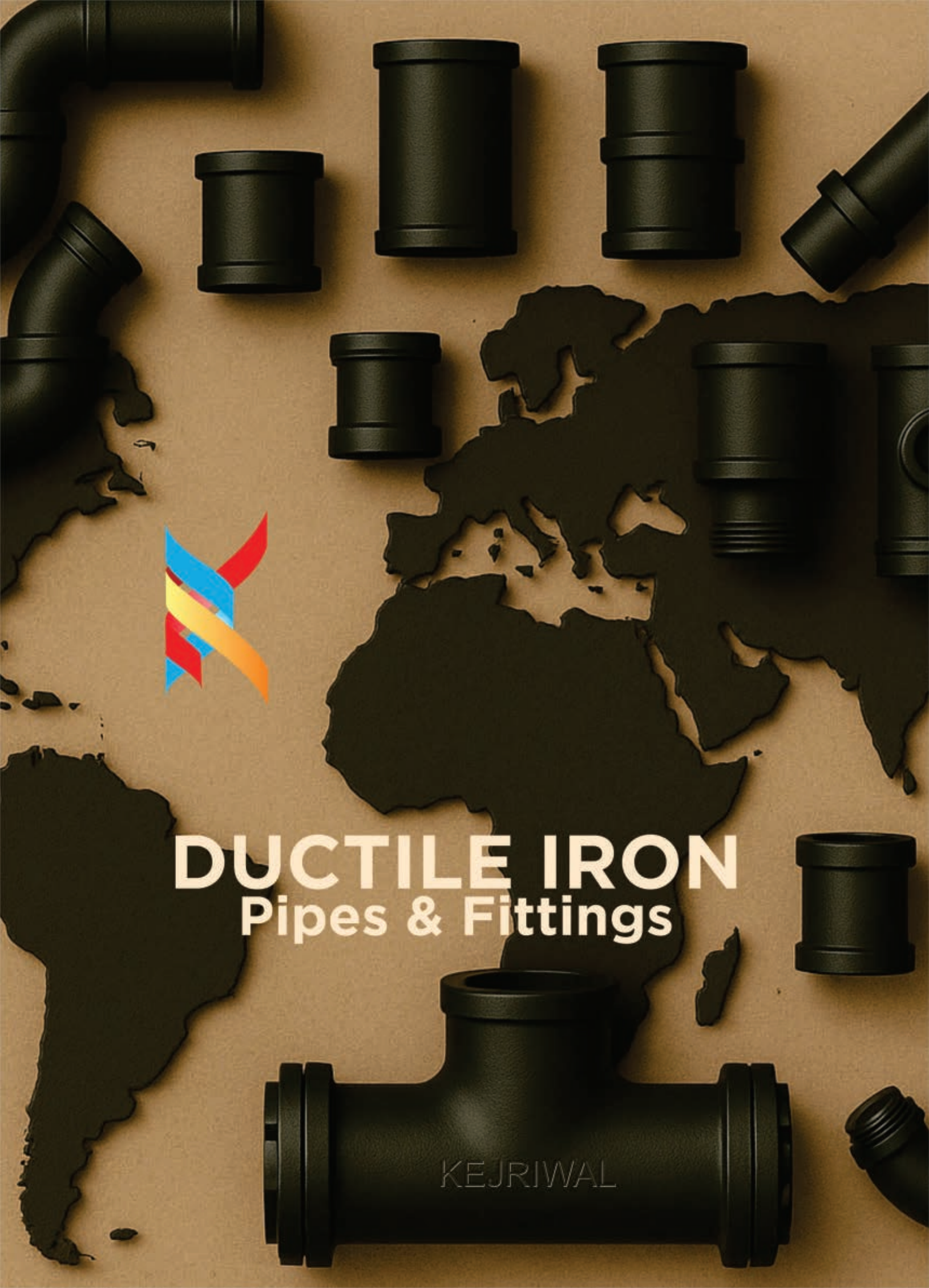

DUCTILE IRON
Pipes & Fittings
KEJRIWAL

We are committed to produce
quality Products
**(C.I., D.I., C.S. Valves, Pipes, Fittings,
Manhole Covers, Surface box etc.)**
consistently on schedule to the best
satisfaction of all our customers.

We shall also strive for improvement in
Quality Management System
by establishing and achieving
Quality Objectives
aimed at overall improvement
in our activities for enhanced
customer satisfaction.

Kejriwal CASTINGS LIMITED

Manufacturers of
Ductile Iron & Cast Iron Pipes, Fittings, Valves Etc

Eleventh Edition
2025-26

Late Bhagawati Prasad Kejriwal

Founder

In 1956, just nine years after India gained independence, the nation was grappling with the aftermath of partition. Amidst this challenging backdrop, a young enthusiast from Rajasthan, driven by a zeal to make a difference and an eye for opportunities, took a bold step. He ventured into setting up a cast iron foundry in Howrah, West Bengal. This marked the beginning of the remarkable journey of our founder, a visionary, the late **Shri Bhagwati Prasad Kejriwal.**

Hailing from the small town of Ramgarh in Rajasthan, Shri Kejriwal had limited formal education. However, he more than compensated for this with his hard work, sincerity, dedication, and acute business sense. His passion and integrity were the cornerstones of his success. As Shri Kejriwal wisely said, "In the realms of business and industry, it is vision and perseverance that pave the way to success."

The journey that began with a modest foundry in 1956 has undergone numerous transformations over nearly seven decades. Today, Kejriwal Castings Ltd stands as a testament to sheer willpower and endurance. Under the visionary leadership of Shri Bhagwati Prasad Kejriwal, the company thrived on a foundation of quality, ethical practices, and forward-thinking approaches.

A true pioneer, Shri Kejriwal's passion for pushing boundaries and embracing new challenges was the hallmark of our growth. From the early days, he recognized the importance of staying ahead of technological advancements and integrating them into our processes. His relentless pursuit of excellence and deep understanding of market dynamics enabled the company to evolve and flourish in an ever-changing landscape, achieving numerous firsts in the field.

As the Rig Veda wisely notes, **"When there is harmony between the mind, heart, and resolution, then nothing is impossible."**

Kejriwal
CASTINGS LIMITED

Contents

DNV PRODUCT CONFORMITY CERTIFICATE FOR PIPE


DNV

STATEMENT OF COMPLIANCE

Ductile Iron Pipes

Kejriwal Castings Limited.


DNV

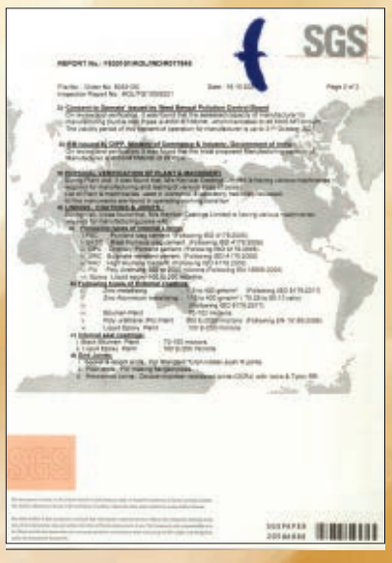
Certificate history:

Products covered by this Statement:


DNV

SGS CAPABILITY CERTIFICATE FOR PIPES


SGS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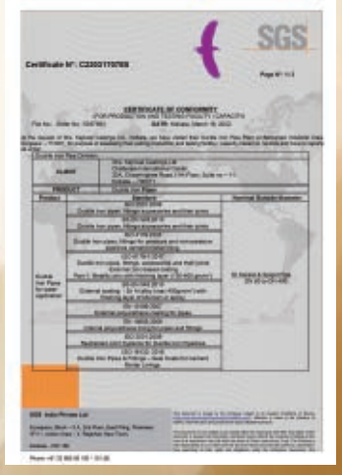
SGS CONFORMITY CERTIFICATE FOR PIPES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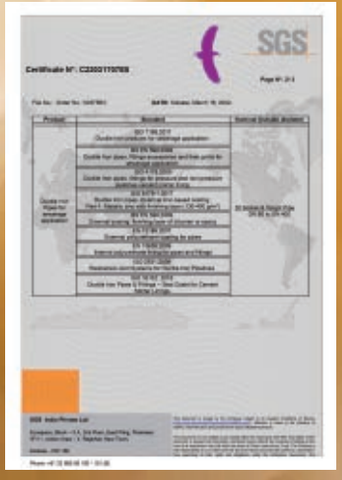
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DNV PRODUCT CONFORMITY CERTIFICATE FOR FITTINGS

DNV

STATEMENT OF COMPLIANCE

This is to certify that the product(s)

Ductile Iron – Flanged Pipes & Fittings
Size – DN 80 To DN 1400

manufactured by,

Kejriwal Castings Limited.

Applications/limitations:

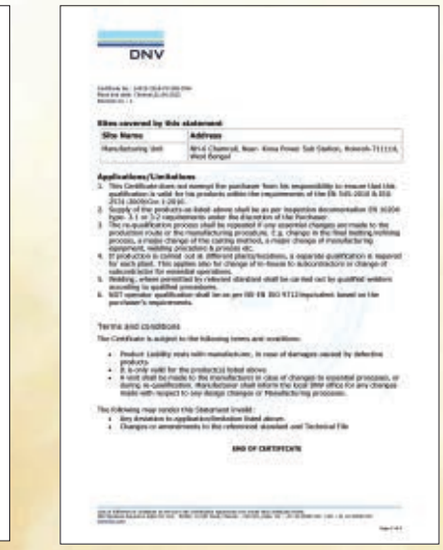
DNV

Certificate history

Revision	Description	Issue Date
0	Original Certificate	17.04.2019
1	Recertification Certificate	21.04.2022

Products covered by this Statement

Product Description	Size	Product Types	Technical File Reference
Ductile Iron – Flanged Pipes and Fittings	DN 80-DN 1400	SCREWED/WELDED FLANGE TYPES: FLANGED socket FLANGED spigot Collars Double socked bends 90° Double socket bends 45° Double socket bends 22°30' Double socket bends 11°15' All socket tees Double socket tees with branch flange Double socket taper Double flanged bends 90° Double flanged bends 45° Double flanged bend 22° 30' Double flanged bends 11°15' Double flanged stub end 90° bends All flanged tees Double flanged taper Blank flange Reducing flange	ISO/TS37001:2016 - Issue 2 dated 2021-09-20 Rev-1 Dated 05.04.2022



DNV

Sites covered by this statement

Site Name	Address
Manufacturing Unit	Mouza Chamrail, Near- Kona Power Sub Station, Howrah-711114, West Bengal

Applications/Limitations

1. This Certificate does not exempt the purchaser from his responsibility to ensure that the qualification is valid for the products within the requirements of the EN 545:2010 & BIS 2531:2009/Cor 1:2010.
2. Supply of the products as listed above shall be as per inspection documentation EN 10204 type- 3.1 or 3.2 requirements under the discretion of the Purchaser.
3. The re-qualification process shall be repeated if any essential changes are made to the production route or the manufacturing procedure, E.g. change in the final melting/holding process, a major change of the casting method, a major change of manufacturing equipment, welding procedure & process etc.
4. If production is carried out at different plants/locations, a separate qualification is required for each plant. This applies also for change of in-house to subcontractors or change of subcontractor for essential operations.
5. Welding, where permitted by relevant standard shall be carried out by qualified welders according to qualified procedures.
6. NDT operator qualification shall be as per ISO EN ISO 9712/equivalent, based on the purchaser's requirements.

Terms and conditions

The Certificate is subject to the following terms and conditions:

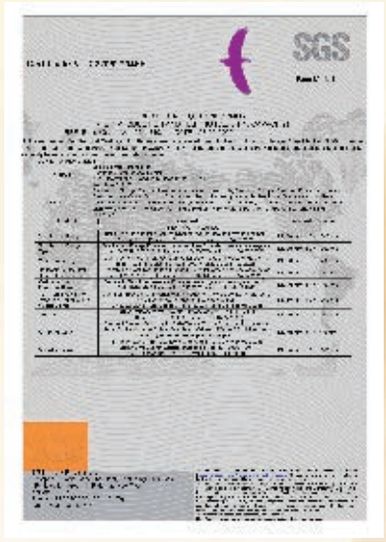
- Product Liability rests with manufacturer, in case of damages caused by defective products.
- It is only valid for the product(s) listed above.
- A visit shall be made to the manufacturers in case of changes to essential processes, or during re-qualification. Manufacturer shall inform the local DNV office for any changes made with respect to any design changes or Manufacturing processes.

The following may render this Statement invalid:

- Any deviation to application/limitation listed above.
- Changes or amendments to the referenced standard and Technical File

END OF CERTIFICATE

SGS CAPABILITY CERTIFICATE FOR FITTINGS & VALVES



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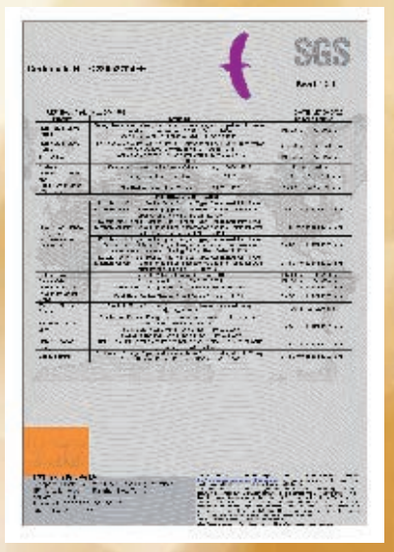

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KEJRIWAL CASTINGS LIMITED

Bureau Veritas Certification

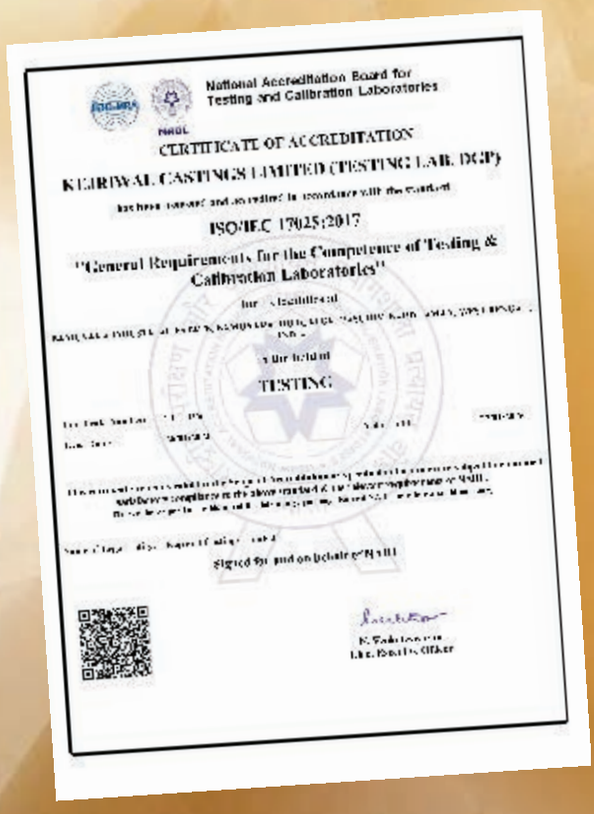
ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018

KEJRIWAL CASTINGS LIMITED

Bureau Veritas Certification

ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018

ISO 9001, 14001, 45001 Certificates


National Accreditation Board for Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

KEJRIWAL CASTINGS LIMITED (TESTING LAB. DGP)

ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

TESTING

NABL

PIPES

Ductile Iron Pipes

Ductile Iron (DI) Pipes

Ductile Iron (DI) Pipe's good mechanical properties, in addition to high durability, strength and corrosion resistance properties make them ideal for high-pressure applications. Ductile Iron pipes are used extensively in systems transporting potable water, industrial water, irrigation water and waste water. Metallic pipes, primarily Cast Iron had been used over two centuries for water and wastewater transportation. Ductile Iron pipes which belong to the family of Cast Iron have been developed by treating the molten low-sulphur and low-phosphorous base iron with magnesium under closely controlled conditions. The startling change in the metal is characterized by the free graphite in Ductile Iron being deposited in the spheroidal or nodular form, leading to maximum continuity of metal matrix thereby forming a stronger and tougher ductile material with high ductility and tensile strength.

With protective linings and coatings like cement mortar, bitumen, epoxy, zinc and polyurethane, Ductile Iron pipes provide an exceptionally long life to serve the water and sanitation networks.

The flexible and leak tight jointing systems in Ductile Iron pipes, which can be easily push fitted (or mechanically joined) provides ease in transportation of pipes as well as laying works. The pipeline and jointing system can withstand the vagaries of nature, thereby ensuring sustainable and quality piping solutions to the customers.

The capacity of Kejriwal Castings Limited is as follows

- Ductile Iron Pipe manufacturing facility (installed capacity 100,000 MT per annum)
- Ductile Iron Castings manufacturing facility (installed capacity 12,000 MT per annum)

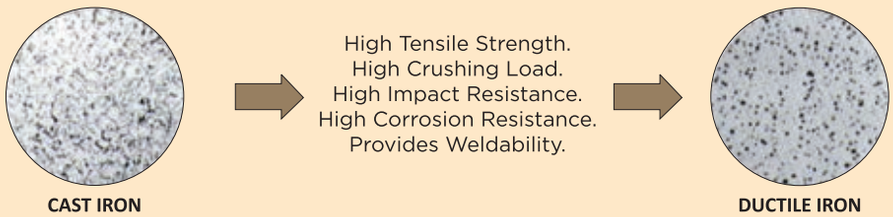
Quality is the key mantra at Kejriwal Castings Limited. Quality checks are carried out at every stage of the manufacturing process to meet the requirements as per international standards.

'Nurture with Nature' is the guiding principle for Kejriwal. To ensure eco-friendly and sustainable growth, all the plants of Kejriwal are equipped with advanced pollution control units and ecology conservation systems. Ductile Iron pipes manufactured by the company conform to both Indian and International Standards like IS 8329, ISO 2531, ISO 7186, BSEN 545 and BSEN 598.

Mechanical Properties of Ductile Iron Pipes

Ductile Iron

Ductile Iron is produced by treating the molten low-Sulphur and low-Phosphorous base Iron with Magnesium under closely controlled conditions. The metal characteristics are enhanced by the free graphite in Ductile Iron being deposited in the spheroidal form or nodular form instead of flaky form as in grey Iron. Due to the presence of free graphite in the nodular form, the continuity of metal matrix is at the maximum, leading to the formation of a stronger, tougher ductile material exceeding grey (or cast) Iron in strength, in ductility and in tensile strength.



Microstructure transformation of Cast Iron to Ductile Iron

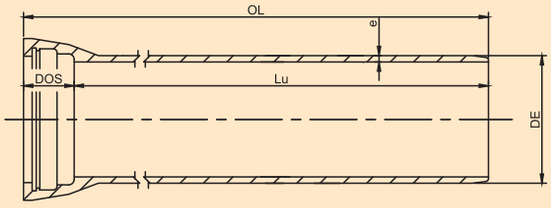
Mechanical Properties of Ductile Iron pipes

Mechanical Properties	Values
Tensile Strength	Min. 4,200 kg/cm² or 420 MPa
Yield Strength	3,000 kg/cm² or 300 MPa
Minimum Elongation	For Pipe - 10% up to DN 1000. For Fittings 5%
Modulus of Elasticity	1.62×10^6 - 1.70×10^6 kg/cm² or 162,000 - 170,000 MPa
Hardness	< 230 BHN
Density	7,050 kg/m³
Bending/Beam Strength	More than 500 MPa or 5098 kg/cm²
Co-efficient or Thermal	11.5×10^{-6} per Degree Celsius
Expansion	(for temperature range 20-100°C)
Thermal Conductivity	36 Wiper Degree Celsius m-k (for temperature range 20-100°C)
Specific Heat	460 J/Kg-K for temperature range 20 - 100°C
Electrical Resistivity	2.24×10^{-5} - 3.56×10^{-5} Ohm/cm (for temperature range 20 - 300°C)
Compressive Strength	550 MPa (minimum)
Torsional Strength	3,800 kg/cm² or 380 MPa
Poisson's Ratio	0.275

Technical Specifications

Product Name	Ductile Iron pipe suitable for Push-on-Joint, Flanged Joint, Restrained Joint as per ISO 2531; BSEN 545; BSEN 598; ISO 7186; IS 8329; ISO 10804
Class of Pipe	C20, C25, C30, C40, C50, C64, C100, Class K7, Class K9 and PP Class
Size Range	DN 80 mm to DN 400 mm
Standard Length	5.5 / 6.0 meter
Internal Lining	• Cement Mortar Lining as per IS 8329/ISO 4179 • Cement Mortar Lining with Bituminous Seal Coat as per IS 8329 / ISO 16132 • Cement Mortar Lining with Epoxy Seal Coat as per IS 8329 / ISO 16132 • Polyurethane Lining as per BSEN 15655 • Cement Type: Ordinary Portland Cement/Sulphate Resistant Cement/ Blast Furnace Slag Cement / High Alumina Cement • Liquid Epoxy Paint as per EN 14901 • Fusion Bonded Epoxy as per EN 14901 • Ceramic Epoxy Lining
Outside Coating	• Zinc Coating (130 gm/m² or 200 gm/m² or 400 gm/m²) with finishing layer of Bitumen / Blue Epoxy / Red Epoxy / Aluminum pigmented Bitumen as per IS 8329 / ISO 8179. • Alloy of Zinc and Alluminium with or without metals having a minimum mass of 400 gm/m² with finishing layer of Bitumen/Blue Epoxy/Red Epoxy as per IS 8329 / ISO 8179. • Polyurethane Coating as per IS 8329 / BSEN 15189.
Outside On-site Protection	• Polyethylene Sleeving as per IS 8329 / ISO 8180
Coating of Joint Area	• Bitumen as per BS 3416 • Epoxy - Blue/ Red as per BSEN 14901 • Polyurethane as per BSEN 15189

Pipe Dimensions



Dimension of Socket and Spigot Pipe

Key
L = Standardized length in meters
e = Nominal wall thickness in mm
DE = Nominal external diameter of spigot in mm

Dimension Details of Kejriwal Pipes

DN (mm)	Nominal Pipe Wall Thickness, e (mm) Various Classes of Pipes											
	Nominal	Limit Deviations	C20	C25	C30	C40	C50	C64	C100	As per BSEN 598 (Pressure Pipe)	K7	K9
80	98	+1/-2.7				4.4	4.4	4.4	4.8	4.8	5.0	6.0
100	118	+1/-2.8				4.4	4.4	4.4	5.5	4.8	5.0	6.0
125	144	+1/-2.8				4.5	4.5	4.8	64	4.8	5.0	6.0
150	170	+1/-2.9				4.5	4.5	5.3	7.4	4.8	5.0	6.0
200	222	+1/-3.0				4.7	5.4	6.5	9.2	4.9	5.0	6.3
250	274	+1/-3.3				5.5	6.4	7.8	11.1	5.3	5.3	6.8
300	326	+1/-3.3			5.1	6.2	7.4	8.9	12.9	5.6	5.6	7.2
350	378	+1/-3.4		5.1	6.3	7.1	8.4	10.2	14.8	6.0	6.0	7.7
400	429	+1/-3.5		5.5	6.5	7.8	9.3	11.3	16.5	6.3	6.3	8.1
450	480	+ 1/-3,6		6.1	6.9	8.6	10.3	12.6	18.4	6.7	6.6	8.6
500	532	+ 1/-3,8		6.5	7.5	9.3	11.2	13.7	20.2	7.0	7.0	9.0
600	635	+ 1/-4,0		7.6	8.7	10.9	13.1	16.1	23.8	7.7	7.7	9.9
700	738	+ 1/-4,3	7.3	8.8	9.9	12.4	15.0	18.5	27.5	9.6	9.0	10.8
800	842	+ 1/-4,5	8.1	9.6	11.1	14.0	16.9	21.0		10.4	9.7	11.3
900	945	+ 1/-4,8	8.9	10.6	12.3	15.5	18.8	23.4		11.2	10.4	11.7
1000	1048	+ 1/-5,0	9.8	11.6	13.4	17.1	20.7			12.0	11.2	12.6
1100	1152	+ 1/-6,0	10.6	12.6	14.7	18.7	22.7			14.4	12.0	13.5
1200	1255	+ 1/-6,0	11.4	13.6	15.8	20.2				15.3	14.4	14.4
1400	1462	+ 1/-6,6	13.1	15.7	18.2					17.1	15.3	15.3
1500	1565	+ 1/-7,0	13.9	16.7	19.4					17.9	17.1	17.1
1600	1668	+ 1/-7,4	14.8	17.7	20.6					18.9	18.9	18.9
1800	1875	+ 1/-8,2	16.4	19.7	23.0					20.7	20.7	20.7
2000	2082	+ 1/-9,0	18.1	21.8	25.4					22.5	22.5	22.5
2200	2288		19.8	23.8								
2400	2495		21.4	25.8								
2600	2702		23.1	27.9								

NOTE:
- The tolerance on pipe wall thickness is - (1.3+0.001 DN) for thickness greater than 6.0 mm and -1.3 mm for thickness less than or equal to 6.0 mm
- For centrifugally cast pipes, minimum wall thickness shall not be less than 3.0 mm

Allowable Pressure

Classification of Ductile Iron Pipes from Thickness (K) Class to Pressure (C) Class

Prior to revision of International Standards in the year 1998, Ductile Iron pipes were classified based on the thickness, i.e K7, K8, K9 etc (also known as Thickness Class). The allowable pressures were calculated based on the nominal wall thickness of the pipe. As per ISO 2531:1998, the minimum thickness in the standards was K9. In event of lower operating pressure in the system users had no choice than to select the K9 class of pipe with higher value of allowable operating pressures. On the other hand, other pipe materials such as for Steel pipes, the pipe's wall thickness were designed on the basis of operating pressure in the system with the assumption of certain safety factors. In view of the above so as to bring parity in classification of Ductile Iron pipes, amendment to ISO 2531:1998 were done to introduce 'C' class pipes in the revised edition of ISO 2531:2009. EN 545:2002 edition introduced class C 40 pipes along with K9 class pipes. Finally in the subsequent revision of EN 545:2010 the pressure class was introduced completely abolishing the Thickness based classification.

In line with the introduction of 'C' class pipes, the Design Standard for Ductile Iron pipes, i.e. ISO 10803:2011 was revised accordingly.

PFA: Allowable Operating Pressure: Maximum hydrostatic pressure that a component is capable of withstanding continuously in service. For 'C' class pipes, the number followed by letter 'C' indicates the PFA. For example C 20 means the pipe has maximum allowable pressure of 20 bar or 20 Kg./cm^2. For 'C' class, the values are given in Table 9.

PMA: Allowable Maximum Operating Pressure: Maximum pressure occurring from time to time, including surge, that a component is capable of withstanding in service. PMA = 1.2x PFA; the values are given in Table 9.

PEA: Allowable Test Pressure: Maximum hydrostatic pressure that a newly installed pipe/component is capable of withstanding for a relatively short duration, in order to ensure the integrity and tightness of the pipeline.

PEA =1.2x PFA + 5 bar; the values are given below

'C' Class Pipe - As per ISO 2531 & BSEN 545

Pressure Class	Allowable Operating Pressure, PFA	Maximum Allowable Operating Pressure, PMA	Allowable SiteTest Pressure , PEA
C	Bar	Bar	Bar
20	20	24	29
25	25	30	35
30	30	36	41
40	40	48	53
50	50	60	65
64	64	76.8	81.8
100	100	120	125

Allowable Pressures of Components with Flanged Joints

Pressure Class	Allowable Operating Pressure, PFA	Maximum Allowable Operating Pressure, PMA	Allowable Site Test Pressure PEA
PN	Bar	Bar	Bar
10	10	12	17
18	16	20	25
25	25	30	35
40	40	48	63

Allowable Pressures of Components with Socketed Fittings

Nominal Size DN	Allowable Operating Bar Pressure, PFA	Maximum Allowable Operating Pressure, PMA Bar	Allowable Site Test Pressure (PEA)
100 - 200	64	77	82
250 - 350	50	60	65
400 - 600	40	48	53
700 - 1400	30	36	41
1500- 2600	25	40	35

(1 bar = 0.1 MPa =1.0197 Kg/cm^2 =10.199 meter of water head)

Allowable Pressures of Components with Socketed Fittings

PIPE SIZE	Allowable Operating Pressure In (MPa)		Allowable Max. Operating Pressure (MPa)		Allowable Site Operating Pressure (MPa)	
DN	K7	K9	K7	K9	K7	K9
80	0.8	6.4	1.25	7.7	1.75	9.6
100	0.8	6.4	1.25	7.7	1.75	9.6
125	0.8	6.4	1.25	7.7	1.75	9.6
150	0.8	6.4	1.25	7.7	1.75	9.6
200	0.8	6.2	1.25	7.4	1.75	7.9
250	0.8	5.4	1.25	6.5	1.75	7.0
300	0.8	4.9	1.25	5.9	1.75	6.4
350	0.8	4.5	1.25	5.4	1.75	5.9
400	0.8	4.2	1.25	5.1	1.75	5.6
450	0.8	4.0	1.25	4.8	1.75	5.3
500	0.8	3.8	1.25	4.6	1.75	5.1
600	0.8	3.6	1.25	4.3	1.75	4.8
700	0.8	3.4	1.25	4.1	1.75	4.6
750	0.8	3.3	1.25	3.9	1.75	4.4
800	1.0	3.2	I.5	3.8	2.0	4.3
900	1.0	3.1	1.5	3.7	2.0	4.2
1000	1.0	3.0	1.5	3.6	2.0	4.1
1100	2.9	2.9	3.5	3.5	4.0	4.0
1200	2.8	2.8	3.4	3.4	3.9	3.9
1400	2.8	2.8	3.3	3.3	3.8	3.8
1600	2.7	3.2	3.2	3.7	3.7	
1800	2.6	2.6	3.1	3.1	3.6	3.6
2000	2.6	2.6	3.1	3.1	3.6	3.6

*All dimensions are in millimetres.

Hydrostatic Work Test Pressure

Hydrostatic Work Test Pressure for Pipes and Fittings

Hydrostatic tests are done at works to check the leak-tightness of pipes. The tests are carried out before application of external coating and internal lining.

a) 'K' Class Ductile Iron Pipes

Hydrostatic Test Pressure at Works for 'K' Class Ductile Iron pipes

Nominal Diameter	Minimum Hydrostatic Test Pressure at Works, MPa					
	Centrifugally Cast Pipes with Flexible Joints		Pipes with Welded-on-Flange			
	K7	K9	PN 10	PN 16	PN 25	PN 40
DN 80 - DN 300	3.2	5.0	1.6	2.5	3.2	4.0
DN 350 - DN 400	2.5	4.0	1.6	2.5	3.2	4.0
450 - 600	2.5	4.0	1.6	2.5	3.2	4.0
700 - 1000	1.8	3.2	1.6	2.5	3.2	--
1100 - 2000	1.2	2.5	1.6	2.5	2.5	–

b) 'C' Class Ductile Pipes

The internal hydrostatic test pressure should be raised until it reaches the works hydrostatic test pressure, equal to the pressure class and limited to the pressure of preferred class. Higher pressures are permissible. The total duration of the pressure cycle shall not be less than 15 seconds including 10 second at test pressure.

c) Ductile Iron Fittings

Hydrostatic Test Pressure at Works for Ductile Iron fittings

Nominal Diameter (DN)	Pipes not centrifugally Cast, Fittings and Accessories (Bar)
80 - 300	25
350 - 600	16
700 - 1400	10
1500-2000	10

Standard Lining

Internal Lining of Cement Mortar

The internal cement mortar lining of Ductile Iron pipes constitute a dense, homo-geneous layer covering the total internal surface of the pipe barrel. The cement mortar mix shall comprise cement, sand and water. The cement should be one of those listed below:

- All kinds of Portland cement
- Blast Furnace Slag cement
- Sulphate Resistant cement and
- High Alumina cement

The water used in the mortar mix complies with standard set for drinking water.

Internal Cement Mortar Lining

Strength of Lining

When measured, the compressive strength of the cement mortar after 28 days of curing shall not be less than 50 MPa. The compressive strength of the lining is directly related to other functional properties such as high density, good bond and low porosity.

Thickness and Surface Condition

The surface of the cement mortar lining should be uniform and smooth. Trowel marks, protrusion of sand grains and surface texture inherent to the method of manufacture are acceptable. However, there should be no recesses or local defects which reduce the thickness to below the minimum value. The nominal thickness of the cement mortar lining and its tolerance should be as given in table below

Thickness of Cement Mortar Lining

As per BS EN 545

DN	Thickness mm	
	Nominal Value	Limit Deviation
40 - 300	4	-1.5
350 - 600	5	-2.0
700 - 1200	6	-2.5
1300 - 1400	9	-3.0
1500 - 2000	9	-3.0
2200 - 2600	12	-5.0

As per ISO 2531

DN	Thickness mm	
	Nominal Value	Limit Deviation
40 - 300	3	2
350 - 600	5	3
700 - 1200	6	3.5
1400 - 2000	9	6
2200 - 2600	12	7

As per IS 9523

DN	Thickness mm		Max Crack width & Radial Displacement
	Nominal Value	Tolerance	
80 - 300	3	-1.5	0.8
350 - 600	5.0	-2.0	1.0
700 - 1200	6.0	-2.5	1.2
1400 - 2000	9.0	-3.0	1.5

Note : Higher thickness can also be provided as per customer requirement.

Standard Coating

All pipes are supplied with an external coating of metallic Zinc or Zinc-Aluminium Alloy (Zn-Al Alloy) with a finishing layer of Bitumen/Epoxy Resin. Aluminium Pigmented Bitumen.

External Coating of Zinc with Finishing Layer of Bitumen

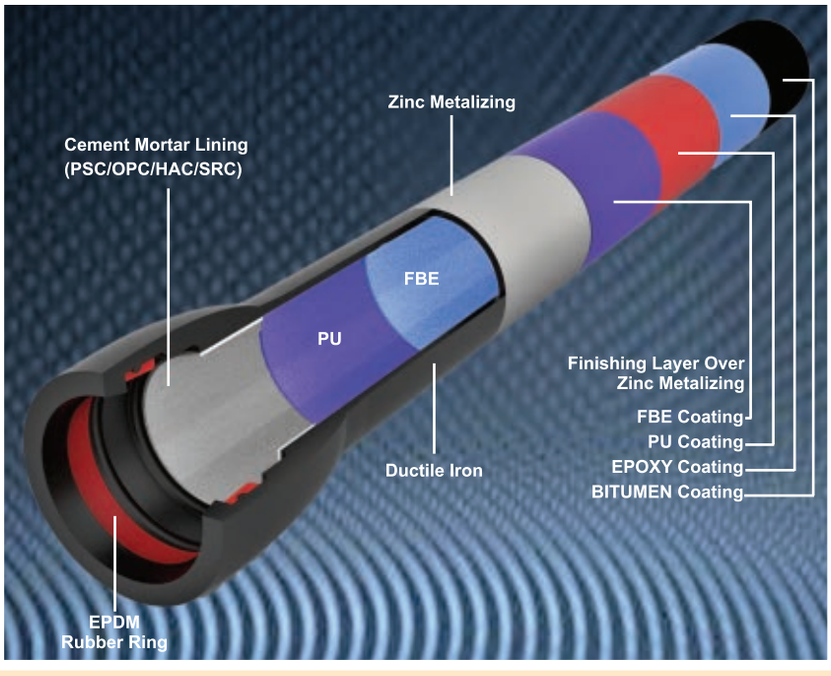
The external coating of Ductile Iron pipes comprise of a layer of metallic Zinc, followed by a finishing layer of a Bituminous/Epoxy resin. The Zinc is normally applied on oxide-free surface pipes after heat treatment or it may also be applied on blast-cleaned pipes. Prior to application of the Zinc, the pipe surface should be dry and free from rust or non-adhering particles or foreign matter such as oil or grease.

Coating Characteristics

The metallic Zinc coating covers the external surface of the pipe and provides a dense, continuous, uniform layer. The purity of the Zinc used should be at least 99.99%. The Ductile Iron pipes are manufactured by Kejriwal with the following option on the basis of Zinc mass applied to the pipe surface:

1. The mean mass of Zinc per unit area is 130g/m^2 (for pipes and fittings)
2. The mean mass of Zinc per unit area is 150g/m^2 (for pipes)
3. The mean mass of Zinc per unit area is 200g/m^2 (for pipes)
4. The mean mass of Zinc per unit area is 400g/m^2 (for pipes)
5. The mean mass of Zinc Aluminium per unit area is 400g/m^2 (for pipes)

The uniformity of the finishing layer is checked and when measured, the mean thickness of the finishing layer should not be less than 70 mm and the local minimum thickness not less than 50 mm.



Special Lining and Coatings

Seal Coat for Cement Mortar Lining

Epoxy seal coat for Cement mortar lining is provided if the customer specifies it. Unless otherwise specified by the purchaser, the minimum Dry Film Thickness (DFT) provided is average 70 micron with minimum at one point of 50 micron. The coating is uniform, free of thin spots and other imperfections.

Pipe Preparation

The pipe internally lined with cement mortar is shot blasted or buffed using a mechanical device and the cement laitance layer is thoroughly removed. The pipe is then thoroughly cleaned of all loose foreign matter with the help of clean, dry, oil free compressed air in a manner that does not adversely affect the cleaned surface. Alternatively, vacuum cleaning or other methods may be used in place of compressed air, without affecting the pipe surface.

Application of Seal Coat System

The seal coat is applied using an airless spray gun mounted on a moving boom. If more than one coat is applied, the subsequent coat is applied within the time limits, surface conditions and temperature recommended by the manufacturer.

Visual Appearance

The seal coat is uniform and when visually examined, it is free from any coating irregularities likely to be detrimental to the performance of the seal coat.

Seal Coat Repair

For minor damage to the seal coat at the ends of pipe, no repair of the seal coat is necessary.

Polyurethane Lining

Polyurethane lining material consists of two component solvent free Epoxy resin. Mineral fillers, pigments and additives are selected in order that the final product complies with the performance requirements given in BSEN 15655.

Application Method: Airless Hot Spray Method

Surface Preparation

Prior to the application of the Polyurethane lining, the surface of the pipes or fittings to be lined, should be clean, free of rust, loose constituent materials, dirt, oil, grease and moisture.

In cold weather, or any time when the moisture tends to condense on the surface of the pipe or fitting, it should be uniformly warmed for sufficient time prior to cleaning. The surface temperature should be maintained at least 5°C above the dew point.

The Polyurethane lining should be of:

- Uniform colour, except the spigot end and the internal socket profile which may be of a different colour and different coating material.
- Uniform appearance and smoothness except for admissible repairs.
- Free from visible defects (pinholes, bubbles, blisters, wrinkles, cracks or voids).

  Slight superficial variations of colour or brilliance due to repairs or prolonged exposure to sunlight of contact with other pipes are permissible.

Polyurethane Lining Thickness

Lining Thickness of Pipes and Fittings for Drinking Water Transportation		
DN	**Mean value x, µm**	**(x-26), µm**
80 - 200	≤ 1300	≤ 800
< 200	≤ 1500	≤ 800
Lining Thickness of Pipes and Fittings for Wastewater Transportation		
80 - 200	≤ 1300	≤ 800
250 - 700	≤ 1500	≤ 800
750 - 1000	≤ 800	≤ 1000
< 1000	≤ 2000	≤ 1000

Note: Higher thickness can also be provided as per customer requirement.

Epoxy (Synthetic) Coating

Epoxy coating is provided if the customer specifies it. Unless otherwise specified by the purchaser, the minimum dry film thickness (DFT) of Epoxy coating should be average 70 micron with minimum at one point of 50 micron. After curing but prior to laying of pipes, the coating should be a continuous film, free of thin spots and other imperfections.

Coating Application

The pipe coating should be applied in accordance with the manufacture's recommendations. Application of Epoxy coating is carried out by airless spray equipment.

Pipe Preparation

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

Application of Epoxy Coating System

If more than one coat is applied, the subsequent coat should be applied within the time limits, surface conditions and temperature recommended by the manufacturer. If the period between coats is exceeded, then a repair procedure should be obtained from the coating manufacturer and its recommendations followed.

Coating Repair

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

Materials	
Polyurethane Minimum Thickness	700 microns
Non-porosity Test Voltage	4.2/6KV
Impact Test (using wire mesh/conductive rubber electrode)	10 J
Adhesion Test	8MPa
Hardness	70 Shore D

Polyurethane Coating

Polyurethane consists of high build, two components, resin. The coating is capable of airless spray application to provide an average 2mm of Dry Film Thickness (DFT) in a continuous application.

The mechanical properties of the coating should meet the requirements of DIN 30671/BS EN 15189.

Surface Preparation

Prior to the application of the Polyurethane coating, the surface of the pipes or fittings to be coated should be clean, free of rust, loose constituent materials, dirt, oil, grease and moisture.

In cold weather, or any time when the moisture tends to condense on the surface of the pipe or fitting, it should be uniformly warmed for sufficient time prior to cleaning. The surface temperature should be maintained at least 5°C above the dew point.

The surface should be prepared by grinding (only for pipes) and sand (grit) blasting.

Finished Polyurethane Coating

The Polyurethane coating should be of:

- Uniform colour, except the spigot end and the socket which may be of a different colour for permitted marking.
- Uniform appearance and smoothness except for admissible repairs.
- Free from visible defects (pinholes, bubbles, blisters, wrinkles, cracks or voids).

Slight superficial variations of colour or brilliance due to repairs or prolonged exposure to sunlight of contact with other pipes are permissible.

Minimum Coating Thickness - 700 micron.

Lay Flat Width of Tubular Polyethylene Sleeve

Nominal Internal Diameter of Pipe (mm)	Lay Flat Width (mm)
80	350
100	350
150	450
200	550
250	650
300	700
350	800
400	1100
450	1100
500	1350
600	1350
700	1750
800	1750
900	2000
1000	2000
1100	2500
1200	2500
1400	2750

Note: Actual lay flat width of the tubular film shall not differ from the nominal by more than ± 2.5%

Polyethylene Sleeve

Protective Polyethylene sleeves are used to cover DI pipes and fittings installed in buried conditions and accordance to ISO 8180.

The Polyethylene sleeve is black in colour and resistant to the effect of ultra violet light.

The material is made from a polymer with a melt flow index as measured according to BS 2782, of 10 or less and a density in the range of 0.910 to 0.935 g/ml. The sleeve is free from pinholes, gels, undispersed raw materials and particles of foreign matter. The film shall not contain more than 5% by weight of material other than Polyethylene.

The material used for making the film is Polyethylene or a mixture of Polyethylene and or Ethylene and Olefin co-polymers. Its density should be between 910 and 930 kg/m^3. Polyethylene sleeves are stored in a cool dry store, away from direct sunlight or excessive heat.

Thickness

The nominal thickness of the sleeving should not be less than 200 mm and not more than 250 mm unless otherwise agreed. The negative tolerance on the nominal thickness shall not exceed 10%. If necessary, it is permitted to use thicker sleeving or double sleeving.

Mechanical Properties

Tensile strength of the film in the longitudinal and transverse direction should not be less than 8.3 MPa.

The elongation at the fracture of the film in the longitudinal and transverse directions should not be less than 300%.

The dielectric strength of the film should be 31.5 V/mm minimum.

Manufacturing Process of Ductile Iron Pipes

Molten Iron Preparation : Molten metal is produced in the Induction furnace. The super heating and chemical correction of the molten metal is done by adding required quantity of Mild Steel scrap. The molten metal from the Induction Furnace is further taken into converter and Magnesium is added to convert the graphite into spheroidal shape.
The molten metal treated with magnesium is transferred to the casting platform.

Centrifugal Casting : The molten metal is poured into the water-cooled jacketed metallic centrifugal casting machine, spinning at high speed. The mould is cooled by the water flowing in the jacket which helps in solidifying the molten metal in the form of a pipe. The casted pipe is extracted by an extractor and transferred to annealing furnace.

Annealing : Annealing is a heat treatment wherein a material composition is altered, causing changes in its properties such as strength and hardness. Annealing is used to induce ductility, soften material, relieve internal stresses, refine the structure by making it homogeneous and improve cold working properties. Annealing furnace is a horizontal chain style furnace made up of heating section, heat holding section, slow cooling section and fast cooling section. The Ductile Iron pipe, after entering the furnace, is pushed rolling forward by claws on chains driven by a speed regulating motor.

Zinc Coating : After heat treatment the DI pipe is transferred to Zinc Coating section where the Zinc wire is melted using electric arc and applied to the external surface of the pipe by spraying evenly.

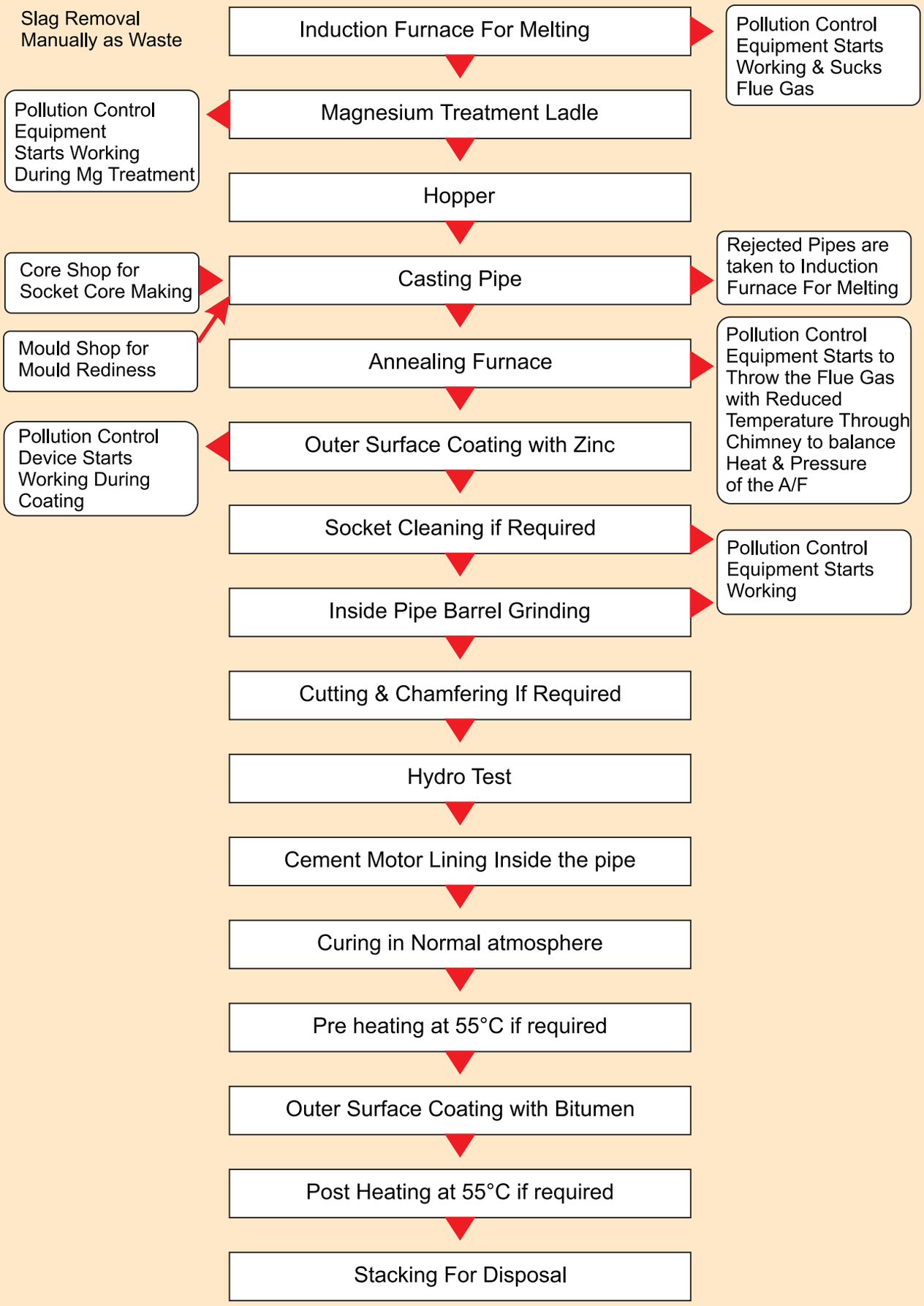
Hydrostatic Testing : After Annealing, bell and spigot end, internal and external surface of the DI pipes are finished to remove fins and so on, and then checked for their dimensions. After cleaning and finishing, Ductile Iron pipes are hydro tested one by one as per the standard specification and requirements.

Cement Lining : A mixture of cement, sand and water as per specified proportion is pumped through a lance into the pipe spinning at low speed. The pipe is then rotated at high speed where excessive water from the cement slurry is discharged leaving behind dense cement mortar lining the internal surface of the pipeline. Cement lining is then passed to the curing chamber where the desired humidity is maintained.

Bitumen Coating : After curing the DI pipes are transferred to Bitumen/Epoxy coating stations. The anti-corrosive Bitumen/ Epoxy layer is applied to external surface of pipes and internal surface of socket. The Bitumen/Epoxy layer applied must be even, without any trace of dripping or flowing. The pipes after coating, are transferred to drying chambers.

Marking, Packing and Shipping : The pipes coming out of drying chambers are marked with installation mark at spigot end and various marking as per specification including the trade mark, if any, are painted on the external surface of pipes. After marking, the pipes are transferred to yard for final inspection and dispatch to respective clients.

Flow Chart Of Manufacturing Process Of Ductile Iron Pipes



Plant Overview

Total Capacity: 100,000 MT per year Machines Allocation:
2 Machines for DN 80 to DN 200: Capacity of 40,000 MT.
2 Machines for DN 80 to DN 400: Capacity of 60,000 MT.

Detailed Process Flow-Chart

1. **Raw Material Handling**

   Inputs: Pig iron, metal scrap

   Process: Sorting and preparation of raw materials; metal scrap is cleaned, and quality pig iron is selected.

   Equipment: EOT crane with magnet.

   Temperature: Ambient.

2. **Melting and Alloying**

   Equipment: Induction furnaces

   Process: Pig iron and scrap are melted; composition is adjusted to meet specifications.

   Temperature: 1450°C to 1500°C

   Time: 40 minute to 45 minute for 04 MT.

Composition:

Percentage	Composition %
C %	- 3.3 to 3.9
Si %	- 1.60 to 2.20
Mn %	- 0.50 Max
P %	- 0.150 Max
S %	- 0.070 Max
Ti %	- 0.150 Max
Cr %	- 0.100 Max
Mo %	- 0.100 Max
Ni %	- 0.080 Max

Additives: Silicon and carburiser (to meet the composition)

3. **Spheroidization**

   Additives: Pure magnesium ingot.

   Process: Treatment with pure magnesium ingot to modify graphite structure and stabilize the microstructure.

   Temperature: 1450°C to 1500°C for spheroidization.

   Equipment: Treatment vessel with tilting mechanisms.

4. **Quality Control**

   Process: Chemical analysis (Mg%- Min 0.030 & S%- Max 0.020) after magnesium treatment.

   Equipment: Coin sample testing in Spectrometer.

   Temperature: Ambient.

5. Centrifugal Casting

Equipment Split:

2 Machines for DN 80 to DN 200

2 Machines for DN 80 to DN 400

Process: Molten iron is poured into centrifugal casting machines. Machine specifications differ based on the pipe size to optimize production.

Temperature: Molten iron at 1400°C, cooling to ambient.

Output Rate: 40,000 MT/year for smaller diameters, 60,000 MT/year for larger diameters.
Additives: Mould powder & Inoculation powder to modify graphite structure and stabilize the microstructure.

Thickness:

Size	Thickness			
	K7		K9	
	Min. (mm)	Nom. (mm)	Min. (mm)	Nom. (mm)
DN 80	5.0	5.0	6.0	6.0
DN 100	5.0	5.0	6.0	6.0
DN 150	5.0	5.0	6.0	6.0
DN 200	5.0	5.0	6.0	6.3
DN 250	5.0	5.3	6.0	6.8
DN 300	5.0	5.6	6.0	7.2
DN 350	5.0	6.0	6.05	7.7
DN 400	5.0	6.3	6.4	8.1

6. Quality Control

Process: Dimensional checks, thickness check, casting defects and visual inspection.
Equipment: Pistol calliper, diameter tape and ultrasonic testing.
Temperature: Ambient.

7. Annealing

Equipment: Continuous annealing oven
Process: Heat treatment in controlled environments to relieve internal stresses and achieve desired mechanical properties. This involves heating the pipes to approximately 900°C, then slowly cooling them to achieve a uniform austenitic matrix, which is later transformed into a ferrite-pearlite structure.
Temperature: Up to 900°C, then slow-cooled.

8. Quality Control

Process: Microstructure analysis (Carbide max 10%, Pearlite max 25% & Ferrite min 75%), dimensional checks.
Equipment: Go gauge, no go gauge, diameter tape and metallurgical microscope.
Temperature: Ambient.

9. Zinc Coating:

Instead of a dip in molten zinc, a hot zinc metal spray is applied. This involves spraying molten zinc onto the rotating pipe to form a uniform, corrosion-resistant coating. This method is particularly effective as it allows for precise control over the thickness of the zinc layer and ensures complete coverage of complex surfaces. Temperature: Ambient for cleaning; the zinc is sprayed at temperatures high enough to keep it molten (around 400°C to 450°C).

Equipment: Zinc spray guns, which are specifically designed for high-temperature metal spraying, and pipe rotation mechanisms that ensure even application of the zinc coating. Zinc coating thickness: Minimum 110 gm/m^2 & Nominal 130 gm/m^2.

10. Cutting & Chamfering

Process: All pipes are checking for chamfering and some pipes are selected for ring cutting to mechanical testing process.

Equipment: Cutting & chamfering machine.

11. Quality Control

Process: Mechanical testing and zinc mass measurement.

Equipment: Mylar sheet, weighing balance, universal testing machine, BrinelL hardness testing machine, Vernier calliper.

Mechanical properties: Tensile 420 MPa Min
Elongation 10% Min
BHN 230 Max

Temperature: Ambient.

12. Socket & barrel grinding

Process: Socket lip grinding, metal removal and socket groove cleaning.

Equipment: Barrel grinding machine, straight grinder.

13. Hydro testing

Equipment: Automated hydro test machinery.

Process: Each pipe undergoes online 100% hydrostatic testing. This involves filling the pipe with water at a specified pressure higher than its operational pressure to ensure there are no leaks or weaknesses in the pipe structure.

Temperature: Ambient.

Quality Check: This stage is crucial for validating the integrity of the pipe under pressure. All pipes must pass this test before moving on to the coating stages.

Hydrostatic test:

Size	Pressure		Holding Time
	K7	K9	
DN 80	32 kg/cm²	50 kg/cm²	10 seconds
DN 100	32 kg/cm²	50 kg/cm²	10 seconds
DN 150	32 kg/cm²	50 kg/cm²	10 seconds
DN 200	32 kg/cm²	50 kg/cm²	10 seconds
DN 250	32 kg/cm²	50 kg/cm²	10 seconds
DN 300	32 kg/cm²	50 kg/cm²	10 seconds
DN 350	25 kg/cm²	40 kg/cm²	10 seconds
DN 400	25 kg/cm²	40 kg/cm²	10 seconds

14. Lining

Types of Lining:

Cement Mortar Lining: Applied using a spinning process.

Polyurethane Lining (Optional): For enhanced corrosion protection.

Equipment: Rotating cement mortar lining machines, polyurethane spray systems.

Temperature: Ambient; controlled curing conditions.

Quality Check: Cement lining thickness check with tyre depth gauge in wet condition and check bore clearance with bore gauge in dry condition.

Thickness & Bore clearance:

Size	Lining Thickness (mm)		K7 Bore clearance (mm)
	Min	Nom	
DN 80	1.5	3.0	82
DN 100	1.5	3.0	102
DN 150	1.5	3.0	154
DN 200	1.5	3.0	206
DN 250	1.5	3.0	257
DN 300	1.5	3.0	309
DN 350	3.0	5.0	356
DN 400	3.0	5.0	406

15. **Pre-heating**

Process: Before preheating pipe to be free from oil/grease/dust and then pipe to be heated up to 55°C for moisture removal.

Equipment: Pre-heating furnace.

Temperature: Up to 55°C.

Process: Before preheating pipe to be free from oil/grease/dust and then pipe to be heated up to 55°C for moisture removal.

Equipment: Pre-heating furnace.

Temperature: Up to 55°C.

16. **Bitumen/Epoxy Coating:**

Following the external coating application, a protective layer of bitumen or epoxy is applied to further protect the pipe from external corrosion. This layer also improves the pipe's aesthetic appearance and provides a smoother surface, which can be critical for certain applications.

Temperature: Epoxy is applied at ambient temperatures. Equipment: Spray or brush application setups for bitumen or epoxy. Coating thickness: Minimum 50 microns & Nominal 70 microns.

17. **Post-heating**

Process: After bitumen/epoxy coating post heating run for fast paint drying purpose.

Equipment: Post-heating furnace.

Temperature: Up to 55°C.

18. **Water sprinkler:**

Sprinkling with water is performed in this station.

19. **Quality Control**

Process: Dimensional checks, ultrasonic testing, hydrostatic testing, and visual inspection.

Equipment: Testing stations equipped with necessary tools and gauges.Temperature: Ambient.

20. **Finishing and Dispatch**

Process: Marking for traceability, application of end protectors, packing, and storage.

Equipment: Marking machines, packing stations.

Temperature: Ambient.

This refined process flow-chart takes into account the specifics of the plant's production capabilities and equipment allocation, ensuring a detailed overview of the entire manufacturing process tailored to the specific capacities and size ranges handled by the plant. This setup optimizes the utilization of equipment and materials for efficient production flow.

Quality Control

Quality Control (QC) is a collection of methods and techniques for ensuring that a product is conforming to standards and is produced & delivered according to given requirements.

Quality is measured by the degree of conformance to pre-determined specifications and standards, and deviations from these standards can lead to poor quality and low reliability. Efforts for quality improvement are aimed for elimination defects, reduction of rejection and hence overall reductions in production costs. Quality checks done on Ductile Iron pipes include the following parameters:

1. **Thorough Check of all Raw Materials for Compliance with Respective National and International Standard Specifications**
2. **Chemical Analysis**
   - Composition of molten metal
   - Chemical analysis
3. **Mechanical Test**
   - Tensile strength
   - Elongation
   - Hardness
   - Microstructure
4. **Dimensions**
   - Sample checking for socket dimensions
   - Checking on external diameter
   - Checking internal diameter
   - Pipe thickness
   - Length of pipes
   - Ovality
   - Straightness of pipes, chamfering of spigot end
5. **Surface Defect Checks**
   - Pin holes
   - Pitting
   - Cut marks
   - Surface netting/imperfection
   - Excess mould powdering/undissolved mould powder
6. **Casting Defects Checks**
   - Cold shots
   - Lapping of metal surface
7. **External Coating - Online Quality Checks**
   - Measurement of Zinc/Zinc Aluminium mass deposit on pipe surface
   - Measurement of finishing layer (Bitumen/resin) thickness on pipe surface
8. **Internal Lining - Online Quality Checks**
   - Checking of type of cement being used
   - Checking of water cement and sand ratio
   - Checking of cement-sand ratio
   - Checking of wet CML thickness
   - Checking for uniform holiday free seal coating over cement mortar lining (if seal coat provided)

Stages of Manufacturing and Quality Checks

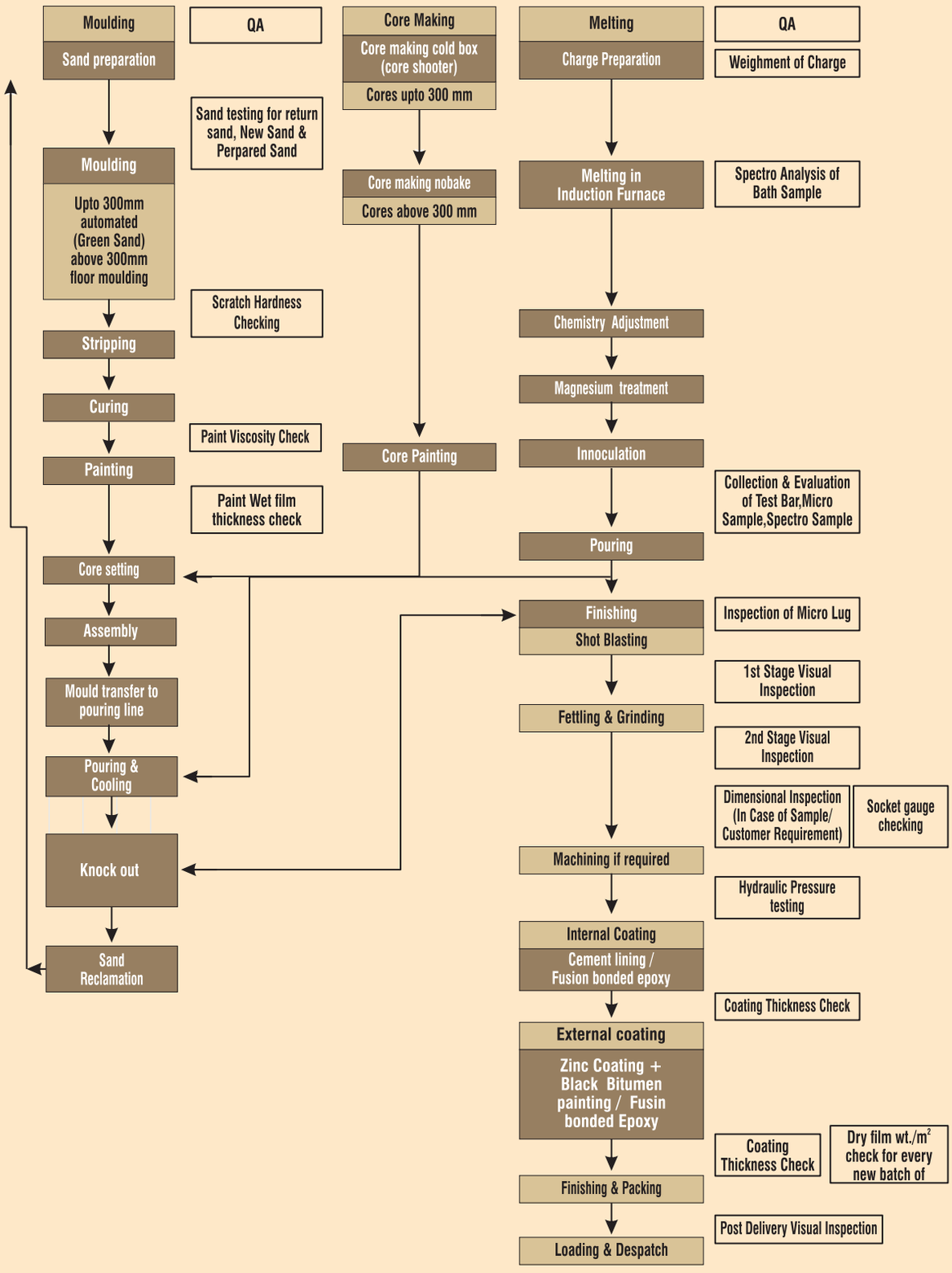
Ductile Iron Pipes

All the tests mentioned earlier are carried out at different stages of production as shown in the following flow chart:

Stages of Manufacturing	Quality Checks
Raw Material Receipt / Storage	Analysis of Raw Material According to Specification for Every Consignment
Liquid Metal Furnace	Chemical Analysis, Temperature
Chemistry Adjustment and Super Heating In Induction Furnace	Chemical Analysis
Magnesium Treatment in Converter	Temperature and Chemical Analysis, Addition of MS Scrap if Required
Pipe Casting	Magnesium Addition by Weight/Length of Wire
Heat Treatment (Annealing)	Spinning Parameter; Temperature, Core for Socket, Mould for Pipe, Inoculation Powder/ Mould Powder
Zinc Coating	Physical Test, Microstructure
Finishing	Zinc Mass Deposit and Continuity
Hydrostatic Pressure Testing	Socket Grove; Visual; Gauging; Spigot Ends for Champhering
Cement Mortar Lining	Pressure Rating, Body Leak and Sweat
Steam Curing	Cement/ Sand/Water Ratio, Thickness. Bore Checking and Uniformity
Bitumen Coating	Temperature; Humidity; Visual and Gauging
Marking	Thickness and Continuity
Stacking & Bundling (if required)	As Per Specification and Client Requirement
Party/ Third Party Inspection	Type of Stacking, Recommended Height and Strength of Bundle
Dispatch	To Ensure Correct Ordered Material Supplied

Flow Chart of Manufacturing Process

Ductile Iron Fittings



Sample Size

To carry out inspection it is practically not possible to check each and every pipe. Hence the sample pipes are segregated from the LOT. The sample size should be as follows:

Sample Size for Different Lots of Pipe Diameter

S. No.	Lot Size (Numbers)	Sample Size (Numbers)	Acceptance (Numbers)
1	Upto 50	8	0
2	51 to 100	13	1
3	101 to 150	20	1
4	151 to 300	32	2
5	301 and above	50	3

Note: From the above sampled size randomly selected pipes are sent for mechanical properties test and chemical composition test.

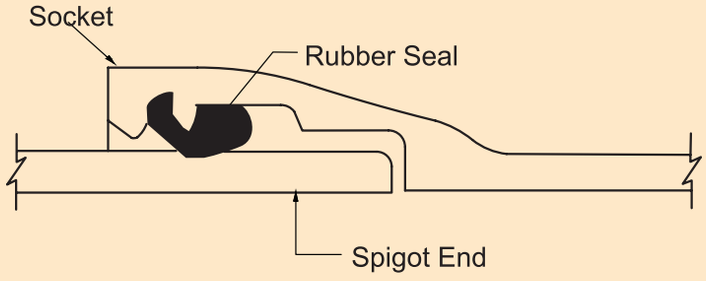
Joints, Allowable Deflection, Type Test

Ductile Iron Pipes can be joined by four types of Joints -

1. Push-on Joint; 2. Mechanical Joint; 3. Flange Joint; 4. Restrained Joint

Push-on Joint

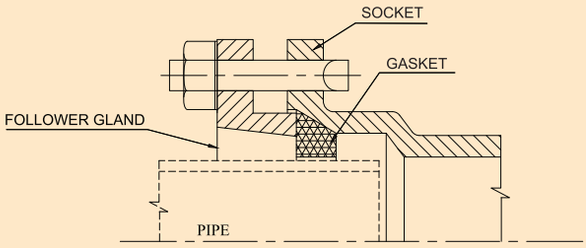
This joint is commonly and widely used. Ductile Iron pipes comprise of socket and spigot ends. The inside surface of the socket has grooves to hold the rubber gasket. The gasket has a hard part called the 'heel' which gets engaged in the groove of the socket to firmly hold the gasket. The other part of the gasket is the bulb portion which is comparatively softer than the heel portion of the gasket. Both softer bulb and the harder heel portions of the gaskets are vulcanized to form a circular single part. The spigot of the next pipe has a taper portion to facilitate smooth insertion of the spigot end in to the socket of the pipes. The spigot is inserted into the socket holding the rubber gasket. The spigot exerts uniform circumferential pressure over the soft portion of the rubber gasket and the pipe is pushed in to the socket until one line of the insertion mark gets into the socket and the other insertion mark is visible. This is to ensure that a small gap is left between the two pipes in order to ensure the deflection in the pipeline and also to accommodate the linear expansion due to thermal effect on the pipeline laid above ground. In this fashion the pipeline is made continuously.



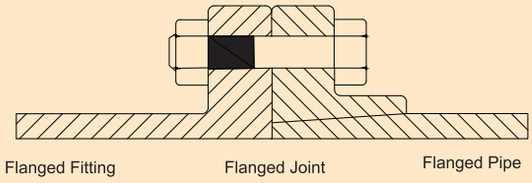
Push on Joint

Mechanical Joint

This joint is used where it is difficult to effect Push-on joint. This joint can also be used to make good a leaking pipe in a pipeline. This joint is also a type of Push-on joint but unlike in Push-on joint the rubber gasket is tightened to exert circumferential pressure on spigot of the pipe to provide a positive seal. This joint comprises a gland, a trapezium shaped gasket and set of bolts, nuts and washers. The socket of the pipe in this joint has a circumferential collar to facilitate gripping of the hooks bolts used in this joint. In order to complete this joint the metal gland is inserted over the spigot end of one pipe. The gland has sufficient number of bolt holes. The gland is of 'L' shaped. The socket of the next pipe to be joined will not have any groves inside but the internal diameter will be sufficient enough to accommodate a trapezium shaped rubber gasket. This trapezium shaped gasket is inserted over the spigot of the pipe where the gland is already inserted. The spigot of pipe with the gland and rubber gasket is inserted in to the socket of the next pipe and bolts are inserted into the gland in such a manner that t he hook heads are towards the socket of the pipe to be joined. The gland along with rubber gasket brought closer the socket of the next pipe and the bolts are tightened from gland side so that proper gripping of the hook bolts over the circumferential collar of the socket is ensure. The gland pushes the rubber gasket and presses it so that the circumferential seal is effected after jointing.



Mechanical Joint



Flanged joint

Flange Joint

Flange joints are rigid joints. Flanges are fixed on either ends of barrel pipe piece. This type of joint can be made in Ductile Iron pipes in three different manufacturing processes. They are:

1. **Integrally Cast flanged pipes:50**

   In Intregally cast flanged pipes the Ductile Iron pipes with flanges are cast in foundries with integrally cast flanges on them. These flange pipes are normally of very small length say 1 to 1.5 m. They are heavier to handle and one may have to use many pipes for vertical lift and as much extra bolts, nuts etc. This type flange pipes are used for very small lengths.

2. **Welded-on flanged pipes:**

   In Welded-on flanged pipes the flanges are welded on to the ends of the pipe barrels.

3. **Screwed-on flanged pipes:**

   In screwed-on flanged pipes both flanges and barrels of DI Pipes are provided with female and male threads respectively. The flanges are threaded over the DI Pipe barrel.

   The jointing of the two flanged end pipes is done by placing gaskets in between the flanges and tightening the flanges with bolts, nuts and washers.

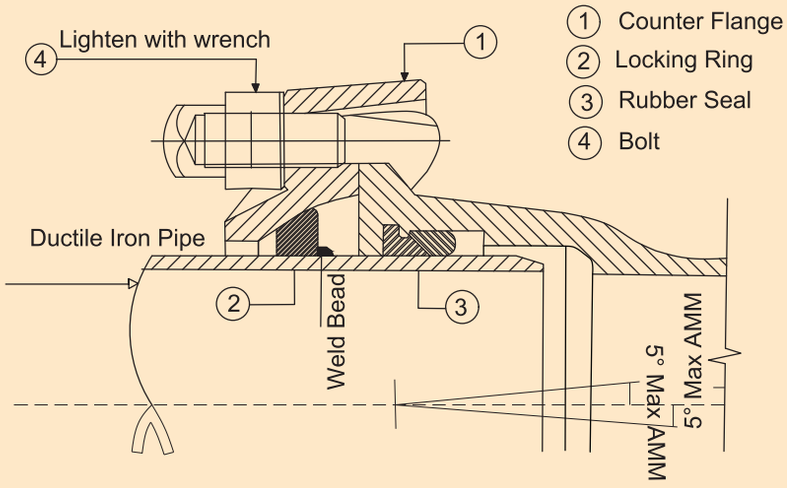
Classification of Flanged Pipes

Size Range (mm)	Pressure Class (N/mm^2)
80 - 1200 mm	PN 10
	PN 16
	PN 25
	PN 40
1400 - 2600 mm	PN 10
	PN 16
	PN 25

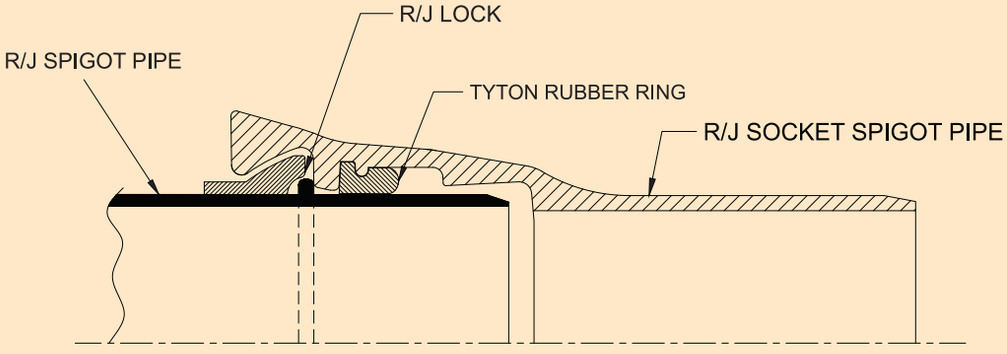
Restrained Joint Pipes

The Ductile Iron pipes are supplied to suit and facilitate restrained jointing in which the axial movement of the pipe is arrested by mechanical means. The DI pipes with these joints are ideally suitable for the pipe line to be laid over loose soil or marshy land where one cannot provide anchor blocks at Tee points, or bends etc. Restrained Jointed DI pipes are used for high pressure water transmission. It is also used where the pipeline traverses a hilly terrain. This joint comprises an assembly of socket and spigot pipes with glands, split ring and a set of hook bolts, nuts and washers. The spigot end of the pipe is provided with a weld bead. The socket of the pipe to be joined, have a circumferential projected collar. The procedure for jointing two pipes is as under:

- The gland made of SG iron have an internal diameter slightly above the dimension of the weld bead outer diameter. The gland is slid over the spigot end of the pipe and rested.
- The split ring or arrester ring or retainer ring has an internal diameter exactly as that of external diameter of the pipe barrel. The split ring is opened slightly and slid over the weld bead and rested within the gland in such manner that the taper of the spit ring and the inside taper of the gland match exactly.
- Insert the rubber gasket into the socket of the next pipe to be joined.
- Make the jointing of the two pipes by inserting the spigot end of one pipe into another.
- Move the gland along with split ring towards the socket of the next pipe till the weld bead on to spigot of the pipe.
- Insert the hook bolts from the socket side into the gland and start tightening using bolts, nuts and washers.
- Complete tightening to ensure restrained jointing.



Restrained Joint



Double Chamber Retrained Joint

Calculation of Length of Pipeline to be Restrained

Restrained Joint System functions in a manner similar to thrust blocks. The thrust force is balanced with the reactive forces generated by the restrained unit of the piping with the soil.

The design of the thrust resistant system will determine the length of the pipe that must be restrained on each side of the focus of the thrust force. The length of restraint of the pipe will be a function of pipe size, the internal pressure, depth of cover, the characteristic of the soil surrounding the pipe and the type of encasement of pipe.

The calculation of length that must be restrained is independent of the system of anchoring used. The source of restraining force is two fold:

i) The static friction between the pipe unit and the soil.

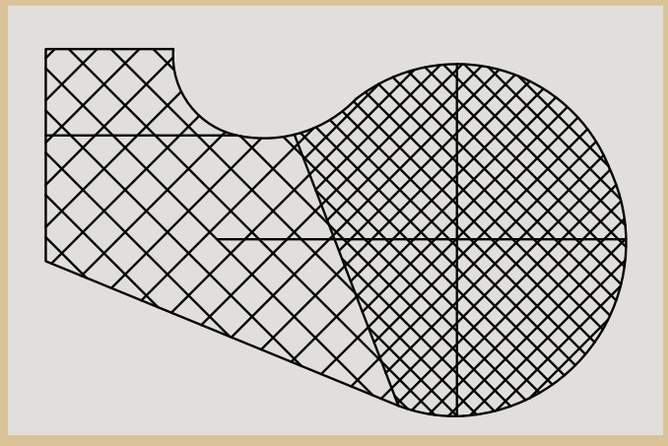
ii) The restraint provided by the pipe as it bears against the side fill soil along each leg of the bend.

Rubber Gaskets for Flexible Jointing System

Rubber Gasket provides leak tight flexible jointing system in Ductile Iron pipelines. Earlier natural rubber was used, but with the advancement in technology SBR (Styrene Butadiene Rubber) gaskets and lately EPDM (Ethylene Propylene Diene Monomer Rubber) gaskets are being successfully used for the jointing system. For special service conditions, Nitrile Butadiene Rubber (NBR) and Fluoro-Carbon gasket are also used.

The Rubber gaskets provide satisfactory sealing of up to 100% compression set. Extrapolated test results like 'Compression Set' & 'Stress Relaxation' on Rubber gaskets have indicated the life of Rubber gasket to be more than 100 years. Moreover, the rubber gasket in a pipe joint is cut off from sunlight, Oxygen contact, Ozone contact and UV radiation, and temperature variance, which enhances the durability of the gasket.

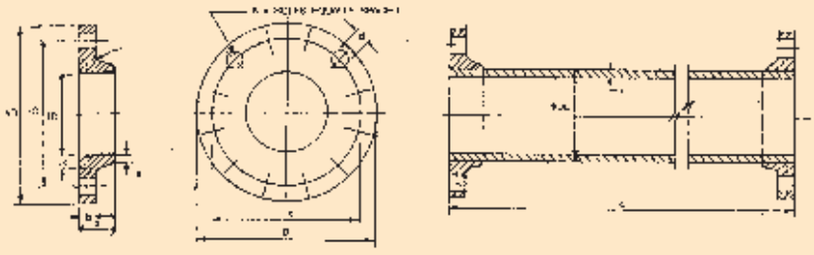
Rubber Gasket



Sectional details of Push on Joint Gasket

A rubber gasket consists of two parts, the harder part called 'Heel' and a softer part called 'Bulb' as shown in the figure. The Heel is the anchorage part of the gasket, which rests in the groove and anchors the gasket from turning over during jointing. This zone has a hardness range of 75 - 85 in the Shore A hardness scale. The bulb is the softer section, which plays the main role in sealing the gap between the socket internal and spigot external. This has a hardness range of 55 - 65 in the Shore A hardness scale.

Double Flanged Pipes



Dimensions of centrifugally cast ductile iron pipes with screwed / welded flanges

Nominal Diameter	Outside Diameter	Wall Thickness	App. Mass (kg) of One Flange		App. Mass of Barrel/mtr.	Mass (kg) of One working Length "L" including Two Flanges					
						PN - 10			PN - 16		
DN	DE	e	PN-10	PN-16	Non-CML	2.75M	5.0M	5.4M	2.75M	5.0M	5.4M
80	98	6.0	3.5	3.5	12.84	42	71	78	42	71	78
100	118	6.0	3.8	3.8	15.66	51	86	94	51	86	94
125	144	6.0	4.7	4.7	20.00	64	109	119	64	109	119
150	170	6.0	5.8	5.8	23.07	75	127	138	75	127	138
200	222	6.3	8.0	8.0	31.95	104	176	191	104	176	191
250	274	6.8	11.0	12.0	42.80	140	236	256	142	238	258
300	326	7.2	15.0	16.0	54.19	179	301	327	181	303	329
350	378	7.7	18.0	23.0	67.43	221	373	406	231	383	416
400	429	8.1	19.0	26.0	80.80	260	442	480	274	456	494
450	480	8.6	22.0	34.0	95.27	306	520	566	330	544	590
500	532	9.0	28.0	46.0	111.98	364	616	670	400	652	706
600	635	9.9	43.0	73.0	147.78	496	829	900	552	885	956
700	738	10.8	62.0	83.0	188.24	642	1065	1155	684	1107	1196
750	790	11.3	74.0	96.0	211.30	729	1205	1306	773	1249	1350
800	842	11.7	82.0	108.0	233.70	807	1333	1445	859	1385	1495
900	945	12.6	92.0	125.0	283.69	964	1602	1740	1030	1668	1805
1000	1048	13.5	126.0	178.0	338.49	1183	1944	2108	1287	2048	2215
1100	1152	14.4	158.0	210.0	367.80	1327	2155	2332	1431	2259	2435
1200	1255	15.3	190.0	270.0	425.80	1551	2509	2715	1711	2669	2875
1400	1462	17.1	175.0	232.0	460.0	1890	3150	3370	2004	3264	3484
1600	1668	18.9	242.0	331.0	710.0	2424	4014	4294	2602	4192	4472
1800	1875	20.7	282.0	394.0	870.0	2954	2904	5254	3178	3128	5478
2000	2082	22.5	337.0	475.0	1050.0	3554	5914	6334	3830	6190	6610
2200	2288	24.3	426.0	600.0	1250.0	4272	7072	7572	4620	7420	7920

NOTE:

1. The method of screwing and the exact form of thread are as per our own discretion as the flanges are never removed after screwing on to the barrel of the pipes.
2. if so required the flanges may be spot welded on the back side after screwing.
3. Alternatively the flanges may be completely welded on to the barrel pipes.
4. Pipes = K 9 or that of higher class.
5. Only weldable Flanges may also be supplied to be welded on to the pipes as per site requirements
6. Puddle flanges (for wall casting) may be welded on pipes as per customer's requirements.

*All dimensions are in millimetres.

FITTINGS

Ductile Iron Fittings

Kejriwal
CASTINGS LIMITED

We manufacture wide variety of DUCTILE IRON FITTINGS

Socket End Fittings
Tyton socket end Fittings (‘T’ type)
Mechanical Joint end Fittings (‘K’ type)

Flange End Fittings

Restrained Joint Fittings

Fittings Suitable for OPVC Pipes

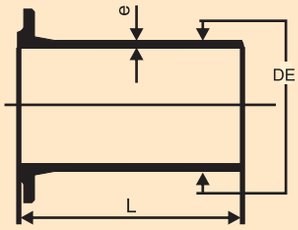
Fittings Suitable for UPVC Pipes

Fittings Dimension

Thickness of Fittings

Nominal Size	Pressure Class	Wall Thickness, e (mm)	
DN	C	Nominal	Tolerances
80	64	7.0	-2.30
100	64	7.2	-2.40
150	64	7.8	-2.45
200	64	8.4	-2.50
250	50	9.0	-2.55
300	50	9.6	-2.60
400	40	10.8	-2.70
450	40	11.4	-2.75
500	40	12.0	-2.80
600	40	13.2	-2.90
700	30	14.4	-3.00
750	30	15.0	-3.05
800	30	15.6	-3.10
900	30	16.8	-3.20
1000	30	18.0	-3.30
1100	30	19.2	-3.40
1200	30	20.4	-3.50
1400	30	22.8	-3.70
1500	25	24	-3.80
1600	25	25.2	-3.90
1800	25	27.6	-4.10
2000	25	30	-4.30
2200	25	32.4	-4.50
2400	25	34.8	-4.70
2600	25	37.2	-4.90

Ductlle Iron pressure pipe fittings are suitable for use with Ductile Iron pressure pipes having Socket or Flanged ends.



- As per BS-EN-545 / ISO-2531, Tees are K-14 only.
- e = K(0.5+0.001 DN)

Dimensions of Fittings for Push-on-Joint and Mechanical Joint

Nominal Diameter DN	External Diameter DE		Wall Thickness,e mm		
	Nominal	Tolerance	K12	K14	Tolerance
(1)	(2)	(3)	(4)	(5)	(6)
80	98	+1/-2.7	7.0	8.1	-2.38
100	118	+1/-2.8	7.2	8.4	-2.40
125	144	+1/-2.8	7.5	8.7	-2.42
150	170	+1/-2.9	7.8	9.1	-2.45
200	222	+1/-3.0	8.4	9.5	-2.50
250	274	+1/-3.1	9.0	10.5	-2.55
300	326	+1/-3.3	9.6	11.2	-2.60
350	378	+1/-3.4	10.2	11.9	-2.65
400	429	+1/-3.5	10.8	12.6	-2.70
450	480	+1/-3.6	11.4	13.3	-2.75
500	532	+1/-3.8	12.0	14.0	-2.80
600	635	+1/-4.0	13.2	15.4	-2.90
700	738	+1/-4.3	14.4	16.8	-3.0
750	790	+1/-4.4	15.0	17.5	-3.05
800	842	+1/-4.5	15.6	18.2	-3.10
900	945	+1/-4.8	16.8	19.6	-3.20
1000	1048	+1/-5.0	18.0	21.0	-3.30
1100	1152	+1/-5.4	19.2	21.4	-3.40
1200	1255	+1/-5.8	20.4	23.8	-3.50
1400	1462	+1/-6.6	22.8	26.6	-3.70
1500	1565	+1/-7.0	24.0	28.0	-3.80
1600	1668	+1/-7.4	25.2	29.0	-3.90
1800	1875	+1/-8.2	27.6	32.2	-4.10
2000	2082	+1/-9.0	30.0	35.0	-4.30
2200	2288	+1/-9.3	32.4	37.8	-4.50

All fittings are of **K-12** Class except Tees which are available in both **K-12 & K-14** Class

A. Zinc Coating :

Zinc Rich Paint or metallic zinc wire for metallising / spraying should have at least 99% zinc by mass & min. 85% zinc in dry film.

Zinc metalising = Average min. mass 130 g/m^2 (local min. 110 gm/m^2)

Zinc Rich Paint = Average min. mass 150 gm/m^2 (local min. 130 gm/m^2)

Conversion

gm / m^2	Microns (Approx.)
110	15.4
130	18.2
150	21.0

B. Bitumin Coating :

Local thickness min. 50 μm & mean thickness 70 μm & to withstand 0°C to 65°C temperature.

C. Cement Mortar Lining (CML) :

Cement to Sand Ratio should be min. **1 : 3.5**

Size	CML Thickness (mm)	Tolerance
80 to 300	4 mm	-1.5
350 to 600	5 mm	-2.0
700 to 1200	6 mm	-2.5
1400 to 2000	9 mm	-3.0

D. Seal Coat :

A seal coat of Bitumen or any other epoxy paint may be given on CML to minimize lime leaching if required specifically.

*All dimensions are in millimetres.

TABLE - 10 Mechanical properties of Fittings (IS-1865)

Nominal Diameter (mm)	Type of Castings	Tensile Strength (mm) (Mpa)	Elongation at break (%)	Hardness (HBS) max.
All Size	Fittings	420	5 (min)	250

TABLE - 11 Hydrostatic Test pressure for Fittings

Nominal Diameter DN (mm)	Work Test Pressure Kgf/cm^2
80 to 300	25
350 to 600	16
700 to 2200	10

The fittings are kept under pressure for 10 secs which it should withstand without showing any leakage and sweating.

Tolerances on the Flange External Diameter D and Raise face E

DN	80	100	125	150	200	250	300	350	400	450	500	600
Tolerance on D	± 4.5			+5.5-2.5				+6.5-3.5				
Tolerance on E	± 4.0			± 4.5				± 5.0				

DN	700	750	800	1000	1100	1200	1400	1600	1800	2000
Tolerance on D	+7.5 - 4				+8.5 - 4		+10 - 5	+12 - 6		
Tolerance on E	±5.5				± 5.5		±6.0	± 6.0		

Tolerances on Thickness of Flange

Type of Flange	Tolerance
Intergrally Cast flanges	± (3+0.05b)
Welded and screwed on flanged	± (2+0.05b)

The tolerance on the wall thickness of fittings

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

Deviation on Lengths of Fittings

Type of Fittings	Nominal Diameter DN (mm)	Deviation in L and H (mm)
Flanged sockets, Flanged spigots, Collars, Tapers	80 to 1200	± 25
	1400 to 2000	± 35
Tees	80 to 1200	+ 50/ – 25
	1400 to 2000	+ 75/ – 35
Bends 90^O (1/4)	80 to 2000	± (15 + 0.030 DN)
Bends 45^O (1/8)	80 to 2000	
Bends 22^{O}30' and 11^{O}15' (1/16 & 1/32)	80 to 1200	± (10 + 0.020 DN)
	1400 to 2000	± (10 + 0.025 DN)

Tolerances on Raised Face Height (f)

Height of Raised	Tolerance
3	+1.5-2.0
4	+2.0-3.0
5	+2.5-4.0

(minimum 1 mm required)

Tolerances on Flange Drilling Dimension Bolt Hole Diameter

	Dia 19 to Dia 28	Dia 31 to Dia 56	Above Dia 62
Bolt hole diameter, d	+2 - 0	+3 - 0	+ 4 - 0
Pitch circle diameter, C	±2	±2.8	±4.8
Centre-to-centre of Adjacent bolt holes	± 2	± 2.8	± 4.8

COATING

Fittings and accessories are normally internally and externally coated. Normally Bituminous paint is applied. However following coating may also be done under agreement.

External Coating

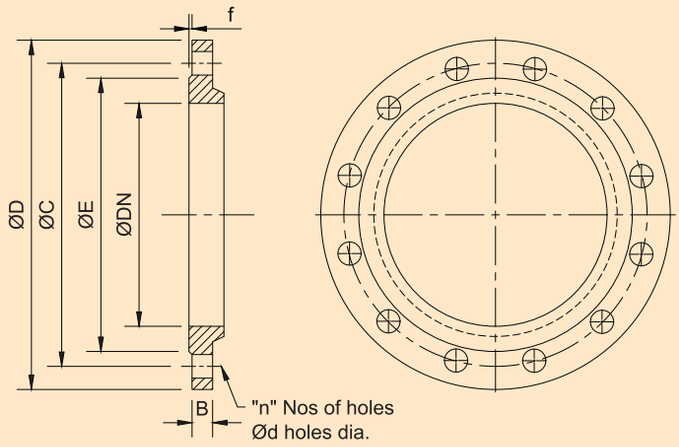
1. Zinc rich paint/Zinc metallisation
2. Bituminous Paint
3. Epoxy Liquid Coating
4. Fusion Bonded Epoxy Powder coating (F.B.E.)
5. Poly Urethane Coating
6. Rilsan Coating

Internal Linings

The following lining may be applied depending on the internal conditions of use :

(1) Portland cement mortar
(2) Blast furnace slag cement mortar
(3) High alumina (HAC) cement mortar
(4) Sulphite Resistant Cement Mortar (SRC)
(5) Bituminous paint
(6) Poly Urethane Coating

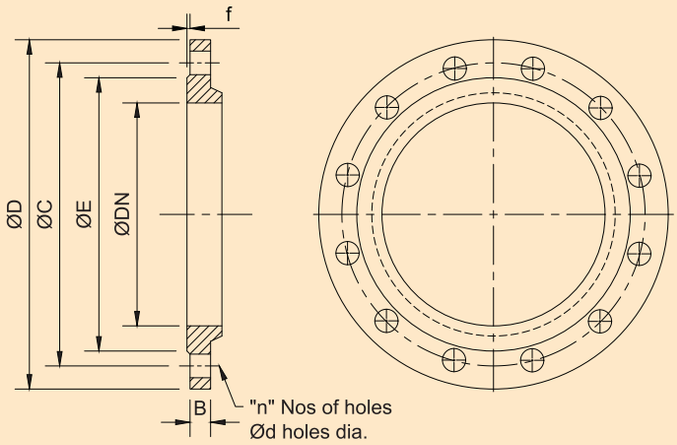
Flange Dimension



AS PER IS 9523, PN 10

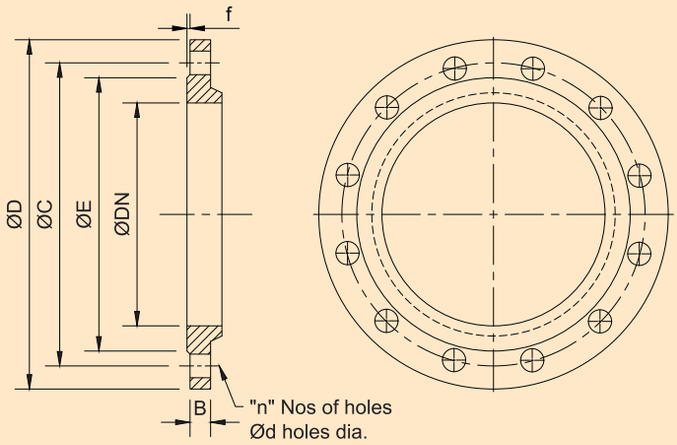
Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
80	200	160	16	3	4	19	132
100	220	180	16	3	8	19	156
125	250	210	16	3	8	19	184
150	285	240	16	3	8	23	211
200	340	295	17	3	8	23	266
250	395	350	19	3	12	23	319
300	445	400	20.5	4	12	23	370
350	505	460	20.5	4	16	23	429
400	565	515	20.5	4	16	28	480
450	615	565	21	4	20	28	530
500	670	620	22.5	4	20	28	582
600	780	725	25	5	20	31	682
700	895	840	27.5	5	24	31	794
750	960	900	29	5	24	31	857
800	1015	950	30	5	24	34	901
900	1115	1050	32.5	5	28	34	1001
1000	1230	1160	35	5	28	37	1112
1100	1340	1270	38	5	32	37	1231
1200	1455	1380	40	5	32	40	1328
1400	1675	1590	41	5	36	43	1530
1600	1915	1820	44	5	40	49	1750
1800	2115	2020	47	5	44	49	1950
2000	2325	2230	50	5	48	49	2150

*All dimensions are in millimetres.



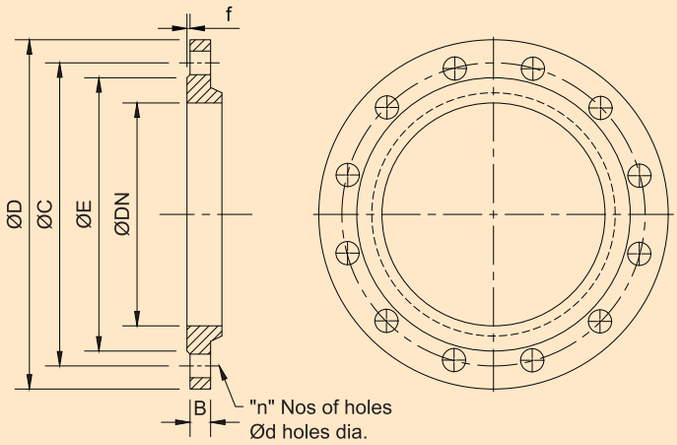
AS PER IS 9523, PN 16

Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
80	200	160	16	3	8	19	132
100	220	180	16	3	8	19	156
125	250	210	16	3	8	19	184
150	285	240	16	3	8	23	211
200	340	295	17	3	12	23	266
250	400	355	19	3	12	28	319
300	455	410	20.5	4	12	28	370
350	520	470	22.5	4	16	28	429
400	580	525	24	4	16	31	480
450	640	585	26	4	20	31	548
500	715	650	27.5	4	20	34	609
600	840	770	31	5	20	37	720
700	910	840	34.5	5	24	37	794
750	970	900	36	5	24	37	857
800	1025	950	38	5	24	40	901
900	1125	1050	41	5	28	40	1001
1000	1255	1170	45	5	28	43	1112
1100	1355	1270	48.5	5	32	43	1218
1200	1485	1390	52	5	32	49	1328
1400	1685	1590	55	5	36	49	1530
1600	1930	1820	60	5	40	56	1750
1800	2130	2020	65	5	44	56	1950
2000	2345	2230	70	5	48	62	2150



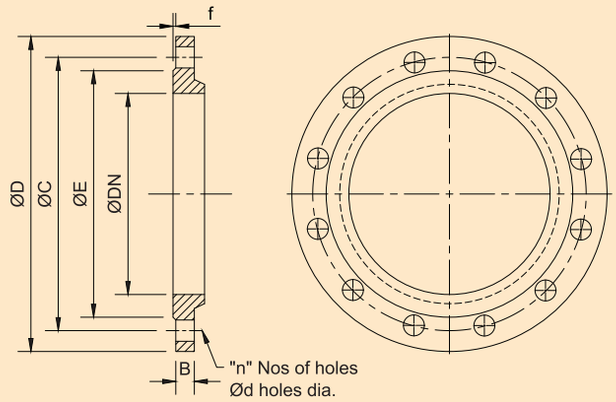
AS PER IS 9523, PN 25

Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
80	200	160	16.0	3	8	19	132
100	235	190	16.0	3	8	23	156
125	270	220	16.0	3	8	28	184
150	300	250	17.0	3	8	28	211
200	360	310	19.0	3	12	28	274
250	425	370	21.5	3	12	31	330
300	485	430	23.5	4	16	31	389
350	555	490	26.0	4	16	34	448
400	620	550	28.0	4	16	37	503
450	670	600	30.5	4	20	37	548
500	730	660	32.5	4	20	37	609
600	845	770	37.0	5	20	40	720
700	960	875	41.5	5	24	43	820
750	1020	940	45.0	5	24	43	883
800	1085	990	46.0	5	24	49	928
900	1185	1090	50.5	5	28	49	1028
1000	1320	1210	55.0	5	28	56	1140
1100	1420	1310	60.5	5	32	56	1240
1200	1530	1420	64.0	5	32	56	1350
1400	1755	1640	69.0	5	36	62	1560
1600	1975	1860	76.0	5	40	62	1780
1800	2195	2070	83.0	5	44	70	1980
2000	2425	2300	90.0	5	48	70	2210



AS PER IS 9523, PN 40

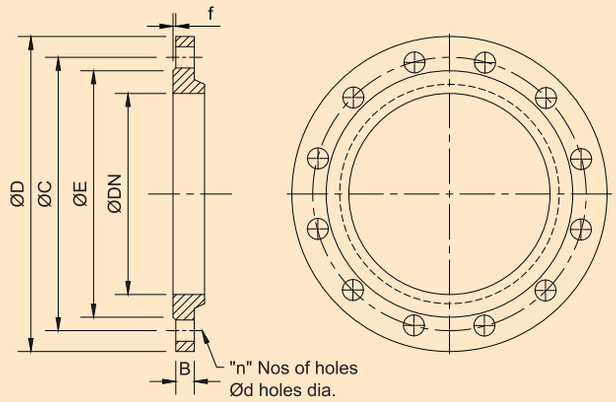
Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
80	200	160	16	3	8	19	132
100	235	190	16	3	8	23	166
125	270	220	20.5	3	8	28	184
150	300	250	23	3	8	28	211
200	375	320	27	3	12	31	284
250	450	385	31.5	3	12	34	345
300	515	450	35.5	4	16	34	409
350	580	510	40	4	16	37	465
400	660	585	44	4	16	40	535
450	685	610	46	4	20	40	560
500	755	670	48	4	20	43	615
600	890	795	53	5	20	49	735



AS PER ISO 7005-2, PN 10

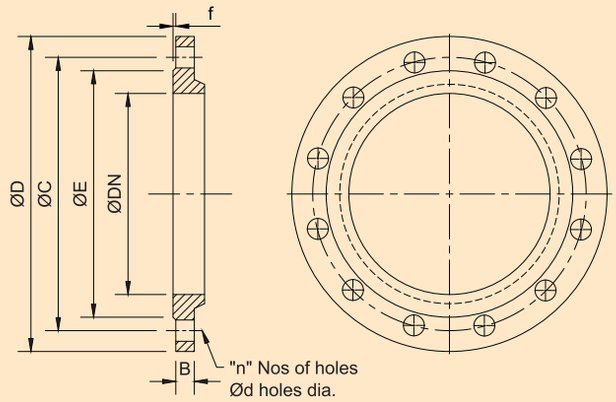
Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
10	90	60	12.0	2	4	14	41
15	95	65	12.0	2	4	14	46
20	105	75	14.0	2	4	14	56
25	115	85	13.0	3	4	14	65
32	140	100	15.0	3	4	19	76
40	150	110	16.0	3	4	19	84
50	165	125	16.0	3	4	19	99
65	185	145	16.0	3	4	19	118
80	200	160	16.0	3	8	19	132
100	220	180	16.0	3	8	19	156
125	250	210	16.0	3	8	19	184
150	285	240	16.0	3	8	23	211
200	340	295	17.0	3	8	23	266
250	400	350	19.0	3	12	23	319
300	455	400	20.5	4	12	23	370
350	505	460	20.5	4	16	23	429
400	565	515	20.5	4	16	28	480
450	615	565	21.5	4	20	28	530
500	670	620	22.5	4	20	28	582
600	780	725	25.0	5	20	31	682
700	895	840	27.5	5	24	31	794
800	1015	950	30.0	5	24	34	901
900	1115	1050	32.5	5	28	34	1001
1000	1230	1160	35.0	5	28	37	1112
1200	1455	1380	40.0	5	32	40	1328
1400	1675	1590	41.0	5	36	43	1530
1600	1915	1820	44.0	5	40	49	1750
1800	2115	2020	47.0	5	44	49	1950
2000	2325	2230	50.0	5	48	49	2150

FLANGE DIMENSIONS



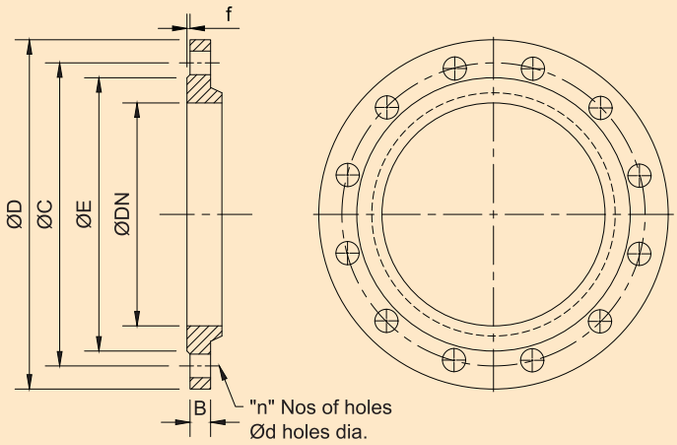
AS PER ISO 7005-2, PN 16

Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
10	90	60	12.0	2	4	14	41
15	95	65	12.0	2	4	14	46
20	105	75	14.0	2	4	14	56
25	115	85	13.0	3	4	14	65
32	140	100	15.0	3	4	19	76
40	150	110	16.0	3	4	19	84
50	165	125	16.0	3	4	19	99
65	185	145	16.0	3	4	19	118
80	200	160	16.0	3	8	19	132
100	220	180	16.0	3	8	19	156
125	250	210	16.0	3	8	19	184
150	285	240	16.0	3	8	23	211
200	340	295	17.0	3	12	23	266
250	400	355	19.0	3	12	28	319
300	455	410	20.5	4	12	28	370
350	520	470	22.5	4	16	28	429
400	580	525	24.0	4	16	31	480
450	640	585	26.0	4	20	31	548
500	715	650	27.5	4	20	34	609
600	840	770	31.0	5	20	37	720
700	910	840	34.5	5	24	37	794
800	1025	950	38.0	5	24	40	901
900	1125	1050	41.5	5	28	40	1001
1000	1255	1170	45.0	5	28	43	1112
1200	1485	1390	52.0	5	32	49	1328
1400	1685	1590	55.0	5	36	49	1530
1600	1930	1820	60.0	5	40	56	1750
1800	2130	2020	65.0	5	44	56	1950
2000	2345	2230	70.0	5	48	62	2150



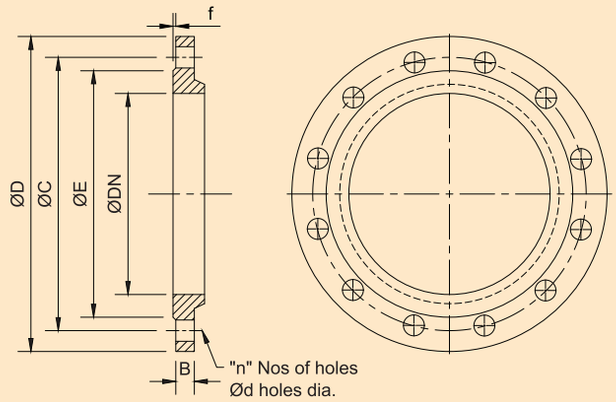
AS PER ISO 7005-2, PN 25

Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
10	90	60	12.0	2	4	14	41
15	95	65	12.0	2	4	14	46
20	105	75	14.0	2	4	14	56
25	115	85	13.0	3	4	14	65
32	140	100	15.0	3	4	19	76
40	150	110	16.0	3	4	19	84
50	165	125	16.0	3	4	19	99
65	185	145	16.0	3	8	19	118
80	200	160	16.0	3	8	19	132
100	235	190	16.0	3	8	23	156
125	270	220	16.0	3	8	28	184
150	300	250	17.0	3	8	28	211
200	360	310	19.0	3	12	28	274
250	425	370	21.5	3	12	31	330
300	485	430	23.5	4	16	31	389
350	555	490	26.0	4	16	34	448
400	620	550	28.0	4	16	37	503
450	670	600	30.5	4	20	37	548
500	730	660	32.5	4	20	37	609
600	845	770	37.0	5	20	40	720
700	960	875	41.5	5	24	43	820
800	1085	990	46.0	5	24	49	928
900	1185	1090	50.5	5	28	49	1028
1000	1320	1210	55.0	5	28	56	1140
1200	1530	1420	64.0	5	32	56	1350
1400	1755	1640	69.0	5	36	62	1560
1600	1975	1860	76.0	5	40	62	1780
1800	2195	2070	83.0	5	44	70	1985
2000	2425	2300	90.0	5	48	70	2210



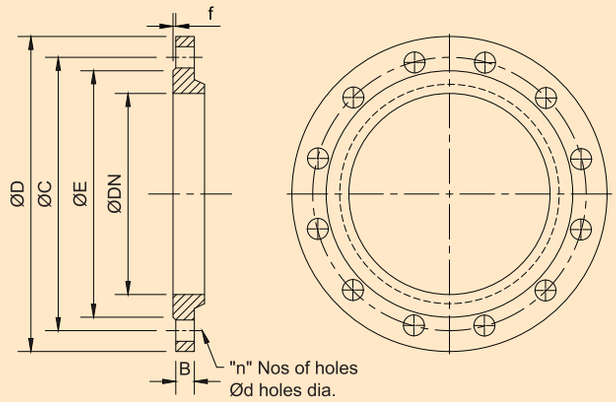
AS PER ISO 7005-2, PN 40

Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
10	90	60	12	2	4	14	41
15	95	65	12	2	4	14	46
20	105	75	14	2	4	14	56
25	115	85	13	3	4	14	65
32	140	100	15	3	4	19	76
40	150	110	16	3	4	19	84
50	165	125	16	3	4	19	99
65	185	145	16	3	8	19	118
80	200	160	16	3	8	19	132
100	235	190	16	3	8	23	156
125	270	220	20.5	3	8	28	184
150	300	250	23	3	8	28	211
200	375	320	27	3	12	31	284
250	450	385	31.5	3	12	34	345
300	515	450	35.5	4	16	34	409
350	580	510	40	4	16	37	465
400	660	585	44	4	16	40	535
450	685	610	45	4	20	40	560
500	755	670	48	4	20	43	615
600	890	795	53	5	20	49	735



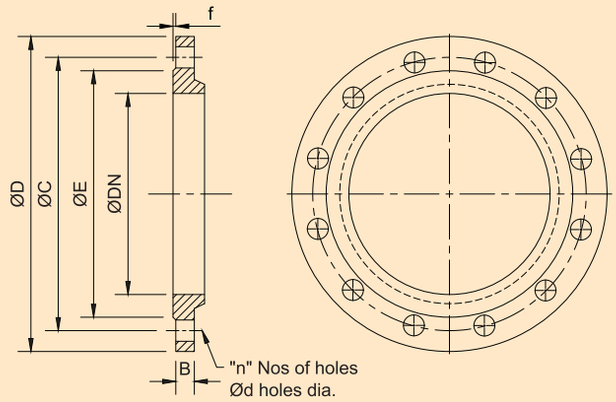
AS PER EN 1092-2, PN 10

Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
10	90	60	12.0	2	4	14	41
15	95	65	12.0	2	4	14	46
20	105	75	14.0	2	4	14	56
25	115	85	13.0	3	4	14	65
32	140	100	15.0	3	4	19	76
40	150	110	16.0	3	4	19	84
50	165	125	16.0	3	4	19	99
60	175	135	16.0	3	4	19	108
65	185	145	16.0	3	4	19	118
80	200	160	16.0	3	8	19	132
100	220	180	16.0	3	8	19	156
125	250	210	16.0	3	8	19	184
150	285	240	16.0	3	8	23	211
200	340	295	17.0	3	8	23	266
250	400	350	19.0	3	12	23	319
300	455	400	20.5	4	12	23	370
350	505	460	20.5	4	16	23	429
400	565	515	20.5	4	16	28	480
450	615	565	21.5	4	20	28	530
500	670	620	22.5	4	20	28	582
600	780	725	25.0	5	20	31	682
700	895	840	27.5	5	24	31	794
800	1015	950	30.0	5	24	34	901
900	1115	1050	32.5	5	28	34	1001
1000	1230	1160	35.0	5	28	37	1112
1100	1340	1270	37.5	5	32	37	1218
1200	1455	1380	40.0	5	32	41	1328
1400	1675	1590	41.0	5	36	44	1530
1500	1785	1700	42.5	5	36	44	1640
1600	1915	1820	44.0	5	40	50	1750
1800	2115	2020	47.0	5	44	50	1950
2000	2325	2230	50.0	5	48	50	2150



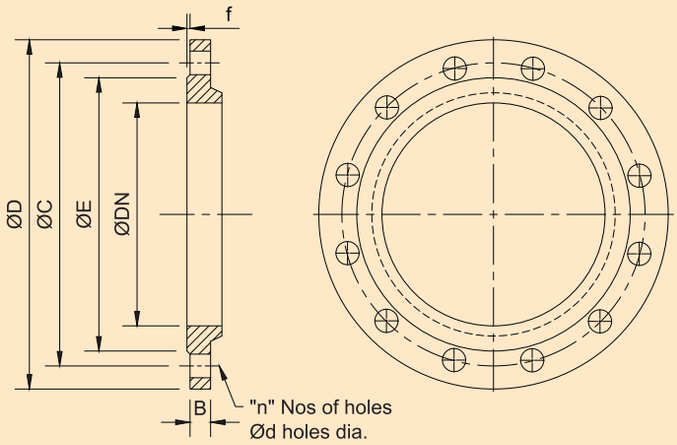
AS PER EN 1092-2, PN 16

Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
10	90	60	12.0	2	4	14	41
15	95	65	12.0	2	4	14	46
20	105	75	14.0	2	4	14	56
25	115	85	13.0	3	4	14	65
32	140	100	15.0	3	4	19	76
40	150	110	16.0	3	4	19	84
50	165	125	16.0	3	4	19	99
60	175	135	16.0	3	4	19	108
65	185	145	16.0	3	4	19	118
80	200	160	16.0	3	8	19	132
100	220	180	16.0	3	8	19	156
125	250	210	16.0	3	8	19	184
150	285	240	16.0	3	8	23	211
200	340	295	17.0	3	12	23	266
250	400	355	19.0	3	12	28	319
300	455	410	20.5	4	12	28	370
350	520	470	22.5	4	16	28	429
400	580	525	24.0	4	16	31	480
450	640	585	26.0	4	20	31	548
500	715	650	27.5	4	20	34	609
600	840	770	31.0	5	20	37	720
700	910	840	34.5	5	24	37	794
800	1025	950	38.0	5	24	41	901
900	1125	1050	41.5	5	28	41	1001
1000	1255	1170	45.0	5	28	44	1112
1100	1355	1270	48.5	5	32	44	1218
1200	1485	1390	52.0	5	32	50	1328
1400	1685	1590	55.0	5	36	50	1530
1500	1820	1710	57.5	5	36	57	1640
1600	1930	1820	60.0	5	40	57	1750
1800	2130	2020	65.0	5	44	57	1950
2000	2345	2230	70.0	5	48	62	2150



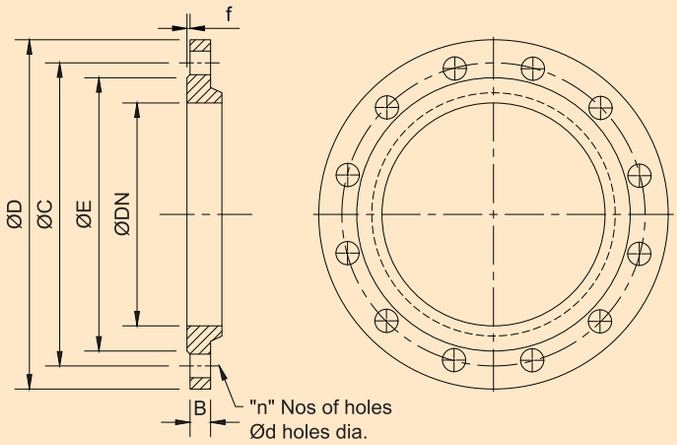
AS PER EN 1092-2, PN 25

Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
10	90	60	12.0	2	4	14	41
15	95	65	12.0	2	4	14	46
20	105	75	14.0	2	4	14	56
25	115	85	13.0	3	4	14	65
32	140	100	15.0	3	4	19	76
40	150	110	16.0	3	4	19	84
50	165	125	16.0	3	4	19	99
60	175	135	16.0	3	8	19	108
65	185	145	16.0	3	8	19	118
80	200	160	16.0	3	8	19	132
100	235	190	16.0	3	8	23	156
125	270	220	16.0	3	8	28	184
150	300	250	17.0	3	8	28	211
200	360	310	19.0	3	12	28	274
250	425	370	21.5	3	12	31	330
300	485	430	23.5	4	16	31	389
350	555	470	26.0	4	16	34	448
400	620	550	28.0	4	16	37	503
450	670	600	30.5	4	20	37	548
500	730	660	32.5	4	20	37	609
600	845	770	37.0	5	20	41	720
700	960	875	41.5	5	24	44	820
800	1085	990	46.0	5	24	50	928
900	1185	1090	50.5	5	28	50	1028
1000	1320	1210	55.0	5	28	57	1140
1100	1420	1310	59.5	5	32	57	1240
1200	1530	1420	64.0	5	32	57	1350
1400	1755	1640	69.0	5	36	62	1560
1500	1865	1750	72.5	5	36	62	1678
1600	1975	1860	76.0	5	40	62	1780
1800	2195	2070	83.0	5	44	70	1985
2000	2425	2300	90.0	5	48	70	2210



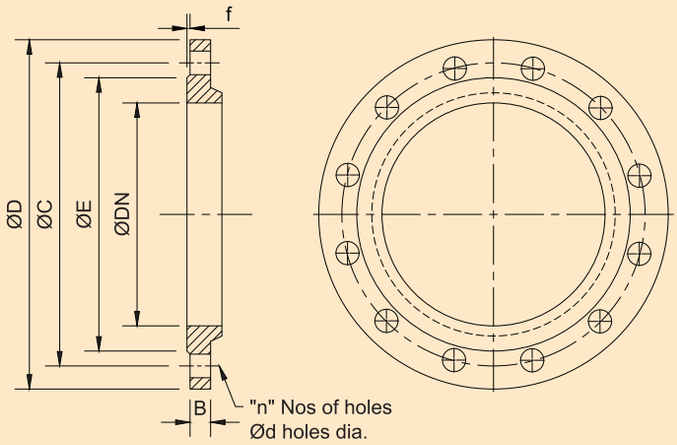
AS PER EN 1092-2, PN 40

Nominal Diameter	Outside Diameter	Pitch Circle Diameter	Flange Thickness		Holes		Raised Face Diameter
					No.	Dia	
DN	D	C	B	f	n	d	E
10	90	60	12.0	2	4	14	41
15	95	65	12.0	2	4	14	46
20	105	75	14.0	2	4	14	56
25	115	85	13.0	3	4	14	65
32	140	100	15.0	3	4	19	76
40	150	110	16.0	3	4	19	84
50	165	125	16.0	3	4	19	99
60	175	135	16.0	3	4	19	108
65	185	145	16.0	3	4	19	118
80	200	160	16.0	3	8	19	132
100	235	190	16.0	3	8	23	156
125	270	220	20.5	3	8	28	184
150	300	250	23.0	3	8	28	211
200	375	320	27.0	3	12	31	284
250	450	385	31.5	3	12	34	345
300	515	450	35.5	4	16	34	409
350	580	510	40.0	4	16	37	465
400	660	585	44.0	4	16	41	535
450	685	610	45.0	4	20	41	560
500	755	670	48.0	4	20	44	615
600	890	795	53.0	5	20	50	735



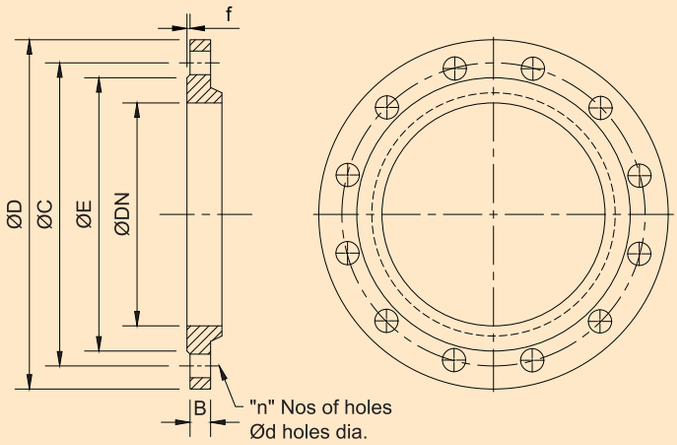
ANSI B 16.5 CLASS 150#

Nominal Bore		OD	PCD	THK		No. of Hole	Hole Dia	RF Dia
mm	inch			B	f			
15	1/2	88.9	60.5	11.2	1.6	4	15.9	35
20	3/4	98.6	69.9	11.2	1.6	4	15.9	43
25	1	108	79.3	11.2	1.6	4	15.9	50.8
32	1 ¼	117.3	88.9	12.7	1.6	4	15.9	63.5
40	1 ½	127	98.6	14.2	1.6	4	15.9	73.2
50	2	152.4	120.7	15.8	1.6	4	19	92
65	2 ½	177.8	139.7	17.5	1.6	4	19	104.6
80	3	190.5	152.4	19.0	1.6	4	19	127
90	3 ½	215.9	177.8	20.6	1.6	8	19	139.7
100	4	228.6	190.5	20.6	1.6	8	19	157.2
125	5	254	215.9	23.9	1.6	8	22.2	185.7
150	6	279.4	241.3	25.4	1.6	8	22.2	215.9
200	8	342.9	298.5	28.4	1.6	8	22.2	269.7
250	10	406.4	362	30.2	1.6	12	25.4	323.9
300	12	482.6	431.8	31.8	1.6	12	25.4	381
350	14	533.4	476.3	35.0	1.6	12	28.6	412.8
400	16	596.9	539.8	36.6	1.6	16	28.6	469.9
450	18	635	577.9	39.6	1.6	16	31.8	533.4
500	20	698.5	635	43.0	1.6	20	31.8	584.2
600	24	812.8	749.3	47.8	1.6	20	35	692.2
750	30	984.3	914.4	--	1.6	28	35	857.3
900	36	1168.4	1085.9	--	1.6	32	41.3	1022.4
1050	42	1346.2	1257.3	--	1.6	36	41.3	1193.8
1200	48	1511.3	1422.4	--	1.6	44	41.3	1358.9



ANSI B 16.5 CLASS 300#

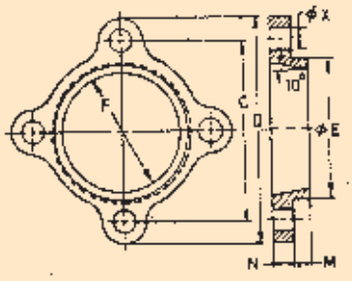
Nominal Bore		OD	PCD	THK		No. of Hole	Hole Dia	RF Dia
mm	inch			B	f			
15	1/2	95.3	66.5	14.2	1.6	4	15.9	35
20	3/4	117.3	82.6	15.7	1.6	4	19	43
25	1	124	88.9	17.5	1.6	4	19	50.8
32	1¼	133.4	98.6	19	1.6	4	19	63.5
40	1½	155.4	114.3	20.6	1.6	4	22.2	73.2
50	2	165.1	127	22.4	1.6	8	19	92
65	2 ½	190.5	149.4	25.4	1.6	8	22.2	104.6
80	3	209.6	168.1	28.5	1.6	8	22.2	127
90	3½	228.6	184.1	30.2	1.6	8	22.2	139.7
100	4	254	200.2	31.8	1.6	8	22.2	157.2
125	5	279.4	235	35	1.6	8	22.2	185.7
150	6	317.5	269.7	36.6	1.6	12	22.2	215.9
200	8	381	330.2	41.1	1.6	12	25.4	269.7
250	10	444.5	387.4	47.8	1.6	16	28.6	323.9
300	12	520.7	450.9	50.8	1.6	16	31.8	381
350	14	584.2	514.4	53.8	1.6	20	31.8	412.8
400	16	647.7	571.5	57.2	1.6	20	35	469.9
450	18	711.2	628.7	60.5	1.6	24	35	533.4
500	20	774.7	685.8	63.5	1.6	24	35	584.2
600	24	914.4	812.8	69.9	1.6	24	41.3	692.2
750	30	1092.2	997	91.9	1.6	28	47.6	857.3
900	36	1270	1168.4	104.6	1.6	32	54	1022.4

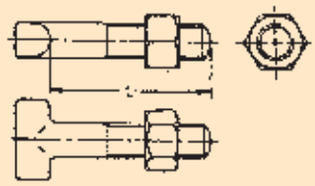


ANSI B 16.5 CLASS 600#

Nominal Bore		OD	PCD	THK		No. of Hole	Hole Dia	RF Dia
mm	inch			B	f			
15	1/2	95.3	66.5	20.6	6.35	4	15.9	35
20	3/4	117.3	82.6	22.2	6.35	4	19	43
25	1	124	88.9	23.9	6.35	4	19	50.8
32	1 ¼	133.4	98.6	26.9	6.35	4	19	63.5
40	1½	155.4	114.3	28.7	6.35	4	22.2	73.2
50	2	165.1	127	31.8	6.35	8	19	92
65	2½	190.5	149.4	35	6.35	8	22.2	104.6
80	3	209.6	168.1	38.1	6.35	8	22.2	127
90	3 ½	228.6	184.1	41.4	6.35	8	25.4	139.7
100	4	273	215.9	44.5	6.35	8	25.4	157.2
125	5	330.2	266.7	50.8	6.35	8	28.6	185.7
150	6	355.6	292.1	54.1	6.35	12	28.6	215.9
200	8	419.1	349.3	62	6.35	12	31.8	269.7
250	10	508	431.8	69.9	6.35	16	35	323.9
300	12	558.8	489	73	6.35	20	35	381
350	14	603.3	527	76.2	6.35	20	38.1	412.8
400	16	685.8	603.3	82.6	6.35	20	41.3	469.9
450	18	743	654	88.9	6.35	20	44.5	533.4
500	20	812.8	723.9	95.3	6.35	24	44.5	584.2
600	24	939.8	838.2	108	6.35	24	50.8	692.2
750	30	1130.3	1022	120	6.35	28	54	857.3

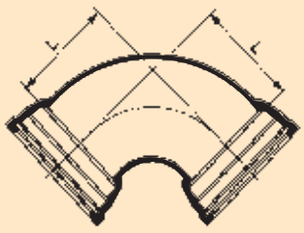
Standard Dimensions of Follower Glands for Mechanical Joints



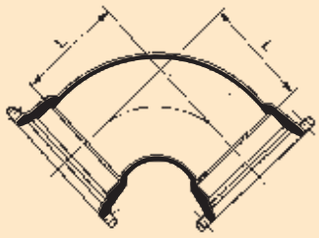


Nominal Diameter	Dimensions							Nominal Mass of each per kg.	BOLTS			App. Mass Total Nut Bolt per Flange
DN	D	C	E	F	x	N	M		Size	Length	Nos.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(11)	(11)	(12)	(Kg)
80	200	160	125	105	19	13	15	2.0	M16	85	4	0.90
100	220	180	145	125	19	13	15	2.5	M16	85	4	0.90
125	250	210	175	151	19	13	15	3.0	M16	85	4	0.90
150	285	240	197	177	23	13	15	4.0	M20	90	4	1.60
200	340	295	249	230	23	13	15	5.0	M20	90	4	1.60
250	395	350	302	282	23	17	15	6.0	M20	90	6	2.40
300	445	400	354	334	23	17	15	8.0	M20	100	6	2.70
350	505	460	411	386	23	17	20	11.0	M20	100	8	3.60
400	565	515	458	438	28	19	20	13.0	M24	110	8	5.20
450	615	565	513	489	28	19	20	15.0	M24	110	10	6.50
500	670	620	563	541	28	19	20	18.0	M24	110	10	6.50
600	780	725	668	645	31	20	20	20.0	M27	120	10	9.40
700	895	840	781	749	31	20	20	30.0	M27	120	12	11.28
750	960	900	833	800	31	20	20	35.0	M27	120	12	11.28
800	1015	950	883	850	34	23	20	45.0	M30	120	12	13.68
900	1115	1050	983	955	34	23	20	55.0	M30	130	14	17.22
1000	1230	1160	1083	1060	37	23	20	70.0	M33	130	14	21.98
1050	1335	1258	1190	1135	37	26	25	80.0	M33	140	14	23.80
1100	1340	1270	1218	1163	37	26	25	100.0	M33	140	16	27.20
1200	1455	1380	1322	1267	40	26	25	130.0	M36	150	16	32.00
1500	1785	1710	1635	1580	43	26	25	170.0	M39	150	18	50.00

Standard Dimensions of Socketed Fittings for Push-on Joints



"T" Type



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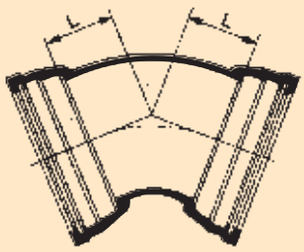

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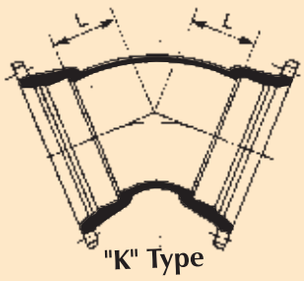

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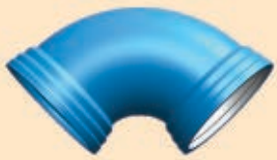


Double Socket 90° Bends

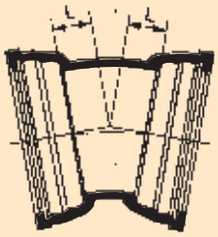
Nominal Diameter DN	L	Mass (kg) T Type
80	100	8
100	120	10
125	145	15
150	170	18
200	220	29
250	270	44
300	320	60
350	370	85
400	420	110
450	470	148
500	520	180
600	620	280
700	720	405
750	770	480
800	820	550
900	920	720
1000	1020	960
1100	1130	1350
1200	1230	1660
1400	1430	2430
1500	1530	3000
1600	1630	3380
1800	1830	4400
2000	--	5500

Double Socket 45° Bend

Nominal Diameter DN	L	Mass (kg) T Type
80	55	8
100	65	9
125	75	13
150	85	14
200	110	24
250	130	33
300	150	47
350	175	61
400	195	80
450	220	104
500	240	128
600	285	198
700	330	270
750	350	330
800	370	370
900	415	480
1000	460	640
1100	505	920
1200	550	1120
1400	515	1450
1500	540	1750
1600	565	1950
1800	610	2300
2000	--	2760

*All dimensions are in millimetres.

IS 9523 | ISO 2531 | ISO 7186 | BS EN 545 | BS EN 598



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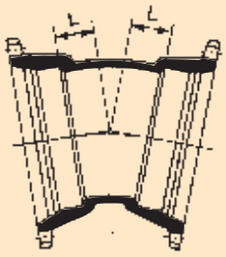

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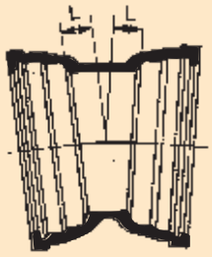

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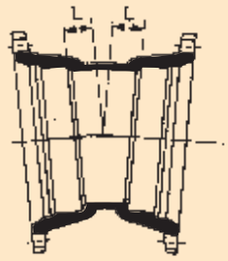

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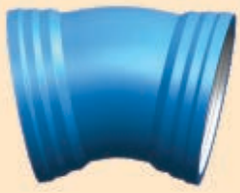


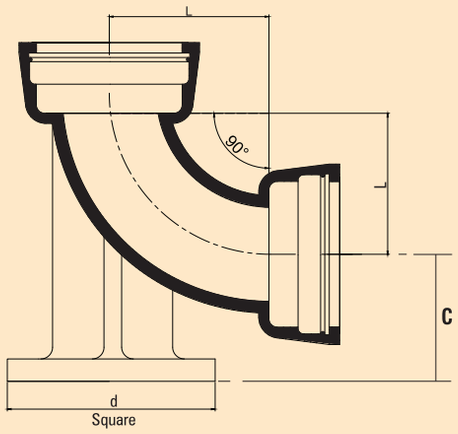
Double Socket 22.5° Bend

Nominal Diameter DN	L	Mass (kg) T Type
80	40	7
100	40	9
125	50	12
150	55	13
200	65	20
250	75	28
300	85	40
350	95	50
400	110	62
450	120	80
500	130	102
600	150	150
700	175	205
750	185	255
800	195	285
900	205	350
1000	210	450
1100	220	600
1200	240	760
1400	260	1000
1500	270	1350
1600	280	1600
1800	305	1900
2000	--	2280

Double Socket 11.25° Bend

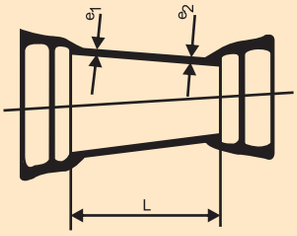
Nominal Diameter DN	L	Mass (kg) T Type
80	30	7
100	30	8
125	35	11
150	35	12
200	40	19
250	50	26
300	55	35
350	60	40
400	65	54
450	70	74
500	75	88
600	85	130
700	95	170
750	100	200
800	110	234
900	120	290
1000	130	360
1100	140	530
1200	150	600
1400	130	820
1500	135	1050
1600	140	1250
1800	155	1390
2000	--	1600

Duckfoot Double Socket 90° Bend

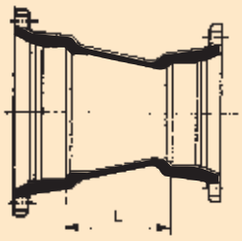


DN mm	e mm	L mm	C mm	d mm	Mass (kg.)
80	7.0	110	110	180	13
100	7.2	130	125	200	16
125	7.5	155	140	225	22
150	7.8	180	160	250	29
200	8.4	230	190	300	47
250	9.0	280	225	350	70
300	9.6	325	255	400	100
350	10.2	380	290	450	135
400	10.8	430	320	500	180
450	11.4	480	355	550	230
500	12.0	530	385	600	290
600	13.2	630	450	700	440
700	14.4	735	515	800	620
750	15.0	790	545	850	730
800	15.6	830	580	900	840
900	16.8	930	645	1000	1110
1000	18.0	1035	710	1100	1460
1100	19.2	1130	775	1200	1880
1200	20.4	1230	840	1300	2300
1400	22.8	1430	970	1500	3590
1500	24.0	1530	1040	1600	4400
1600	25.2	1630	1100	1700	4900
1800	27.6	1830	1230	1900	6800

Double Concentric Tapers



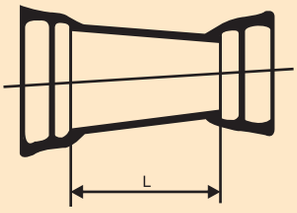
"T" TYPE



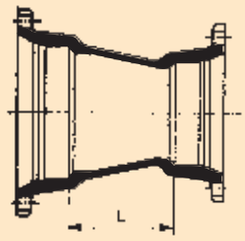
"K" TYPE

Nominal Diameter		e_1	e_2	L	App. Mass (kg)
Larger End	Smaller End				
100	80	7.2	7.0	90	8
125	80	7.5	7.0	140	11
125	100	7.5	7.2	100	11
150	80	7.8	7.0	190	12
150	100	7.8	7.2	150	13
150	125	7.8	7.5	100	14
200	100	8.4	7.2	250	19
200	125	8.4	7.5	200	21
200	150	8.4	7.8	150	21
250	125	9.0	7.5	300	28
250	150	9.0	7.8	250	27
250	200	9.0	8.4	150	26
300	150	9.6	7.8	350	37
300	200	9.6	8.4	250	36
300	250	9.6	9.0	150	34
350	200	10.2	8.4	360	48
350	250	10.2	9.0	260	47
350	300	10.2	9.6	160	46
400	200	10.8	8.4	360	68
400	250	10.8	9.0	360	60
400	300	10.8	9.6	260	59
400	350	10.8	10.2	160	50
450	250	11.4	9.0	260	72
450	300	11.4	9.6	260	74
450	350	11.4	10.2	260	68
450	400	11.4	10.8	160	62

Double Concentric Tapers



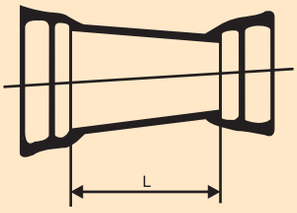
"T" TYPE



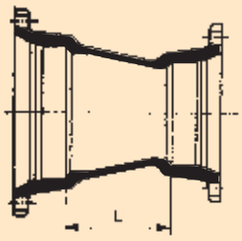
"K" TYPE

Nominal Diameter		e1	e2	L	App. Mass (kg)
Larger End	Smaller End				
500	300	12.0	9.6	360	94
500	350	12.0	10.2	360	90
500	400	12.0	10.8	260	88
500	450	12.0	11.4	160	85
600	350	13.2	10.2	460	138
600	400	13.2	10.8	460	135
600	450	13.2	11.4	360	136
600	500	13.2	12.0	260	124
700	400	14.4	10.8	480	184
700	450	14.4	11.4	480	188
700	500	14.4	12.0	480	192
700	600	14.4	13.2	280	172
750	450	15.0	11.4	480	210
750	500	15.0	12.0	480	215
750	600	15.0	13.2	280	200
750	700	15.0	14.4	180	185
800	450	15.6	11.4	480	246
800	500	15.6	12.0	480	248
800	600	15.6	13.2	480	245
800	700	15.6	14.4	280	224
900	500	16.8	12.0	480	312
900	600	16.8	13.2	480	315
900	700	16.8	14.4	480	316
900	800	16.8	15.6	280	288
1000	600	18.0	13.2	480	380
1000	700	18.0	14.4	480	385
1000	800	18.0	15.6	480	390
1000	900	18.0	16.8	280	360
1100	700	19.2	14.4	480	560
1100	800	19.2	15.6	480	570
1100	900	19.2	16.8	480	580
1100	1000	19.2	18.0	280	500

Double Concentric Tapers



"T" TYPE

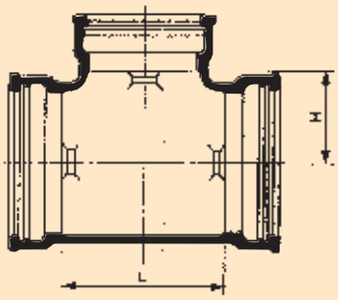


"K" TYPE

Nominal Diameter		e1	e2	L	App. Mass (kg)
Larger End	Smaller End				
1200	700	20.4	14.4	480	630
1200	800	20.4	15.6	480	640
1200	900	20.4	16.8	480	650
1200	1000	20.4	18.0	480	660
1200	1100	20.4	19.2	280	610
1400	800	22.8	15.6	360	780
1400	900	22.8	16.8	360	810
1400	1000	22.8	18.0	360	840
1400	1100	22.8	19.2	360	880
1400	1200	22.8	20.4	360	900
1500	900	24.0	16.8	360	990
1500	1000	24.0	18.0	360	1010
1500	1100	24.0	19.2	360	1030
1500	1200	24.0	20.4	260	1010
1500	1400	24.0	22.8	260	1040
1600	1000	25.2	18.0	360	1070
1600	1100	25.2	19.2	360	1100
1600	1200	25.2	20.4	360	1120
1600	1400	25.2	22.8	360	1140
1600	1500	25.2	24.0	260	1110
1800	1100	27.6	19.2	480	1520
1800	1200	27.6	20.4	480	1530
1800	1400	27.6	22.8	360	1440
1800	1500	27.6	24.0	360	1490
1800	1600	27.6	25.2	360	1550

NOTE
1. Size and Dimensions in **RED** are non standard as per IS-9523:2000
2. We can manufacture products of any size and type as per requirement.

All Socket Tee



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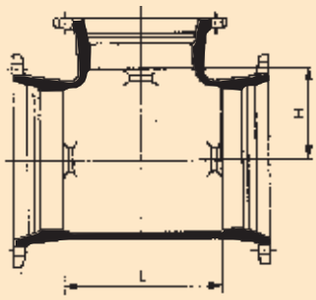


"K" TYPE

Nominal Diameter		e	e_1	L	H	All Socket
DN Body	dn Branch					
80	80	7.0	7.0	170	85	11
100	80	7.2	7.0	170	95	13
100	100	7.2	7.2	190	95	14
125	80	7.5	7.0	170	105	17
125	100	7.5	7.2	195	110	18
125	125	7.5	7.5	225	110	20
150	80	7.8	7.0	170	120	19
150	100	7.8	7.2	195	120	20
150	150	7.8	7.8	255	125	23
200	80	8.4	7.0	175	145	26
200	100	8.4	7.2	200	145	28
200	150	8.4	7.8	255	150	32
200	200	8.4	8.4	315	155	39
250	80	9.0	7.0	180	170	35
250	100	9.0	7.2	200	170	37
250	150	9.0	7.8	260	175	40
250	200	9.0	8.4	315	180	48
250	250	9.0	9.0	375	190	54
300	80	9.6	7.0	180	220	44
300	100	9.6	7.2	210	220	45
300	150	9.6	7.8	260	220	54
300	200	9.6	8.4	325	220	60
300	250	9.6	9.0	380	220	68
300	300	9.6	9.6	440	220	74
350	80	10.2	7.0	185	260	55
350	100	10.2	7.2	205	260	56
350	150	10.2	7.8	265	265	64
350	200	10.2	8.4	325	270	70
350	250	10.2	9.0	380	280	85
350	300	10.2	9.6	440	285	95
350	350	10.2	10.2	495	290	100
400	80	10.8	7.0	185	285	73
400	100	10.8	7.2	210	285	72
400	150	10.8	7.8	270	290	90
400	200	10.8	8.4	325	295	92
400	250	10.8	9.0	385	305	100
400	300	10.8	9.6	440	310	110
400	400	10.8	10.8	560	320	130

NOTE : Also available in K-14 as per ISO-2531/BS-EN-545

All Socket Tee

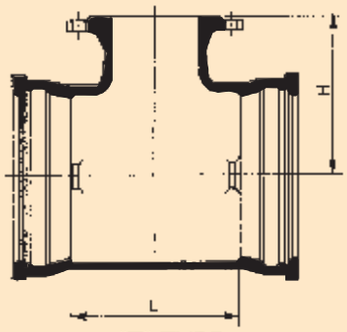
Nominal Diameter		e	e_1	L	H	All Socket
DN Body	dn Branch					
450	80	11.4	7.0	190	310	89
450	100	11.4	7.2	215	310	90
450	150	11.4	7.8	270	315	105
450	200	11.4	8.4	330	320	110
450	250	11.4	9.0	390	330	112
450	300	11.4	9.6	445	335	125
450	400	11.4	10.8	560	345	155
450	450	11.4	11.4	620	350	160
500	80	12.0	7.0	195	335	104
500	100	12.0	7.2	215	335	105
500	150	12.0	7.8	275	340	127
500	200	12.0	8.4	330	345	130
500	250	12.0	9.0	390	355	155
500	300	12.0	9.6	450	360	160
500	350	12.0	10.2	505	365	170
500	400	12.0	10.8	565	370	185
500	500	12.0	12.0	680	380	205
600	80	13.2	7.0	200	385	166
600	100	13.2	7.2	220	385	168
600	150	13.2	7.8	280	390	170
600	200	13.2	8.4	340	395	172
600	300	13.2	9.6	455	410	220
600	400	13.2	10.8	570	420	240
600	500	13.2	12.0	685	430	290
600	600	13.2	13.2	800	440	300
700	100	14.4	7.2	230	435	205
700	150	14.4	7.8	285	440	215
700	200	14.4	8.4	345	445	230
700	300	14.4	9.6	460	460	270
700	400	14.4	10.8	575	470	320
700	500	14.4	12.0	690	480	420
700	600	14.4	13.2	810	490	470
700	700	14.4	14.4	925	500	500
750	100	15.0	7.2	230	460	315
750	150	15.0	7.8	290	465	330
750	200	15.0	8.4	345	470	360
750	300	15.0	9.6	465	485	390
750	400	15.0	10.8	580	495	430
750	500	15.0	12.0	695	505	480
750	600	15.0	13.2	810	515	520
750	700	15.0	14.4	925	525	570
750	750	15.0	15.0	985	535	590
800	100	15.6	7.2	235	485	260
800	150	15.6	7.8	290	490	280
800	200	15.6	8.4	350	495	300
800	300	15.6	9.6	465	510	370
800	400	15.6	10.8	580	520	420
800	500	15.6	12.0	700	530	490
800	600	15.6	13.2	815	540	530
800	700	15.6	14.4	930	550	550
800	800	15.6	15.6	1045	565	610

All Socket Tee

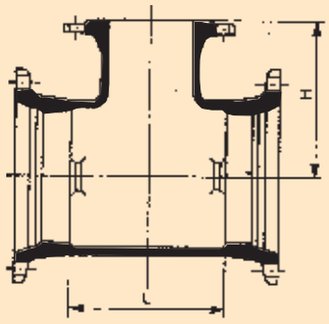
Nominal Diameter		e	e_1	L	H	All Socket
DN Body	dn Branch					
900	150	16.8	7.8	300	540	370
900	200	16.8	8.4	355	545	400
900	400	16.8	10.8	590	570	500
900	600	16.8	13.2	1170	590	680
900	800	16.8	15.6	1170	615	725
900	900	16.8	16.8	1170	625	750
1000	150	18.0	7.8	305	590	440
1000	200	18.0	8.4	360	595	460
1000	400	18.0	10.8	595	620	550
1000	600	18.0	13.2	1290	640	900
1000	800	18.0	15.6	1290	665	940
1000	1000	18.0	18.0	1290	685	1000
1100	200	19.2	8.4	370	645	670
1100	400	19.2	10.8	600	670	780
1100	600	19.2	13.2	830	690	910
1100	800	19.2	15.6	1065	715	1190
1100	1000	19.2	18.0	1295	735	1360
1100	1100	19.2	19.2	1410	745	1460
1200	200	20.4	8.4	375	695	800
1200	400	20.4	10.8	605	720	930
1200	600	20.4	13.2	840	740	1060
1200	800	20.4	15.6	1070	765	1250
1200	1000	20.4	18.0	1300	785	1490
1200	1200	20.4	20.4	1535	805	1710
1400	400	22.8	10.8	800	820	1380
1400	600	22.8	13.2	1030	840	1550
1400	800	22.8	15.6	1260	865	1750
1400	1000	22.8	18.0	1495	885	1960
1400	1200	22.8	20.4	1725	905	2200
1400	1400	22.8	22.8	1960	930	2500
1500	400	24.0	10.8	805	870	1400
1500	600	24.0	13.2	1035	890	1600
1500	800	24.0	15.6	1270	915	1850
1500	1000	24.0	18.0	1500	935	2200
1500	1200	24.0	20.4	1730	955	2400
1500	1400	24.0	22.8	1965	980	2700
1500	1500	24.0	24.0	2080	990	2900
1600	400	25.2	10.8	810	920	1770
1600	600	25.2	13.2	1040	940	1980
1600	800	25.2	15.6	1275	965	2220
1600	1000	25.2	18.0	1505	985	2460
1600	1200	25.2	20.4	1740	1005	2800
1600	1400	25.2	22.8	1970	1030	3000
1600	1600	25.2	25.2	2200	1050	3400
1800	600	27.6	13.2	1055	1040	2300
1800	800	27.6	15.6	1285	1065	2600
1800	1000	27.6	18.0	1520	1085	3000
1800	1200	27.6	20.4	1750	1105	3300
1800	1400	27.6	22.8	1980	1130	3700
1800	1600	27.6	25.2	2215	1150	4100
1800	1800	27.6	27.6	2445	1175	4600

NOTE : 1. Size & Dimensions in **RED** are non standard as per IS-9523:2000.
2. TEES in combination of sizes other than above can also be manufactured against specific requirements.

Double Socket Branch Flange Tee



"T" TYPE



"K" TYPE

Nominal Diameter		e	e_1	L	H	App. Mass (kg)	
DN Body	dn Branch					PN 10	PN 16
80	80	7.0	7.0	170	165	13	13
100	80	7.2	7.0	170	175	15	15
100	100	7.2	7.2	190	180	16	17
125	80	7.5	7.0	170	190	18	18
125	100	7.5	7.2	195	195	19	20
125	125	7.5	7.5	225	200	21	22
150	80	7.8	7.0	170	205	21	21
150	100	7.8	7.2	195	210	22	23
150	150	7.8	7.8	255	220	27	28
200	80	8.4	7.0	175	235	28	28
200	100	8.4	7.2	200	240	30	31
200	150	8.4	7.8	255	250	36	37
200	200	8.4	8.4	315	260	42	44
250	80	9.0	7.0	180	265	36	36
250	100	9.0	7.2	200	270	38	39
250	150	9.0	7.8	260	280	44	46
250	200	9.0	8.4	315	290	52	54
250	250	9.0	9.0	375	300	60	62
300	80	9.6	7.0	180	295	48	48
300	100	9.6	7.2	210	300	50	51
300	150	9.6	7.8	260	310	56	57
300	200	9.6	8.4	325	320	63	65
300	250	9.6	9.0	380	330	74	76
300	300	9.6	9.6	440	340	80	89
350	80	10.2	7.0	185	325	58	58
350	100	10.2	7.2	205	330	59	60
350	150	10.2	7.8	265	340	70	71
350	200	10.2	8.4	325	350	75	77
350	250	10.2	9.0	380	360	90	92
350	300	10.2	9.6	440	370	100	105
350	350	10.2	10.2	495	380	110	115
400	80	10.8	7.0	185	355	70	70
400	100	10.8	7.2	210	360	71	72
400	150	10.8	7.8	270	370	80	86
400	200	10.8	8.4	325	380	92	94
400	250	10.8	9.0	385	390	103	105
400	300	10.8	9.6	440	400	114	116
400	400	10.8	10.8	560	420	145	150

NOTE : Also available in K-14 as per ISO-2531/BS-EN-545

Double Socket Branch Flange Tee

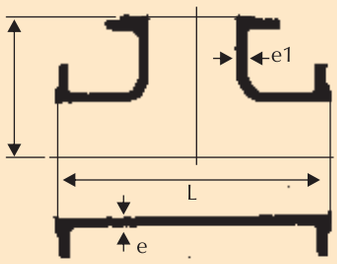
Nominal Diameter		e	e_1	L	H	App. Mass (kg)	
DN Body	dn Branch					PN 10	PN 16
450	80	11.4	7.0	190	385	86	86
450	100	11.4	7.2	215	390	88	89
450	150	11.4	7.8	270	400	95	96
450	200	11.4	8.4	330	410	108	110
450	250	11.4	9.0	390	420	120	122
450	300	11.4	9.6	445	430	134	136
450	400	11.4	10.8	560	450	159	164
450	450	11.4	11.4	620	460	173	181
500	80	12.0	7.0	195	415	102	102
500	100	12.0	7.2	215	420	103	104
500	150	12.0	7.8	275	430	123	124
500	200	12.0	8.4	330	440	126	128
500	250	12.0	9.0	390	450	150	152
500	300	12.0	9.6	450	460	154	156
500	350	12.0	10.2	505	470	172	175
500	400	12.0	10.8	565	480	181	186
500	500	12.0	12.0	680	500	213	227
600	80	13.2	7.0	200	475	151	151
600	100	13.2	7.2	220	480	155	156
600	150	13.2	7.8	280	490	160	161
600	200	13.2	8.4	340	500	171	173
600	300	13.2	9.6	455	520	220	222
600	400	13.2	10.8	570	540	240	245
600	500	13.2	12.0	685	560	290	304
600	600	13.2	13.2	800	580	320	335
700	100	14.4	7.2	230	510	200	200
700	150	14.4	7.8	285	520	210	211
700	200	14.4	8.4	345	525	220	226
700	300	14.4	9.6	460	540	270	272
700	400	14.4	10.8	575	555	300	305
700	500	14.4	12.0	690	570	370	384
700	600	14.4	13.2	810	585	410	425
700	700	14.4	14.4	925	600	440	455
750	100	15.0	7.2	230	540	240	240
750	150	15.0	7.8	290	550	255	256
750	200	15.0	8.4	345	555	270	272
750	300	15.0	9.6	465	570	305	307
750	400	15.0	10.8	580	585	340	345
750	500	15.0	12.0	695	600	382	396
750	600	15.0	13.2	810	615	422	437
750	700	15.0	14.4	925	630	465	477
750	750	15.0	15.0	985	640	490	503
800	100	15.6	7.2	235	570	260	265
800	150	15.6	7.8	290	580	280	290
800	200	15.6	8.4	350	585	300	305
800	300	15.6	9.6	465	600	350	355
800	400	15.6	10.8	580	615	380	385
800	500	15.6	12.0	700	630	500	514
800	600	15.6	13.2	815	645	525	560
800	700	15.6	14.4	930	660	550	562
800	800	15.6	15.6	1045	675	580	595

Double Socket Branch Flange Tee

Nominal Diameter		e	e_1	L	H	App. Mass (kg)	
DN Body	dn Branch					PN 10	PN 16
900	150	16.8	7.8	300	645	330	331
900	200	16.8	8.4	355	645	350	352
900	400	16.8	10.8	590	675	450	455
900	600	16.8	13.2	1170	705	720	746
900	800	16.8	15.6	1170	735	750	768
900	900	16.8	16.8	1170	750	760	780
1000	150	18.0	7.8	305	700	430	430
1000	200	18.0	8.4	360	705	450	452
1000	400	18.0	10.8	595	735	560	565
1000	600	18.0	13.2	1290	765	925	942
1000	800	18.0	15.6	1290	795	955	970
1000	1000	18.0	18.0	1290	825	985	1020
1100	200	19.2	8.4	370	765	690	692
1100	400	19.2	10.8	600	795	785	790
1100	600	19.2	13.2	830	825	920	935
1100	800	19.2	15.6	1065	855	1100	1115
1100	1000	19.2	18.0	1295	885	1300	1335
1100	1100	19.2	19.2	1410	900	1415	1450
1200	200	20.4	8.4	375	825	720	722
1200	400	20.4	10.8	605	855	895	900
1200	600	20.4	13.2	840	885	1070	1085
1200	800	20.4	15.6	1070	915	1240	1255
1200	1000	20.4	18.0	1300	945	1440	1475
1200	1200	20.4	20.4	1535	975	1770	1825
1400	400	22.8	10.8	800	950	1400	1405
1400	600	22.8	13.2	1030	980	1565	1580
1400	800	22.8	15.6	1260	1010	1770	1785
1400	1000	22.8	18.0	1495	1040	1985	2020
1400	1200	22.8	20.4	1725	1070	2320	2375
1400	1400	22.8	22.8	1960	1100	2630	2690
1500	400	24.0	10.8	805	1005	1510	1515
1500	600	24.0	13.2	1035	1035	1780	1795
1500	800	24.0	15.6	1270	1065	2070	2085
1500	1000	24.0	18.0	1500	1095	2370	2405
1500	1200	24.0	20.4	1730	1125	2700	2755
1500	1400	24.0	22.8	1965	1155	3040	3100
1500	1500	24.0	24.0	2080	1170	3230	3320
1600	400	25.2	10.8	810	1060	1780	1785
1600	600	25.2	13.2	1040	1090	1980	1995
1600	800	25.2	15.6	1275	1120	2230	2245
1600	1000	25.2	18.0	1505	1150	2480	2520
1600	1200	25.2	20.4	1740	1180	2790	2850
1600	1400	25.2	22.8	1970	1210	3250	3310
1600	1600	25.2	25.2	2200	1240	3800	3900
1800	600	27.6	13.2	1055	1200	2530	2550
1800	800	27.6	15.6	1285	1230	2900	2920
1800	1000	27.6	18.0	1520	1260	3300	3340
1800	1200	27.6	20.4	1750	1290	3700	3760
1800	1400	27.6	22.8	1980	1320	4100	4160
1800	1600	27.6	25.2	2215	1350	4600	4700
1800	1800	27.6	27.6	2445	1380	5100	5220

NOTE : 1. Size & Dimensions in **RED** are non standard as per IS-9523:2000.
2. TEES in combination of sizes other than above can also be manufactured against specific requirements.

All Flanged Tee



"T" TYPE

Nominal Diameter		e_1	e_2	L	H	App. Mass (kg)	
DN	dn					PN 10	PN 16
80	80	7.0	7.0	330	165	16	16
100	80	7.2	7.0	360	175	18	18
100	100	7.2	7.2	360	180	19	19
125	80	7.5	7.0	400	190	23	23
125	100	7.5	7.2	400	195	24	24
125	125	7.5	7.5	400	200	25	25
150	80	7.8	7.0	440	205	28	28
150	100	7.8	7.2	440	210	29	29
150	125	7.8	7.5	440	215	30	30
150	150	7.8	7.8	440	220	32	32
200	80	8.4	7.0	520	235	41	41
200	100	8.4	7.2	520	240	42	42
200	150	8.4	7.8	520	250	45	45
200	200	8.4	8.4	520	260	49	49
250	80	9.0	7.0	700	235	64	67
250	100	9.0	7.2	700	275	65	68
250	150	9.0	7.8	700	325	69	71
250	200	9.0	8.4	700	325	71	75
250	250	9.0	9.0	700	350	77	81
300	80	9.6	7.0	800	265	83	88
300	100	9.6	7.2	800	300	85	90
300	150	9.6	7.8	800	350	90	95
300	200	9.6	8.4	800	350	95	100
300	250	9.6	9.0	800	350	103	108
300	300	9.6	9.6	800	400	110	115
350	80	10.2	7.0	850	295	107	115
350	100	10.2	7.2	850	325	110	118
350	150	10.2	7.8	850	325	113	122
350	200	10.2	8.4	850	325	116	125

NOTE : Also available in K-14 as per ISO-2531/BS-EN-545

All Flanged Tee

Nominal Diameter		e	e_1	L	H	App. Mass (kg)	
DN	dn					PN 10	PN 16
350	250	10.2	9.0	850	325	133	138
350	300	10.2	9.6	850	425	137	144
350	350	10.2	10.2	850	425	140	150
400	80	10.8	7.0	900	325	135	145
400	100	10.8	7.2	900	350	140	150
400	150	10.8	7.8	900	350	149	158
400	200	10.8	8.4	900	350	145	155
400	250	10.8	9.0	900	350	152	163
400	300	10.8	9.6	900	450	158	170
400	400	10.8	10.8	900	450	170	185
450	80	11.4	7.0	950	355	160	180
450	100	11.4	7.2	950	375	166	185
450	150	11.4	7.8	950	375	168	188
450	200	11.4	8.4	950	375	170	190
450	250	11.4	9.0	950	375	177	197
450	300	11.4	9.6	950	475	184	204
450	400	11.4	10.8	950	475	196	216
450	450	11.4	11.4	950	475	201	230
500	80	12.0	7.0	1000	385	208	238
500	100	12.0	7.2	1000	400	210	240
500	150	12.0	7.8	1000	400	213	243
500	200	12.0	8.4	1000	400	215	245
500	250	12.0	9.0	1000	400	220	250
500	300	12.0	9.6	1000	500	230	260
500	350	12.0	10.2	1000	500	240	270
500	400	12.0	10.8	1000	500	250	280
500	500	12.0	12.0	1000	500	270	300
600	80	13.2	7.0	1100	445	290	340
600	100	13.2	7.2	1100	450	292	342
600	150	13.2	7.8	1100	450	295	345
600	200	13.2	8.4	1100	450	300	355
600	300	13.2	9.6	1100	550	315	370
600	400	13.2	10.8	1100	550	330	390
600	500	13.2	12.0	1100	550	350	420
600	600	13.2	13.2	1100	550	370	440

All Flanged Tee

Nominal Diameter		e	e_1	L	H	App. Mass (kg)	
DN	dn					PN 10	PN 16
700	100	14.4	7.2	540	510	245	270
700	150	14.4	7.8	600	520	265	290
700	200	14.4	8.4	650	525	280	305
700	300	14.4	9.6	760	540	315	340
700	400	14.4	10.8	870	555	350	375
700	500	14.4	12.0	1000	570	405	435
700	600	14.4	13.2	1200	585	475	515
700	700	14.4	14.4	1200	600	505	545
750	100	15.0	7.2	550	540	270	300
750	150	15.0	7.8	610	550	280	310
750	200	15.0	8.4	670	555	287	317
750	300	15.0	9.6	780	570	349	384
750	400	15.0	10.8	890	585	359	394
750	500	15.0	12.0	1020	600	485	530
750	600	15.0	13.2	1130	615	500	545
750	700	15.0	14.4	1250	630	515	560
750	750	15.0	15.0	1275	640	525	570
800	100	15.6	7.2	560	570	350	375
800	150	15.6	7.8	620	580	355	380
800	200	15.6	8.4	690	585	360	385
800	300	15.6	9.6	800	600	413	443
800	400	15.6	10.8	910	615	440	480
800	500	15.6	12.0	1030	630	546	590
800	600	15.6	13.2	1350	645	610	650
800	700	15.6	14.4	1350	660	659	709
800	800	15.6	15.6	1350	675	660	700
900	150	16.8	7.8	650	640	390	430
900	200	16.8	8.4	730	645	400	440
900	400	16.8	10.8	950	675	510	560
900	600	16.8	13.2	1500	705	730	800
900	800	16.8	15.6	1500	735	830	890
900	900	16.8	16.8	1500	750	840	900
1000	150	18.0	7.8	720	700	505	565
1000	200	18.0	8.4	770	705	510	570
1000	400	18.0	10.8	990	735	670	730
1000	600	18.0	13.2	1650	765	970	1050
1000	800	18.0	15.6	1650	795	1050	1130
1000	1000	18.0	18.0	1650	825	1100	1200

All Flanged Tee

Nominal Diameter		e	e_1	L	H	App. Mass (kg)	
DN	dn					PN 10	PN 16
1100	200	19.2	8.4	760	765	650	720
1100	400	19.2	10.8	980	795	770	860
1100	600	19.2	13.2	1210	825	940	1030
1100	800	19.2	15.6	1470	855	1140	1225
1100	1000	19.2	18.0	1690	885	1345	1450
1100	1100	19.2	19.2	1800	900	1450	1555
1200	200	20.4	8.4	780	825	800	900
1200	400	20.4	10.8	1070	855	990	1110
1200	600	20.4	13.2	1240	885	1100	1220
1200	800	20.4	15.6	1470	915	1300	1420
1200	1000	20.4	18.0	1700	945	1500	1650
1200	1200	20.4	20.4	1950	975	1790	1950
1400	400	22.8	10.8	1050	950	1240	1380
1400	600	22.8	13.2	1550	980	1527	1665
1400	800	22.8	15.6	1760	1010	1755	1884
1400	1000	22.8	18.0	2015	1040	1995	2143
1400	1200	22.8	20.4	2015	1070	2262	2431
1400	1400	22.8	22.8	2200	1100	2545	2715
1500	400	24.0	10.8	1070	1005	1525	1730
1500	600	24.0	13.2	1350	1035	1700	1900
1500	800	24.0	15.6	1570	1065	1900	2100
1500	1000	24.0	18.0	1790	1095	2200	2400
1500	1200	24.0	20.4	2010	1125	2500	2700
1500	1400	24.0	22.8	2230	1155	2750	2980
1500	1500	24.0	24.0	2340	1170	2900	3130
1600	400	25.2	10.8	1100	1060	1700	1900
1600	600	25.2	13.2	1600	1090	2000	2200
1600	800	25.2	15.6	1835	1120	2300	2500
1600	1000	25.2	18.0	2065	1150	2500	2700
1600	1200	25.2	20.4	2300	1180	2800	3000
1600	1400	25.2	22.8	2300	1210	3208	3444
1600	1600	25.2	25.2	2480	1240	3586	3854
1800	600	25.2	13.2	1410	1200	2521	2768
1800	800	27.6	15.6	1660	1230	2848	3087
1800	1000	27.6	18.0	1880	1260	3184	3442
1800	1200	27.6	20.4	2100	1290	3543	3822
1800	1400	27.6	22.8	2320	1320	3910	4190
1800	1600	27.6	25.2	2540	1350	4328	4641
1800	1800	27.6	27.6	2760	1380	4750	5086

NOTE :

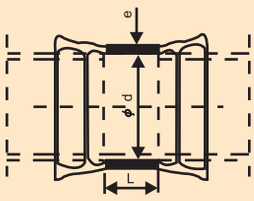
TEES in combination of sizes other than above can also be manufactured against specific requirements.

NOTE : 1. Sizes & Dimensions in **RED** are non standard as per IS-9523-2000

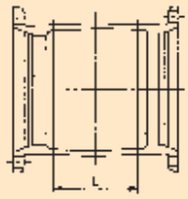
2. Tees in combination of sizes other than above can also be manufactured against specific requirement.

Collars

"T" TYPE



"K" TYPE



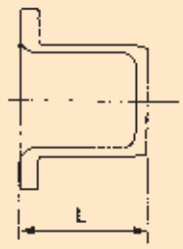
Nominal Dia (DN)	e	d	SHORT TYTON COLLAR (Non Standard) Mass	STD TYTON COLLAR		M/J COLLAR		
				L	App. Mass (kg)	L	App. Mass (kg)	
							Main Fitting	Complete Set Wt.
80	7	109	6	160	9	160	9	15
100	7.2	130	7	160	11	160	11	18
125	7.5	156	9	165	16	165	16	24
150	7.8	183	11	165	17	165	17	28
200	8.4	235	16	170	22	170	22	36
250	9	288	19	175	29	175	29	47
300	9.6	340	24	180	38	180	38	61
350	10.2	393	32	185	50	185	50	80
400	10.8	445	40	190	66	190	66	105
450	11.4	498	47	195	72	195	72	118
500	12	550	52	200	90	200	90	143
600	13.2	655	80	210	115	210	115	177
700	14.4	760	—	220	172	220	172	262
750	15	810	—	225	180	225	180	281
800	15.6	865	—	230	220	230	220	346
900	16.8	970	—	240	270	240	270	424
1000	18	1075	—	250	325	250	325	520
1100	19.2	1180	—	260	415	260	415	683
1200	20.4	1285	—	270	480	270	480	820
1400	22.8	1477	—	—	—	340	690	1116
1500	24	1580	—	—	—	350	770	1228
1600	25.2	1683	—	—	—	360	920	1430
1800	27.6	1892	—	—	—	380	1170	1770
2000	30.0	2095	—	—	—	400	1460	2120
2200	32.4	2301	—	—	—	420	1800	2570
2400	34.8	2507	—	—	—	440	2150	—
2600	37.2	2713	—	—	—	460	2750	—

*All dimensions are in millimetres.

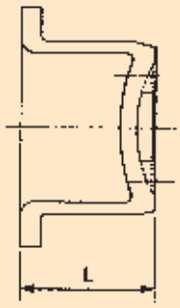
Plugs

"T" TYPE

80 to 300 mm dia



350 to 1200 mm dia



"K" TYPE

80 to 300 mm dia

350 to 1200 mm dia

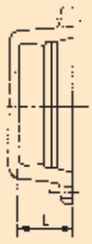
Nominal Diameter DN	e	e_1	"T" TYPE		"K" TYPE	
			L	App. Mass(kg)	L	App. Mass(kg)
80	7	9.5	113	3	92	6
100	7.2	10.5	120	5	93	7
150	7.8	12.5	130	9	104	11
200	8.4	13.5	146	14	105	16
250	9	14.5	152	19	106	28
300	9.6	15.5	159	30	127	31
350	10.2	16.5	176	44	128	41
400	10.8	17.5	178	52	129	53
450	11.4	19	180	66	130	63
500	12	20	187	82	131	76
600	13.2	21	194	120	132	116
700	14.4	23	200	180	143	166
750	15	24	225	220	144	210
800	15.6	25	250	240	144	250
900	16.8	27	300	310	145	333
1000	18	28	325	390	156	434
1100	19.2	30	350	500	158	538
1200	20.4	32	375	620	160	671

Caps

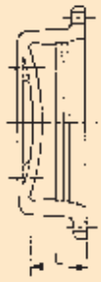
80 to 300 mm dia

350 to 1200 mm dia

80 to 300 mm dia



350 to 1200 mm dia



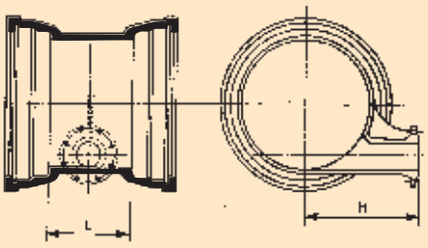
"T" TYPE

"K" TYPE

Nominal Diameter DN	e	e_1	L	App. Mass (Kg)
80	7	9.5	80	4
100	7.2	10.5	80	5
150	7.8	12.5	90	9
200	8.4	13.5	90	16
250	9	14.5	90	19
300	9.6	15.5	110	30
350	10.2	16.5	110	46
400	10.8	17.5	110	60
450	11.4	19	110	76
500	12	20	110	91
600	13.2	21	110	127
700	14.4	23	120	175
750	15	24	120	202
800	15.6	25	120	227
900	16.8	27	120	295
1000	18	28	130	379
1100	19.2	30	130	466
1200	20.4	32	130	567

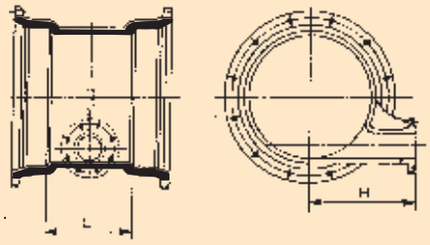
Double Socket Level Invert Tee with Flanged Branch

Pushon Type (T)



"T" TYPE

Mechanical Type (K)

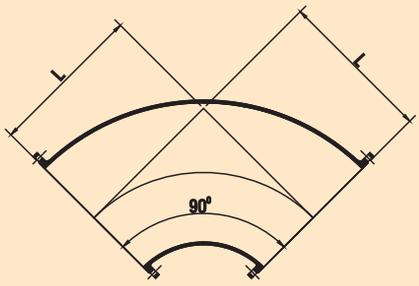


"K" TYPE

Nominal Diameter		e	L	e1	H	App. Mass (Kg)
DN	dn					
200	80	8.4	245	7	250	40
250	80	9.0	250	7	275	50
300	80	9.6	255	7	300	62
350	100	10.2	280	7.2	325	83
400	100	10.8	280	7.2	350	98
450	100	11.4	285	7.2	375	115
500	100	12.0	290	7.2	400	134
600	100	13.2	295	7.2	450	173
700	150	14.4	360	7.8	500	255
750	150	15.0	360	7.8	500	288
800	150	15.6	365	7.8	550	320
900	150	16.8	370	7.8	600	396
1000	200	18.0	435	8.4	650	514
1100	200	19.2	440	8.4	700	617
1200	200	20.4	445	8.4	750	744
1400	200	22.8	460	8.4	850	950
1500	200	24.0	465	8.4	900	1070
1600	400	25.2	700	10.8	950	1500
1800	400	27.6	715	10.8	1050	1900

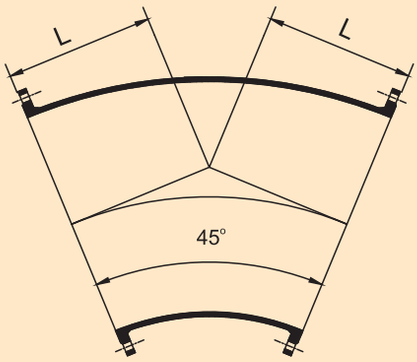
NOTE : Size & Dimensions in **RED** are non standard as per IS-9523:2000.

Double Flanged 90° Bend



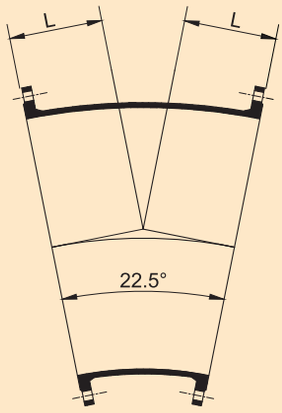
Nominal Size (DN)	e	L	App. Mass (kg)	
			PN 10	PN 16
80	7	165	10	10
100	7.2	180	12	12
125	7.5	200	16	16
150	7.8	220	22	22
200	8.4	260	32	32
250	9	350	50	52
300	9.6	400	68	70
350	10.2	450	92	98
400	10.8	500	130	140
450	11.4	550	160	175
500	12	600	210	240
600	13.2	700	290	325
700	14.4	800	410	440
750	15	850	490	530
800	15.6	900	590	630
900	16.8	1000	760	810
1000	18	1100	990	1070
1100	19.2	1235	1250	1300
1200	20.4	1340	1480	1600
1400	22.8	1550	2150	2280
1500	24	1660	2650	2800
1600	25.2	1765	3070	3270
1800	27.6	1970	4020	4300

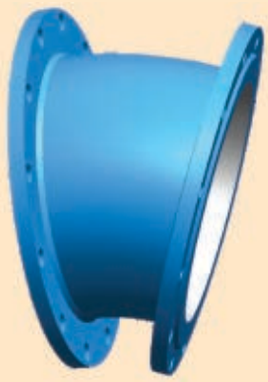
Double Flanged 45° Bend



Nominal Size (DN)	e	L	App. Mass (kg)	
			PN 10	PN 16
80	7.0	130	10	10
100	7.2	140	12	12
125	7.5	150	15	15
150	7.8	160	19	19
200	8.4	180	28	28
250	9.0	350	58	60
300	9.6	400	76	78
350	10.2	298	80	86
400	10.8	324	98	108
450	11.4	350	120	140
500	12.0	375	148	176
600	13.2	426	220	260
700	14.4	478	310	340
750	15.0	504	360	390
800	15.6	529	415	445
900	16.8	581	530	580
1000	18.0	632	685	760
1100	19.2	694	860	935
1200	20.4	750	1070	1185
1400	22.8	775	1435	1550
1500	24/0	810	1680	1860
1600	25.2	845	1970	2150
1800	27.6	910	2540	2770

Double Flanged 22.5° Bend

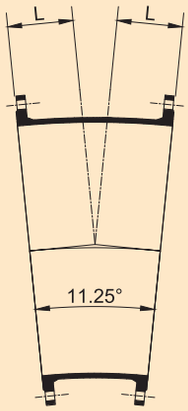




Nominal Size (DN)	e	L	App. Mass (kg)	
			PN 10	PN 16
80	7	85	9	9
100	7.2	90	10	10
125	7.5	95	13	13
150	7.8	105	18	18
200	8.4	120	25	25
250	9	135	41	43
300	9.6	150	51	53
350	10.2	165	67	73
400	10.8	175	80	90
450	11.4	190	92	107
500	12	205	104	131
600	13.2	235	160	190
700	14.4	265	230	260
750	15	280	280	310
800	15.6	295	289	319
900	16.8	320	363	401
1000	18	350	468	538
1100	19.2	380	583	655
1200	20.4	410	727	837
1400	22.8	465	1012	1126
1500	24	495	1199	1375
1600	25.2	525	1429	1607

NOTE : The above bends are non standard as per IS 9523 : 2000

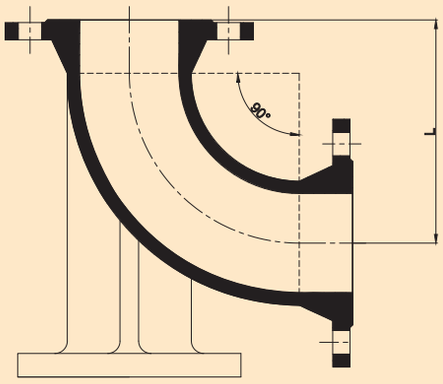
Double Flange 11.25° Bends

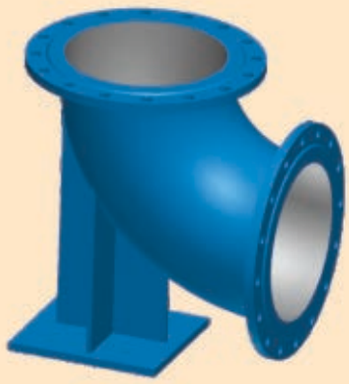


Nominal Size (DN)	e	L	App. Mass (kg)	
			PN 10	PN 16
80	7	75	8	8
100	7.2	80	10	10
125	7.5	85	12	12
150	7.8	90	17	17
200	8.4	100	23	23
250	9	110	38	40
300	9.6	120	45	47
350	10.2	130	61	67
400	10.8	140	70	80
450	11.4	145	85	100
500	12	155	100	127
600	13.2	175	140	170
700	14.4	195	200	230
750	15	210	250	280
800	15.6	215	260	290
900	16.8	235	307	345
1000	18	255	394	464
1100	19.2	265	481	551
1200	20.4	275	582	692
1400	22.8	295	775	889
1500	24	330	940	1116
1600	25.2	370	1158	1336

NOTE : The above bends are non standard as per IS 9523 : 2000

Double Flanged Duckfoot 90° Bend

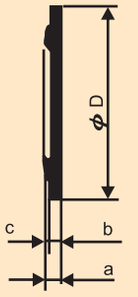




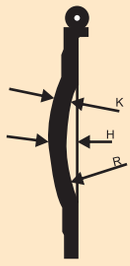
Nominal size (DN)	e	L	C	D	Mass (kg)	
					PN 10	PN 16
80	7	155	110	180	16	16
100	7.2	175	125	200	20	20
125	7.5	220	140	225	30	30
150	7.8	230	160	250	38	38
200	8.4	280	190	300	55	55
250	9	335	225	350	80	82
300	9.6	385	255	400	118	120
350	10.2	440	290	450	160	166
400	10.8	495	320	500	210	220
450	11.4	545	355	550	250	265
500	12	600	385	600	300	325
600	13.2	705	450	700	480	532
700	14.4	810	515	800	610	645
750	15	860	550	850	730	760
600	15.6	915	580	900	860	900
900	16.8	1020	645	1000	1110	1150
1000	18	1130	710	1100	1410	1480
1100	19.2	1235	775	1200	1800	1900
1200	20.4	1340	840	1300	2300	2400
1400	22.8	1550	970	1500	3300	3420
1500	24	1660	1035	1600	4100	4240
1600	25.2	1765	1100	1700	4700	4850
1800	27.6	1970	1240	1900	7100	7300

Blank Flanges - PN 10, PN 16

80 to 300 mm dia



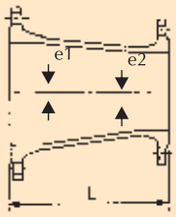
350 mm and above



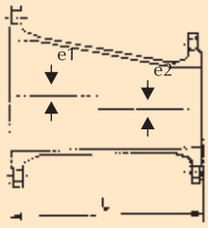
Nominal Dia (DN)	a		b		D		H	App. Mass (kg)	
	PN 10	PN 16	PN 10	PN 16	PN 10	PN 16		PN 10	PN 16
80	19	19	16	16	200	200	–	4	4
100	19	19	16	16	220	220	–	5	5
125	19	19	16	16	250	250	–	6	6
150	19	19	16	16	285	285	–	8	8
200	20	20	17	17	340	340	–	11	11
250	22	22	19	19	400	400	–	17	17
300	24.5	24.5	20.5	20.5	455	455	–	24	24
350	24.5	26.5	20.5	22.5	505	520	71	33	37
400	24.5	28.5	20.5	24	565	580	80	41	49
450	25.5	30	21.5	26	615	640	88	56	64
500	26.5	31.5	22.5	27.5	670	775	97	65	84
600	30	36	25	31	780	840	114	94	130
700	32.5	39.5	27.5	34.5	895	910	131	139	169
750	33	41	28	36	960	970	139	175	205
800	35	43	30	38	1015	1025	148	195	235
900	37.5	46.5	32.5	41.5	1115	1125	165	250	307
1000	40	50	35	45	1230	1255	182	330	415
1100	42.5	53.5	37.5	48.5	1340	1355	199	420	520
1200	45.0	57.0	40	52	1455	1455	216	520	660
1400	46.0	60.0	41	55	1675	1685	244	710	910
1500	47.5	62.0	42.5	57.5	1785	1820	276	830	1100
1600	49.0	65.0	44	60	1915	1930		990	1280
1800	52.0	70.0	47	65	2115	2130		1270	1690

NOTE : 1. PN-16 is the preferred flange in IS Standard.
2. Dimensions in **RED** are Non-Standard as per IS:9523 : 2000

Double Flanged Concentric Tapers



Concentric



Eccentric

Nominal Diameter		e_1	e_2	L	App. Mass (kg)			
					Concentric		Eccentric	
DN	dn				PN 10	PN 16	PN 10	PN 16
100	80	7.2	7.0	200	9	9	12	12
125	80	7.5	7.0	200	14	14	17	17
125	100	7.5	7.2	200	15	15	18	18
150	80	7.8	7.0	200	15	15	20	20
150	100	7.8	7.2	200	16	16	19	22
150	125	7.8	7.5	200	17	17	17	23
200	100	8.4	7.2	300	20	20	34	26
200	125	8.4	7.5	300	21	21	32	28
200	150	8.4	7.8	300	22	22	28	28
250	125	9.0	7.5	300	30	31	36	36
250	150	9.0	7.8	300	30	31	36	36
250	200	9.0	8.4	300	31	32	37	37
300	150	9.6	7.8	300	36	38	47	48
300	200	9.6	8.4	300	38	40	48	50
300	250	9.6	9.0	300	40	42	49	52
350	200	10.2	8.4	300	48	51	58	61
350	250	10.2	9.0	300	48	52	59	64
350	300	10.2	9.6	300	50	54	60	64
400	200	10.8	8.4	300	57	65	68	78
400	250	10.8	9.0	300	60	66	70	79
400	300	10.8	9.6	300	62	68	71	80
400	350	10.8	10.2	300	64	72	72	82
450	250	11.4	9.0	300	68	77	82	97
450	300	11.4	9.6	300	70	79	83	98
450	350	11.4	10.2	300	72	83	84	100
450	400	11.4	10.8	300	75	88	85	101

Double Flanged Concentric Tapers

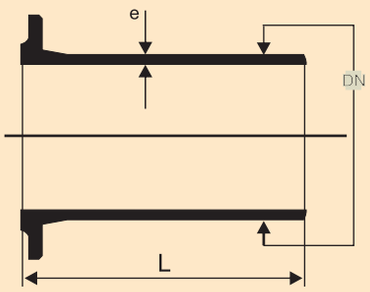
Nominal Diameter		e_1	e_2	L	App. Mass (kg)			
					Concentric		Eccentric	
DN	dn				PN 10	PN 16	PN 10	PN 16
500	300	12.0	9.6	600	109	123	132	154
500	350	12.0	10.2	600	110	126	133	156
500	400	12.0	10.8	600	113	131	136	160
500	450	12.0	11.4	600	116	137	140	173
600	350	13.2	10.2	600	145	182	178	218
600	400	13.2	10.8	600	148	185	180	222
600	450	13.2	11.4	600	150	189	182	227
600	500	13.2	12.0	600	154	193	185	232
700	400	14.4	10.8	600	188	226	236	271
700	450	14.4	11.4	600	190	230	238	276
700	500	14.4	12.0	600	194	235	240	282
700	600	14.4	13.2	600	204	241	245	290
750	450	15.0	11.4	600	213	250	256	300
750	500	15.0	12.0	600	215	255	258	306
750	600	15.0	13.2	600	220	260	264	312
750	700	15.0	14.4	600	234	270	281	324
800	450	15.6	11.4	600	254	280	305	336
800	500	15.6	12.0	600	256	284	307	341
800	600	15.6	13.2	600	260	288	312	346
800	700	15.6	14.4	600	263	292	316	350
900	500	16.8	12.0	600	310	345	372	414
900	600	16.8	13.2	600	315	348	378	418
900	700	16.8	14.4	600	320	352	384	422
900	800	16.8	15.6	600	325	360	390	432
1000	600	18.0	13.2	600	380	420	456	504
1000	700	18.0	14.4	600	385	425	462	510
1000	800	18.0	15.6	600	390	435	468	522
1000	900	18.0	16.8	600	393	450	472	540
1100	700	19.2	14.4	600	455	515	546	618
1100	800	19.2	15.6	600	460	525	552	630
1100	900	19.2	16.8	600	465	540	558	648
1100	1000	19.2	18.0	600	474	550	569	660

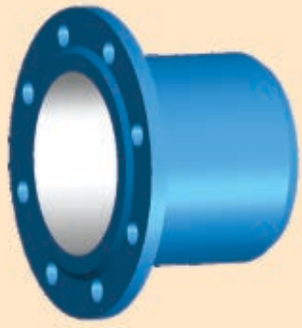
Double Flanged Concentric Tapers

Nominal Diameter		e_1	e_2	L	App. Mass (kg)			
					Concentric		Eccentric	
DN	dn				PN 10	PN 16	PN 10	PN 16
1200	700	20.4	14.4	790	597	685	716	822
1200	800	20.4	15.6	790	600	695	720	834
1200	900	20.4	16.8	790	605	700	726	840
1200	1000	20.4	18.0	790	614	710	737	852
1200	1100	20.4	19.2	790	640	740	768	888
1400	800	22.8	15.6	850	825	930	990	1116
1400	900	22.8	16.8	850	830	935	996	1122
1400	1000	22.8	18.0	850	840	950	1008	1140
1400	1100	22.8	19.2	850	850	960	1020	1152
1400	1200	22.8	20.4	850	859	980	1031	1176
1500	900	24.0	16.8	910	1100	1215	1320	1458
1500	1000	24.0	18.0	910	1110	1230	1332	1476
1500	1100	24.0	19.2	910	1120	1250	1344	1500
1500	1200	24.0	20.4	910	1130	1270	1356	1524
1500	1400	24.0	22.8	910	1145	1290	1374	1548
1600	1000	25.2	18.0	910	1130	1265	1356	1518
1600	1100	25.2	19.2	910	1140	1275	1368	1530
1600	1200	25.2	20.4	910	1150	1295	1380	1554
1600	1400	25.2	22.8	910	1165	1311	1398	1573
1600	1500	25.2	24.0	910	1200	1380	1440	1656
1800	1100	27.6	19.2	970	1475	1690	1770	2028
1800	1200	27.6	20.4	970	1485	1700	1782	2040
1800	1400	27.6	22.8	970	1500	1715	1800	2058
1800	1500	27.6	24.0	970	1510	1730	1812	2076
1800	1600	27.6	25.2	970	1530	1750	1836	2100

NOTE : 1. Sizes & Dimensions in **RED** are non standard as per IS-9523-2000.
2. Tapers in combination of sizes other than above can also be manufactured against specific requirement.

Flanged Spigot



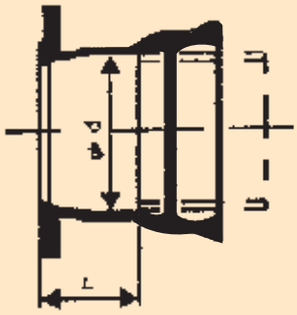


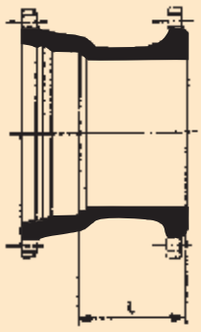
Nominal Dia (DN)	DN	e	L	App. Mass (kg)	
				PN 10	PN 16
80	98	7	130	8	8
100	118	7.2	130	9	9
125	144	7.5	135	12	12
150	170	7.8	135	14	14
200	222	8.4	140	20	20
250	274	9	145	26	27
300	326	9.6	150	34	35
350	378	10.2	155	44	47
400	429	10.8	160	54	60
450	480	11.4	165	60	70
500	532	12	170	72	87
600	635	13.2	180	105	125
700	738	14.4	190	148	168
750	790	15	195	180	200
800	842	15.6	200	200	220
900	945	16.8	210	250	275
1000	1048	18	220	320	360
1100	1152	19.2	230	420	460
1200	1255	20.4	240	464	570
1400	1462	22.8	310	760	770
1500	1565	24.0	320	880	910
1600	1668	25.2	330	1000	1040
1800	1875	27.6	350	1250	1220

Pushon Type (T)

Flanged Socket

Mechanical Type (K)





"T" TYPE

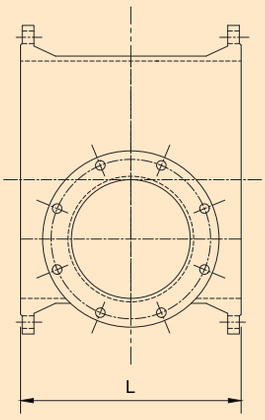
"K" TYPE

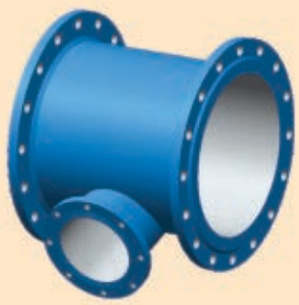
Nominal Dia (DN)	DN	e	L	App. Mass (kg)	
				PN 10	PN 16
80	98	7	350	8	8
100	118	7.2	360	10	10
125	144	7.5	370	13	13
150	170	7.8	380	16	16
200	222	8.4	400	23	23
250	274	9	420	32	33
300	326	9.6	440	41	42
350	378	10.2	460	53	56
400	429	10.8	480	65	71
450	480	11.4	500	80	90
500	532	12	520	96	110
600	635	13.2	560	135	155
700	738	14.4	600	180	200
750	790	15	600	210	230
800	842	15.6	600	228	249
900	945	16.8	600	280	300
1000	1048	18	600	340	375
1100	1152	19.2	600	402	437
1200	1255	20.4	600	470	530
1400	1462	22.8	710	690	750
1500	1565	24.0	745	815	910
1600	1668	25.2	780	955	1045
1800	1875	27.6	850	1240	1350

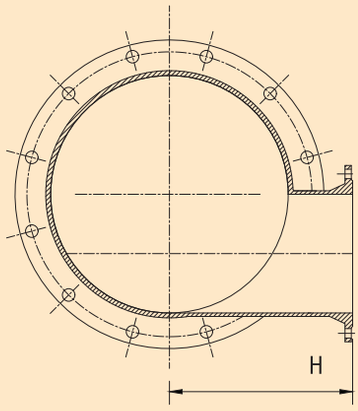
*All dimensions are in millimetres.

IS 9523 | ISO 2531 | ISO 7186 | BS EN 545 | BS EN 598

All Flanged Level Invert Tee



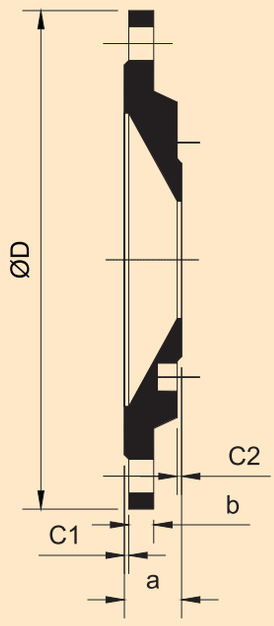


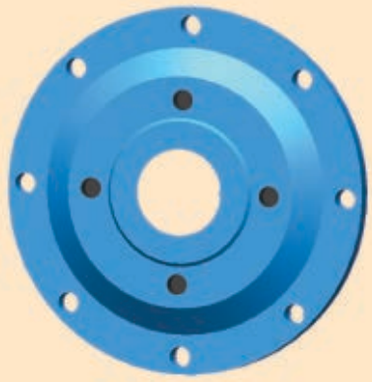


Nominal Diemeter		L	H	Mass (kg)
DN	dn			
200	80	245	250	40
250	80	250	275	50
300	80	255	300	62
350	100	280	325	83
400	100	280	350	98
450	100	285	375	115
500	100	290	400	134
600	100	295	450	173
700	150	360	500	255
750	150	360	500	268
800	150	365	550	320
900	150	370	600	398
1000	206	435	650	514
1100	200	440	700	617
1200	200	445	750	744
1400	200	460	850	950
1500	200	465	900	1070
1600	400	700	950	1500
1800	400	715	1050	1900

*All dimensions are in millimetres.

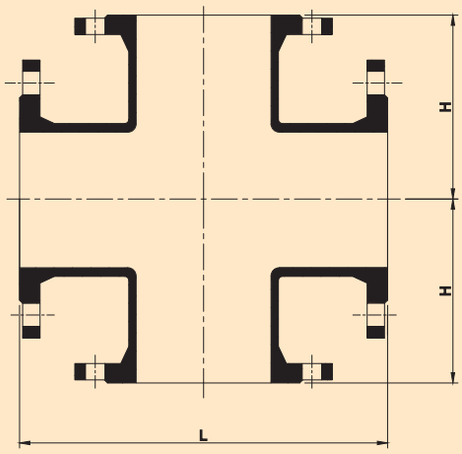
Reducing Flange PN 10 & PN 16





DN	PN 10							PN 16					
	dn	D	a	b	C1	C2	Mass (kg)	D	a	b	C1	C2	Mass (kg)
150	100	385	40.0	17.0	3	3	10	285	40.0	17.0	3	3	11
200	80	340	40.0	17.0	3	3	12	340	400	17.0	3	3	13
200	100	340	40.0	17.0	3	3	13	340	40.0	17.0	3	3	13
200	125	340	40.0	17.0	3	3	13	340	40.0	17.0	3	3	14
350	250	505	48.0	20.5	4	3	35	520	54.0	22.5	4	3	37
400	250	565	48.0	20.5	4	3	42	580	54.0	24.0	4	3	46
400	300	565	49.0	20.5	4	4	43	580	55.0	24.0	4	4	44.5
700	500	895	56.0	27.0	5	4	131	910	67.0	34.5	5	4	134
900	700	1115	63.0	32.5	5	5	197	1125	73.0	41.5	5	5	200
1000	700	1230	63.0	35.0	5	5	282	1255	73.0	45.0	5	5	285
1000	800	1230	68.0	35.0	5	5	252	1255	77.0	45.0	5	5	260

All Flanged Cross

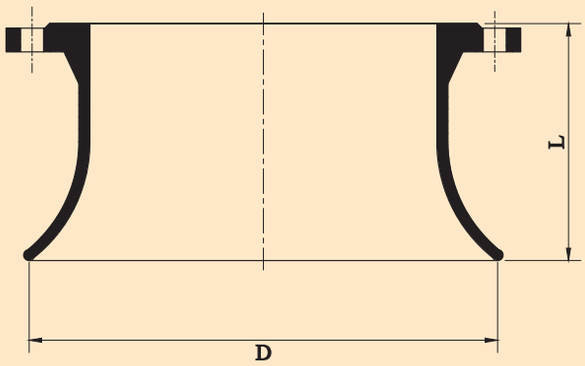


All Flanged Cross

Nominal Diameter		e	L	H	App. Mass (kg)	
DN	dn				PN 10	PN 16
80	80	7	330	165	22	22
100	100	7.2	360	180	26	26
150	150	7.8	440	220	42	42
200	200	8.4	520	260	66	66
250	250	9.0	700	350	98	108
300	300	9.6	800	400	143	150
350	350	10.2	850	425	189	200
400	400	10.8	900	450	236	247
450	450	11.4	950	475	286	307
500	500	12.0	1000	500	370	400
600	600	13.2	1100	550	542	585
700	700	14.4	1200	600	730	790
750	750	15.0	1275	640	760	830
800	800	15.6	1350	675	957	1015
900	900	16.8	1500	750	1220	1305
1000	1000	18.0	1650	825	1600	1750

NOTE : Size & Dimensions in **RED** are non standard as per IS-9523 : 2000

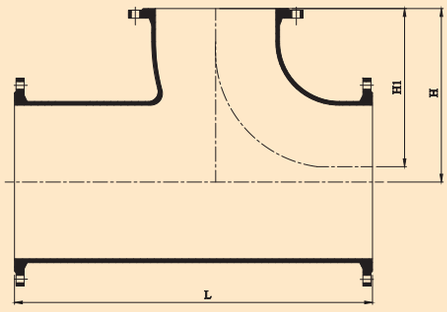
Flanged Bell Mouth

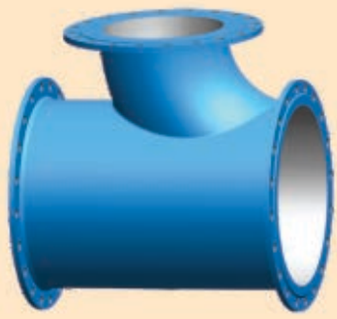


Nominal Diameter DN	D	L	App. Mass (kg)	
			PN 10	PN 16
80	150	130	6	6
100	175	135	7	7
150	230	150	10	11
200	290	170	15	15
250	345	185	22	23
300	405	205	30	31
350	460	220	40	43
400	520	240	52	57
450	575	255	65	75
500	635	275	80	95
600	750	310	110	125
700	865	345	145	160
750	925	360	165	180
800	980	380	190	210
900	1095	415	240	260
1000	1210	450	300	340
1100	1325	485	370	405
1200	1440	520	457	512
1400	1670	590	646	702
1500	1785	625	763	851
1600	1900	660	906	995
1800	2130	730	1185	1297

NOTE : Size & Dimensions in **RED** are non standard as per IS-9523 : 2000.

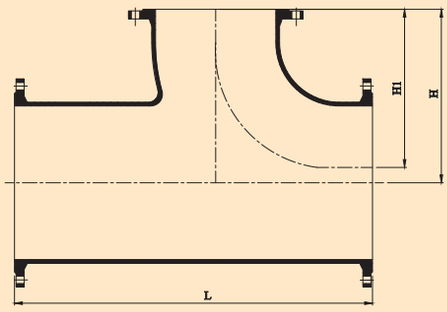
Radial Tee

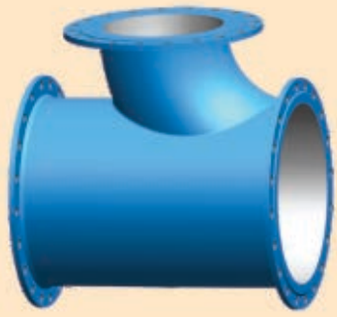




SIZE		Radial Tee					Mass (kg)		
		e	e1	L	H	H1	PN 10	PN 16	PN 25
80	80	7	7	381	195	195	16	16	19
100	80	7.2	7	400	205	205	18.6	18.6	23
100	100	7.2	7.2	410	205	205	19.5	19.5	24.6
125	80	7.5	7	420	218	195	22	22	27
125	100	7.5	7.2	425	218	205	23.3	23.3	29
125	125	7.5	7.5	450	225	225	25	25	31
150	80	7.8	7	390	231	195	25.7	25.7	30.5
150	100	7.8	7.2	408	231	205	27	27	32.5
150	150	7.8	7.8	490	245	245	32.3	32.3	38
200	80	8.4	7	410	257	195	35.7	39.8	46.5
200	100	8.4	7.2	430	257	205	36.5	36.5	48
200	150	8.4	7.8	510	271	245	43.3	43.3	55
200	200	8.4	8.4	530	265	265	52.3	52.3	67
250	80	9	7	410	283	205	46	48	61
250	100	9	7.2	430	283	205	48.3	50.3	64
250	150	9	7.8	510	297	245	55.1	57.1	71
250	200	9	8.4	530	291	265	60.1	62.1	79
250	250	9	9	590	295	295	75	78	96
300	100	9.6	7.2	400	310	205	58.3	60.3	76
300	150	9.6	7.8	450	325	244	65.1	67.1	83
300	200	9.6	8.4	450	325	265	68.1	70.1	89
300	300	9.6	9.6	620	310	310	88	91	112
350	100	10.2	7.2	500	335	205	75.7	81.1	108
350	150	10.2	7.8	500	350	244	79.5	84.9	112
350	200	10.2	8.4	500	350	265	82.5	87.9	118
350	300	10.2	9.6	680	340	315	105.4	111.8	144
350	350	10.2	10.2	680	340	340	109.1	117.2	155
400	100	10.8	7.2	500	350	195	90.7	99.7	135
400	150	10.8	7.8	500	350	244	93.5	102.5	138
400	200	10.8	8.4	540	350	265	99.5	108.5	147
400	300	10.8	9.6	700	365	314	124.4	134.4	175
400	400	10.8	10.8	760	380	380	138.1	154.6	205
450	450	11.4	11.4	840	420	420	174.6	198	249
500	150	12	7.8	500	425	244	122.7	150.1	188
500	200	12	8.4	520	425	288	127.7	155.1	196

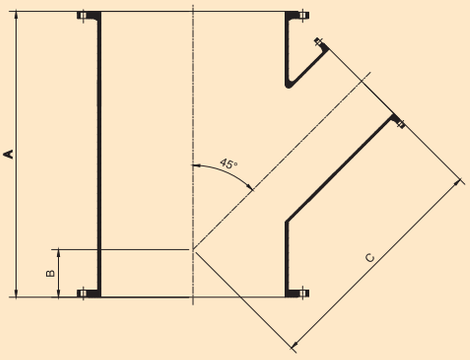
Radial Tee





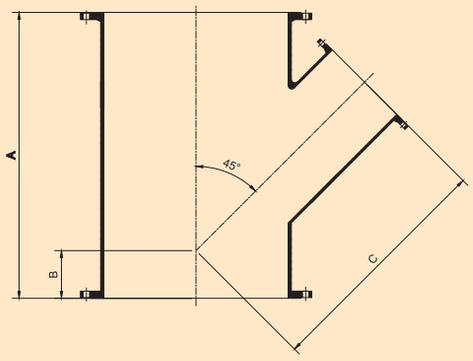
SIZE		Radial Tee					Mass (kg)		
		e	e1	L	H	H1	PN 10	PN 16	PN 25
500	300	12	9.6	600	425	323	146.6	175	218
500	400	12	10.8	730	434	383	172.3	204.2	257
500	500	12	12	920	460	460	373.9	415	469
600	150	13.2	7.8	500	476	244	167.1	219.1	261
600	200	13.2	8.4	520	476	272	173.1	225.1	270
600	300	13.2	9.6	600	480	326	195	248	295
600	400	13.2	10.8	740	485	382	227.7	284.2	341
600	600	13.2	13.2	1000	500	500	297	375	435
700	200	14.4	8.4	600	525	269	241.1	273.1	366
700	300	14.4	9.6	620	530	325	253	286	381
700	400	14.4	10.8	740	535	379	286.7	323.2	428
700	600	14.4	13.2	1000	550	498	361	419	527
700	700	14.4	14.4	1080	540	540	488	536	668
750	750	15	15	1160	580	580	574	619	793
800	200	15.6	8.4	600	577	269	292.1	342.1	477
800	300	15.6	9.6	640	577	325	310	361	498
800	400	15.6	10.8	800	590	382	361.7	416.2	563
800	600	15.6	13.2	1060	610	506	458	534	684
800	800	15.6	15.6	1240	620	620	665	740	935
900	200	16.8	8.4	700	635	276	399.1	437.1	600
900	400	16.8	10.8	790	635	376	440.7	483.2	658
900	600	16.8	13.2	1080	670	515	563	627	805
900	800	16.8	15.6	1240	700	648	656	719	942
900	900	16.8	16.8	1360	680	680	881	938	1175
1000	200	18	8.4	700	690	279	483.1	555.1	770
1000	400	18	10.8	810	710	399	541.7	616.2	843
1000	600	18	13.2	1090	725	518	676	772	1002
1000	800	18	15.6	1290	775	672	798	893	1168
1000	1000	18	18	1500	750	750	1147	1252	1567

Y Tee



SIZE		Y Tee					Mass (kg)		
		e	e1	A	B	C	PN 10	PN 16	PN 25
100	80	7.2	7	305	76	305	19.6	19.6	24
150	80	7.8	7	368	89	368	29.2	29.2	34
150	100	7.8	7.2	368	89	368	30.5	30.5	36
200	100	8.4	7.2	444	114	444	44.5	44.5	56
200	150	8.4	7.8	444	114	444	49.3	49.3	61
250	100	9	7.2	521	127	521	62.3	64.3	78
250	150	9	7.8	521	127	521	67.1	69.1	83
250	200	9	8.4	521	127	521	72.1	74.1	91
300	100	9.6	7.2	622	140	622	86.3	88.3	104
300	150	9.6	7.8	622	140	622	92.1	94.1	110
300	200	9.6	8.4	622	140	622	98.1	100.1	119
300	250	9.6	9	622	140	622	106	109	129
350	150	10.2	7.8	686	152	686	114.5	119.9	147
350	200	10.2	8.4	686	152	686	120.5	125.9	156
350	250	10.2	9	686	152	686	128.4	134.8	166
350	300	10.2	9.6	686	152	686	138.4	144.8	177
400	150	10.8	7.8	762	165	762	143.5	152.5	188
400	200	10.8	8.4	762	165	762	150.5	159.5	198
400	250	10.8	9	762	165	762	158.4	168.4	208
400	300	10.8	9.6	762	165	762	168.4	178.4	219
400	350	10.8	10.2	762	165	762	178.1	189.8	236
450	150	11.4	7.8	813	178	813	175.5	191.1	227
450	200	11.4	8.4	813	178	813	180.5	196.1	235
450	250	11.4	9	813	178	813	188.4	205	245
450	300	11.4	9.6	813	178	813	199.4	216	257
450	350	11.4	10.2	813	178	813	209.1	227.4	274
450	400	11.4	10.8	813	178	813	224.1	244.2	295
500	200	12	8.4	889	203	889	224.7	252.1	293
500	250	12	9	889	203	889	232.6	261	303
500	300	12	9.6	889	203	889	240.6	269	312
500	350	12	10.2	889	203	889	249.3	279.4	328
500	400	12	10.8	889	203	889	271.3	303.2	356
500	450	12	11.4	889	203	889	285.8	321	374
600	200	13.2	8.4	1029	229	1029	323.1	375.1	420
600	250	13.2	9	1029	229	1029	333	386	432

Y Tee



SIZE		Y Tee					Mass (kg)		
		e	e1	A	B	C	PN 10	PN 16	PN 25
600	300	13.2	9.6	1029	229	1029	342	395	442
600	350	13.2	10.2	1029	229	1029	350.7	405.4	458
600	400	13.2	10.8	1029	229	1029	360.7	417.2	474
600	450	13.2	11.4	1029	229	1029	372.2	432	489
600	500	13.2	12	1029	229	1029	385.3	451	509
750	300	15	9.6	1245	254	1245	548	579	702
750	350	15	10.2	1245	254	1245	557.7	590.4	719
750	400	15	10.8	1245	254	1245	568.7	603.2	736
750	450	15	11.4	1245	254	1245	580.2	618	751
750	500	15	12	1245	254	1245	595.3	639	773
750	600	15	13.2	1245	254	1245	628	684	820
900	300	16.8	9.6	1524	495	1524	907	946	1111
900	350	16.8	10.2	1524	495	1524	918.7	959.4	1130
900	400	16.8	10.8	1524	495	1524	932.7	975.2	1150
900	450	16.8	11.4	1524	495	1524	947.2	993	1168
900	500	16.8	12	1524	495	1524	963.3	1015	1191
900	600	16.8	13.2	1524	495	1524	1001	1065	1243
900	750	16.8	15	1524	495	1524	1074	1127	1343
1000	300	18	9.6	1740	533	1740	1194	1265	1482
1000	350	18	10.2	1740	533	1740	1207.7	1280.4	1503
1000	400	18	10.8	1740	533	1740	1222.7	1297.2	1524
1000	450	18	11.4	1740	533	1740	1239.2	1317	1544
1000	500	18	12	1740	533	1740	1258.3	1342	1570
1000	600	18	13.2	1740	533	1740	1300	1396	1626
1000	750	18	15	1740	533	1740	1380	1465	1733
1000	900	18	16.8	1740	533	1740	1473	1562	1851
1200	300	20.4	9.6	1956	571	1956	1766	1877	2142
1200	350	20.4	10.2	1956	571	1956	1779.7	1892.4	2163
1200	400	20.4	10.8	1956	571	1956	1795.7	1910.2	2185
1200	450	20.4	11.4	1956	571	1956	1812.2	1930	2205
1200	500	20.4	12	1956	571	1956	1831.3	1955	2231
1200	600	20.4	13.2	1956	571	1956	1874	2010	2288
1200	750	20.4	15	1956	571	1956	1953	2078	2394
1200	900	20.4	16.8	1956	571	1956	2043	2172	2509
1200	1000	20.4	18	1956	571	1956	2139	2264	2627

*All dimensions are in millimetres.

IS 9523 | ISO 2531 | ISO 7186 | BS EN 545 | BS EN 598

DUCTILE IRON
UPVC & OPVC PIPES

Ductile Iron Fittings

Suitable for
OPVC / UPVC / HDPE / PE
Piping Systems

Ductile Iron Fittings for OPVC/UPVC/HDPE or PE Piping System

Requirements and test methods

Scope

This European Standard specifies the requirements and associated test methods applicable to ductile iron fittings, ductile iron and mild steel couplings and flange adaptors and their joints to be used with poly (vinyl chloride) (PVC-U) pipes or polyethylene (PE) pipes

Standardized sizes

The standardized sizes of fittings, corresponding to the nominal outside diameter dn (in millimeters) of the pipes to which they shall be connected, are as follows : 63, 75, 90, 110, 125, 140, 160, 18, 200, 225, 250, 280, 315, 355, 400, 450, 500, 560, 630, 710.

Surface condition and repairs

Materials shall be free from defects and surface imperfections which could lead to non-compliance. Material characteristics

Ductile Iron

Tensile properties

Ductile iron fittings, couplings and flange adaptors shall have a minimum tensile strength of 420 Mpa and a minimum elongation after fracture of 5%. The tensile strength shall be tested in accordance.

Hardness

The Brinell hardness, shall not exceed 250 HBW. For components manufactured by welding, a higher Brinell hardness is allowed in the heat-affected zone of the weld.

Coatings

General All Materials shall be delivered with an external and internal epoxy coating in compliance with EN 14901. Alternatively, the coatings may also be supplied as required by the purchaser. (By agreement between the manufacturer and the purchaser, the lining/coating may be applied depending on the internal conditions of use)

Minimum Wall Thickness

dn	Min. Thickness, mm
$dn \leq 225$	4.0
$225 < dn \leq 315$	5.0
$315 < dn \leq 710$	6.0

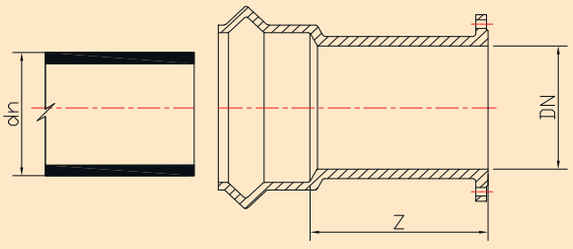
Hydrostatic Works Test Pressures

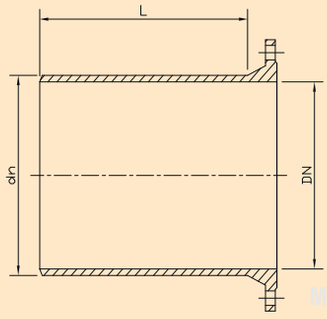
When Hydrostatic test is carried out, it shall be with the min. test pressure 16 bar for DN 40 mm to 630 mm, and the total duration of the pressure cycle shall be not less than 15 s, including 10 s at test pressure (as per EN:12842)

Tolerance / Deviations

The tolerance of fittings shall be as follows BS EN 12842

Note : Unless otherwise agreed between the purchaser and the manufacturer the requirement of sleeving shall comply with the requirements.





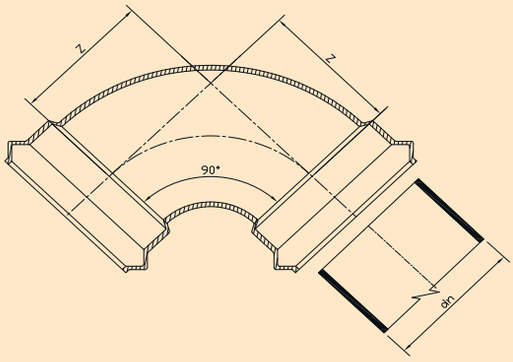
Mass (kg)
T Type

Flanged Socket

Nominal Outside Diameter of the Pipe dn	Nominal Diameter of the Flange DN	Minimum effective length Z
40	32	15
50	40	15
63	50	15
63	60	15
75	60	15
75	65	15
90	80	15
110	100	15
125	100	15
125	125	20
140	125	20
160	150	35
180	150	35
200	200	40
225	200	40
250	200	40
250	250	50
280	250	50
315	300	60
355	300	60
400	350	70
400	400	70
450	400	70
500	500	80
560	500	80
630	600	90
710	700	100

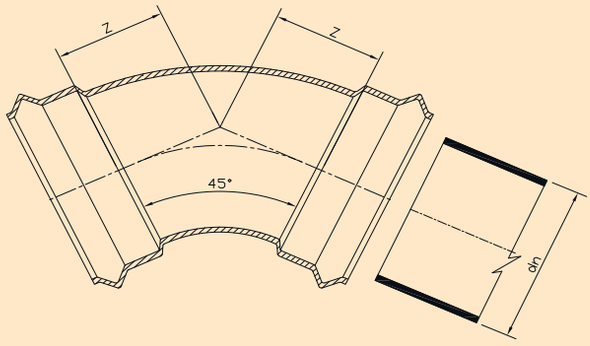
Flanged Spigot

Nominal Diameter dn	Tolerance on dn	Nominal Diameter of the Flange DN	Minimum Length L
40	0.2	32	85
50	0.2	40	89
63	0.3	50	93
63	0.3	60	93
75	0.3	60	98
75	0.3	65	98
90	0.3	80	102
110	0.4	100	110
125	0.4	100	114
125	0.4	125	114
140	0.5	125	119
160	0.5	150	127
180	0.6	150	133
200	0.6	200	139
225	0.7	200	147
250	0.8	200	156
250	0.8	250	156
280	0.9	250	166
315	1.0	300	176
355	1.1	300	187
400	1.2	350	198
400	1.2	400	198
450	1.4	400	212
500	1.5	500	224
560	1.7	500	241
630	1.9	600	260
710	2.0	700	281



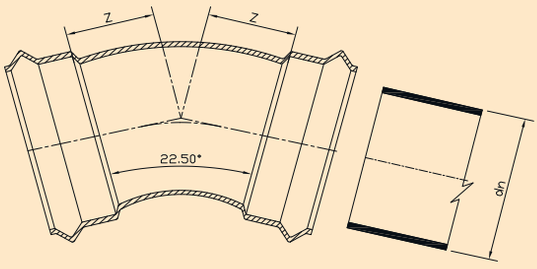
Double Socket 90° Bend

Nominal Outside Diameter of the Pipe dn	Minimum effective length Z
40	60
50	60
63	65
75	70
90	75
110	85
125	110
140	110
160	130
180	160
200	160
225	160
250	185
280	205
315	215



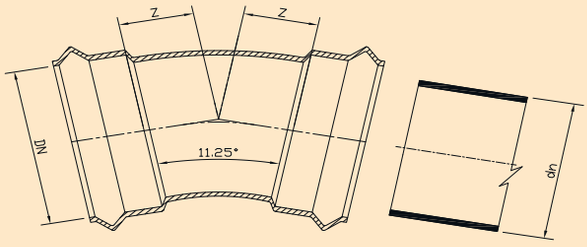
Double Socket 45° Bend

Nominal Outside Diameter of the Pipe dn	Minimum effective length Z
40	40
50	40
63	40
75	40
90	50
110	60
125	65
140	65
160	70
180	70
200	70
225	80
250	110
280	130
315	135
355	170
400	175
450	200



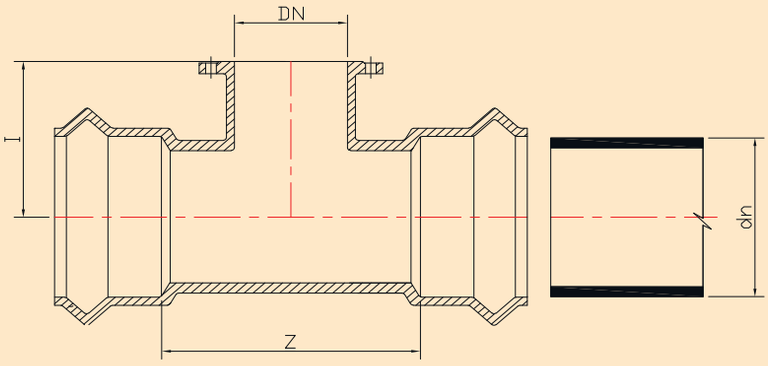
Double Socket 22.5° Bend

Nominal Outside Diameter of the Pipe dn	Minimum effective length Z
40	20
50	20
63	20
75	25
90	25
110	30
125	30
140	30
160	35
180	40
200	40
225	45
250	50
280	75
315	85
355	95
400	110
450	120



Double Socket 11.25° Bend

Nominal Outside Diameter of the Pipe dn	Minimum effective length Z
40	20
50	20
63	20
75	25
90	25
110	30
125	30
140	30
160	30
180	30
200	30
225	40
250	40
280	50
315	55
355	60
400	65
450	70



Double Socket Tee with Flanged Branch

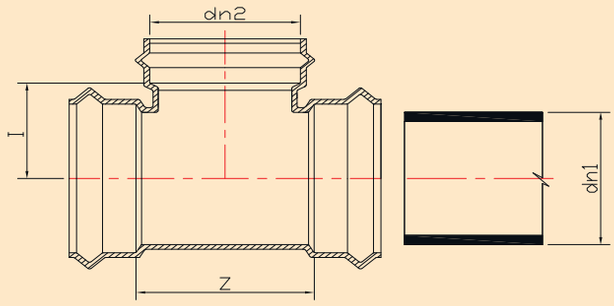
Nominal Diameter of the Pipe dn	Nominal Diameter of the Branch DN	Minimum Effective Length Z	Minimum Height I
40	40	60	130
50	40	60	130
63	40	70	140
63	50	70	140
63	60	70	140
75	40	60	130
75	50	70	140
75	60-65	85	140
90	40	65	135
90	50	75	145
90	60-65	90	155
90	80	105	160
110	40	65	145
110	50	75	145
110	60-65	90	165
110	80	105	170
110	100	125	170
125	40	65	160
125	60-65	90	160
125	80	105	170
125	100	125	180
125	125	150	180
140	40	65	160
140	60-65	90	180
140	80	105	185
140	100	125	195

Nominal Diameter of the Pipe dn	Nominal Diameter of the Branch DN	Minimum Effective Length Z	Minimum Height I
140	125	150	200
160	40	65	170
160	50	75	170
160	60-65	90	190
160	80	105	200
160	100	125	205
160	125	150	210
160	150	175	220
180	40	65	195
180	60-65	90	215
180	80	105	225
180	100	125	230
180	125	150	240
180	150	175	245
180	200	220	250
200	40	100	195
200	50	110	195
200	60-65	125	215
200	80	140	225
200	100	160	230
200	125	185	240
200	150	210	245
200	200	260	250
225	40	100	195
225	50	110	195
225	60-65	125	215

Double Socket Tee with Flanged Branch

Nominal Diameter of the Pipe dn	Nominal Diameter of the Branch DN	Minimum Effective Length Z	Minimum Height I
225	80	140	225
225	100	160	230
225	125	185	240
225	150	210	245
225	200	260	260
250	60-65	140	250
250	80	155	250
250	100	175	255
250	125	200	260
250	150	225	265
250	200	275	275
250	250	325	285
280	60-65	140	260
280	80	155	265
280	100	175	270
280	150	225	280
280	200	275	280
280	250	325	290
315	60-65	140	290
315	80	155	295
315	100	175	300
315	125	200	305
315	150	225	310
315	200	275	310
315	250	325	310
315	300	375	310

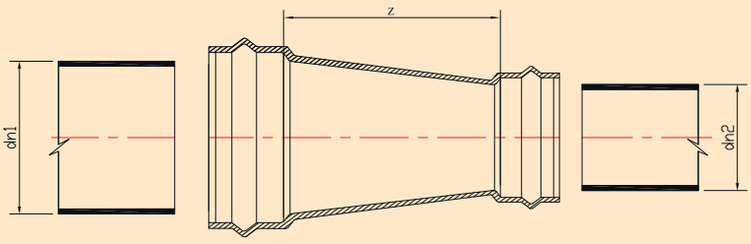
Nominal Diameter of the Pipe dn	Nominal Diameter of the Branch DN	Minimum Effective Length Z	Minimum Height I
355	60-65	140	320
355	80	155	325
355	100	175	330
355	150	225	340
355	200	275	350
355	250	325	360
355	350	420	280
400	80	175	340
400	100	210	355
400	150	275	360
400	200	325	365
400	250	370	375
400	300	420	385
400	400	520	395
450	100	210	340
450	150	275	360
450	200	325	365
450	250	370	375
450	300	420	385
450	400	520	395
450	450	570	460
500	150	275	380
500	300	420	440
600	150	275	400
600	300	420	460



All Socket Tee

Nominal Diameter of the Pipe d_{n1}	Nominal Diameter of the Branch d_{n2}	Minimum Effective Length Z	Minimum Height I
40	40	60	25
50	50	60	30
63	63	70	30
75	63	70	45
75	75	85	45
90	63	75	50
90	75	90	50
90	90	105	50
110	63	75	60
110	75	90	60
110	90	105	60
110	110	125	60
125	63	75	70
125	75	90	70
125	90	105	70
125	110	125	70
125	125	150	70
140	63	75	75
140	75	90	75
140	90	105	75
140	110	125	75
140	125	150	75
140	140	150	75
160	63	75	85
160	75	90	85
160	90	105	85
160	110	125	85
160	125	125	85
160	140	150	85
160	160	175	85
180	63	75	95
180	90	90	95
180	110	125	95

Nominal Diameter of the Pipe d_{n1}	Nominal Diameter of the Branch d_{n2}	Minimum Effective Length Z	Minimum Height I
180	160	175	95
180	180	190	95
200	63	110	105
200	90	140	105
200	110	160	105
200	125	160	105
200	140	185	105
200	160	210	105
200	180	230	105
200	200	240	105
225	63	110	120
225	90	140	120
225	110	160	120
225	160	210	120
225	200	240	120
225	225	260	120
250	90	155	130
250	110	175	130
250	160	225	130
250	200	250	130
250	225	270	130
250	250	300	130
280	90	155	145
280	110	175	145
280	160	225	145
280	200	250	145
280	250	300	145
280	280	325	125
315	110	170	165
315	160	225	165
315	200	250	165
315	250	300	165
315	280	325	165
315	315	375	165



Double Socket Taper

Nominal Outside Diameter of the Pipe		Minimum Effective Length	
d_{n1}	d_{n2}	Series A Long Z_A	Series B Short Z_B
50	40	70	20
63	50	70	20
75	63	80	20
90	50	80	30
90	63	80	25
90	75	80	20
110	63	160	35
110	75	120	35
110	90	85	130
125	75	190	55
125	90	135	45
125	110	100	40
140	75	190	55
140	90	135	45
140	110	100	40
140	125	100	40
160	90	190	55
160	110	150	50
160	125	100	40
160	140	100	40
180	90	250	90
180	110	250	80
180	125	200	70
180	140	145	65
180	160	145	60
200	90	250	95
200	110	250	85

Nominal Outside Diameter of the Pipe		Minimum Effective Length	
d_{n1}	d_{n2}	Series A Long Z_A	Series B Short Z_B
200	125	250	75
200	140	200	70
200	160	145	70
200	180	145	60
225	125	250	80
225	140	200	75
225	160	145	70
225	180	145	65
225	200	145	60
250	125	300	95
250	160	250	90
250	200	150	80
280	160	250	100
280	200	150	80
280	250	150	60
315	200	250	105
315	250	150	90
315	280	150	80
355	200	360	160
355	250	260	110
355	315	160	100
400	250	360	200
400	315	260	160
400	355	155	155
450	315	360	175
450	355	260	160
450	400	160	155

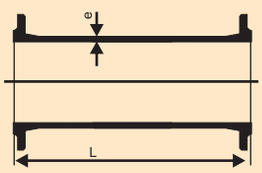
DUCTILE IRON SPECIALS

Ductile Iron Specials

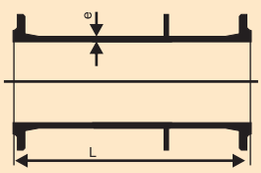

ELECTRICITY & WATER AUTHORITY
PROJECTS DIRECTORATE (PD)
CONTRACT NO:
FITTINGS CODE NO:

Specials

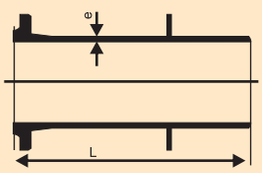
Intergally Casted Double Flanged Pipe, Puddle Pipe (K-12)



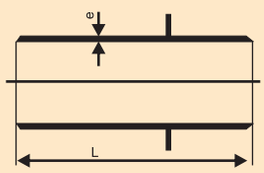
Double Flanged Pipe



Double Flanged Puddle Pipe



Flanged Spigot Puddle Pipe



Plain End Puddle Pipe

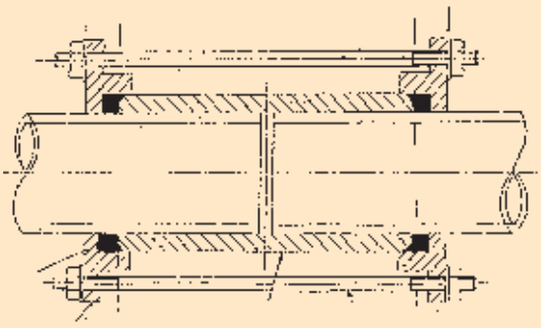
Nominal Size (DN)	Barrel		Integral Flange	
	e mm	Mass per Meter Kg/m	PN 10	PN 16
80	7.0	14.1	3.0	3.0
100	7.2	17.7	3.3	3.3
125	7.5	22.7	4.0	4.0
150	7.8	28.0	5.1	5.1
200	8.4	39.7	7.1	7.1
250	9.0	52.8	10.0	10.0
300	9.6	67.3	13.0	13.0
350	10.2	83.1	14.7	17.4
400	10.8	100.0	17.7	22.2
450	11.4	118.3	20.2	28.0
500	12.0	138.2	24.3	38.0
600	13.2	181.8	34.0	48.0
700	14.4	230.8	46.0	58.0
750	15.0	258.0	55.0	68.0
800	15.6	285.5	62.0	77.0
900	16.8	345.4	73.0	92.0
1000	18.0	410.6	93.0	128.0
1100	19.2	482.0	113.0	148.0
1200	20.4	558.0	138.0	193.0
1400	22.8	727.0	175.0	232.0
1500	24.0	820.0	202.0	290.0
1600	25.2	917.0	242.0	331.0
1800	27.6	1130.0	282.0	394.0
2000	30.4	1400.0	337.0	475.0
2200	32.4	1640.0	426.0	600.0

NOTE :

1. Puddle Flange will be 10mm thick upto 300 mm dia, 15 mm from 350 to 600 mm & 20 mm from 700 to 1800 mm dia, unless otherwise specified
2. Pipes can be supplied with Flanged ends, Plain ends, Flange Spigot ends and with puddles flanges in all combination and in all length with max limit being 2.0 mtrs.

*All dimensions are in millimetres.

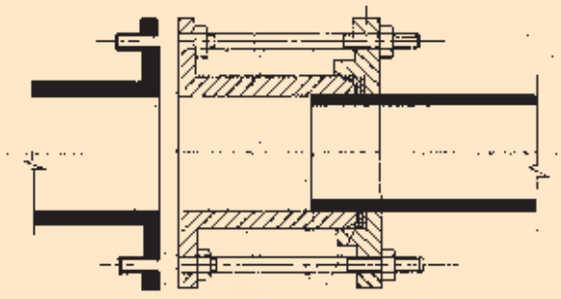
Mechanical Coupling



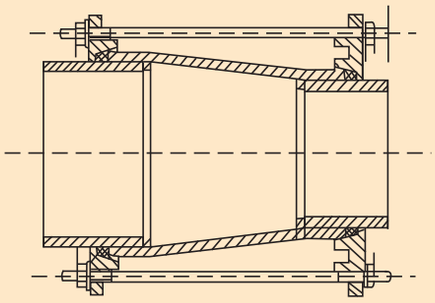
End Connection
To join two similar plain ends only.
Use
I) With CI & DI pipes
ii) can be manufactured specially to suit all other kinds of pipes such as AC, PVC, uPVC, MS, SS etc.
Working
Tightening of bolts draws the two flanges together compressing the sealing ring in the recess between sleeve and flanges on to the pipe thus effecting a leak tight joint.
Size 80mm to 1800mm NB.
Material Used Ductile Iron
Advantages
It can absorb limited expansion, contraction, ground movement and long radius curves and adjust gaps in pipelines.

Flanged Mechanical Adapters

End Connection
To join one plain end and other flanged end only.
Use
i) with CI & DI pipes
ii) can be manufactured specially to suit all other kinds of pipes such as AC, PVC, uPVC, MS, SS etc.
Working
Tightening of bolts draws compression flange towards spigot end of flanged barrel thereby compressing the sealing rubber ring in the recess between compression flange and the spigot **end of flange barrel** effecting a leak **tight joint.**
Size 80mm to 1800mm NB.
Material Used Ductile Iron
Advantages
It can absorb limited expansion, contraction, ground movement and long radius curves and adjust gaps in pipelines.



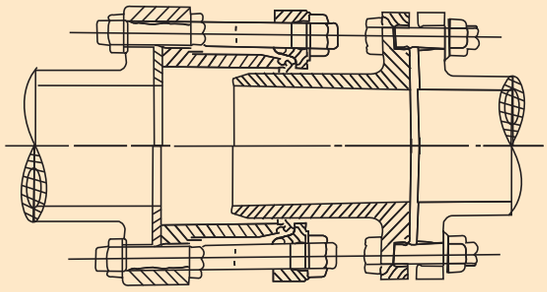
Reducing Mechanical Coupling



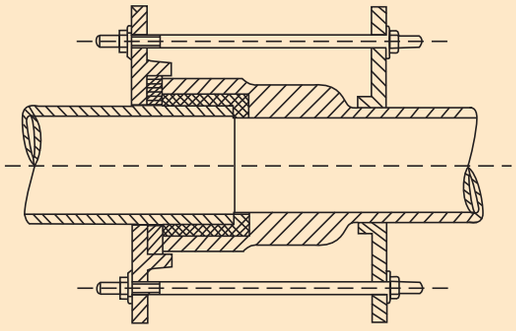
End Connection
To join two dis-similar plain ends having different outside diameters.
Use
with CI, DI, AC, PVC, uPVC, MS, S.S, etc virtually all kinds of rigid pipes.
Working
Tightening of bolts draws the two flanges together compressing the seal ring in the recess between sleeve and flanges on to the pipe thus effecting a leak tight joint.
Size 80mm to 1800mm NB.
Material Used Ductile Iron
Advantages
It can absorb limited expansion, contraction, ground movement and long radius curves.

Adjustable Dismantle Joints

End Connection
To join two flanged end.
Use
I) with all kinds of pipes but having flanged ends.
ii) can be manufactured specially to suit all other kinds of pipes such as AC, PVC, uPVC, MS, SS etc.
Working
A flanged spigot of same nominal bore as that of adjoining pipeline slides inside a flanged spigot barrel of higher diameter to create space in the pipeline upto a maximum of 0 to 100 mm.
Size 80mm to 1800mm NB.
Material Used Ductile Iron
Advantages
i) to create gaps/space in flanged pipeline.
Ii) to fill up/adjust gaps/space in flanged pipelines
iii) can absorb limited vibration/expansion contraction



Socket Leak Repair Joint Clamps



End Connection
To seal the leaking socket joints/ends of pipes having Tyton Rubber Ring Joints or lead caulked Joints.

Use
CI DI socket end pipes (Lead or Tyton Rubber Joints)

Working
Compression Ring, Clamp and Rubber rings are supplied in two parts to be joined with nut bolt and J-hook. The compression Ring is pulled towards socket thereby sealing the gap inbetween the socket and Compression Ring with the help of rubber ring on to the pipe.

Size 80mm to 1800mm
Material Used Ductile Iron

Advantages
Leaking socket ends on Running pipeline can be repaired by digging trenches only near the socket ends.

Expansion Bellow

End Connection
Double flanged end.

Working
Expansion bellows are flexible mechanical devices used in piping systems, ducts, and equipment to absorb dimensional changes caused by thermal expansion, contraction, vibration, or pressure fluctuations. They help maintain the integrity of the system by preventing damage to pipes, pumps, vessels, and other components.

Use for both CI & DI Pipes
Size 80mm to 1800mm
Material Used Ductile Iron

Advantages
Automatically absorbs expansion/contraction in pipeline thereby prolonging the lifespan of pipeline and reducing chances of bending / zig zag lines.

Saddle Pieces - Screwed End

End Connection
For branch connection of screwed end in small dia of 15 to 65 mm.

Use On C.I/D.I/M.S/U.P.V/P.V.C/A.C/S.S Pipe etc.

Working

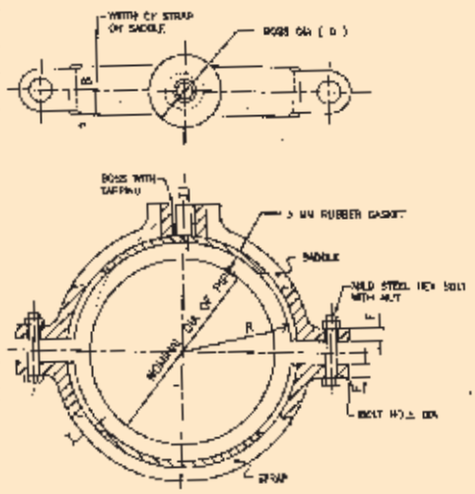
Saddle piece is supplied in two parts bolted together. The bottom half has rubber pad for support only. The top half has screwed outlet at the top. It's base has a round flat rubber gasket pasted with a hole drilled in the centre, to seal the opening. This top half sits on the drilled hole of equal diameter on main pipe. When the end flange nut bolts are tightened the pasted rubber pad tightens towards the main pipes barrel O.D. to seal the opening.

Size **Main Pipes** : 50 mm to 2000 mm dia
Outlet (Screwed) : 15 mm to 65 mm dia

Material Used Ductile Iron / M.S. Zinc metallised / Stainless Steel

Advantages

A threaded branch connection for fitting an air valve, pressure gauge, meters or branch pipe connection can be taken out from an existing, laid out pipe line without disturbing the main pipe line. A hole of required diameter is drilled by portable drill at site on the pipe & the Saddle piece simply sits on the hole & end nut bolts tightend.



Saddle Pieces - Flanged End

End Connection
For branch connection of flanged end in dia of 25 to 200 mm

Use On C.I/D.I/M.S/U.P.V.C/A.C/S.S Pipe etc.

Working

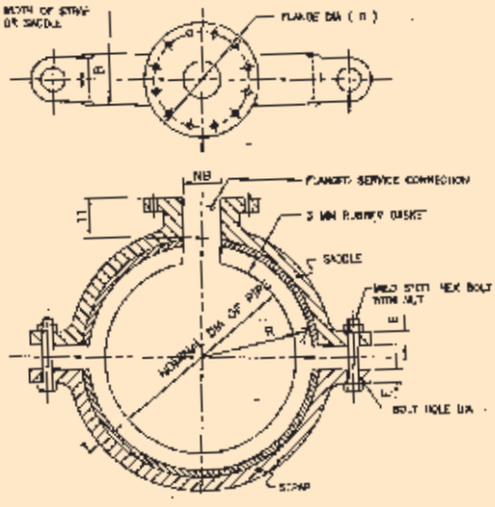
Saddle piece is supplied in two parts bolted together. The bottom half has rubber pad for support only. The top half has flanged outlet at the top. It's base has a round flat rubber gasket pasted with a hole drilled in the centre, to seal the opening. This top half sits on the drilled hole of equal diameter on main pipe. When the end flange nut bolts are tightened the pasted rubber pad tightens towards the main pipe barrel O.D to seal the opening.

Size **Main Pipes** : 50 mm to 2000 mm dia
Outlet (Flanged) : 25 mm to 200 mm dia

Material Used Ductile Iron/M.S. Zinc metallised/Stainless Steel.

Advantages

A flanged branch connection for fitting an air valve, pressure gauge,meters or branch pipe connection can be taken out from an existing, laid out pipe line without disturbing the main pipe line. A hole of required diameter is drilled by portable drill at site on the pipe & the Saddle piece simply sits on the hole & end nut bolts tightened.



Telescopic Surface Box

Working
Telescopic surface box is a type of access box used in water supply, gas, drainage, and utility networks to provide easy access to underground valves, hydrants, or other fittings while allowing for ground-level adjustments. It is designed in a telescoping (sliding) arrangement, meaning its height can be adjusted on-site to match the final ground surface level.

Size 100 mm dia to 200 mm dia

Material Used Ductile Iron

Wide Tollerance Coupling

End Connection
To join two various type of plain ends pipes

Use
with CI, DI, AC, PVC, uPVC, MS, S.S, etc
virtually all kinds of rigid pipes.

Working
A wide tolerance coupling is a flexible mechanical sleeve or joint that can accommodate pipes made of different materials (such as ductile iron, steel, PVC, asbestos cement, GRP, etc.) and different outside diameters, while still ensuring a leak-tight and pressure-resistant connection.

Size 80mm to 400mm NB.

Material Used Ductile Iron

Advantages
It can absorb limited expansion, contraction, ground movement and long radius curves.

Pipe Body Patch Clamp

End Connection
To seal small leakages / cracks on pipe body.

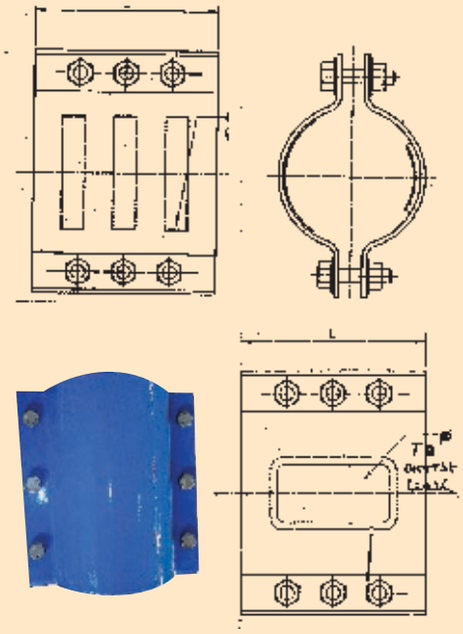
Use
CI /DI/MS/AC/PVC/UPVC/SS etc. i.e. Virtually all kinds of Rigid Pipes.

Working
The patch clamp consists of two halves. One half contains three straight patches of rubber for support. The other half contains a rubber pad with a recessed centre to cover the pipe body crack/leak. Tightening the end flange nut bolt tightens the rubber pad on to the crack/leak portion thereby sealing the leak.

Size 50 mm dia to 2000 mm dia

Material Used Ductile Iron / M.S / S.S

Advantages
Can be used to seal small longitudinal/circumferential cracks/leakages on a running/in use pipeline to arrest leak.



Quick Flange Adapter

End Connection
To join one plain end and other flanged end only.

Use
To join UPVC, OPVC, HDPE, PE Pipes etc.

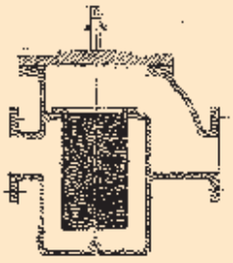
Working
A Quick Flange Adapter (QFA) is a mechanical fitting used in piping systems to quickly connect plain-end (spigot) pipes to flanged equipment, valves, or fittings without the need for complex welding or threading.It's commonly used in water supply, sewage, and industrial pipelines for fast and secure installation.

Size 80mm to 600mm NB.

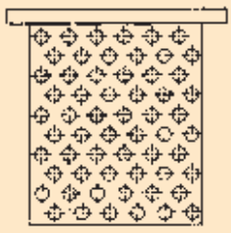
Material Used Ductile Iron

Advantages
It can absorb limited expansion, contraction, ground movement and long radius curves and adjust gaps in pipelines.

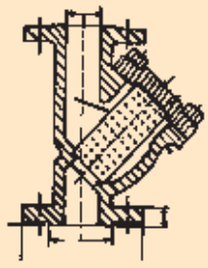
Strainers



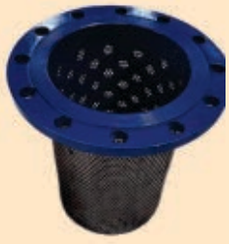
POT STRAINER



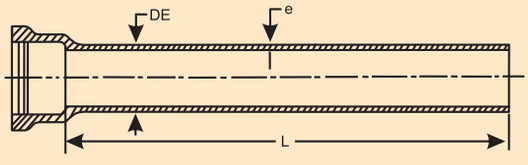
BUCKET STRAINER



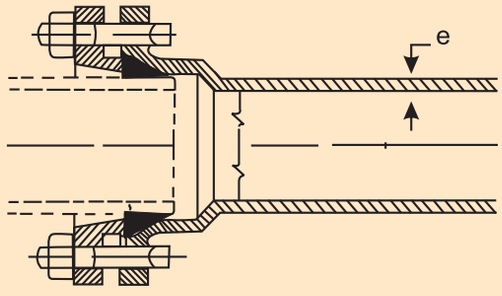
'Y' TYPE STRAINER



Special Pipes



Socket Spigot Pipe suitable for Lead / Tyton Joint



Socket Spigot Pipe suitable for Mechanical Joint

Socket And Spigot Pipes — Class K-12 (10 Bar Pressure)

Nominal Diameter DN	Barrel DE mm	BARREL e mm
1100	1152	19.2
1200	1255	20.4
1400	1462	22.8
1500	1565	24.0
1600	1668	25.2
1800	1875	27.6
2000	2082	30.0
2200	2288	32.4
2400	2458	34.8
2600	2684	37.2

*All dimensions are in millimetres.

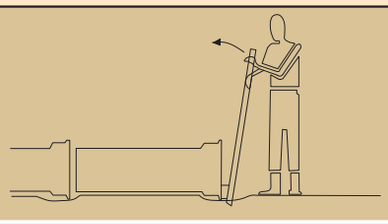
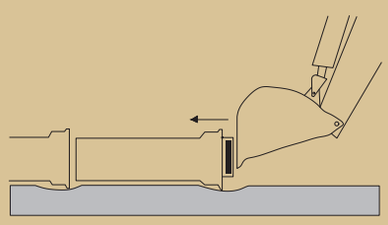
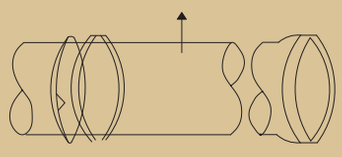
Jointing

Jointing procedures will vary according to the type of joint being used. Basic conditions which should be ensured for all types of joints are:

- Cleanliness of all parts
- Correct location of components
- Centralization of spigot within socket
- Strict compliance with jointing instructions

Jointing Methods

- Centre the spigot in the socket and keep it in this position.
- Push the spigot into the socket, checking alignment and level.
- Deflect, if required, within the permissible limits.
- Push in the spigot until the mark is in line with the socket face. Do not go beyond this position.
- The assembly of DI push-on joint pipes and connections is easily performed using some standard equipment such as crowbars, TIRFOR type winches or the bucket of a mechanical excavator.

CROWBAR METHOD (for DN 80 to 150) The crowbar levers against the ground. The pipe socket face must be protected with a piece of hard wood. The jointing done by the leverage of the crowbar.	
EXCAVATOR BUCKET (for all Diameter) The hydraulic force of the arm of a mechanical excavator can be effectively used to assemble pipes and straight fittings. However the following precautions are to be taken: • Between the socket and excavator bucket, place a wooden batten as a cushion • Exert a slow and steady force observing the rules for joint assembly	
TIRFOR type mechanical winches or chain pulley: • **DN 150 to 300:** TIRFOR type winch, capacity 1.6 Tons, steel cable and rubber protected hooks • **DN 350 to 400:** TIRFOR type winch, capacity 3.5 Tons, steel cable and rubber protected hooks	

#Any of the above methods as found suitable can be used

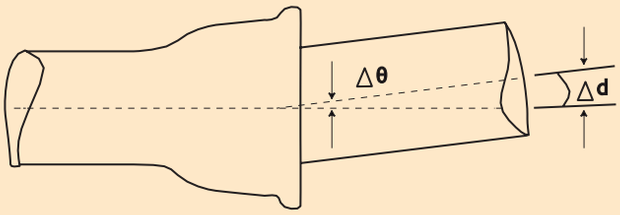
Push-on Jointing Method for DI Pipes

End Preparation for Jointing

Where Push-on joints are to be used, the cut ends should be chamfered by filing or grinding similar to the original spigot ends.

For DN 300 and above sizes, where the pipes are to be checked and ascertained as being suitable for cutting i.e. the pipe OD should be within the ovality tolerances as specified in the relevant standard.

Permissible Deflection after Laying



Δθ = Deflection, Δd=Deviation, for Push-on Joint and Mechanical Joint
Allowable Deflection has been given in Table 2.10.4

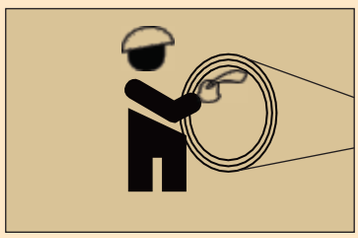
Lubrication

A layer of lubrication should be applied on the exposed surface of the gasket, and the spigot end. The lubricating paste to be brush applied. No petroleum base lubricant should be used.

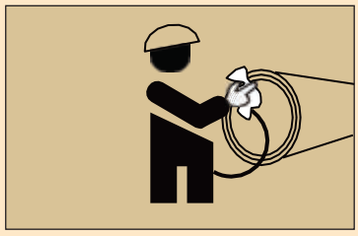
Jointing of Push-on Joint

A. Procedure for Insertion of Rubber Gasket for Push-on Joint

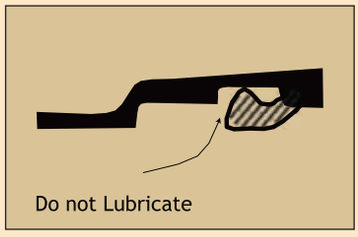
- Clean the inside of socket groove where gasket heel is to be inserted using a wire brush and a rag.



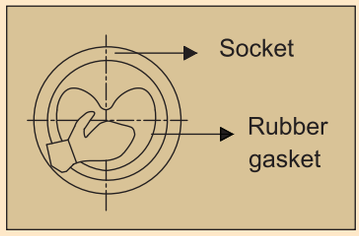
- Clean gasket and insert to socket with the square section gasket heel in the retaining groove.



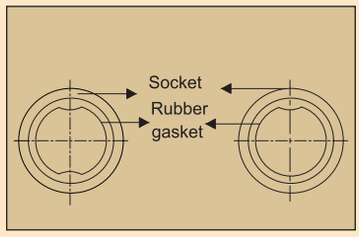
- Coat with lubrication paste on the spigot end of the pipe and the exposed surface of the gasket



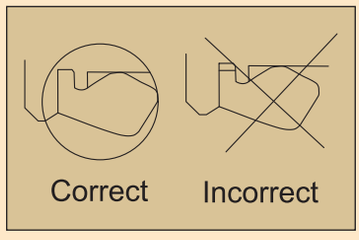
- The insertion of DN 80 to DN 150 gaskets is facilitated by turning the gasket inside out, gripping one end and folding the free end down (to make Heart shape) as shown below:



- The insertion of DN 200 and larger gaskets is facilitated by folding the gasket as shown by looping it into a heart shape with the gasket bulb towards the back of the socket. For DN 800 - DN 1600 it is preferable to loop the gasket into shape of a cross for insertion.

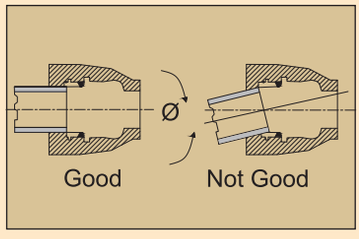


- After insertion of the gasket, confirm that the Heel position is properly seated in socket groove.



B. Insertion Depth of Socket

- The insertion depth of the spigot is indicated by two parallel lines at the outside of spigot end as shown in figure 5.5.2. The pipe spigot should be inserted in the socket in aligned condition as shown in fig below. The deflection in the pipe should be provided (within the allowable limit) after the insertion.



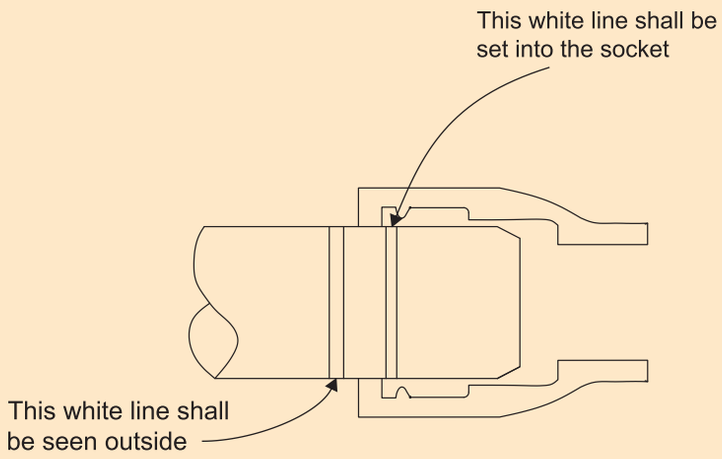
Insertion Depth for Socketed Joints

DN	Insertion Depth for TJ pipe		Insertion Depth for AJ pipe	
	Minimum	Maximum	Minimum	Maximum
80	65	73	72	80
100	68	76	74	82
125	70	78	77	85
150	74	82	80	88
200	80	88	86	94
250	85	93	86	94
300	90	98	87	95
350	90	98	90	98
400	90	103	92	100

*All dimensions are in millimetres.

C. Joint Correction

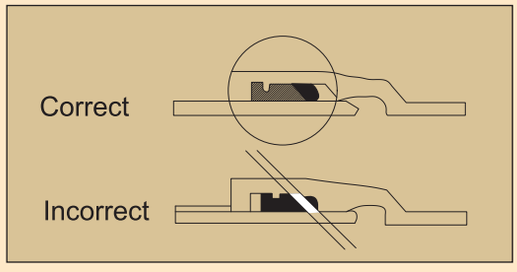
- Ensure that gasket is located correctly around its whole circumference with its groove on the retaining bead in the socket and retaining heel firmly bedded in its seat. At time of insertion of the spigot end check alignment of the pipes and fittings.
- Ensure that the gasket is correctly in position by inserting the end of a metal under (130mm to 200mm length) through the annular spigot and socket gap until it touches the gasket. The ruler must penetrate to the same depth around the whole circumference. If a difference is found, the gasket may have been displaced and the join should be dismantled and attempted again.



Figures Showing Push-on Jointing Procedures for DI Pipes

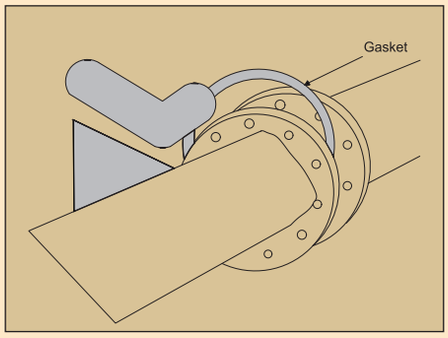
D. Joint Dismantling

- Socketed joints can usually be separated by using lifting equipment appropriate to the size of the pipe. Secure a webbing sling, of suitable size and strength, around the pipe near the end farthest from the joint to be dismantled. Then attach to the lifting equipment and raise and lower the pipe, within the specified deflection limitations, whilst at the same time exerting slight pulling force, so that the spigot is 'walked' out of the socket.



Procedure for Jointing of Flanged Fittings

Flanged joints are both rigid and self anchoring, and are primarily used in above ground installations. To ensure a proper jointing, it is imperative to align the faces of the flanged ends in a straight line.



Manual Bolt Tightening Procedure

a) Ensure that the flanges are parallel and axially aligned.

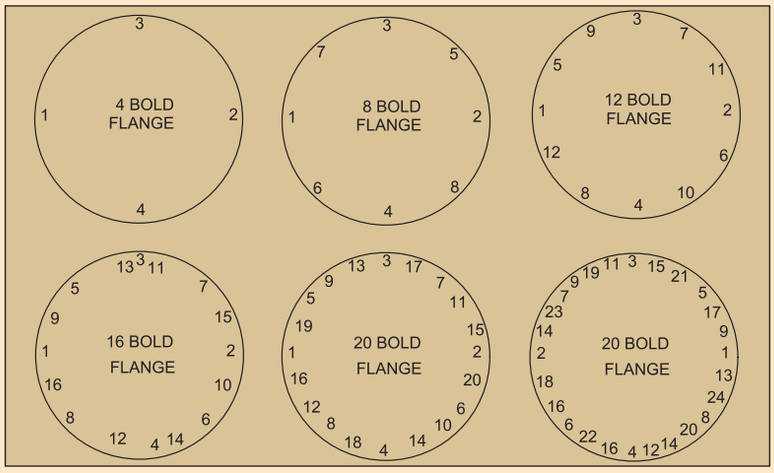
b) Lubricate the nut and bolt threads, and the contact face of the nut on the flange.

c) Locate the gasket and lightly nip the bolts.

d) Tighten evenly to approximately one third of the final torque following the sequence shown in Bolt Tightening Sequence below.

e) Repeat the tightening sequence in at least three more steps to the full torque. If required by the procedure, use a torque wrench.

f) Finally re-tighten adjacent bolts, start and finish at the same bolt, e.g. 1, 3, 2, 4 and 1. Use a torque wrench if required.



Figures Showing Manual Bolt Tightening Procedure

Bolting Torques Required for Tightening of Flanged Joints

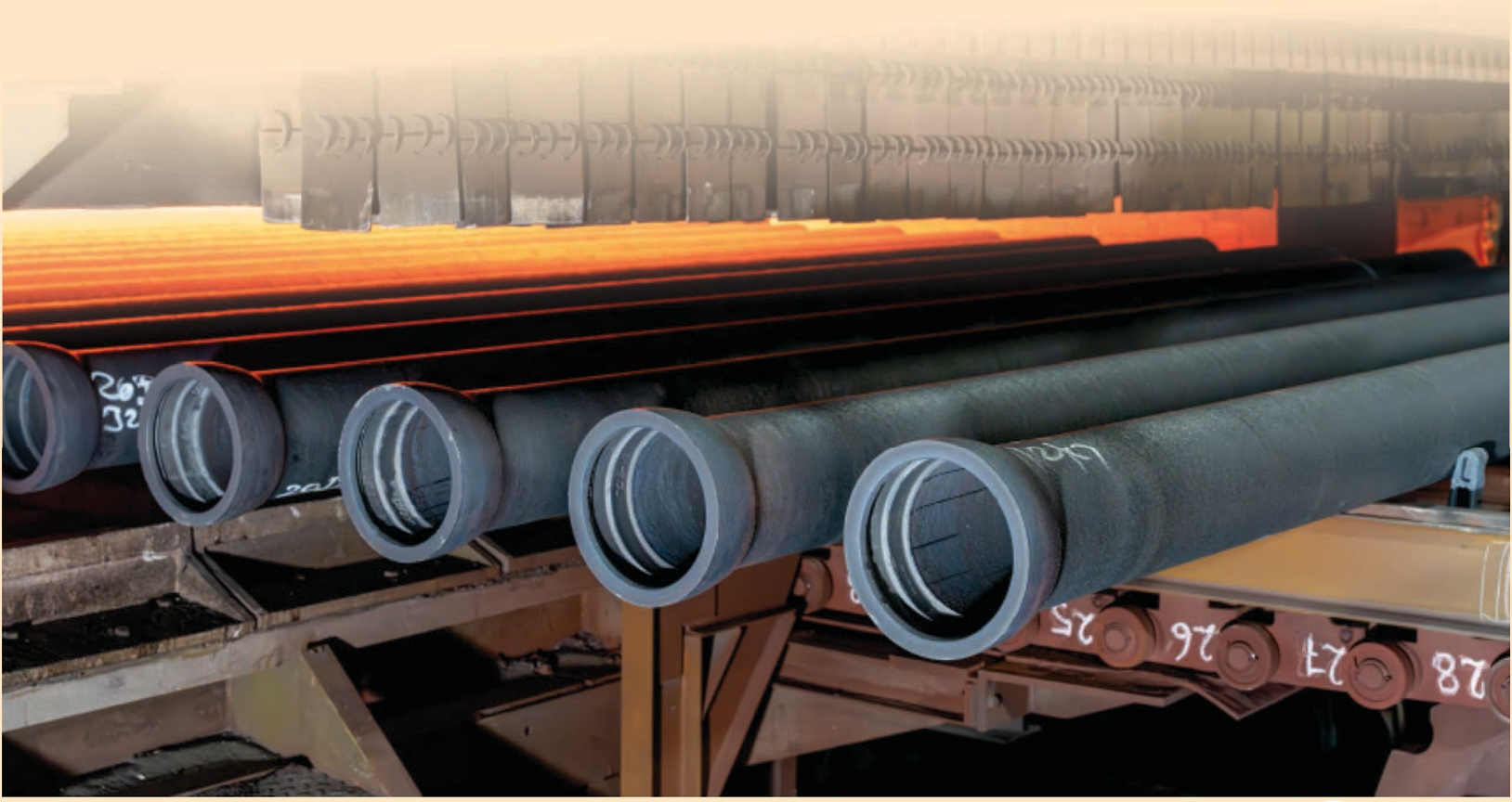
Class	PN - 10 Flanged Joints - Approx Bolting Torque (Nm)			PN - 16 Flanged Joints - Approx Bolting Torque (Nm)			PN - 25 Flanged Joints - Approx Bolting Torque (Nm)			PN - 40 Flanged Joints - Approx Bolting Torque (Nm)		
DN	Bolt Size	No. of Bolts	Tightening Torque (Nm)	Bolt Size	No. of Bolts	Tightening Torque (Nm)	Bolt Size	No. of Bolts	Tightening Torque (Nm)	Bolt Size	No. of Bolts	Tightening Torque (Nm)
80	M16	4	69	M16	8	70	M16	8	85	M16	8	141
100	M16	8	75	M16	8	80	M20	8	125	M20	8	249
150	M20	8	115	M20	8	120	M24	8	185	M24	8	321
200	M20	8	130	M20	12	115	M24	12	200	M27	12	575
250	M20	12	120	M24	12	165	M27	12	250	M30	12	808
300	M20	12	130	M24	12	180	M27	16	285	M30	16	808
350	M20	16	125	M24	16	175	M30	16	330	M30	16	843
400	M24	16	170	M27	16	220	M33	16	435	M36	16	1113
450	M24	20	165	M27	20	250	M33	20	450	M36	20	1113
500	M24	20	180	M30	20	270	M33	20	485	M39	20	759
600	M27	20	225	M33	20	365	M36	20	700	M45	20	1086
700	M27	24	230	M33	24	465	M39	24	795			
800	M30	24	300	M36	24	630	M45	24	1150			
900	M30	28	300	M36	28	645	M45	28	1185			
1000	M33	28	390	M39	28	835	M52	28	1620			
1100	M33	28	395	M39	32	850	M52	32	1655			
1200	M36	32	495	M45	32	1140	M52	32	1940			
1400	M39	36	590	M45	36	1300	M56	36	2395			

Procedure for Assembly System Ductile Iron Pipe of Kejriwal Mechanical Restrained Joint

1. Before assembling, make sure that the coupling faces of the ring and the gland are clean, then position the gland and the locking ring on the spigot end of the pipe.
2. Keep sufficient space beneath the socket in order to tighten the bolts with the torque wrench during the installation of MR joint accessories.
3. The locking ring should be fitted on the spigot end of the pipe to be jointed and passed over the weld bead. The ring has to adhere solidly to the pipe and its flat side should be adjacent to the weld bead.
4. During installation make sure that the components to be assembled are aligned.
5. When the joint has been assembled, check again to ensure the correct position of the ring and its adherence to the pipe near the weld bead, then fix the gland to the socket using the locking bolts.
6. Make sure the gland and pipe are coaxial, using centring spacers if necessary, and make sure that the moment between the pipe and gland is constant when the pipes are aligned.
7. Once the MRJ gland has been positioned correctly, fit and tighten the bolts in crossed sequence, using a torque wrench to tighten to the correct torque.
8. After hydraulic testing, it is highly recommended that the tightness of the bolts are checked with the torque wrench, and further tightened if necessary.

Procedure for Assembly Ductile Iron Pipe of Kejriwal Restrained Joint System

1. Keep the lock insertion grooves/opening on the top side to facilitate the easy insertion of locks.
2. Before assembling, make sure that all the chambers of the Double chamber sockets are thoroughly clean.
3. Install the gasket in the innermost chamber of the socket as per the procedure explained earlier in the catalogue for push-on joint.
4. Clean the spigot end of pipe with weld bead using a soft brush thoroughly removing all the dust, foreign particles, excess paints etc.
5. Apply a thin layer of lubricant on the spigot end of pipe particularly near the bevel end of the pipe.
6. The spigot end with weld bead is pushed in the socket using suitable tools depending upon the pipe size. Care should be taken to keep the pipe at perfect aligned condition without having any angular deflection.
7. The lock segments should be inserted one by one through the window provided in the socket face and distributed along the pipe circumference of the pipe working alternatively left and right.
8. After inserting the last lock, all the locks should be clamped using a strap. The clamping strap should be tightened until the locking segments are bearing firmly against the pipe surface all around.



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