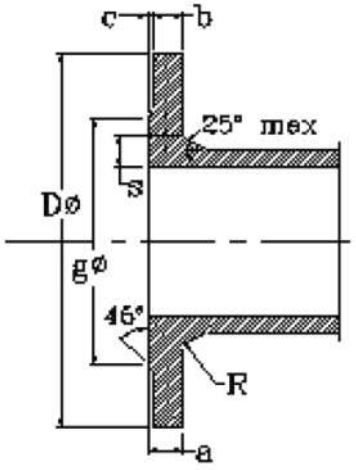


Note: Thickness ‘e’ is equal to the thickness of fitting comprising the flange and not to exceed value of ‘s’

Table 2.24 Dimensions of Raised Flanges

(*Ref: Table 7 of IS 13382:2018)*

Nominal Diameter, DN	D	c	R	Type A			
				g	a	b	s
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80	200	3	6	132	19	16	15
100	220	3	6	156	19	16	15
125	250	3	7	183	19	16	15
150	285	3	8	211	19	16	15
200	340	3	8	266	20	17	16
250	395	3	10	319	22	19	17.5
300	445	4	10	370	24.5	20.5	19.5
350	505	4	10	429	24.5	20.5	19.5
400	565	4	10	480	24.5	20.5	19.5
450	615	4	12	530	25.5	21.5	20.5
500	780	4	12	582	26.5	22.5	21
600	780	5	12	682	30	25	24

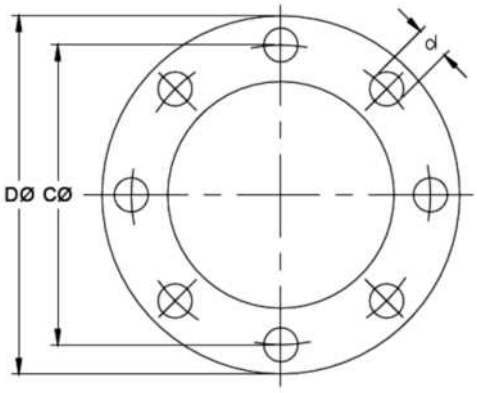


Note: Thickness ‘e’ is equal to the thickness of fitting comprising the flange and not to exceed value of ‘s’.

Table 2.25 Standard Flange Drilling of Flanged Fittings

(*Ref: Table 8 of IS 13382:2018)*

Nominal Diameter DN	D	C	Holes		Dia. of Bolts
			Nos.	Dia. (d)	
(1)	(2)	(3)	(4)	(5)	(6)
80	200	160	4	19	16
100	220	180	8	19	16
125	250	210	8	19	16
150	285	240	8	23	20
200	340	295	8	23	20
250	395	350	12	23	20
300	445	400	12	23	20
350	505	460	16	23	20
400	565	515	16	28	24
450	615	565	20	28	24
500	670	620	20	28	24
600	780	725	20	31	27

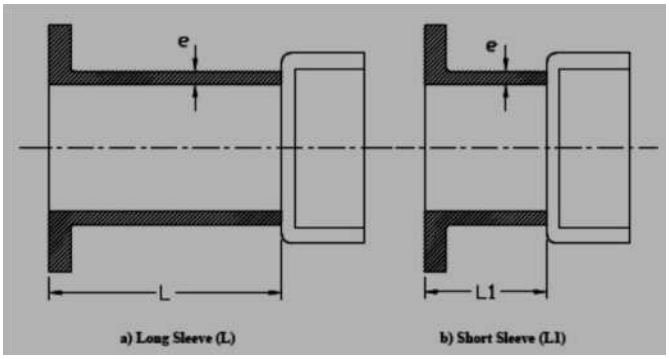


Note: Holes drilled off centered unless otherwise specified.

Table 2.26 Flanged Sockets

(*Ref: Table 9 of IS 13382:2018)*

Nominal Diameter DN	e	Long Sleeve	Short Sleeve
		L	L_1
(1)	(2)	(3)	(4)
80	10.0	150	100
100	10.5	150	100
125	11.1	150	100
150	11.7	150	125
200	12.8	150	125
250	14.0	300	150
300	15.2	300	150
350	16.3	300	150
400	17.5	300	150
450	18.7	300	150
500	19.8	300	200
600	22.2	300	200

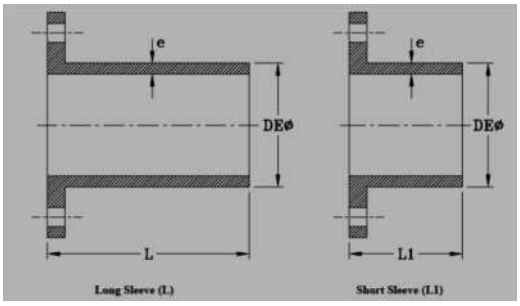


Note: The castings may be supplied with a plain or raised flange.

Table 2.27 Flanged Spigot

(*Ref: Table 10 of IS 13382:2018)*

Nominal Diameter, DN	e	DE (External Diameter of Spigot)	TYPE A	TYPE B
			L_1	L
(1)	(2)	(3)	(4)	(5)
80	10.0	98	180	400
100	10.5	118	190	400
125	11.1	144	195	400
150	11.7	170	200	400
200	12.8	222	210	500
250	14.0	274	220	500
300	15.2	326	230	500
350	16.3	378	240	500
400	17.5	429	250	500
450	18.7	480	260	500
500	19.8	532	270	500
600	22.2	635	280	600

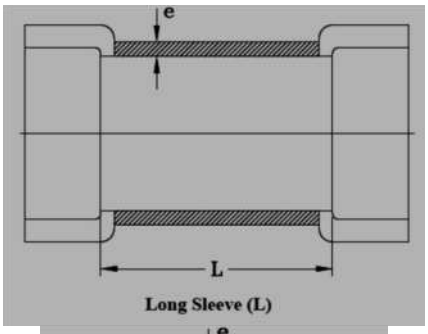


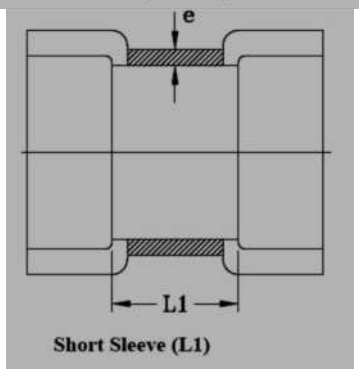
Note: The castings may be supplied with a plain or raised flange

Table 2.28 Collar

(*Ref: Table 11 of IS 13382:2018)*

Nominal Diameter DN	e	Short Sleeve	Long Sleeve	
			TYPE A	TYPE B
		L_1	L	L
(1)	(2)	(3)	(4)	(5)
80	10.9	100	300	158
100	11.4	100	300	160
125	12.0	100	300	163
150	12.6	100	300	165
200	13.8	100	300	170
250	15.0	125	300	175
300	16.2	125	300	180
350	17.5	150	400	185
400	18.6	150	400	190
450	19.8	150	400	195
500	21.1	200	400	200
600	23.5	200	400	210



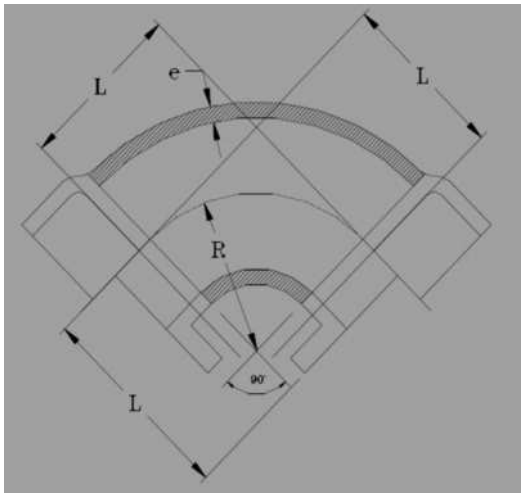


Note: Collars will be available with mechanical and push on Joint

Table 2.29 Double Socket and Double Flanged 90° Bends

(***Ref: Table 12 of IS 13382:2018)***

DN	e	Type A		
		R	L	
		(approx)	Double Socket	Double Flanged
(1)	(2)	(3)	(4)	(5)
80	10	85	110	155
100	10.5	105	130	175
125	11.1	130	155	205
150	11.7	155	180	230
200	12.8	205	230	280
250	14	255	280	335
300	15.2	300	325	385
350	16.3	350	380	440
400	17.5	400	430	495



450	18.7	445	480	545	
500	19.8	495	530	600	
600	22.2	590	630	705	

Table 2.30 Double Socket and Double Flanged 45° Bends

(*Ref: Table 13 of IS 13382:2018)*

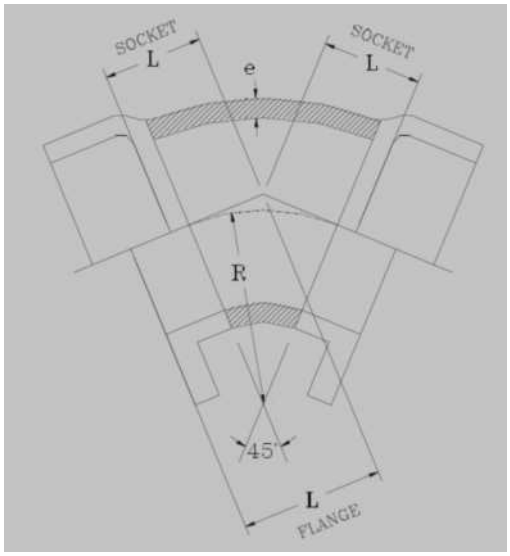
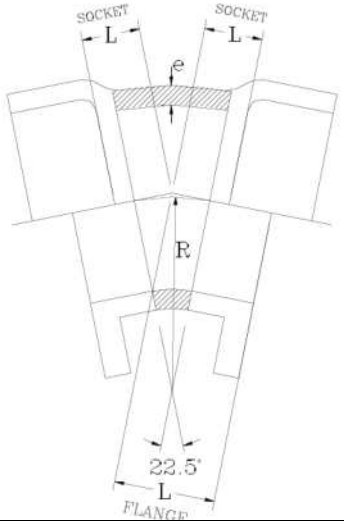
Nominal Diameter DN	e	Type A			
		R (Approx.)	L		
			Double Socket	Double Flanged	
(1)	(2)	(3)	(4)	(5)	
80	10	85	60	105	
100	10.5	110	70	115	
125	11.1	135	80	130	
150	11.7	155	90	140	
200	12.8	215	115	165	
250	14	265	135	190	
300	15.2	315	155	215	
350	16.3	360	180	240	
400	17.5	410	200	265	
450	18.7	445	220	285	
500	19.8	495	240	310	
600	22.2	590	285	360	

Table 2.31 Double Socket and Double Flanged 22½° Bends

(*Ref: Table 14 of IS 13382:2018)*

Nominal Diameter DN	e	R	L		
		(Approx.)	Double Socket	Double Flanged	
(1)	(2)	(3)	(4)	(5)	
80	10	75	40	85	
100	10.5	100	45	90	
125	11.1	125	50	95	
150	11.7	150	55	105	
200	12.8	225	70	120	
250	14	275	80	135	
300	15.2	325	90	150	
350	16.3	375	105	165	

400	17.5	400	120	175	
450	18.7	450	125	190	
500	19.8	505	135	205	
600	22.2	605	160	235	

Table 2.32 Double Socket and Double Flanged 11¼° Bends

(*Ref: Table 15 of IS 13382:2018)*

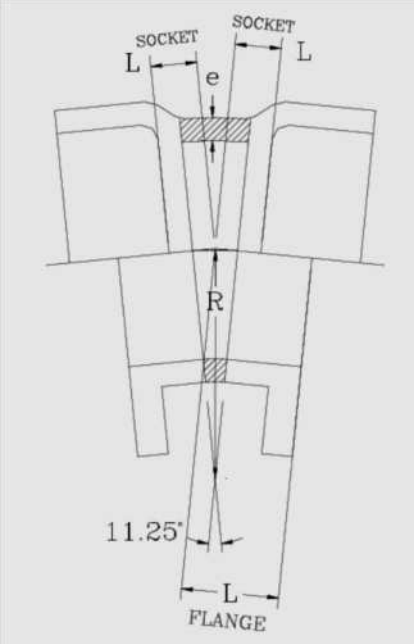
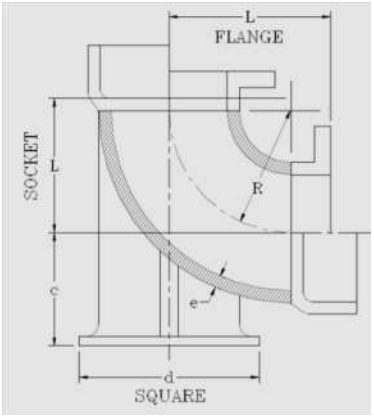
Nominal Diameter DN	e	R	L		
		(Approx.)	Double Socket	Double Flanged	
(1)	(2)	(3)	(4)	(5)	
80	10	50	30	75	
100	10.5	100	35	80	
125	11.1	125	38	85	
150	11.7	150	40	90	
200	12.8	255	50	100	
250	14	305	55	110	
300	15.2	355	60	120	
350	16.3	405	70	130	
400	17.5	455	75	140	
450	18.7	455	80	145	
500	19.8	510	85	155	
600	22.2	610	100	175	

Table 2.33 Double Socket and Double Flanged 90° Duckfoot Bends

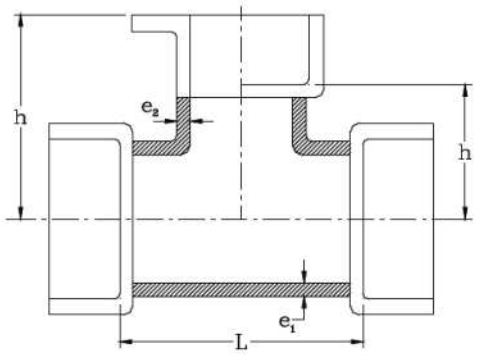
(*Ref: Table 16 of IS 13382:2018)*

Nominal Diameter DN	e	Type A					
		d	c	R (Approx.)	L		
					Double Socket	Double Flanged	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
80	10	180	110	85	110	155	
100	10.5	200	125	105	130	175	
125	11.1	225	140	130	155	200	
150	11.7	250	160	155	180	230	
200	12.8	300	190	205	230	280	
250	14	350	225	255	280	335	

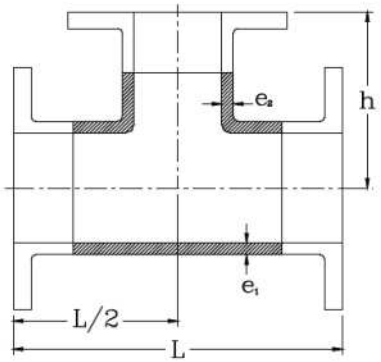
300	15.2	400	255	300	325	385	
350	16.3	450	290	350	380	440	
400	17.5	500	320	400	430	495	
450	18.7	550	355	445	480	545	
500	19.8	600	385	495	530	600	
600	22.2	700	450	590	630	705	

Table 2.34 All Socket Tee, Double Socket Branch Flanged Tee and All Flanged Tees

(*Ref: Table 17 of IS 13382:2018)*



All Socket & Double Socket Branch Flanged Tee



All Flanged Tee

Nominal Diameters		e_1	e_2	Type A					
				L			H		
Body, DN	Branch, dn			All Socket	All Flanged	Double Socket Br. Flanged	All Socket	All Flanged	Double Socket Br. Flanged
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
500	100	19.8	17.5	270	530	225	315	385	400
500	150	19.8	17.5	275	600	275	305	395	400
500	200	19.8	18	380	640	340	325	410	415
500	250	19.8	18	390	705	390	315	420	410
500	300	19.8	19.5	480	740	460	325	430	430
500	350	19.8	19.8	510	800	505	325	440	430
500	400	19.8	19.8	590	850	575	335	455	445
500	450	19.8	19.8	625	900	625	335	460	445
500	500	19.8	19.8	690	950	690	345	475	460
600	100	22.2	18	290	570	230	365	435	460
600	150	22.2	18.5	340	620	290	370	450	470
600	250	22.2	19	450	730	405	375	470	485

600	300	22.2	19.5	455	780	455	370	840	520
600	350	22.2	22.2	550	830	520	385	495	500
600	400	22.2	22.2	570	880	570	380	510	540
600	450	22.2	22.2	650	930	640	395	520	515
600	500	22.2	22.2	685	1010	685	390	530	560
600	600	22.2	22.2	810	1090	810	405	545	535

Table 2.35 Equal Crosses — All Sockets and All Flanges

(***Ref: Table 18 of IS 13382:2018)***

Nominal Diameter DN	e	L		h	
		All Socket	All Flanged	All Socket	All Flanged
(1)	(2)	(3)	(4)	(5)	(6)
80	10	212	360	106	180
100	10.5	240	400	120	200
125	11.1	275	450	137.5	225
150	11.7	310	500	155	250
200	12.8	380	600	190	300
250	14	450	700	225	350
300	15.2	520	800	260	400

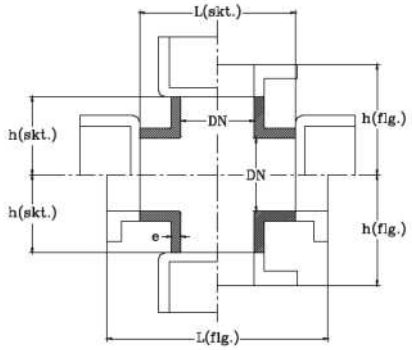
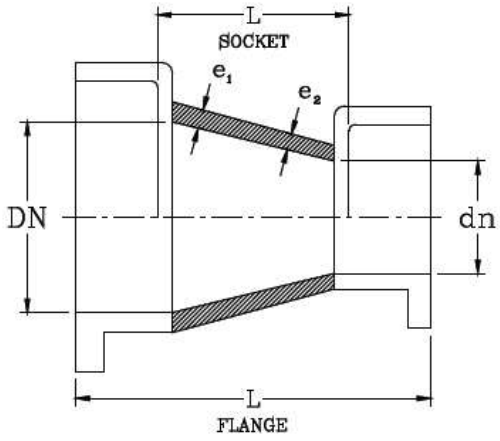


Table 2.36 Double Socket and Double Flanged Central Tapers

(*Ref: Table 19 of IS 13382:2018)*

Nominal Diameters		e_1	e_2	TYPE A	
				L	
DN	dn			Double Socket	Double Flanged
(1)	(2)	(3)	(4)	(5)	(6)
400	200	17.5	12.8	410	525
400	250	17.5	14	330	450
400	300	17.5	15.2	245	370
400	350	17.5	16.3	170	295
450	250	18.7	14	415	535
450	300	18.7	15.2	335	460
450	350	18.7	16.3	255	380
450	400	18.7	17.5	175	305
500	250	19.8	14	500	625
500	300	19.8	15.2	415	545

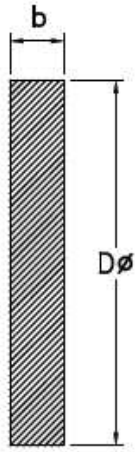


500	350	19.8	16.3	340	470	
500	400	19.8	17.5	255	390	
500	450	19.8	18.7	180	315	
600	300	22.2	15.2	585	720	
600	350	22.2	16.3	510	645	
600	400	22.2	17.5	425	565	
600	450	22.2	18.7	350	490	
600	500	22.2	19.8	265	410	

Table 2.37 Blank Flanges

(*Ref: Table 20 of IS 13382:2018)*

Nominal Diameter, DN	D	b
(1)	**(2)**	**(3)**
80	200	21
100	220	22
125	250	22.5
150	285	23
200	340	24.5
250	395	26
300	445	27.5
350	505	29
400	565	30
450	615	31.5
500	670	33
600	780	36

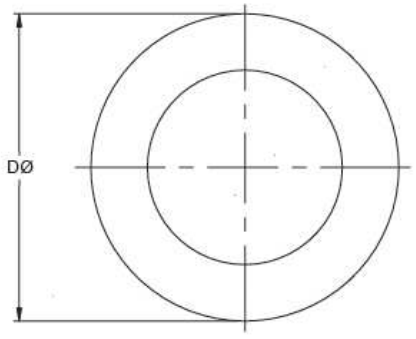


Note: Beyond the Nominal Diameter 300 mm, the flanges may be ribbed and strengthened, if desired.

Table 2.38 Puddle Flanges

(*Ref: Table 21 of IS 13382:2018)*

Nominal Diameter DN	Flange Outer Diameter D	Puddle Flange Thickness	
		PN 10	PN 16
(1)	**(2)**	**(3)**	**(4)**
80	200	19	20
100	220	19	20
150	285	19	20
200	340	20	20



250	400	22	22	
300	455	25	25	
350	505	25	27	
400	565	25	28	
450	615	26	30	
500	670	27	32	
600	780	30	36	

Table 2.39 Caps

(*Ref: Table 22 of IS 13382:2018)*

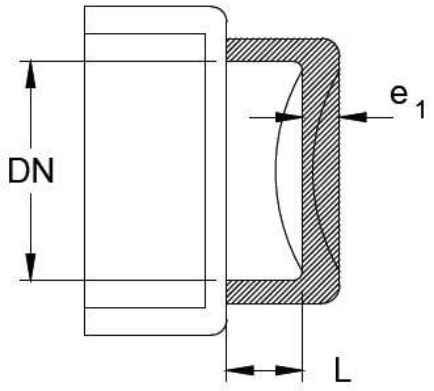
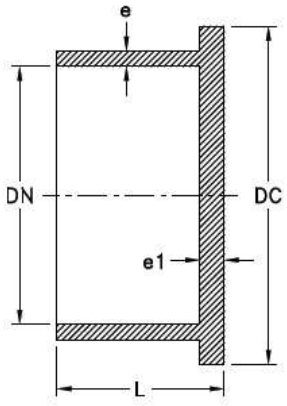
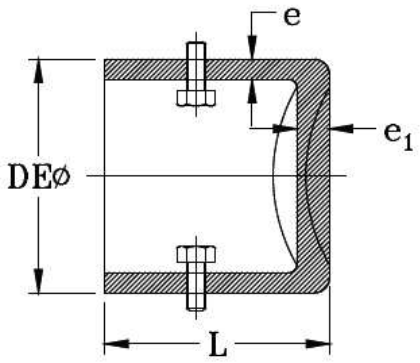
Nominal Diameter, DN	**e_1**	**L**	
(1)	**(2)**	**(3)**	
80	21	15	 $e_1 = 19 + 0.028$ DN
100	22	15	
125	22.5	15	
150	23	15	
200	24.5	20	
250	26	20	
300	27.5	30	
350	29	30	
400	30	30	
450	31.5	35	
500	33	35	
600	36	35	

Table 2.40 Plugs

(*Ref: Table 23of IS 13382:2018)*

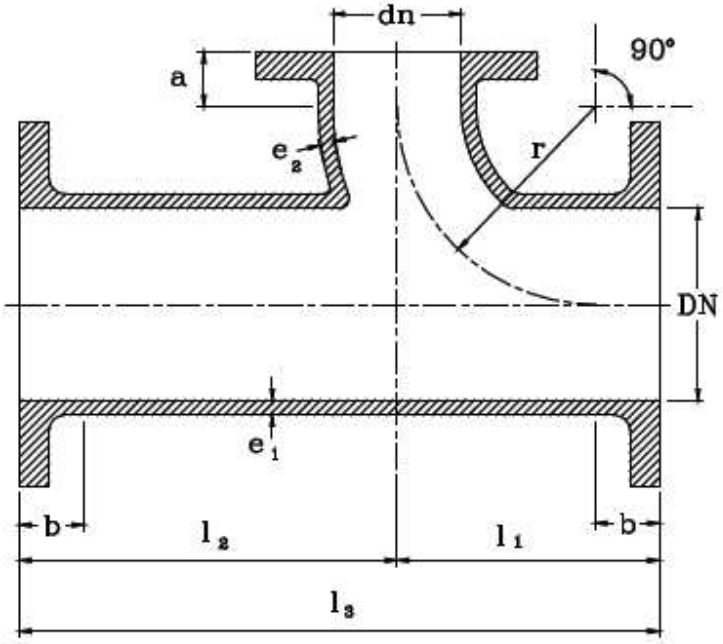




Nominal Diameter DN	DE	e	e_1	DC	L	
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	
80	98	10	21	104	125	e = 14/12(7+0.02DN) e_1 = 19 + 0.028 DN
100	118	10.5	22	124	130	
125	144	11.1	22.5	150	135	
150	170	11.7	23	176	140	
200	222	12.8	24.5	228	150	
250	274	14	26	281	155	
300	326	15.2	27.5	333	160	
350	378	16.3	29	385	165	
400	429	17.5	30	436	170	
450	480	18.7	31.5	487	175	
500	532	19.8	33	539	180	
600	635	22.2	36	642	185	

Table 2.41 All Flanged Radial Tees

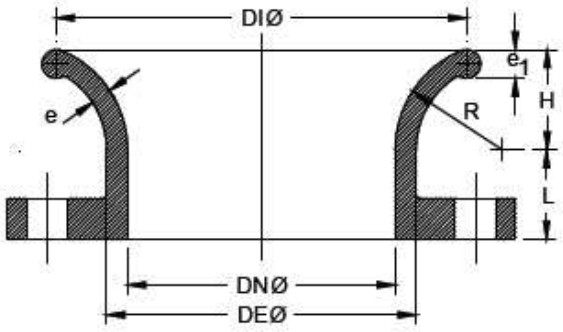
(*Ref: Table 24 of IS 13382:2018)*



Nominal Diameter		e_1	e_2	b	l_1	l_2	l_3	r	a	
Large DN					Small dn					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
80	80	10.0	10.0	43	180	180	360	137	43	e = 14/12 (7 + 0.02DN) r = 65 + 0.9 dn a = 35 + 0.1 dn b = 35 + 0.1 DN l_1 = r + b l_3 = 200 + 2DN (for DN = 80 to 300) l_3 = 500 + DN (for DN = 350 to 1000) $l_2 = l_3 - l_1$
100	80	10.5	10.5	45	182	218	400	137	43	
125	100	11.1	11.1	47	202	248	450	155	45	
150	100	11.7	11.7	50	205	295	500	155	45	
200	100	12.8	12.8	55	210	390	600	155	45	
250	150	14.0	14.0	60	260	440	700	200	50	
300	150	15.2	15.0	65	265	535	800	200	50	
350	200	16.3	16.3	70	315	535	850	245	55	
400	200	17.5	16.5	75	320	580	900	245	55	
450	300	18.7	17.5	80	415	535	950	335	65	
500	400	19.8	19.8	85	510	490	1000	425	75	
600	400	22.2	22.2	95	520	580	1100	425	75	

Table 2.42 Flanged Bell mouth

(*Ref: Table 25of IS 13382:2018)*



Tolerances on L and H : ± 5.0 mm

Nominal Diameter, DN	DE	e	TYPE A				
			e_1	DI	R	L	H
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80	98	10	14	125	37.3	50	30
100	118	10.5	14	150	47.3	50	40
125	144	11.1	15	175	52.2	50	50
150	170	11.7	16	230	60.1	50	56

200	222	12.8	16	300	81.5	50	75
250	274	14	17	375	103.7	50	95
300	326	15.2	18	450	118.4	60	110
350	378	16.3	19	530	139.2	60	130
400	429	17.5	20	600	162.8	60	150
450	480	18.7	21	680	183.6	70	170
500	532	19.8	23	750	207.6	70	190
600	635	22.2	25	900	252.4	80	230

Table 2.43Hat Flanged for Air Valve and Hydrant

(*Ref: Table 26 of IS 13382:2018)*

Nominal Diameter		e_1	e_2	H	R_1	R_2
Body DN	Opening dn					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
350	100	16.3	11	200	80	350
400	100	17.5	11	200	80	400
450	100	18.7	11	225	80	450
450	150	18.7	14	225	100	450
500	100	19.8	11	225	80	500
500	150	19.8	14	225	100	500
600	100	22.2	11	240	80	600
600	150	22.2	14	240	100	600

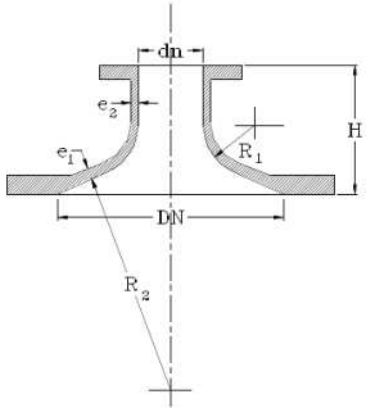
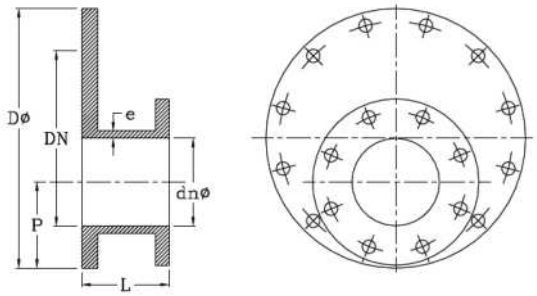


Table 2.44 Flanged Outlets for Washouts

(*Ref: Table 27 of IS 13382:2018)*

Nominal Diameter		e	D	L	P
Body DN	Branch dn				
(1)	(2)	(3)	(4)	(5)	(6)
300	150	12.6	445	150	147.5
350	150	12.6	505	150	152.5
400	200	13.8	565	200	182.5
450	200	13.8	615	200	182.5
500	200	13.8	670	200	185.0
600	200	13.8	780	200	190.0



**

Chapter-3

Ductile Iron Fittings

3.0 Ductile Iron Pipe

Ductile iron pipe is pipe made of ductile cast iron commonly used for potable water transmission and distribution. Ductile iron is a type of iron used for pipes, in which graphite is present primarily in spheroidal or nodular form

The requirements for ductile iron pipes are covered in IS 8329:1990. The requirements for ductile iron fittings for water supply pipes are covered in IS 9523: 1980 Fittings conforming to IS 13382:2018 may also be used with ductile iron pipes, when the pressure requirement matches.

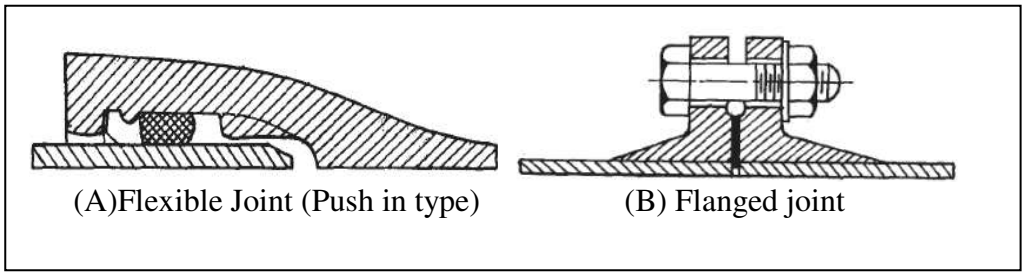
3.1 Joints and Jointing of Ductile Iron Pipes: Two main types of joints are used with ductile iron pipes and fittings:

a) Socket and spigot flexible joints:
   1) Push on joints; and
   2) Mechanical joints.
b) Rigid flanged joint.

3.1.1 Flexible Joint: The spigot and socket flexible joint should be designed to permit angular deflection in direction and axial movement to compensate for ground movement and thermal expansion and contraction. They incorporate gasket of elastomeric materials and the joints may be of the simple push-on-type or the type where the seal is effected by the compression of a rubber gasket between a seating on the inside of the socket and the external surface of spigot. Joints of the latter type are referred to as mechanical joints.

Both push-in (Fig. A) and mechanical joints are flexible joints. Flexible joints require to be externally anchored at all changes in direction such as at bends, etc, and at blank end to resist the thrust created by internal pressure and to prevent the withdrawal of spigots.

3.1.2 Flanged Joint: Flanged joints are made on pipes having a machined flange at each end of the pipe. The seal is usually effected by means of a flat rubber gasket compressed between two flanges by means of bolts which also serve to connect the pipe rigidly (see Fig. B). Gaskets of other materials, both metallic and non-metallic, are used for special applications.



(A)Flexible Joint (Push in type) (B) Flanged joint

Since only K-12 class DI specials for push-on & mechanical jointing are there in IRUSSOR & DSR, only these fittings for up to 1000 mm dia. size have been discussed further. For more details concerned code may be referred at.

3.2 Codal Requirements for Ductile Iron Fittings & Special Castings

SN	Test	Requirement	Remarks
(1)	**(2)**	**(3)**	**(4)**
1.	Metal used for the manufacture	Should conform to the appropriate grade as specified in IS 1865	-
2.	Tolerances in dimensions	As per Table 3.2, 3.3, 3.4,3.5	-
3.	Requirement of Dimensional	Table 3.6 to 3.14 of respective fittings	-
4	Mechanical tests for tensile strength	(minimum) 420 MPa (N/mm2)	To be carried out during manufacture on bar cast from the same metal
5	Elongation at break	Minimum 5%	
6	Brinell hardness Test	Not to exceed 250 HBS.	
7	Hydrostatic tests (Test pressure as per table 3.1)	Should withstand the pressure test without showing any leakage, sweating or other defect of any kind.	The hydrostatic test shall be conducted before coating the fittings.

Table 3.1 Hydrostatic Test Pressure for Castings
(*Ref: Table 2 of IS 9523: 2000 (2020)*)

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
Over 600 and up to and including 2000	1.0

3.3 Tolerances in Dimensions

3.3.1 The tolerance on the wall thickness of fittings shall be as follows:

Type of Casting	Wall Thickness (mm)	Tolerance (mm)
Fittings	7, Greater than 7	> -2.3, - (2.3+0.001 DN)

3.3.2 **Tolerance on Ovality:** Fittings and special castings shall be as far as possible circular internally and externally. The tolerance for out of roundness of the socket and spigot ends in the jointing zone for push-on-joint as given in **Table 3.2** and for mechanical joint as given in **Table 3.3**.

3.3.3 The permissible deviations on the lengths of fittings and special castings shall be as given in **Table 3.4**.

3.3.4 The tolerance on dimensions of barrel and socket for push-on-joints fittings shall be as given in **Table 3.5**.

Table 3.2 Allowable Ovality for Push-on-Joint Fittings
(*Ref: Table 12 of IS 9523: 2000 (2020)*)

Nominal Diameter DN(mm)	Allowable Difference Between Minor Axis and DE, Min (mm)
(1)	**(2)**
80 to 300	1.0
350 to 600	1.75
700	2.0
750 to 800	2.4
900 to 1000	3.5

Table 3.3 Allowable Ovality for Mechanical Joint Fittings
(*Ref: Table 13 of IS 9523: 2000 (2020)*)

Nominal Diameter DN (mm)	Maximum Ovality of Spigot of External Diameters DE(mm)
(1)	**(2)**
80-150	5
200-350	10
400-500	20
600-800	30
900-1000	40

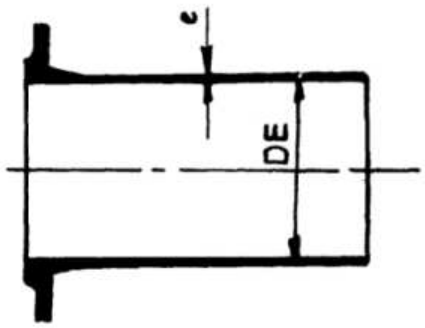
Table 3.4 Deviation on Lengths of Fittings
(*Ref: Table 14 of IS 9523: 2000 (2020)*)

Type of Fittings	Nominal Diameter DN (mm)	Deviation in L and H (mm)
(1)	**(2)**	**(3)**
Flanged sockets Flanged spigots collars, tapers	80 to 1200 1400 to 2000	±25 ±35
Tees	80 to 1200 1400 to 2000	+50/-25 +75/-35
Bends 90° Bends 45°	80 to 2000 80 to 2000	±(15 + 0.03 DN) ±(10 + 0.025 DN)
Bends 22° 30’ and 11° 15’ (1/16 and 1/32)	80 to 1200 1400 to 2000	±(10 + 0.02 DN) ±(10 + 0.025 DN)

Table 3.5 Dimensions of Fittings for Push-On-Joint and Mechanical Joints

(*Ref: Table 3 of IS 9523: 2000 (2020)*)

Nominal Diameter (DN)	External Diameter (DE)		Wall Thickness (e) mm	Tolerance
	Nominal	Tolerance	K12	
(1)	(2)	(3)	(4)	(5)
80	98	+1/-2.7	7.0	-2.38
100	118	+1/-2.8	7.2	-2.40
125	144	+1/-2.8	7.5	-2.42
150	170	+1/-2.9	7.8	-2.45
200	222	+1/-3.0	8.4	-2.50
250	274	+1/-3.1	9.0	-2.55
300	326	+1/-3.3	9.6	-2.60
350	378	+1/-3.4	10.2	-2.65
400	429	+1/-3.5	10.8	-2.70
450	480	+1/-3.6	11.4	-2.75
500	532	+1/-3.8	12.0	-2.80
600	635	+1/-4.0	13.2	-2.90
700	738	+1/-4.3	14.4	-3.0
750	790	+1/-4.4	15.0	-3.05
800	842	+1/-4.5	15.6	-3.10
900	945	+1/-4.8	16.8	-3.20
1000	1048	+1/-5.0	18.0	-3.30

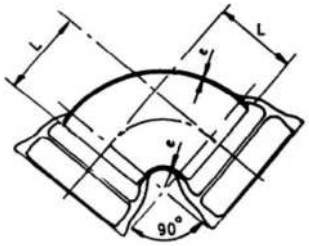
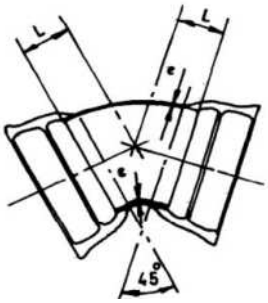


3.4 Dimensional Requirement for Fittings & Special Castings

Dimensional and other requirements for socket/ spigot of push-on joints, mechanical joints and special castings with their ends socketed (for mechanical joints or push-on joints) should conform to the requirements specified in **Tables 3.6** to **3.14** as under.

Table 3.6 & 3.7 Double Socket 90° Bend and 45° Bend

(*Ref: Table 15&16 of IS 9523: 2000 (2020)*)

Nominal Size	Double Socket 90° Bend			Double Socket 45° Bend		
	e	L		e	L	
(1)	(2)	(3)		(4)	(5)	
80	7.0	100		7.0	55	
100	7.2	120		7.2	65	
125	7.5	145		7.5	75	
150	7.8	170		7.8	85	
200	8.4	220		8.4	110	
250	9.0	270		9.0	130	
300	9.6	320		9.6	150	
350	10.2	370		10.2	175	
400	10.8	420		10.8	195	

450	11.4	470		11.4	220	
500	12.0	520		12.0	240	
600	13.2	620		13.2	285	
700	14.4	720		14.4	330	
750	15.0	770		15.0	350	
800	15.6	820		15.6	370	
900	16.8	920		16.8	415	
1000	18.0	1020		18.0	460	

Table 3.8 & 3.9 Double Socket 22 ½^0 & 11 ¼^0 Bend

(*Ref: Table 17&18 of IS 9523: 2000 (2020)*)

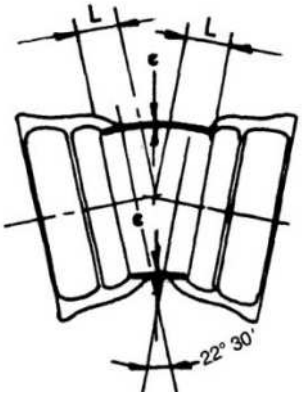
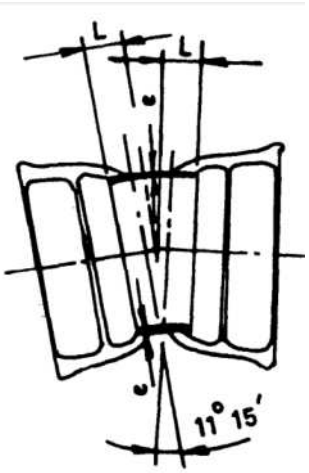
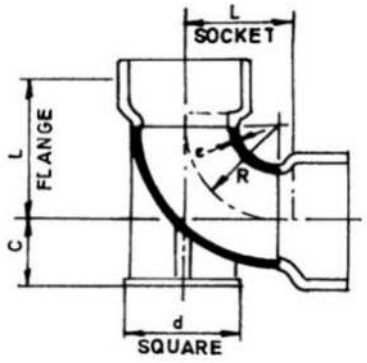
Nominal Size	Double Socket 22 ½^0 Bend			Double Socket 11¼^0 Bend		
	e	L		e	L	
(1)	(2)	(3)		(4)	(5)	
80	7.0	40		7.0	30	
100	7.2	40		7.2	30	
125	7.5	50		7.5	35	
150	7.8	55		7.8	35	
200	8.4	65		8.4	40	
250	9.0	75		9.0	50	
300	9.6	85		9.6	55	
350	10.2	95		10.2	60	
400	10.8	110		10.8	65	
450	11.4	120		11.4	70	
500	12.0	130		12.0	75	
600	13.2	150		13.2	85	
700	14.4	175		14.4	95	
750	15.0	185		15.0	100	
800	15.6	195		15.6	110	
900	16.8	205		16.8	115	
1000	18.0	210		18.0	120	

Table 3.10 Duckfoot Double Sock 90° Bend

(*Ref: Table 19 of IS 9523: 2000 (2020)*)

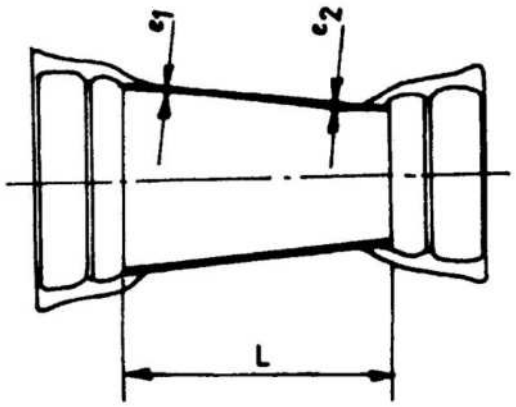
Nominal Size	e	L	c	d	
(1)	(2)	(3)	(4)	(5)	
80	7.0	110	110	180	
100	7.2	130	125	200	
125	7.5	155	140	225	
150	7.8	180	160	250	
200	8.4	230	190	300	
250	9.0	280	225	350	
300	9.6	325	255	400	

350	10.2	380	290	450	
400	10.8	430	320	500	
450	11.4	480	355	550	
500	12.0	530	385	600	
600	13.2	630	450	700	
700	14.4	735	515	800	
750	15.0	790	545	850	
800	15.6	830	580	900	
900	16.8	930	645	1000	
1000	18.0	1035	710	1100	

Table 3.11 Double Socket Concentric Tapers

(*Ref: Table 20 of IS 9523: 2000 (2020)*)

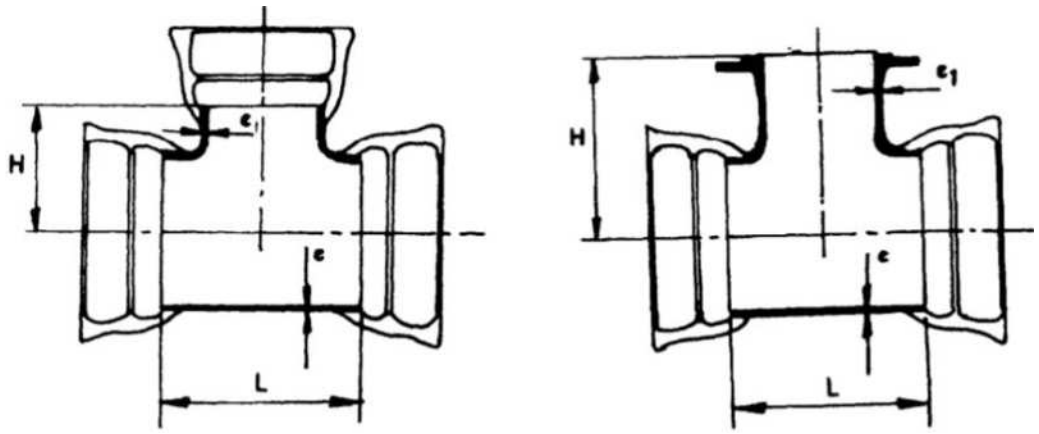
Nominal Diameter (DN)		e_1	e_2	**L**	
Larger End	**Smaller End**				
(1)	**(2)**	**(3)**	**(4)**	**(5)**	
100	80	7.2	7.0	90	
125	80	7.5	7.0	140	
150	80	7.8	7.0	190	
150	100	7.8	7.2	150	
200	100	8.4	7.2	250	
200	150	8.4	7.8	150	
250	150	9.0	7.8	250	
250	200	9.0	8.4	150	
300	150	9.6	7.8	350	
300	200	9.6	8.4	250	
300	250	9.6	9.0	150	
350	200	10.2	8.4	360	
350	250	10.2	9.0	260	
350	300	10.2	9.6	160	
400	250	10.8	9.0	360	
400	300	10.8	9.6	260	
400	350	10.8	10.2	160	
450	350	11.4	10.2	260	
450	400	11.4	10.8	160	
500	350	12.0	10.2	360	
500	400	12.0	10.8	260	
600	400	13.2	10.8	460	
600	500	13.2	12.0	260	
700	500	14.4	12.0	480	
700	600	14.4	13.2	280	
750	500	15.0	12.0	480	
750	600	15.0	13.2	280	
800	600	15.6	13.2	480	
800	700	15.6	14.4	280	



900	700	16.8	14.4	480	
900	800	16.8	15.6	280	
1000	800	18.0	15.6	480	
1000	900	18.0	16.8	280	

Table 3.12 All Socket, Flange on Double Socket Tees

(*Ref: Table 21 of IS 9523: 2000 (2020)*)



All dimensions in millimetres.

Nominal Diameter (DN)		e	e_1	L		H	
Body	Branch			Branch Flange on Double Socket	All Socket	Flange on Double Socket	All Socket
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80	80	7	7	170	170	165	85
100	80	7.2	7	170	170	175	95
100	100	7.2	7.2	190	190	180	95
125	80	7.5	7	170	170	190	105
125	100	7.5	7.2	195	195	195	100
125	125	7.5	7.5	225	225	200	110
150	80	7.8	7	170	170	205	120
150	100	7.8	7.2	195	195	210	120
150	150	7.8	7.8	255	255	220	125
200	80	8.4	7	175	175	235	145
200	100	8.4	7.2	200	200	240	145
200	150	8.4	7.8	255	255	250	150
200	200	8.4	8.4	315	315	260	155
250	80	9	7	180	180	265	170
250	100	9	7.2	200	200	270	170
250	150	9	7.8	260	260	280	175
250	200	9	8.4	315	315	290	180

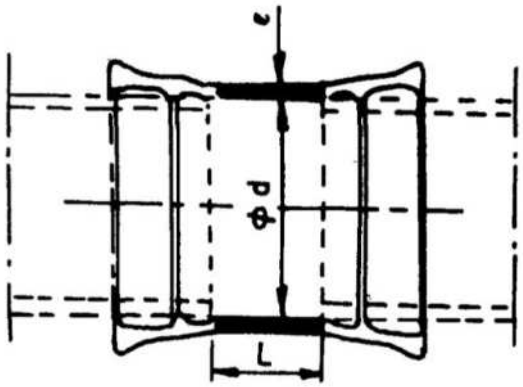
250	250	9	9	375	375	300	190
300	100	9.6	7.2	210	210	300	220
300	200	9.6	8.4	325	325	320	220
300	300	9.6	9.6	440	440	340	220
350	100	10.2	7.2	205	---	330	---
350	200	10.2	8.4	325	---	350	---
350	350	10.2	10.2	495	---	380	---
400	80	10.8	7.0	185	---	355	---
400	100	10.8	7.2	210	---	360	---
400	150	10.8	7.8	270	---	370	---
400	200	10.8	8.4	325	---	380	---
400	300	10.8	9.6	440	---	400	---
400	400	10.8	10.8	560	---	420	---
450	100	11.4	7.2	215	---	390	---
450	250	11.4	9.0	390	---	420	---
450	450	11.4	11.4	620	---	460	---
500	100	12.0	7.2	215	---	420	---
500	200	12.0	8.4	330	---	440	---
500	400	12.0	10.8	565	---	480	---
500	500	12.0	12.0	680	---	500	---
600	200	13.2	8.4	340	---	500	---
600	400	13.2	10.8	570	---	540	---
600	600	13.2	13.2	800	---	580	---
700	200	14.4	8.4	345	---	525	---
700	400	14.4	10.8	575	---	555	---
700	700	14.4	14.4	925	---	600	---
750	400	15.0	10.8	575	---	585	---
750	750	15.0	15.0	985	---	635	---
800	200	15.6	8.4	350	---	585	---
800	400	15.6	10.8	580	---	615	---
800	600	15.6	13.2	1045	---	645	---
800	800	15.6	15.6	1045	---	675	---
900	200	16.8	8.4	355	---	645	---
900	400	16.8	10.8	590	---	675	---
900	600	16.8	13.2	1170	---	705	---
900	900	16.8	16.8	1170	---	750	---
1000	200	18.0	8.4	360	---	705	---
1000	400	18.0	10.8	595	---	735	---
1000	600	18.0	13.2	1290	---	765	---
1000	1000	18.0	18.0	1290	---	825	---

NOTE – *PN 16* is the preferred flange. *PN 25* and *PN 40* flanges are supplied when ordered.

Table 3.13 Collars

(*Ref: Table 22 of IS 9523: 2000 (2020)*)

Nominal Dia (DN)	e	L	d
(1)	(2)	(3)	(4)
80	7.0	160	109
100	7.2	160	130
125	7.5	165	156
150	7.8	165	183
200	8.4	170	235
250	9.0	175	288
300	9.6	180	340
350	10.2	185	393
400	10.8	190	445
450	11.4	195	498
500	12.0	200	550
600	13.2	210	655
700	14.4	220	760
750	15.0	225	810
800	15.6	230	865
900	16.8	240	970
1000	18.0	250	1075



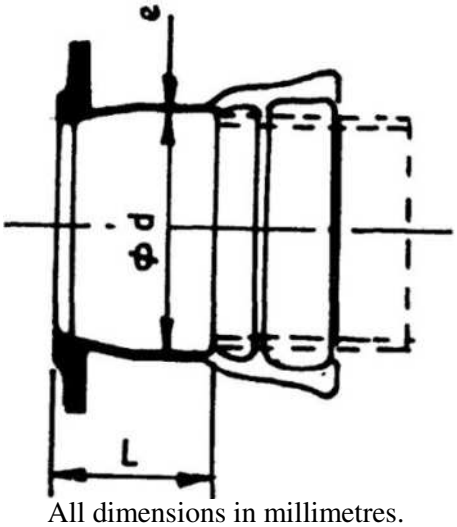
All dimensions in millimetres.

Note: For operational convenience collars are with mechanical joints only.

Table 3.14 Flanged Socket

(*Ref: Table 23 of IS 9523: 2000 (2020)*)

Nominal Dia (DN)	e	L	d
(1)	(2)	(3)	(4)
80	7.0	130	109
100	7.2	130	130
125	7.5	135	156
150	7.8	135	183
200	8.4	140	235
250	9.0	145	288
300	9.6	150	340
350	10.2	155	393
400	10.8	160	445
450	11.4	165	498
500	12.0	170	550
600	13.2	180	655
700	14.4	190	760
750	15.0	195	810
800	15.6	200	865
900	16.8	210	970
1000	18.0	220	1075



All dimensions in millimetres.

Note: *PN 16* is the preferred flange. *PN 25* and *PN 40* flanges are supplied when ordered.

***

Chapter-4

Galvanised Iron Fittings

4.0 General

The requirements for butt welded and seamless, plain ended, screwed sockets, steel tubulars and other welded and seamless steel pipe fittings for water supply are covered in IS 1239(Part-2). Since railway requirement is for galvanised iron fittings, the zinc coating should be done in accordance with IS 4736.

4.1 Codal Requirements of GI fittings

SN	Test	Requirement	Remarks
(1)	(2)	(3)	(4)
1.	Requirement of Material	Refer 4.2	
2.	Requirement of Dimensional	Table 4.1 to 4.28 (Respective table)	
3.	Tolerances in Dimensions	Table 4.29	
4.	Hydraulic pressure tests	a) Application of an internal hydraulic pressure of not less than 5 MPa, or b) Application of an internal air pressure of 0.7 MPa whilst the fittings is completely immersed in water or light oil	The hydrostatic test shall be conducted before coating the fittings.
5.	Expansion Tests	Drift Expanding Test or Taper Screw Plug Test	
5A.	Drift Expanding Test	The minimum increase in outside diameter after expansion should be as follows: Nominal Bore (mm) — % Expansion (min) Up to & including 25 — 2.0 32-40 — 1.5 50-80 — 1.0 100-150 — 0.5	
5B.	Taper Screw Plug Test	Sockets shall be capable of withstanding the expansion without showing any sign of fracture of failure	

4.2 Requirement of Material

4.2.1 Tubulars should be made from tested quality steel with following chemical composition in Laddle analysis- Carbon (0.20% Max), Manganese (1.30% Max), Sulphur (0.04% Max), and Phosphorus (0.04% Max).

Steel tubes shall be manufactured through one of the following processes:

a) Hot finished seamless (HFS)
b) Cold finished seamless (CDS)
c) Hot finished welded (HFW)
d) Electric resistance welded or high frequency induction welded (ERW or HFIW)

4.2.2 Sockets shall be manufactured from mild steel by any of the following processes:

a) Hot-finished seamless (HFS)
b) Electric resistance welded or high frequency induction welded ERW or HFIW
c) Hot-finished welded (HFW)
d) Hand welded

4.2.3 Other steel pipe fittings excluding socket shall be manufactured from steel by any approved process.

4.2.4 The steel from which the fittings are made, when tested in accordance with IS 1608 should show on test a minimum tensile strength of 320 MPa. The percentage elongation on a gauge length of 5.65 So (where So is the original cross-section of the test specimen) should not be less than 20 percent.

4.2.5 *Chemical Composition:* The ladle analysis of steel should not show sulphur and phosphorus in amounts exceeding 0.05 percent each. The maximum permissible variation of sulphur and phosphorus, in case of product analysis from the limits specified should be 0.005 percent each.

4.3 General Requirements

Tubulars, sockets and fitting shall be clearly finished and reasonably free from scale, surface flaws, laminations and other defects. The screw threads of tubulars, sockets and fittings shall be clean and well cut. The ends shall be cut clearly and square unless otherwise specified.

The zinc coating shall be reasonably smooth and free from such imperfections as flux, ash and dross inclusions, bare patches, black spots, pimples, lumpiness, runs, rust stains, bulky white deposits and blisters. The adhesion of zinc coating on fittings shall be determined by pivoted hammer test in accordance with IS 2629.

4.4 Marking

Tubulars, sockets and fittings shall be suitably packed and threads protected from damage and marked with the following details:

a) Manufacturer’s name or trade-mark
b) Size designation

4.5 Designation

Steel sockets and tubular shall be designated by their nominal bore. Other steel fittings shall be designated giving the following particulars in the sequence shown:

a) *Type of fittings:* The types of fittings are denoted as elbow, tee, cross, etc.
b) *Size designation:* This is determined by the nominal bore, in millimetre of the pipe at the outlets. Where all outlets in a given fitting are of the same size, the fitting shall be referred to by that one size, irrespective of the number of the outlets known as equal fitting. If the sizes of outlets are different, it may called unequal fitting.

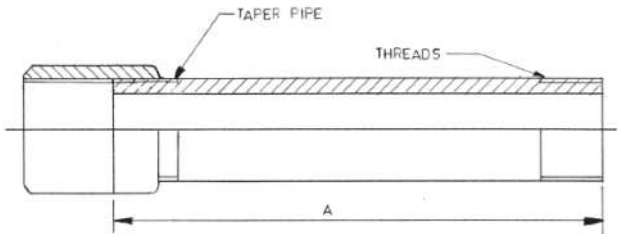
4.6 Dimensional Requirements

Dimensional requirement for various fittings are given in following tables.

4.6.1 Pieces: Pieces shall conform to the dimensions given in **Table 4.1.**

Table 4.1 Dimensions of Pieces
(*Ref: Table 1 of IS 1239part 2:2011(2021)*)

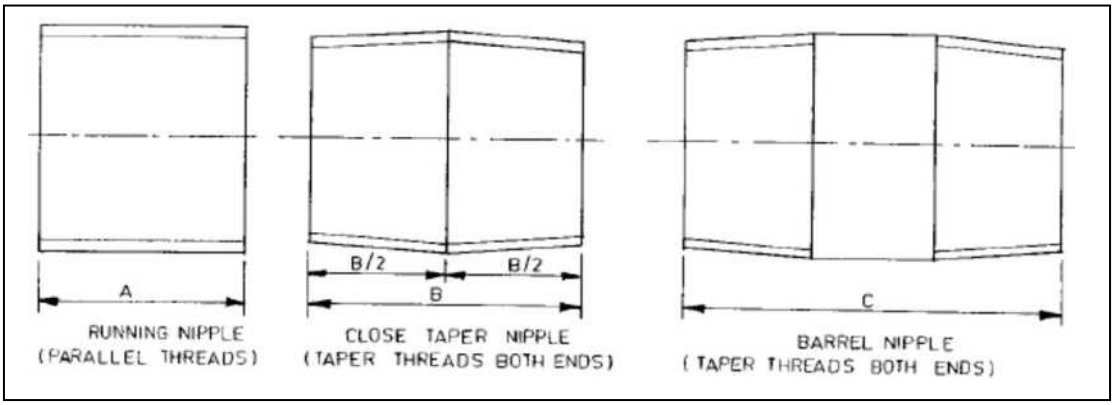
SN	Nominal Bore	Approximate standard length A			
(1)	(2)	(3)	(4)	(5)	(6)
1	6	100	150	200	250
2	8	100	150	200	250
3	10	100	150	200	250
4	15	100	150	200	250
5	20	100	150	200	250
6	25	100	150	200	250
7	32	150	200	250	300
8	40	150	200	250	300
9	50	150	200	250	300
10	65	150	200	250	300
11	80	150	200	250	400
12	100	150	200	250	400
13	125	250	300	400	500
14	150	250	300	400	500



All dimensions in millimetres

4.6.2 Nipples: Close taper and running nipples shall be made only from heavy tubes. Barrel nipples shall be made either from medium or heavy tubes. The dimensions of nipples shall be as given in **Table 4.2.**

Table 4.2 Dimensions of Running Nipples; Close Taper Nipples and Barrel Nipples
(*Ref: Table 2 of IS 1239part 2:2011(2021)*)



SN	Nominal bore	Approximate standard length					Tolerance
		Running Nipple A		Close Tapper Nipple B		Barrel Nipple C	
		Minimum	Tolerance	Minimum	Tolerance	minimum	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	6	13	+1.5	19	+1.5	32	+3
2	8	19		27		38	
3	10	21		28		38	
4	15	27		37		51	+4.5
5	20	30		39		54	
6	25	33		46		60	
7	32	38	-	51	-	70	+6
8	40	38	-	51	-	70	
9	50	48	-	60	-	79	
10	65	51	+3	69	+3	89	+8
11	80	57		75		102	
12	100	70		87		114	
13	125	78		96		124	
14	150	78		96		127	

4.6.3 Long Screws (Connectors): Long screws (connectors) shall be made only from heavy tube and shall be supplied single or double, as may be specified, and shall conform to the appropriate dimensions given in **Table 4.3**.

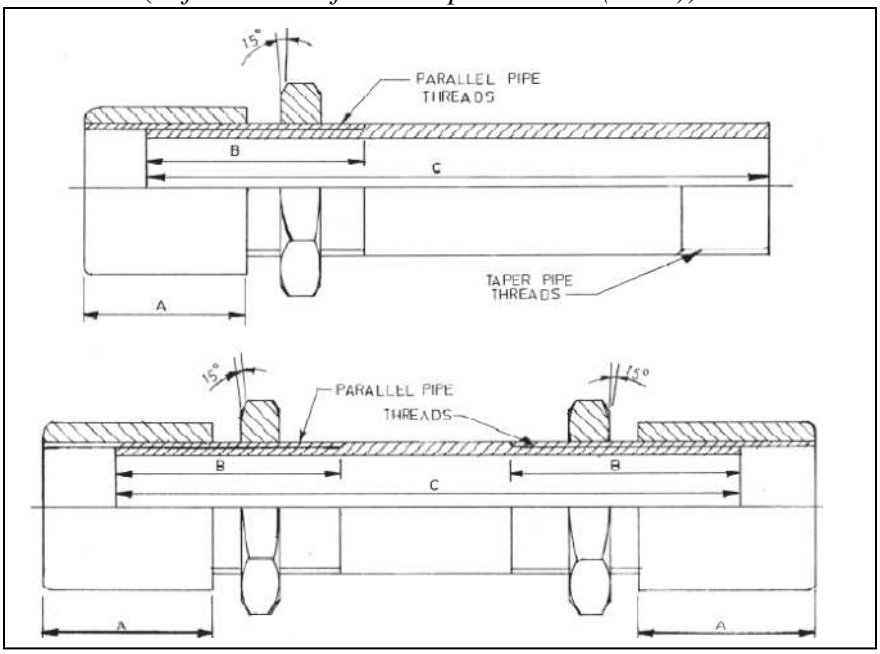
The sockets shall be suitably faced on the end which the back nut abuts. The face of the back nut which abuts against the sockets shall be concave at an angle of approximately 15°.

The parallel threads on the long screw and in the socket shall, in addition to complying with the appropriate requirement of IS 554, be of such a size that the socket runs on the connector hand-tight without perceptible shake. This type of joints is permissible for low

pressures, but is not recommended for higher pressures or for work in which there are wide variations of temperature.

Note: When it is necessary to use long screw for running joints, the threads of the long screw which accommodates, the running socket and back nut shall be parallel.

Table 4.3 Dimensions of Long Screws
(*Ref: Table 3 of IS 1239part 2:2011(2021)*)



SN	Nominal bore	Faced socket A		Minimum effective length of long thread B	Approximate standard length C			
		Length Minimum	Tolerance					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	6	17	+1.5	29	100	150	200	250
2	8	25		37	100	150	200	250
3	10	25		40	100*	150	200	250
4	15	35	+3	52	100*	150	200	250
5	20	37		54	100*	150	200	250
6	25	43		62	100*	150	200	250
7	32	48	+4.5	70	150*	200	250	300
8	40	48		71	150*	200	250	300
9	50	57		82	150*	200*	250	300
10	65	65	+6	97	150*	200*	250*	300
11	80	71		106	200*	200*	300	400
12	100	84		121	200*	250*	300	400
13	125	92		130	250*	300*	400	500
14	150	92		132	250*	300*	400	500

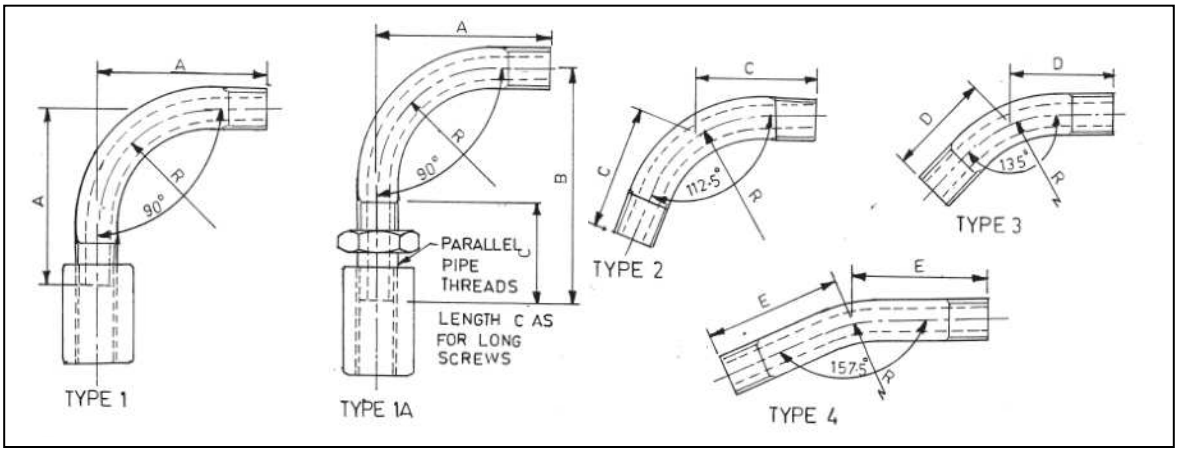
Note: *Double long screw are not supplied in this length.

4.6.4 Bends and Springs: Bends and springs shall conform to the approximate dimensions given in Table 5.4. A tolerance of ±1.5° on the specified angle shall be permitted.

Type 1A bends shall be made only from heavy tubes and in addition to conforming to the approximate dimensions given in Table 4.4, shall be fitted with sockets and back nuts conforming to the requirements given in 4.6.3 pera 2.

Each bend and spring shall be supplied with one socket, if so specified by the purchaser.

Table 4.4 Dimensions of Bends and Springs
(*Ref: Table 4 of IS 1239part 2:2011(2021)*)

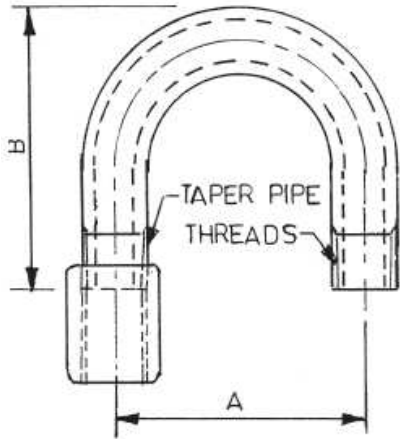


SN	Nominal bore	Bends 90^0 Approximate centre of face		Approximate radius	Approximate centre to face for spring		
					112.5^0	135^0	157.5^0
		A	B	R	C	D	E
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	6	51	73	32	48	44	44
2	8	64	92	41	60	57	54
3	10	73	105	48	67	64	60
4	15	86	127	57	79	76	73
5	20	102	143	73	92	89	86
6	25	121	168	89	108	105	102
7	32	146	197	108	133	127	124
8	40	165	219	127	149	143	140
9	50	203	264	159	181	175	168
10	65	248	321	197	222	213	206
11	80	292	371	232	260	248	241
12	100	381	467	308	340	324	318
13	125	540	632	460	476	457	444
14	150	622	718	540	572	540	527

4.6.5 Return Bends: Return bends shall be made from heavy tube, supplied with socket at one end if so specified by the purchaser, and shall conform to the dimensions given in **Table 4.5**. The ends of the bends shall be parallel within ±1.5°.

Table 4.5 Dimensions of Return Bends

(*Ref: Table 5 of IS 1239part 2:2011(2021)*)

SN	Nominal bore	Approximate centres	Approximate back to face	
		A	B	
(1)	(2)	(3)	(4)	
1	6	44	51	
2	8	51	64	
3	10	64	70	
4	15	89	102	
5	20	102	121	
6	25	114	140	
7	32	127	152	
8	40	165	178	
9	50	190	210	
10	65	305	292	
11	80	356	330	
12	100	457	400	
13	125	762	578	
14	150	914	692	

4.6.6 Sockets: Whenever tubulars are to be supplied with sockets, the dimensions of sockets shall be as given in Table 4.6. Tapping of sockets shall be done from one end only.

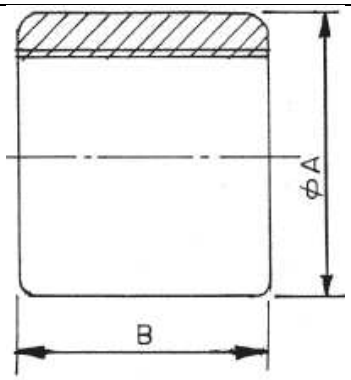
Notes: 1. The socket lengths shown in Table 6 of IS 1239 Part 2 meet the requirements of ISO/R 50, but the minimum length has been increased to allow for the chamfer at the ends of the socket and is based on: $B = 2L + 3.5p$. Where, L = length of useful thread of pipe (*see* IS 554), P = pitch of thread.

2. For minimum length of faced sockets (*see* **Table 4.3**)

Table 4.6 Dimensions of Steel Sockets

(*Ref: Table 6 IS 1239part 2:2011(2021)*)

SN	Nominal bore	Minimum Outside Diameter	Minimum Length	Maximum Inside Diameter of Internal Parallel Thread	
		A	B		
(1)	(2)	(3)	(4)	(5)	
1	6	15	19	8.637	
2	8	18.5	27	1.549	
3	10	22	28	15.054	

4	15	27	37	18.773	
5	20	32.5	39	24.259	
6	25	39.5	46	30.471	
7	32	49	51	39.132	
8	40	56	51	45.025	
9	50	68	60	56.836	
10	65	84	69	72.442	
11	80	98	75	85.142	
12	100	124	87	110.228	
13	125	151	96	135.688	
14	150	178	96	161.088	

4.7 Dimensions of Steel Fittings (Other Than Tubulars)

Sizes and dimensions of these fittings shall be as specified in **Tables 4.7 to 4.28**. All the dimensions given in these tables enable the fittings to be assembled with tubes screwed in accordance with IS 554.

Table 4.7 Dimensions of Screwed Ends of Fittings

(*Ref: Table 7 of IS 1239part 2:2011(2021)*)

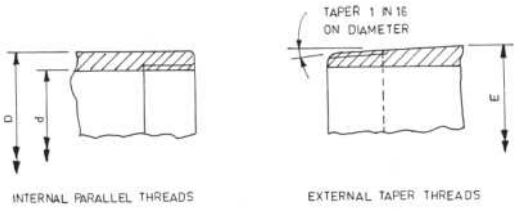
SN	Nominal size of outlet	Minimum Outside Diameter	Minimum Outside Diameter of Body Behind External Thread	Maximum Inside Diameter of Body Behind Internal Thread	
		D	E	d	
(1)	(2)	(3)	(4)	(5)	
1	6	15	9.8	8.6	
2	8	18.5	13.3	11.4	
3	10	22	16.8	15.0	
4	15	27	21.1	18.6	
5	20	32.5	26.6	24.1	
6	25	39.5	33.4	30.3	
7	32	49	42.1	39.0	
8	40	56	48.0	44.8	
9	50	68	59.8	56.7	
10	65	84	75.4	72.2	
11	80	98	88.1	84.9	
12	100	124	113.3	110.1	
13	125	151	138.7	135.5	
14	150	178	164.1	160.9	

Table 4.8 Dimensions of Elbows, Tees and Crosses, Equal

(*Ref: Table 8 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet	Minimum Length, Centre to Face
(1)	(2)	(3)
1	6	16
2	8	22
3	10	24
4	15	32
5	20	35
6	25	43
7	32	51
8	40	62
9	50	64
10	65	76
11	80	89
12	100	115
13	125	140
14	150	160

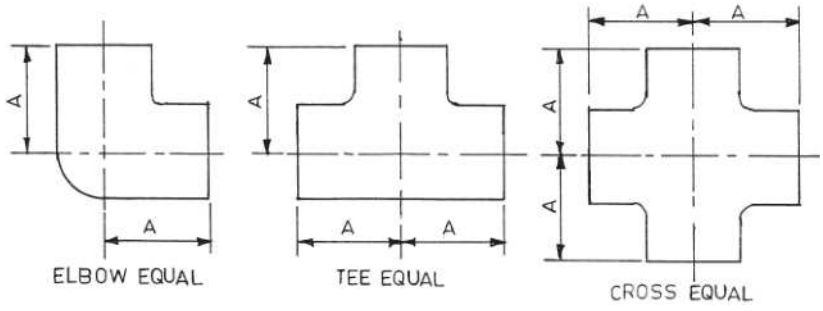
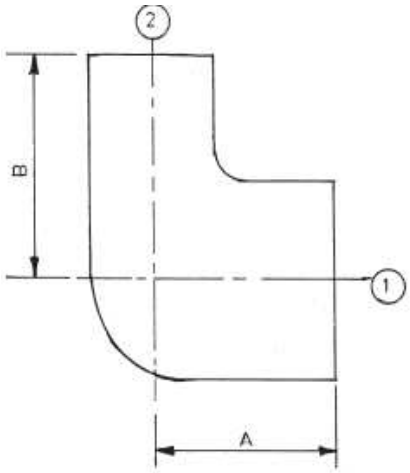


Table 4.9 Dimensions of Elbows Reducing

(*Ref: Table 9 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet (1)x(2)	Minimum Length, Centre to Face A	Minimum Length, Centre to Face B
(1)	(2)	(3)	(4)
1	8 × 6	21	22
2	10 × 6	21	24
3	10 × 8	22	24
4	15 × 8	25	32
5	15 × 10	27	32
6	20 × 8	27	35
7	20 × 10	29	35
8	20 × 15	32	35
9	25 × 10	32	43
10	25 × 15	35	43
11	25 × 20	38	43
12	32 × 15	38	51
13	32 × 20	41	51
14	32 × 25	44	51
15	40 × 15	38	52
16	40 × 20	41	52
17	40 × 25	44	52
18	40 × 32	48	52
19	50 × 15	41	64



20	50 × 20	44	64	
21	50 × 25	**48**	64	
22	50 × 32	52	64	
23	50 × 40	56	64	
24	65 × 40	60	76	
25	65 × 50	67	76	
26	80 × 25	60	89	
27	80 × 50	73	89	
28	100 × 50	83	115	
29	100 × 80	95	115	

Table 4.10 Dimensions of Tees, Reducing (on the Branch)

(*Ref: Table 10 of IS 1239part 2:2011(2021)*)

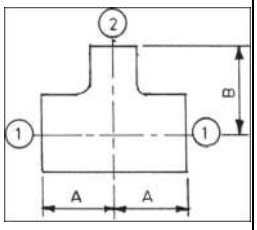
SN	Nominal Size of Outlet (1)x(2)	Minimum Length, Centre to Face	Minimum Length Centre to Face	SN	Nominal Size of Outlet (1)x(2)	Minimum Length Centre to Face	Minimum Length Centre to Face	
		A	B			A	B	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
1	8x6	21	22	23	50x20	44	64	
2	10x6	21	24	24	50x25	48	64	
3	10x8	22	24	25	50x32	52	64	
4	15x8	25	32	26	50x40	56	64	
5	15x10	27	32	27	65x25	54	76	
6	20x8	27	35	28	65x32	57	76	
7	20x10	29	35	29	65x40	60	76	
8	20x15	32	35	30	65x50	67	76	
9	25x10	30	43	31	80x25	60	89	
10	25x8	32	43	32	80x32	64	89	
11	25x15	35	43	33	80x40	67	89	
12	25x20	38	43	34	80x50	73	89	
13	32x10	35	51	35	80x65	79	89	
14	32x15	38	51	36	100x25	70	115	
15	32x20	41	51	37	100x40	76	115	
16	32x25	44	51	38	100x50	83	115	
17	40x10	37	52	39	100x80	95	115	
18	40x15	38	52	40	125x80	115	140	
19	40x20	41	5	41	125x100	130	140	
20	40x25	48	52	42	150x80	120	160	
21	40x32	49	52	43	150x100	135	160	
22	50x15	51	64					

Table 4.11 Dimensions of Tees, Reducing (on the Run and Branch, or on the Run Only)

(*Ref: Table 11 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet (1) × (2) × (3)	Minimum Length, Centre to Face(A)	Minimum Length, Centre to Face(B)
(1)	(2)	(3)	(4)
1	20 × 15 × 15	32	35
2	20 × 15 × 20	35	35
3	25 × 20 × 15	35	43
4	25 × 20 × 20	38	43
5	25 × 20 × 25	43	43
6	32 × 25 × 20	41	51
7	32 × 25 × 25	44	51
8	32 × 25 × 32	51	51
9	32 × 25 × 40	52	52
10	40 × 32 × 25	44	52
11	40 × 32 × 32	49	52
12	40 × 32 × 40	52	52
13	40 × 32 × 50	64	64
14	50 × 32 × 50	64	64
15	50 × 40 × 25	48	64
16	50 × 40 × 40	56	64
17	50 × 40 × 50	64	64
18	50 × 50 × 50	67	76
19	50 × 50 × 65	76	76
20	80 × 50 × 50	73	89
21	80 × 50 × 80	89	89
22	100 × 80 × 80	85	115

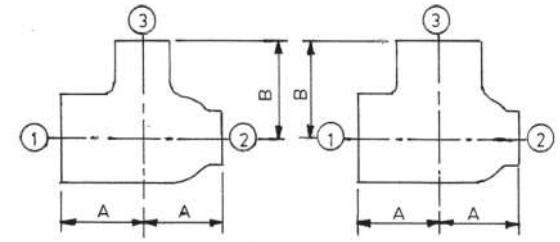
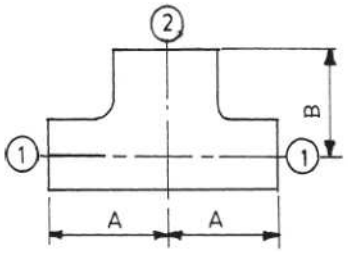


Table 4.12 Dimensions of Tees (Increasing on the Branch)

(*Ref: Table 12of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet (1) × (2)	Minimum Length, Centre to Face(A)	Minimum Length, Centre to Face(B)
(1)	(2)	(3)	(4)
1	6x8	22	21
2	8x10	24	22
3	10x15	32	27
4	15x20	35	32
5	15x25	43	35
6	20x25	43	38
7	25x32	52	44
8	24x40	52	44
9	32x40	52	49
10	40x50	64	56
11	50x65	76	67

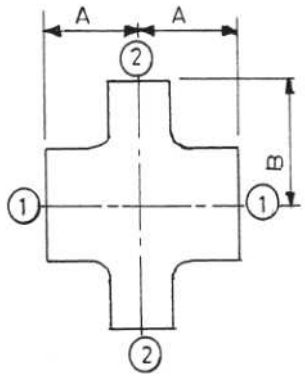


12	50x80	89	73	
13	65x80	89	79	
14	80x100	115	95	

Table 4.13 Dimensions of Crosses, Reducing

(*Ref: Table 13 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet (1) × (2)	Minimum Length, Centre to Face(A)	Minimum Length, Centre to Face(B)	
(1)	**(2)**	**(3)**	**(4)**	
1	8x6	21	22	
2	10x8	22	24	
3	15x10	27	32	
4	20x15	32	35	
5	25x15	35	43	
6	25x20	38	43	
7	32x15	38	51	
8	32x25	44	51	
9	40x15	38	52	
10	40x25	44	52	
11	50x25	48	64	
12	50x40	56	64	
13	65x50	67	76	
14	80x40	67	89	
15	80x50	73	89	
16	100x50	83	115	
17	100x80	95	115	
18	125x80	115	140	
19	125x100	130	140	
20	150x80	120	160	
21	150x100	135	160	

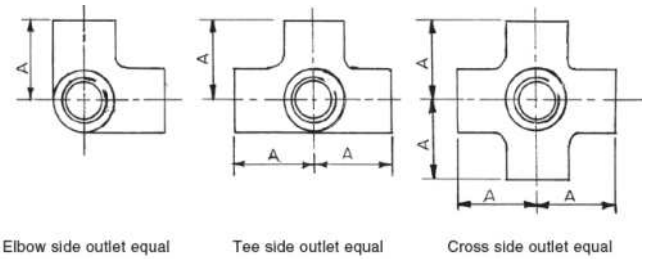


Cross, Reducing

Table 4.14 Elbows, Tees and Crosses, Side Outlet, Equal

(*Ref: Table 14of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet	Minimum Length, Centre to Face for All Outlets (A)	
(1)	**(2)**	**(3)**	
1	15	32	
2	20	35	
3	25	43	
4	32	51	
5	40	52	
6	50	64	

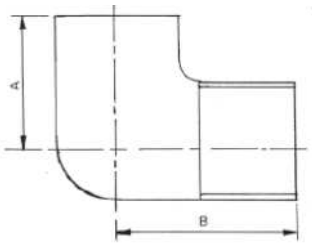


Elbow side outlet equal Tee side outlet equal Cross side outlet equal

Table 4.15 Dimensions of Elbows, Round, Male and Female, Equal

(*Ref: Table 15 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet	Minimum Length, Centre to Face (A)	Minimum Length, Centre to Face (B)	Minimum Bore of Male End	Maximum Bore of Male End
(1)	(2)	(3)	(4)	(5)	(6)
1	8	19	27	6.5	8
2	10	21	29	8.5	10.5
3	15	25	35	11.5	13
4	20	30	40	18	21
5	25	37	46	24	26
6	32	43	54	30	32
7	40	49	57	37	39
8	50	59	70	48	51
9	65	68	83	63	66
10	80	81	94	75	79
11	100	100	115	97	104

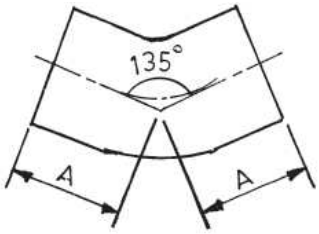


Elbow, Male & Female, Equal

Table 4.16 Dimensions of Elbows, Equal, 135°

(*Ref: Table 16of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet	Minimum Length, Centre to Face (A)
(1)	(2)	(3)
1	6	16
2	8	17
3	10	19
4	15	22
5	20	27
6	25	33
7	32	38
8	40	44
9	50	51
10	65	60
11	80	73
12	100	105

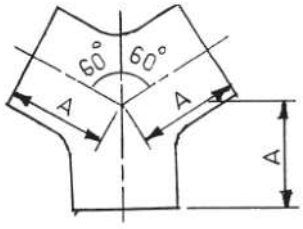


Elbow-135, Equal

Table 4.17 Dimensions of Y-Pieces, Female, Equal

(*Ref: Table 17 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet	Minimum Length, Centre to Face (A)
(1)	(2)	(3)
1	15	27
2	20	35
3	25	36
4	32	44
5	40	49



Y-Piece, Equal

6	50	57	
7	65	71	
8	80	79	
9	100	100	

Table 4.18 Dimensions of Socket, Reducing

(*Ref: Table 18 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of Outlet (1)x(2)	Minimum Length (A)	SN	Nominal Size of Outlet (1)x(2)	Minimum Length (A)
(1)	(2)	(3)	(4)	(5)	(6)
1	8x6	25	23	50x20	68
2	10x6	30	24	50x25	67
3	10x8	29	25	50x32	65
4	15x6	41	26	50x40	64
5	15x8	40	27	65x25	76
6	15x10	38	28	65x32	75
7	20x8	44	29	65x40	73
8	20x10	43	30	65x50	71
9	20x15	41	31	80x25	86
10	25x8	54	32	80x32	84
11	25x10	52	33	80x40	83
12	25x15	51	34	80x50	81
13	25x20	49	35	80x65	79
14	32x10	60	36	100x40	105
15	32x15	59	37	100x50	100
16	32x20	57	38	100x65	100
17	32x25	56	39	100x80	98
18	40x15	65	40	125x80	115
19	40x20	64	41	125x100	115
20	40x25	62	42	150x80	140
21	40x32	60	43	150x100	140
22	50x15	70			

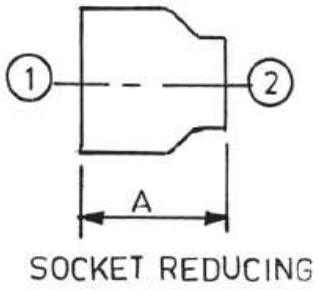
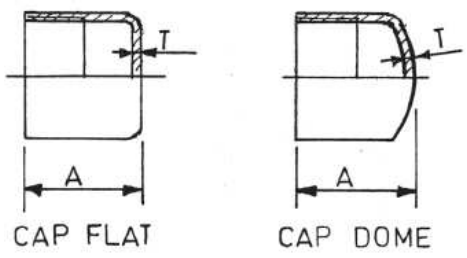


Table 4.19 Dimensions of Caps

(*Ref: Table 19 of IS 1239part 2:2011(2021)*)

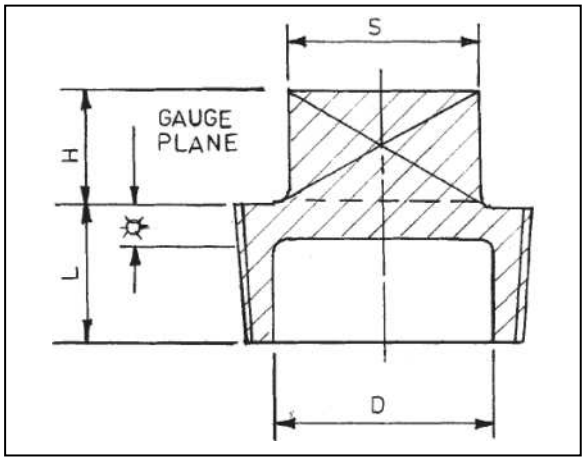
SN	Nominal Size	Minimum Length (A)	Minimum Thickness (T)
(1)	(2)	(3)	(4)
1	6	19	3.5
2	8	24	3.5
3	10	27	3.5
4	15	37	4.0
5	20	38	4.0
6	25	44	4.5
7	32	51	5.0



8	40	54	5.5	**Note:** Flat or dome pattern caps may be supplied at the option of the manufacturer.
9	50	60	6.0	
10	65	67	6.0	
11	80	73	7.0	
12	100	86	7.0	
13	125	98	7.0	
14	150	98	7.0	

Table 4.20 Dimensions of Plug

(*Ref: Table 20 of IS 1239part 2:2011(2021)*)



SN	Nominal Size	Minimum Length of Thread for Basic Gauge	Approximate Size of Square (S)	Approximate Height of Square (H)	Maximum Internal Diameter (D)	Minimum Thickness of Metal (K)	Fittings Allowance in Accordance with IS 554
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	6	6.5	6	6	-	-	2 ¾
2	8	9.7	9	6	-	-	2 ¾
3	10	10.1	11	10	-	-	2 ¾
4	15	13.2	13	10	-	-	2 ¾
5	20	14.5	14	12	-	-	2 ¾
6	25	16.8	17	12	22	4	2 ¾
7	32	19.1	22	16	31	5	2 ¾
8	40	19.1	27	16	33	5	2 ¾
9	50	23.4	32	19	48	5	3 ¼
10	65	26.7	37	19	62	6	4
11	80	29.8	37	22	73	8	4
12	100	35.8	46	25	97	10	4 ½
13	125	40.1	51	29	120	12	5
14	150	40.1	60	32	145	12	5

Note: Plugs of nominal sizes 25 to 150 mm may be either solid or hollow, and the attention of the purchaser is drawn to the necessary of stating in his enquiry and order which pattern is required.

Table 4.21 Dimensions of Elbows, Tees and Crosses, Male, Equal

(*Ref: Table 21 of IS 1239part 2:2011(2021)*)

SN.	Nominal Size of outlet	Minimum Length centre to face (A)
(1)	(2)	(3)
1	15	90
2	20	95
3	25	100
4	32	110
5	40	115
6	50	125
7	65	140
8	80	150
9	100	180
10	125	200
11	150	230

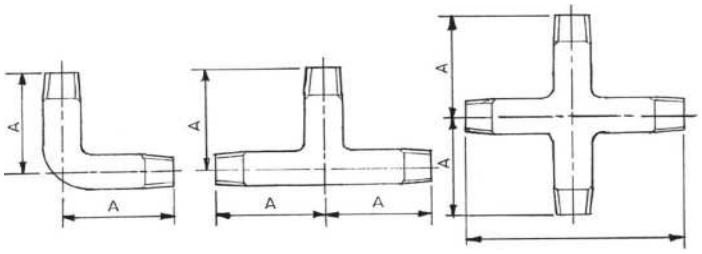


Table 4.22 Dimensions of Y-Pieces and Angle Tees, Male, Equal

(*Ref: Table 22 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of outlet	Minimum Length centre to face (A)	Minimum Length centre to face (B)
(1)	(2)	(3)	(4)
1	15	120	57
2	20	130	64
3	25	150	70
4	32	160	73
5	40	170	76
6	50	190	83
7	65	200	90
8	80	220	100
9	100	260	110
10	125	300	115
11	150	340	125

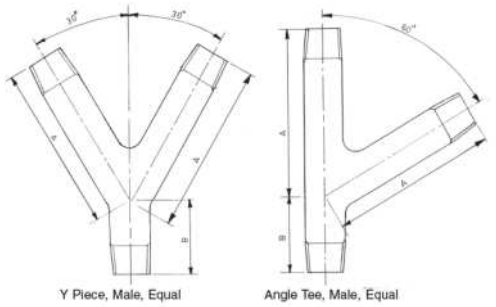


Table 4.23 Dimensions of Twin Elbows and Sweep Tees, Male, Equal

(*Ref: Table 23 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of outlet	Minimum Length centre to face (A)	Minimum Length centre to face (B)
(1)	(2)	(3)	(4)
1	15	80	85
2	20	90	90
3	25	120	100
4	32	150	105
5	40	170	110
6	50	200	125
7	65	250	135
8	80	290	145
9	100	380	170
10	125	530	195
11	150	620	220

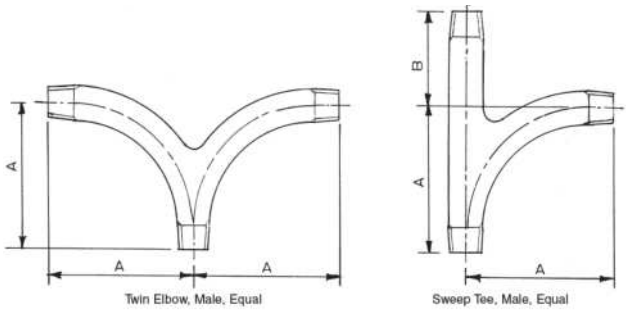
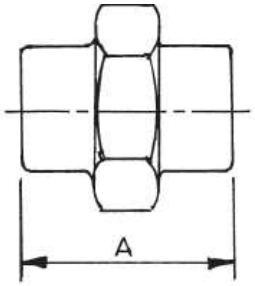
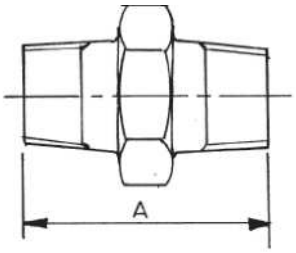


Table 4.24 & 4.25 Dimensions of Socket Unions and pie union

(*Ref: Table 24 &25 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of outlet	Minimum Length (A) for socket union		Minimum Length (A) for pipe union	
(1)	(2)	(3)		(4)	
1	6	38		95	
2	8	44		100	
3	10	51		110	
4	15	57		115	
5	20	67		120	
6	25	76		125	
7	32	85		135	
8	40	100		140	
9	50	110		150	
10	65	120		165	
11	80	135		180	
12	100	160		205	
13	125	185		215	
14	150	210		230	

Note: Unions are normally supplied with flat seats and fitted with a washer. Other types of seating are obtainable, if required.

Notes:

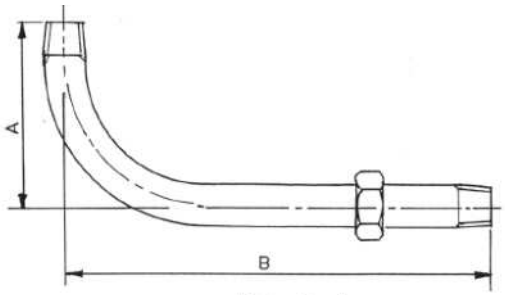
1. Bodies made from heavy tube conforming to IS 1239 (Part 1).

2. Unions are normally supplied with flat seats and fitted with a washer. Other types of seating are obtainable, if required.

Table 4.26 Dimensions of Union Bends

(*Ref: Table 26 of IS 1239part 2:2011(2021)*)

SN	Nominal Size of outlet	Minimum Length centre to face (A)	Minimum Length centre to face (B)
(1)	**(2)**	**(3)**	**(4)**
1	6	54	100
2	8	64	115
3	10	73	125
4	15	83	140
5	20	100	160
6	25	120	185
7	32	150	220
8	40	170	240
9	50	205	280
10	65	245	330
11	80	290	380



Union Bend

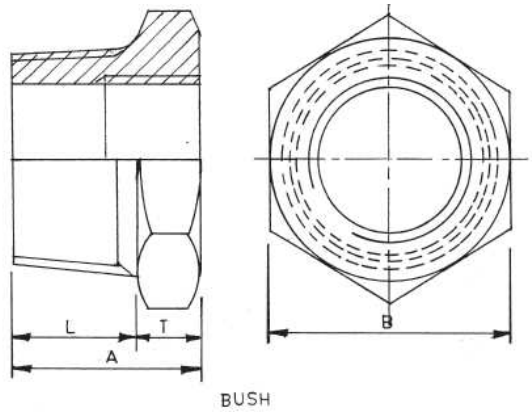
NOTES

1. Bodies made from heavy tube conforming to IS 1239 (Part 1).

2. Unions are normally supplied with flat seats and fitted with a washer. Other types of seating are obtainable, if required.

Table 4.27 Dimensions of Hexagon Bushes

(*Ref: Table 27 of IS 1239part 2:2011(2021)*)



BUSH

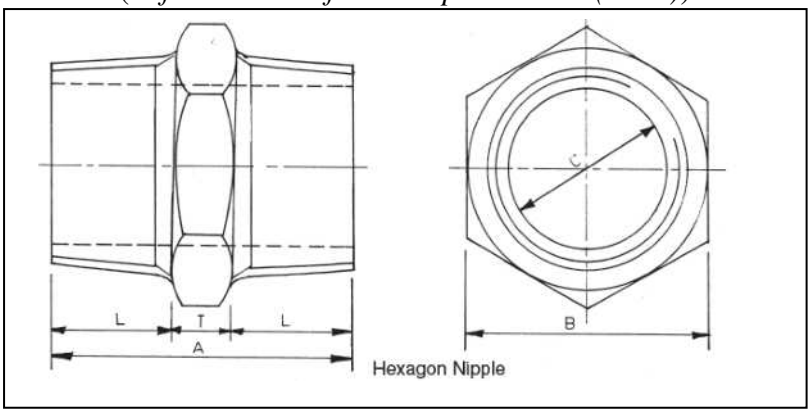
Note: External and internal threads shall be made as per IS 554.

SN	Normal Size		Length of Useful Threads for Basic Gauge Lengths Plus Clearance *(L, Min)*	Thickness of Hexagon *(T, Max)*	Minimum Overall Lengths *(A, Min)*	Width Across Flats of Hexagon (B)
	External Threads	Internal Threads				
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
1	8	6	12.5	6	18.5	15.5
2	10	8	12.5	7	20.5	17.9
3	15	8	17.5	8	25.5	23
		10	17.5	7	25.5	23
		10	19	10	29	27.8

4	20	15	19	10	29	27.8
5	25	15	21	10	31	35.3
		20	21	10	31	35.3
6	32	15	24	11	35	47.2
		20	24	11	35	47.2
		25	24	11	35	47.2
7	40	20	24	13	37	52
		25	24	13	37	52
		32	24	13	37	52
8	50	25	27	14	41	61.1
		32	27	14	41	61.1
		40	27	14	41	61.1
9	65	32	32	16	48	79
		40	32	16	48	79
		50	32	16	48	79
10	80	40	35	19	54	92
		50	35	19	54	92
		65	35	19	54	92
11	100	50	40	22	62	117
		65	40	22	60	117
		80	40	22	62	117
12	125	80	45	25	70	143
		100	45	25	70	143
13	150	80	45	25	70	168
		100	45	25	70	168

Table 4.28 Dimensions of Nipples, Hexagon, Equal

(*Ref: Table 28 of IS 1239part 2:2011(2021)*)



SN	Nominal Size	Minimum Length of Thread for Basic Gauge Length Plus Diameter Clearance (L)	Thickness of Hexagon (T)	Minimum Overall Length (A)	Maximum Diameter of Bore (C)	Width Across Flats of Hexagon (B)
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
1	6	9.5	6	25	5.5	13.1
2	8	12.5	6	31	6.5	15.5
3	10	12.5	8	33	9.5	17.9
4	15	17.5	8	43	12.5	23
5	20	19	10	48	19	27.8
6	25	21	20	52	25	35.3
7	32	24	11	59	32	47.2
8	40	24	13	61	38	52
9	50	27	14	68	51	61.1
10	65	32	16	80	64	79
11	80	32	19	89	76	92
12	100	40	22	102	100	117
13	125	45	25	115	125	143
14	150	45	25	115	150	168

Tolerances: Where maximum and minimum dimensions are not specified, the tolerance for centre to face and centre to centre dimensions shall be as specified in **Table 4.29**.

Table 4.29 Tolerance

(*Ref: Table 29 of IS 1239part 2:2011(2021)*)

SN	Dimensions		Tolerance
	Above	Up to and including	
(1)	**(2)**	**(3)**	**(4)**
1	-	30	±1.5
2	30	50	±2.0
3	50	75	±2.5
4	75	100	±3.0
5	100	175	±3.5

Notes:

1. Centre to face dimensions apply to elbows, bends, tees, crosses, etc.
2. Face to face dimensions apply to sockets, nipples, etc.
3 . Centre to centre dimensions apply to return bends.

**

Reference

SN	Description
1.	Indian standard 1538:1993(2018) cast iron fittings for pressure pipes for water, gas and sewage – specification
2.	Indian standard 9523:2000(2020) ductile iron fittings for pressure pipes for water, gas and sewage - specification
3.	Indian standard 1239 part 2:2011 (2021)- steel tubes, tubulars and other steel fittings — specification part 2 steel pipe fittings
4.	Indian Standard 13382:2018- Cast iron specials for Mechanical and push-on flexible joints for pressure pipes for water, gas and sewage-Specification
5	Indian Railways USSOR 2010
6	CPWD DSR 2023

NOTES

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If at any point contradiction is observed, then Indian Standards, regulations issued by Government bodies, Railway Board/RDSO guidelines shall be referred.

हमारा उद्देश्य

अनुरक्षण प्रौद्योगिकी और कार्यप्रणाली को उन्नयन करना तथा उत्पादकता और रेल्वे की परिसंपत्ति एवं जनशक्ति के निष्पादन में सुधार करना जिससे अन्तर्विषयों में विश्वसनीयता, उपयोगिता और दक्षता प्राप्त की जा सके।

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