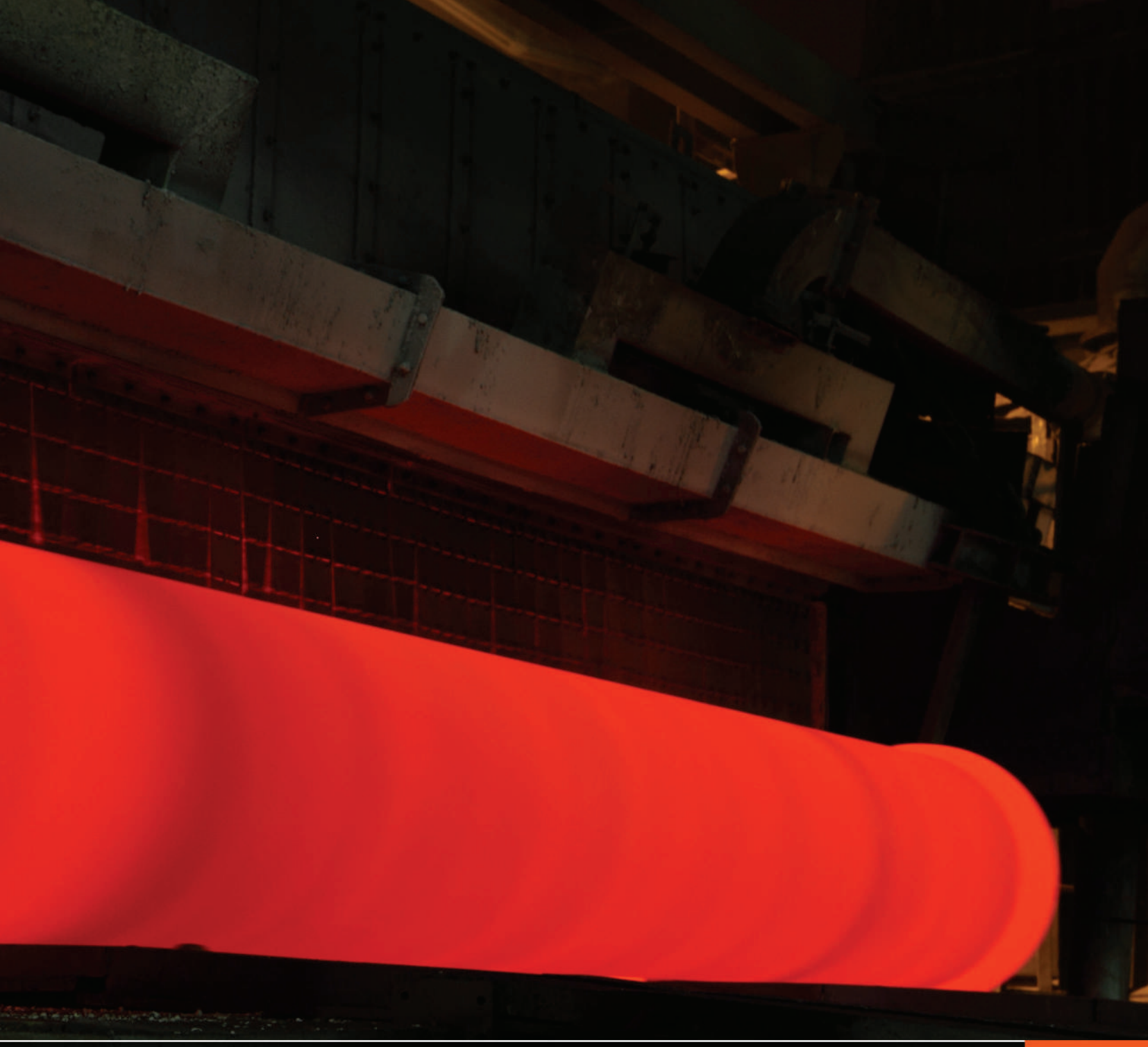
ELECTROSTEEL
CASTINGS LTD.

VISION

Electrosteel Castings Limited (ECL) aims to be world-class, committed to customer satisfaction and to encourage the spirit of leadership amongst our dedicated team by creating a healthy environment for continuous growth, profit and prosperity.

Umang Kejriwal
Managing Director



CONTENTS

A Profile

ELECTROSTEEL CASTINGS LIMITED (ECL) is a six-decade old company engaged in water infrastructure business. It caters to a large customer base spread in the Indian subcontinent, South East Asia, Middle East, Europe, Africa, USA etc. A coherent marketing network spearheaded by a dedicated workforce serves customers spread around the globe. More than 20,000 water supply projects have already been implemented in India and abroad with Ductile Iron Spun Pipes & Fittings made by ECL.

Plant and Facilities

KHARDAH WORKS

Khardah Works (KW) is one of the main two units situated at Khardah near Kolkata, where Electrosteel's Ductile Iron Pipes are manufactured. It has facilities for manufacturing Ductile Iron Pipe right from producing the base metal in Blast Furnace to pipe casting and finishing. It also has facilities for producing Ductile Iron fittings. It has a Blast Furnace Gas based captive power plant and a sinter plant.

SRIKALAHASTHI WORKS

Srikalahasthi Works (SW) of Electrosteel has a state-of-the art manufacturing facility in Rachagunneri Village on Tirupati-Srikalahasthi Road, Srikalahasthi Mandal, Tirupati District of Andhra Pradesh, India. The integrated facility comprises of backward and forward integration units in a centralized complex spread across a sprawling 242 acres. The Ductile Iron Pipe Plant is integrated with the Blast Furnace, Coke Oven Plant, Waste Heat Recovery captive Power Plant, Cement Plant, Ferro Silicon Plant and Municipal Sewage Water Treatment Plant to conserve Ground water/Surface water. The Blast Furnace Gas from the Mini Blast Furnace caters to various energy requirements, thereby reducing carbon emission significantly.

HALDIA WORKS

Haldia Works (HW) is located in the industrial town of Haldia in West Bengal. It has a Coke Oven Plant and Sponge Iron Unit. Here, we also have a DI Fittings and accessories plant and one Ferro-Alloy producing units. A Waste Heat Recovery Power Plant is also located here, which generates power using the waste heat of Coke Oven Plant and Sponge Iron Plant.

BANSBERIA WORKS

Spread over 22 acres of land Bansberia Works (BW), is our ultra-modern DI Pipe coating and finishing plant. It is located at Bansberia near Kolkata. Our wide range of linings and coatings allow us to produce premium quality bespoke pipes to suit the unique needs of each of our customers.

ELAVUR WORKS

At Elavur near Chennai in Tamil Nadu, Electrosteel has a Cast Iron Spun Pipe manufacturing facility.

Electrosteel - Towards a sustainable Future

Electrosteel is committed to reducing its carbon footprint through responsible use of natural resources and continuous process improvement. We have also initiated a number of initiatives to enhance our sustainability credentials.

- **Mineral recycling in Sinter Plant** - Iron ore fines, coke breeze, limestone and dolomite fines along with recycled metallurgical wastes, are converted into sinters and charged in the Blast Furnace to produce hot metal.

- **Sponge iron in metal processing**- Electrosteel has an integrated sponge iron plant at Haldia. Sponge iron is used to replace blast furnace pig iron partially. It is an effective measure to reduce the use of virgin raw materials.

- **Recycling of process rejection**- Process rejection of pipes & Fittings are crushed and recycled in the process. Our Fittings manufacturing process at Haldia works uses 85% recycled scrap in the form of Remelt, DI scrap & Mild steel scrap.

- **Reuse of waste Gas/waste heat**: Blast Furnace waste gas is used for heating & power generation and contributes to recovery of approx. 25% of total energy input. Waste heat from Coke Ovens & DRI Plants are used to generate power.

- **Reuse of wastewater**: 94% of the wastewater at the Company's plant is recycled and reused. Electrosteel's Srikalahasthi plant brings wastewater from Tirupati municipality through a 21-kilometer pipeline and uses it for process requirements.

- **Greenery Development**: Plantation within and around the plant boundary is a regular activity. About 750 species of different plants help to compensate to carbon emission.

- **Solar lights**- A large number of solar LED lights have been installed to provide for necessary illumination.

- **Our Sustainability credential**: We are already a member of the United Nations Global Compact(UNGC) initiative, by incorporating the Ten Principles of the UNGC into strategies, policies and procedures. We are also preparing and publishing full-scale third-party assured sustainability report as per Global Reporting Initiative (GRI) Standards.

- **Environmental Management System**: Electrosteel effectively maintains the Environmental Management System Standard ISO: 14001 since 2004. Electrosteel, Khardah Works is one of the first Ductile Iron Pipe plant in the world to get ISO 14001 certification.

- **Energy Management System**: The organization has implemented an effective Energy Management System having UKAS accredited ISO 50001 certification.

Social Accountability and Responsibility (SA 8000)

We have the coveted SA 8000 certification, which ensures the following:

- Child labour - No engagement of child labour.
- Forced labour - No engagement in forced labour. No lodging of identity papers upon employment.
- Health and Safety - Ensuring Safe and healthy working environment.
- Freedom of association and the right to collective bargaining and right to form and join trade unions.
- Discrimination - No discrimination in hiring, compensation, promotion etc. No sexual harassment.
- Disciplinary practices - No corporal punishment, mental or physical coercion and verbal abuse.
- Working hour - Max. 48 hours per week and 1 day-off in every 7 days.
- Compensation - Wages are at least at the legal minimum requirement or at industry standard.

Health and Safety

Safety and Health Management is the foremost priority of our company. This management system is running through leadership commitment across the organization with an Occupational Health and Safety Policy. Company has taken different initiatives to achieve the desired objectives "Zero Accident "& "Zero Health Impairment".

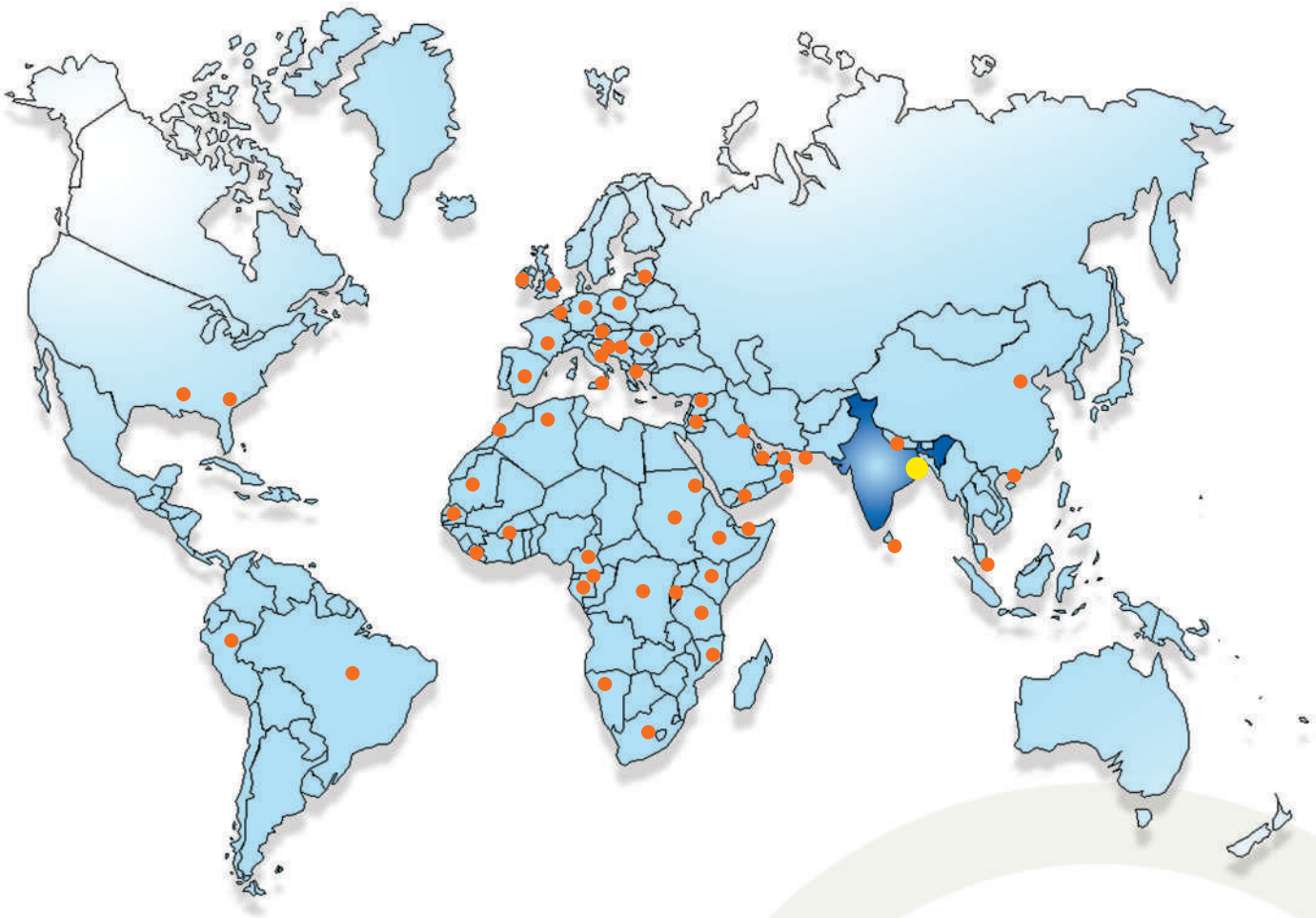
Some of the steps taken on this account are as under:

- The Company conducts regular training programmes to create health and safety awareness among employees and also to improve their safety skills.
- In addition to normal Pre-Employment and Periodical medical check-ups for the employees, special tests like Pulmonary functions, audiometric tests, chest X-rays are regularly done for concerned areas to prevent Health Impairment.
- JIPM - TPM methodology of KYT (Danger Prediction Drill) is being continuously used to further improve the consciousness of our workmen and supervisors. In addition, to avoid failure, mistake proof (Pokayoke) and Safety assurance perfect line (SAPL) have been introduced.
- All Safety & HIRA committees are performing their activities through active participation of Staff and workman representatives to identify the workplace hazards and its corrective action with proper time frame. Apart from these workmen also participated in various activities like Quiz, KYT, Drama, Mock-drill, Poster Competition etc.
- Plant inspection is done by senior officials to determine any deviation of standard safety practices & correct those. This is also used to implement advanced technology suggested to eliminate the safety risk.
- Safety audits by experts of outside agencies are a regular practice.
- There is a regular thrust on involvement of the associate agencies like transporters, contractors etc. by way of training and monitoring ensuring implementation of safe operating procedures in their area of work.
- Ambient air quality in and around the Factory is regularly monitored to ensure healthy work environment at our plants.
- Electrosteel also focuses on the development of the eco-system and improvement of the green belt in and around its manufacturing plants.

Corporate Social Responsibility

Social Welfare, community development, economic and environmental responsibilities are at the core of the CSR of the company. As part of its policy for corporate social responsibility, the company undertakes a range of activities to improve living conditions of people in the neighborhood of all its plants. These activities include education, healthcare, sports, cultural events, vocational training such as:

- Development, repair, renovation and extension of classrooms of local Institutes.
- Rewards for good & bright students in the locality. Distribution of Education & Kit to poor children. Supplying study benches to local schools.
- Free Medical check-up and blood donation camps in the neighborhood. Our company runs and operates two charitable medical facilities involving local people.
- Setting up of Drinking water Kiosks in the local area.
- Giving entrepreneurial opportunity to local unemployed youths to supply material and through encouraging contract activities.
- Financial assistance to local organizations to pursue their sports activities. Distribution of sports kits in nearby localities.
- Organize sports Tournaments involving local schools and clubs at District level with an aim to promote sports activities in the District.
- Organizing Cultural Programs involving local residents.
- Organizing Workers day for promoting cultural activities among workers, their families and locality.
- Development, repair and renovation of local religious shrines.
- Distribution of free clothes and assistance to the underprivileged.
- "ORGANIC FARMING" is conducted that benefits employees through distribution of healthy food-grain, fruits & vegetables at a subsidized rate.

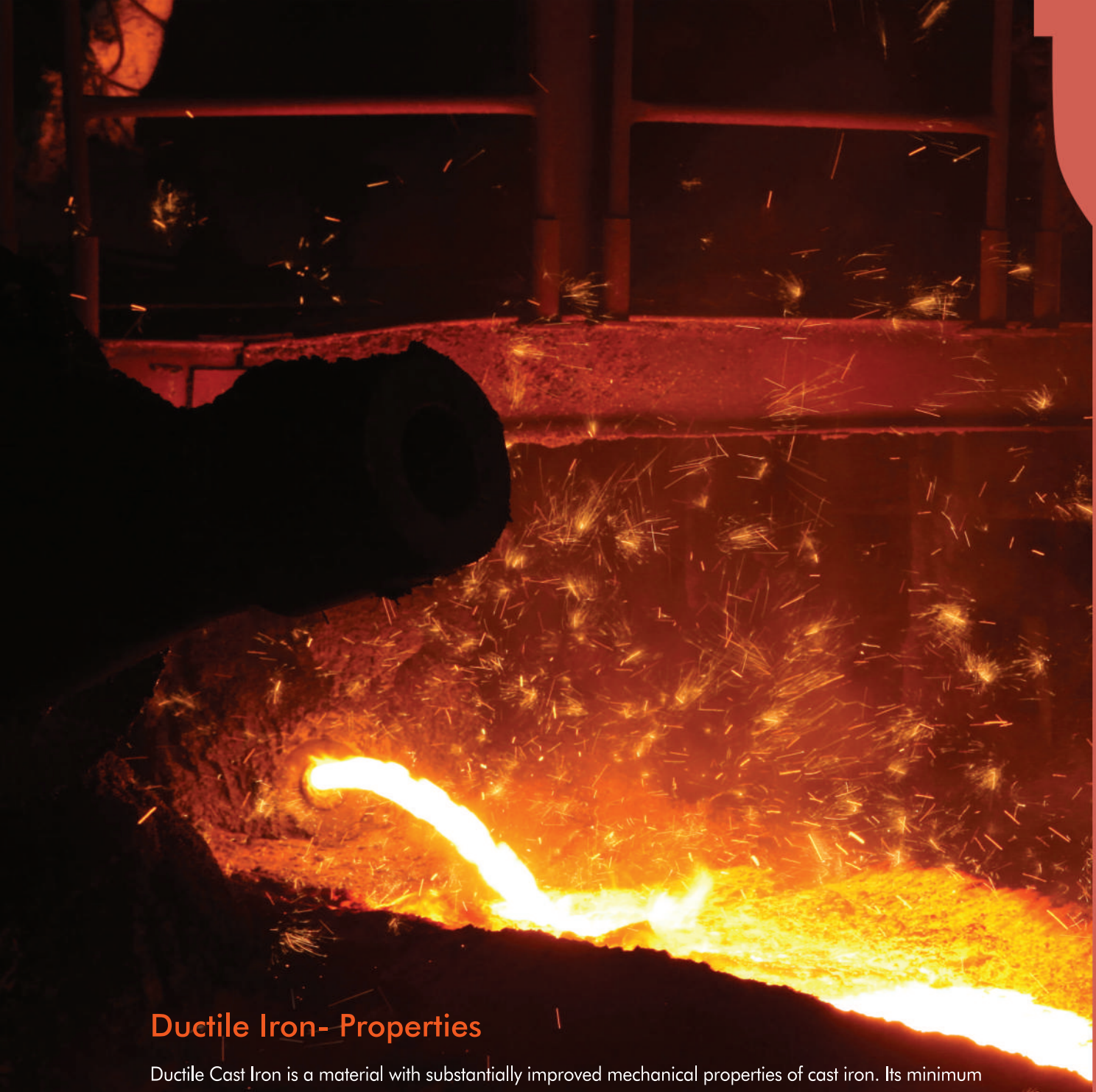


ELECTROSTEEL WORLDWIDE

Electrosteel exports Ductile Iron Pipes and Fittings to various countries in Europe, Africa, USA, South America, Middle East and Gulf, SAARC Countries, South East Asia etc. competing with other global manufacturers.

Electrosteel has subsidiaries in France, Spain, Italy, Brazil, Germany, UK, USA, Singapore, Algeria, Jebel Ali, Qatar, Bahrain and branch office in Abu Dhabi stocking and selling DI pipes and fittings to the local and neighboring markets/countries. Stockyards have a comprehensive stock of DI pipes, fittings and flanged pipes. It offers technical advice at the design stage and later after-sales support to its customers.

Besides the above, Electrosteel also has a network of distributors and agents in many countries in the world.



Ductile Iron- Properties

Ductile Cast Iron is a material with substantially improved mechanical properties of cast iron. Its minimum elongation of 10% before failure offers adequate strength to bear traffic and top load without being brittle.

DI pipes are very robust, can withstand mechanical stress and physical abuse, can be laid in unfavorable terrain and operating conditions and work without failure offering a very long service life.

Properties	Value
Tensile Strength	Min. 420 MPa
Elongation	Min. 10%
Modulus of Elasticity	$1.7X10^{10}$ kg/m^2
Hardness	Max. 230 BHN
Density	7050 kg/m^2
Bending/Beam Strength	Over 200 MPa
Bursting Strength (min)	Factor of Safety against bursting is 8 to 10

Quality Checks at Every Stage of Manufacturing

Strict selection of raw materials is an indispensable requirement for production of Quality Ductile Iron pipes & fittings. Electrosteel endeavors to achieve 'Quality right the first time' with strict quality control on raw material selection and procurement.

Electrosteel has a Mini Blast Furnace (MBF) at its plant at Khardah using TKES technology. MBF produces liquid metal suited to the manufacture of Ductile Iron pipes. The liquid metal is further processed and superheated in induction furnaces. It is then treated with magnesium for nodularisation and transferred to the centrifugal spun casting machines.

The pipes are then heat treated and hydrostatically tested. Various types of coatings and linings are applied depending on soil corrossivity and aggressivity of the fluid to be transmitted. Special coating/lining like PU coating or Ceramic lining is also available. The in-process inspection and quality control at all points during the production cycle is strictly maintained and documented as per ISO 9001 quality systems.

Process / Test

1. Blast furnace/Analysis of raw materials
2. Induction furnace / Chemical composition
3. Magnesium treatment / Micro and chemical composition
4. Pipes spinning / Temperature
5. Heat treatment / Microscopic structure and mechanical strength
6. Zinc coating
7. Dimensional checks / Thickness and Dia
8. Hydraulic test / Pressure
9. Internal lining / Thickness
10. External coating / Thickness

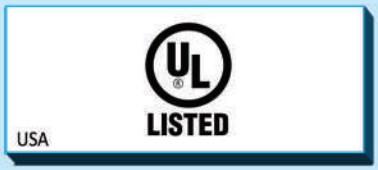
Quality Policy

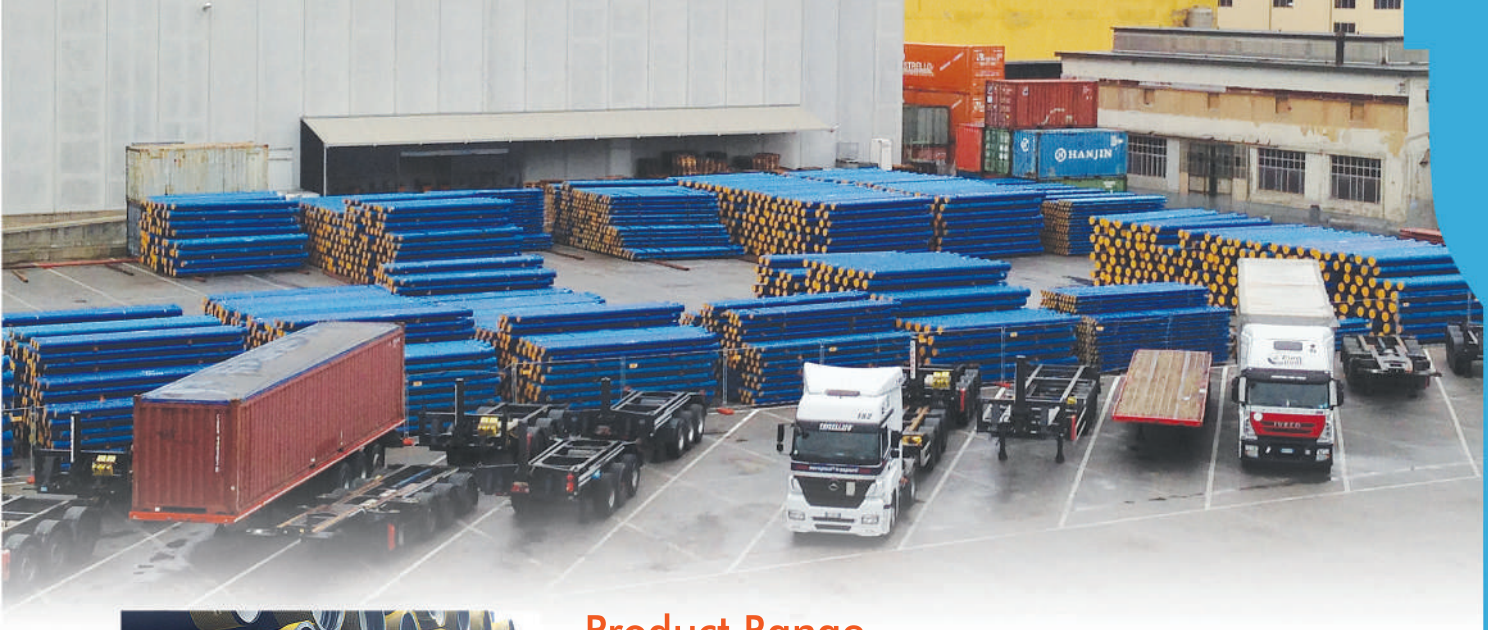
- Electrosteel is committed to providing goods and services which meet customer's expectations and needs.
- The aim is to achieve "Quality right the first Time".
- Electrosteel is committed to comply with the requirements and to continually improve the effectiveness of quality management system through teamwork, training and motivation.
- Electrosteel shall formulate Quality objectives for all functions and involve employees in fulfilment of the same.
- The quality policy and the quality objectives will be reviewed for continuing suitability.

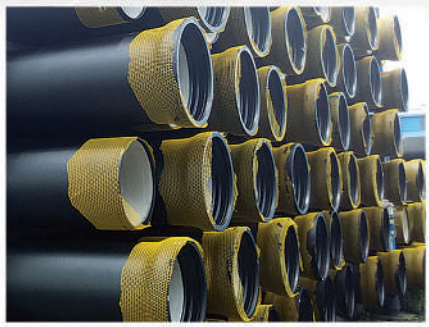
Total Productive Maintenance (TPM)

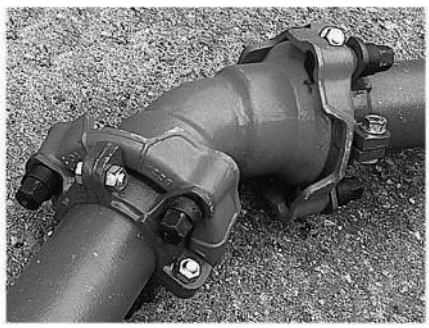
Electrosteel is practising TPM and awarded for TPM Excellence by JIPM (Japan). Electrosteel is also awarded for Excellence in consistent TPM commitment by JIPM. TPM culture have been made a way of life and percolated, through out the hierarchy. It is continuously maintained with all the enthusiasm involving and motivating personnel at all levels. TPM with the support of all pillars are working for achieving TPM Mission of 'Zero Loss, Zero Defect, Zero Accident, Zero Pollution.

Quality Accreditions









Product Range

Electrosteel produces pipes and fittings in the range DN 80mm DN I200mm in accordance with the following standards:

- ISO 2531/EN 545 for Water
- ISO 7186/ EN 598 for Sewerage
- IS 8329/IS 9523 for water and sewerage
- AWWA C I51 (Pipes), AWWA C 153/C 110 (Fittings)/C 115 (Flanged Pipes)
- DIN EN 545
- ABNT 7675 & ABNT 15420
- ONORM 545

RANGE OF PIPES

- Socket and spigot pipes with flexible Push-on joint pipes
- Restrained flexible joint pipes (Electrolock)
- Restrained flexible joint pipes (Bolted)
- Flanged pipes (Welded and Screwed)
- Piling pipes

RANGE OF FITTINGS

Electrosteel produces comprehensive range of fittings and ancillaries including:

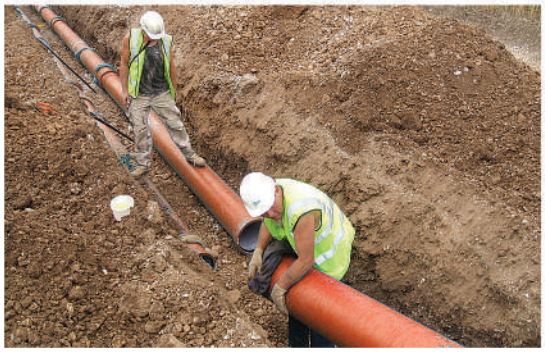
- Push-on joint socketed fittings
- Flanged fittings
- Rotating flange fittings
- Mechanical joint fittings
- Express Type Mechanical joint fittings
- Restrained Push-on joint fittings
- Electrolock fittings
- Restrained express Mechanical joint fittings (RSE Joint)

OUR BRANDS

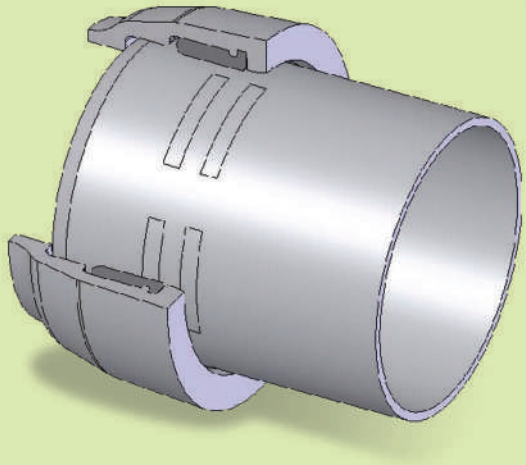
- Electrosteel brand of pipes, fittings & Flanged pipes
- Electrofresh brand of pipes
- Electrofresh Plus brand of pipes
- Electrolock Joint
- Electrotuf
- Electronet
- Pushtite/ Pushlok
- Electropur
- Electropux

Application

- Raw and Clearwater transmission (Pumping and Gravity Main)
- Distribution Network of Potable Water
- Water Supply for Industrial/Process Plant Application
- Ash-Slurry Handling & Disposal system
- Fire-fighting systems - on-shore and off-shore
- Desalination Plants
- Sewerage and wastewater Force Main
- Gravity Sewerage Collection and Disposal System
- Storm Water Drainage Piping
- Effluent Disposal System for Domestic and Industrial Application
- Recycling System
- Piping work inside water and Sewage Treatment Plants
- Vertical connection to utilities and Reservoirs
- Piling for Ground Stabilization
- Protective Piping under major carriage-ways
- Trenchless Applications



Various Jointing Systems



1) Socket and spigot push-on joints

The socket and spigot push fit joint is a simple male-female flexible joint that uses the compression of a synthetic rubber gasket to provide the watertight seal. The simplicity of the joint and its flexible nature accommodates angular defection and some longitudinal withdrawal without any loss in performance. The design of the gasket incorporating a hard 'heel' and softer 'bulb' ensures that gasket compression is achieved without it being displaced on insertion of the spigot.

Rubber Gaskets

Gaskets are normally made of EPDM Rubber as per ISO 4633 / EN 681. These gaskets are approved by WRAS (Water Regulations Advisory Scheme) UK for safe use with potable drinking water.

Jointing Procedure

a. Clean: Clean the inside of the socket and outside of the spigot end of the two pipelines to be joined.

b. Install the gaskets: Insert the rubber gasket into the groove of the socket.

c. Lubrication: Apply a thin layer of lubricant on the visible surface of gasket and the plain end of pipe.

d. Assembly: Align the two pipes and insert the plain end into the socket.

e. Check: Verify that the gasket is properly seated in its housing around the perimeter.

Electrosteel Ductile Iron Pipe joint designs are Type Tested

Electrosteel's design of the socket and the rubber gasket ensures leak-tight joint through Type Tests as per BSEN:545 and ISO:2531. Type Test is testing the pipe and pipe joint at extreme working conditions (the product and use) to ensure satisfactory performance.

2) Restrained Joints

Normal Push-On or Mechanical Joint in DI Pipes and Fittings does not provide significant restraint against longitudinal separation. Hydraulic thrust forces are created due to change of direction, reduction in diameter and at the end of pipelines under pressure during operation. These forces may cause joint separation if anchor blocks or anchoring devices are not provided in the pipeline.

One of the most common methods of providing resistance to thrust forces is the use of thrust blocks. Resistance is provided by transferring the thrust force to the soil through this thrust block.

In many cases, the site condition does not allow the space required to construct concrete thrust block and time to cure the concrete of the Thrust Block to be effective.

So, Electrosteel offers different designs of self-restrained joints to replace the concrete thrust block.

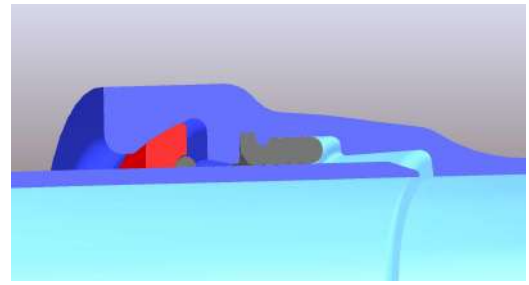
These include:

- Boltless Restrained Joint (Electrolock)
- Bolted Restrained Joint
- Tooth gasket Restrained Joint

Remember...

- Restrained joints are mainly for Underground Application.
- All pipes in the pipeline need not be Restrained.
- Restraining length depends on Soil type, backfill compaction, Pipeline Profile and Working Pressure.
- All Bends, Reducers End blocks and Tees with its adjacent restraining lengths are to be with Restrained Joints.
- Joints on both sides of the fittings within the restraining length are to be Restrained.

Boltless Restrained Joint (Electrolock)



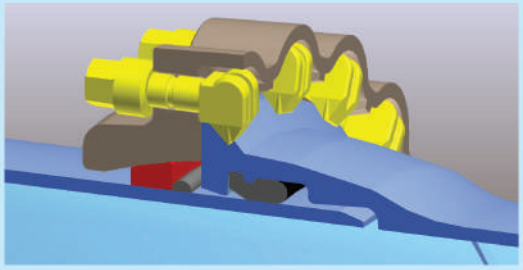
1. Can withstand very high pressure.
2. Need Factory manufacture Long Socket Pipes with two chambers one for normal sealing and the other for restraining axial movement.
3. The water sealing is done by Push-on gasket and restraining is done by Weld Bead and Locking Bar.
4. Normal Push-on joint gasket to be used for sealing.
5. After assembly, the locking bars in parts are to be inserted in the Locking Chamber. The weld bead on the spigot gets locked with the locking bar against separation force.
6. Can be used for trenchless applications where all pipes with such joints are used in the trenchless portion.
7. Easy to assemble and disassemble when required.
8. Please contact us for Snow Application.

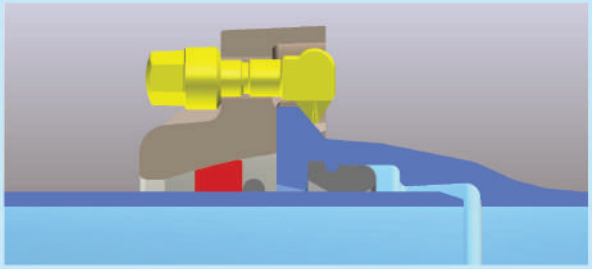
DN (mm)	Allowable Angular Deflection (Degree)	PFA (Bar) For Class K9 or Equivalent class
80	5°	64
100	5°	64
125	5°	64
150	5°	55
200	4°	44
250	4°	39
300	4°	37
350	3°	32
400	3°	30
450	3°	30
500	3°	30
600	3°	30
700	3°	30
800	3°	25
900	3°	25
1000	3°	25

To use this system for other class of pipes, the manufacturer may be contacted

Note : PFA - Maximum Operating Pressure (Excluding Surge)

Bolted Restrained Joint





1. Can withstand very high pressure.
2. Need specially manufactured pipes, with Factory manufactured Hood on the socket and Weld Bead on spigot.
3. Need special accessories like Gland, Split Retainer Ring and Nuts/ Hook Bolts.
4. The water sealing and restraining are in two different systems.
5. Normal gasket to be used for sealing.
6. The Hook Bolts with the support from socket hood hold the gland and the socket together. The welding bead on the other pipe's spigot cannot pass through Retainer Ring housed in the gland, ensures restraining axial movement between the two pipes.
7. Easy to assemble and disassemble when required.

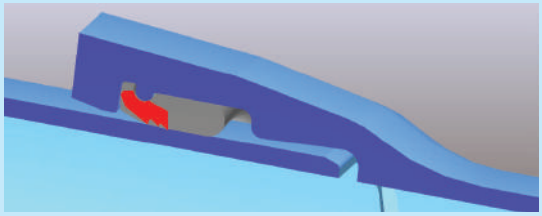
DN (mm)	Allowable Angular Deflection (Degree)	PFA (Bar) For Class K9 or Equivalent class
80	5°	64
100	5°	64
125	5°	64
150	5°	55
200	4°	44
250	4°	39
300	4°	37
350	3°	32
400	3°	30
450	3°	30
500	3°	30
600	3°	27
700	2°	25
800	2°	16
900	2°	16
1000	2°	16

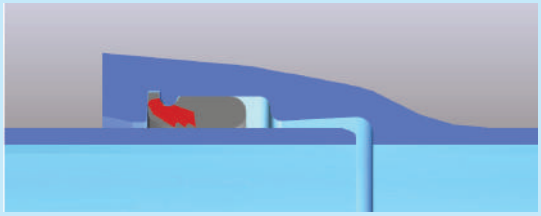
To use this system for other class of pipes, the manufacturer may be contacted

Note : PFA - Maximum Operating Pressure (Excluding Surge)

Tooth Gasket Restrained Joint

1. Can be used on any Push on Joint Socket & Spigot pipe.
2. Need specially manufactured Steel teeth Inserted Gasket in place of normal Gasket.
3. Gasket has to be set in the Socket Groove like any other gasket.
4. Like any other pipe the steel teeth allow the spigot to be pushed into the socket.
5. Once the Spigot is fully inserted, teeth bite into the spigot and restrict the spigot to come out.
6. This specially designed gasket performs the dual role of water sealing and restraining.
7. After assembly, pull bock the pipe to ensure engagement of teeth.

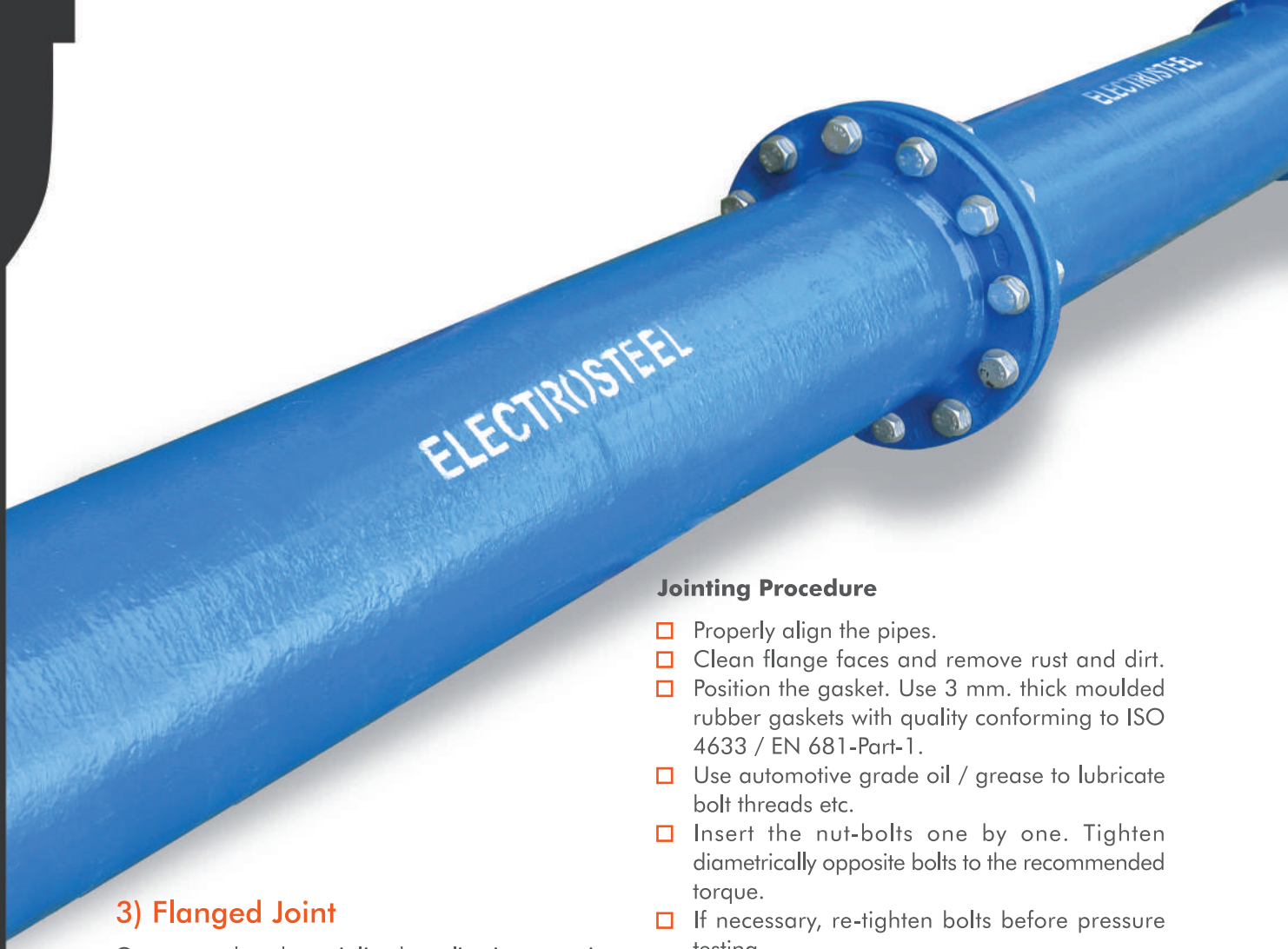




DN (mm)	Allowable Angular Deflection (Degree)	PFA (Bar) For Class K9 or Equivalent class
80	5°	23
100	5°	23
125	5°	22
150	5°	18
200	4°	16
250	4°	16
300	4°	16
350	3°	16
400	2°	16
450	2°	13
500	2°	11
600	2°	10

To use this system for other class of pipes, the manufacturer may be contacted

Note : PFA - Maximum Operating Pressure (Excluding Surge)



3) Flanged Joint

Overground and specialized applications require restrained joints where Flanged pipes are used. Flanged Pipes have the following advantages:

1. Acts as self -Restrained Joint reducing the requirement of thrust blocks.
2. Ideal for over-ground and Exposed Installations.
3. Flanged Pipes are ideal for Vertical pipelines.
4. Used for Temporary Installations (over pillars) where pipelines need to be disengaged or displaced.
5. Widely used for interconnection in Pump House and Treatment Plant.

Type of Pipe	Dia Range & lengths	PN Ratings
Welded Flanged Pipes		
Flanges are welded on either side of a Class K9 Barrel or equivalent C Class.	From 80 to 1200 mm diameter & length up to 5.4 mtr.	PN 10, PN 16, PN 25, PN 40
Screwed Flanged Pipes		
Flanged are screwed-fit on either side of a Class K9 barrel or equivalent C Class.	From 80 to 400mm diameter & length up to 5.4 mtr.	PN 10, PN 16
"As Cast" Flanged Pipes		
Flanged Pipe is cast as a single unit using advanced Lost Foam method.	From 80 to 1200mm diameter.	PN 10, PN 16, PN 25, PN 40

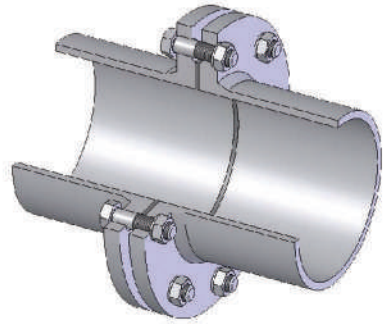
Jointing Procedure

- Properly align the pipes.
- Clean flange faces and remove rust and dirt.
- Position the gasket. Use 3 mm. thick moulded rubber gaskets with quality conforming to ISO 4633 / EN 681-Part-1.
- Use automotive grade oil / grease to lubricate bolt threads etc.
- Insert the nut-bolts one by one. Tighten diametrically opposite bolts to the recommended torque.
- If necessary, re-tighten bolts before pressure testing.

Electrosteel manufactures Flanged Pipes using all the three methods, that is, Welded Flanged Pipes, Screwed Flanged Pipes and integrally Cast Flanged Pipes (short lengths). Other types of coating and lining to the Flanged Pipes are also available. All flanged pipes are normally lined with Cement Mortar and have outside Zinc and Bitumen Coating. Other types of coating and lining to the Flanged Pipes are also available.

Remember...

- Buried installation is not recommended.
- Flanged joint being a rigid joint, perfect alignment of the flange faces during jointing and bolt tightening is absolutely vital.
- Use of duck foot bend at bottom of vertical flange pipeline is necessary.
- For high pressure application, flanged pipeline needs thrust block/support at bends/tees.



Pipe Dimensions

DIMENSION OF SOCKET AND SPIGOT PIPES (Thickness Class)

Nominal Dia DN (mm)	External Dia DE (mm)	Tolerance on DE (mm)	*Nominal Thickness K7(mm)	*Nominal Thickness K9 (mm)	Allowable Deflection (Degree)
80	98	+1/-2.7		6.0	5
100	118	+1/-2.8		6.0	5
150	170	+1/-2.9		6.0	5
200	222	+1/-3	6.0	6.3	4
250	274	+1/-3.1	6.0	6.8	4
300	326	+1/-3.3	6.0	7.2	4
350	378	+1/-3.4	6.0	7.7	3
400	429	+1/-3.5	6.3	8.1	3
450	480	+1/-3.6	6.7	8.6	3
500	532	+1/-3.8	7.0	9.0	3
600	635	+1/-4	7.7	9.9	3
700	738	+1/-4.3	8.4	10.8	2
800	842	+1/-4.5	9.1	11.7	2
900	945	+1/-4.8	9.8	12.6	2
1000	1048	+1/-5	10.5	13.5	2
1100	1152	+1/-6	11.2	14.4	2
1200	1255	+1/-6.2	11.9	15.3	2

*As per ISO:2531-1998/EN:545-2006

DIMENSION OF SOCKET AND SPIGOT PIPES (Pressure Class)

Nominal Dia DN (mm)	External Dia DE (mm)	Tolerance on DE (mm)	Preferred Class#		Minimum Thickness* (mm)	Allowable Deflection (Degree)
			Pressure Class	Nominal Thickness (mm)		
80	98	+1/-2.7	C40	4.4	3.0	5
100	118	+1/-2.8	C40	4.4	3.0	5
125	144	+1/-2.8	C40	4.5	3.0	5
150	170	+1/-2.9	C40	4.5	3.0	5
200	222	+1/-3	C40	4.7	3.1	4
250	274	+1/-3.1	C40	5.5	3.9	4
300	326	+1/-3.3	C40	6.2	4.6	4
350	378	+1/-3.4	C30	6.3	4.7	3
400	429	+1/-3.5	C30	6.5	4.8	3
450	480	+1/-3.6	C30	6.9	5.1	3
500	532	+1/-3.8	C30	7.5	5.6	3
600	635	+1/-4	C30	8.7	6.7	3
700	738	+1/-4.3	C25	8.8	6.8	2
800	842	+1/-4.5	C25	9.6	7.5	2
900	945	+1/-4.8	C25	10.6	8.4	2
1000	1048	+1/-5	C25	11.6	9.3	2
1100	1152	+1/-6	C25	12.6	10.2	2
1200	1255	+1/-6.2	C25	13.6	11.1	2

#As per ISO:2531-2009 *As per EN 545-2010

DIMENSION OF SOCKET & SPIGOT PIPES (For Sewerage application)

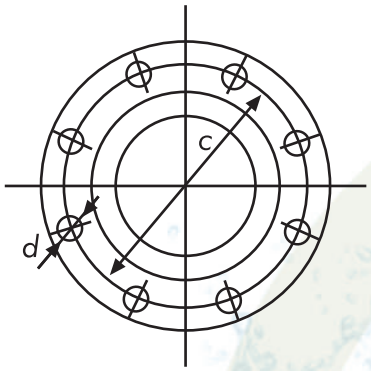
Nominal Dia DN (mm)	External Dia DE (mm)	Tolerance on DE (mm)	Pressure Sewer		Allowable Deflection (Degree)
			Nominal Thickness (mm)*	Nominal Thickness (mm)*	
80	98	+1/-2.7	4.4	4.8	5
100	118	+1/-2.8	4.4	4.8	5
125	144	+1/-2.8	4.5	4.8	5
150	170	+1/-2.9	4.5	4.8	5
200	222	+1/-3	4.7	4.9	4
250	274	+1/-3.1	4.9	5.3	4
300	326	+1/-3.3	5.1	5.6	4
350	378	+1/-3.4	5.7	6.0	3
400	429	+1/-3.5	6.3	6.3	3
450	480	+1/-3.6	6.4	6.7	3
500	532	+1/-3.8	6.5	7.0	3
600	635	+1/-4	7.5	7.7	3
700	738	+1/-4.3	8.5	9.6	2
800	842	+1/-4.5	9.6	10.4	2
900	945	+1/-4.8	10.6	11.2	2
1000	1048	+1/-5	11.6	12.0	2
1100	1152	+1/-6	12.6	14.4	2
1200	1255	+1/-6.2	13.6	15.3	2

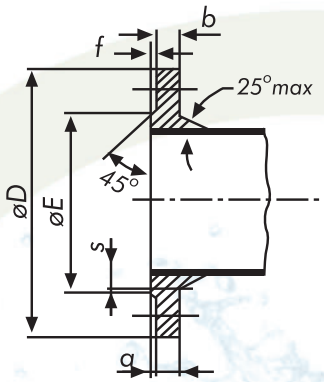
#As per ISO:7186 *As per EN 598-2007

Dimensions

Flanged Joint

DN Nom.	PN-10						PN-16					
	D	E	C	b	N	Metric	D	E	C	b	N	Metric
	Out side Dia	Dia. of raised Face	Pitch Circle Dia.	Flange Width	No. of Bolts	Bolt size/ Total length/ Thread length	Out side Dia	Dia. of raised Face	Pitch Circle Dia.	Flange Width	No. of Bolts	Bolt size/ Total length/ Thread length
80	200	132	160	16	4	M 16 x 65/38	200	132	160	16	8	M 16 x 65/38
100	220	156	180	16	8	M 16 x 65/38	220	156	180	16	8	M 16 x 65/38
125	250	184	210	16	8	M 16 x 65/38	250	184	210	16	8	M 16 x 65/38
150	285	211	240	16	8	M 20 x 70/46	285	211	240	16	8	M 20 x 70/46
200	340	266	295	17	8	M 20 x 70/46	340	266	295	17	12	M 20 x 70/46
250	395	319	350	19	12	M 20 x 70/46	400	319	355	19	12	M 24 x 90/54
300	445	370	400	20.5	12	M 20 x 85/46	455	370	410	20.5	12	M 24 x 90/54
350	505	429	460	20.5	16	M 20 x 85/46	520	429	470	22.5	16	M 24 x 90/54
400	565	480	515	20.5	16	M 24 x 90/54	580	480	525	24	16	M 27 x 100/60
450	615	530	565	21	20	M 24 x 90/54	640	548	585	26	20	M 27 x 100/60
500	670	582	620	22.5	20	M 24 x 105/54	715	609	650	27.5	20	M 30 x 110/66
600	780	682	725	25	20	M 27 x 100/60	840	720	770	31	20	M 33 x 120/78
700	895	794	840	27.5	24	M 27 x 110/60	910	794	840	34.5	24	M 33 x 130/78
750	960	857	900	29	24	M 27 x 110/60	970	857	900	36	24	M 33 x 130/78
800	1015	901	950	30	24	M 30 x 120/66	1025	901	950	38	24	M 36 x 140/84
900	1115	1001	1050	32.5	28	M 30 x 120/66	1125	1001	1050	41	28	M 36 x 150/84
1000	1230	1112	1160	35	28	M 33 x 130/78	1255	1112	1170	45	28	M 39 x 160/103
1100	1340	1231	1270	38	28	M 33 x 130/82	1355	1218	1270	48.5	32	M 39 x 160/110
1200	1455	1328	1380	40	32	M 36 x 140/84	1485	1328	1390	52	32	M 45 x 170/115





DN Nom.	PN-25						PN-40					
	D	E	C	b	N	Metric	D	E	C	b	N	Metric
	Out side Dia	Dia. of raised Face	Pitch Circle Dia.	Flange Width	No. of Bolts length	Bolt size/ Total length/ Thread	Out side Dia	Dia. of raised Face	Pitch Circle Dia.	Flange Width	No. of Bolts length	Bolt size/ Total length/ Thread
80	200	132	160	16	8	M 16 x 65/38	200	132	160	16	8	M 16 x 65/38
100	235	156	190	16	8	M 20 x 70/46	235	166	190	16	8	M 20 x 70/46
125	270	184	220	16	8	M 24 x 85/54	270	184	220	20.5	8	M 24 x 90/54
150	300	211	250	17	8	M 24 x 90/54	300	211	250	23	8	M 24 x 100/54
200	360	274	310	19	12	M 24 x 90/54	375	284	320	27	12	M 27 x 100/60
250	425	330	370	21.5	12	M 27 x 100/60	450	345	385	31.5	12	M 30 x 120/66
300	485	389	430	23.5	16	M 27 x 100/60	515	409	450	35.5	16	M 30 x 130/72
350	555	448	490	26	16	M 30 x 110/66	580	465	510	40	16	M 33 x 140/78
400	620	503	550	28	16	M 33 x 120/78	660	535	585	44	16	M 36 x 150/84
450	670	548	600	30.5	20	M 33 x 120/78	685	560	610	46	20	M 36 x 150/84
500	730	609	660	32.5	20	M 33 x 120/78	755	615	670	48	20	M 39 x 170/90
600	845	720	770	37	20	M 36 x 140/84	890	735	795	53	20	M 45 x 180/102
700	960	820	875	41.5	24	M 39 x 160/90						
750	1020	883	940	45	24	M 39 x 170/90						
800	1085	928	990	46	24	M 45 x 180/102						
900	1185	1028	1090	50.5	28	M 45 x 180/102						
1000	1320	1140	1210	55	28	M 52 x 200/116						
1100	1420	1240	1310	60.5	32	M 52 x 210/124						
1200	1530	1350	1420	64	32	M 52 x 210/124						

Note : 1) Total length/Thread length are indicative.Actual length will depend on exact flange thickness and gasket thickness.
2) All dimensions are in mm

DI Fittings

Manufacturing Procedure

Electrosteel employs state of the art 'Lost Foam' process along with high pressure green sand moulding process for manufacturing DI fittings. These are advanced casting techniques and score over other conventional process on many accounts

Lost Foam Technique

- First an exact replica of the fitting is made with 'Styro-foam' popularly known as Thermocole.
- This replica, moulded in special machines, acts as a pattern for the costing. The patterns are then kept in mechanized moulding box and then packed with sand.
- When hot metal is poured, the Styro-foam pattern vaporizes and the metal takes the shape of the fitting by filling up the cavity.
- After cooling, castings are taken out, shot blasted, fettled and cleaned.
- After thorough inspection and fettling, the castings (Fittings) are subjected to hydrostatic testing.

Advantages of Lost Foam Technique

- Higher productivity. Casting process is much faster.
- No need of core setting. So no question of core displacement, resulting in even thickness.
- Much lower chances of having pinhole, slag inclusion or blowhole.
- Maintains high dimensional tolerance, which is so vital for proper fitment and leak - tightness. The castings have excellent finish.
- In flanged fitting no drilling hole is necessary as all the holes are as cast.

Hydrostatic Testing

DI fittings are tested at works at the following test pressure as specified in ISO/EN

Diameter (mm)	Works Test Pressure (Kg/cm^2)
80-300	25
350-600	16
700-1200	10

It may appear that test pressures of Fittings are low, compared to the allowable working pressures in pipes. But fittings with K- 12 thickness of Ductile Iron have higher factor of safety and do not fail at allowable working pressure.

Loose Flange Fittings

Electrosteel has also introduced fittings with Adjustable Flange or Loose Flange. Unlike 'As cast' Flanged fitting, in this case, separately cast loose Flanges are mounted on the fittings. A loose Flanged Fittings comprises of a Flange ring (in two or more parts bolted together), which can be fixed on the fittings end. This loose Flange can be freely rotated around the axis of the fittings.

Advantages

- Since the flanges can be freely rotated, bolthole alignment with the mating Flange becomes easier.
- As it can be fixed and removed easily, dismantling of adjoining accessories becomes easier. Small angles can be adjusted.
- The PN rating of the Fittings can be changed at will, just by changing the loose flange.

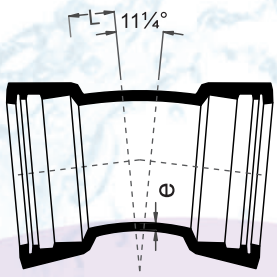
Special fittings

Apart from push-on joint and mechanical joint fittings we also manufacture some special fittings, which are extremely useful for practical applications which would have same wall thickness, material and quality tests of standard fittings. Few of these are mentioned below:

- 4 way Crosses
- Double Socket Branch Flange level Invert Tee (Scour Tee/Washout Tee)
- Puddle flange of required length
- Special variation of conventional Fittings such as:
  - Fittings with one side Flange & one side plain-ended/socketed of a particular length.
  - Tees and Reducers with other non-standard DN x dn combinations.
  - In fact due to the immense flexibility of our manufacturing process by Lost Foam method, virtually any combination of socket/flange /plain-end is possible.

Flange Adaptors and Dismantling Joint

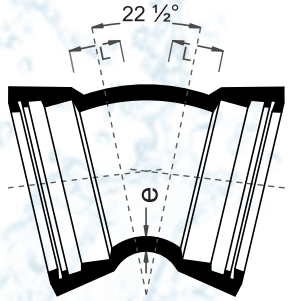
We are also making special Fitting like Flange Adaptor and Dismantling Joint in the size range of 80mm -1200 mm dia.



DOUBLE SOCKET 11 ¼° BEND

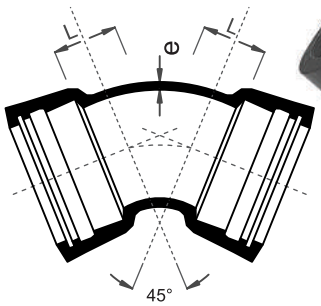
Double Socket 11 1/4 ° Bend

Nominal Size mm	e mm	L mm
80	7.0	30
100	7.2	30
150	7.8	35
200	8.4	40
250	9.0	50
300	9.6	55
350	10.2	60
400	10.8	65
450	11.4	70
500	12.0	75
600	13.2	85
700	14.4	95
800	15.6	110
900	16.8	120
1000	18.0	130
1100	19.2	140
1200	20.4	150



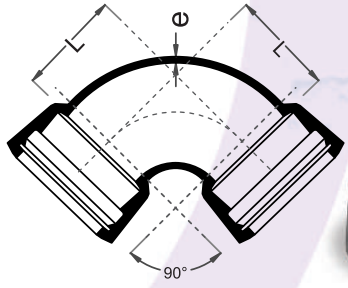
Double Socket 22 1/2 °Bend

Nominal Size mm	e mm	L mm
80	7.0	40
100	7.2	40
150	7.8	55
200	8.4	65
250	9.0	75
300	9.6	85
350	10.2	95
400	10.8	110
450	11.4	120
500	12.0	130
600	13.2	150
700	14.4	175
800	15.6	195
900	16.8	220
1000	18.0	240
1100	19.2	260
1200	20.4	285



Double Socket 45° Bend

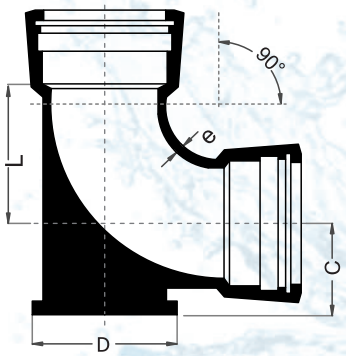
Nominal Size mm	e mm	L mm
80	7.0	55
100	7.2	65
150	7.8	85
200	8.4	110
250	9.0	130
300	9.6	150
350	10.2	175
400	10.8	195
450	11.4	220
500	12.0	240
600	13.2	285
700	14.4	330
800	15.6	370
900	16.8	415
1000	18.0	460
1100	19.2	505
1200	20.4	550



Double Socket 90° Bend

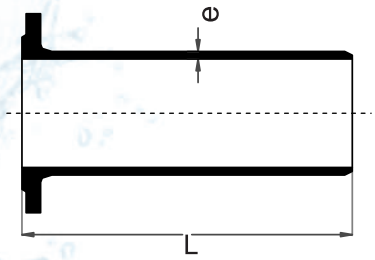
Nominal Size mm	e mm	L mm
80	7.0	100
100	7.2	120
150	7.8	170
200	8.4	220
250	9.0	270
300	9.6	320
350	10.2	370
400	10.8	420
450	11.4	470
500	12.0	520
600	13.2	620
700	14.4	720
800	15.6	820
900	16.8	920
1000	18.0	1020
1100	19.2	1130
1200	20.4	1230

Double Socket 90° Duck Foot Bend



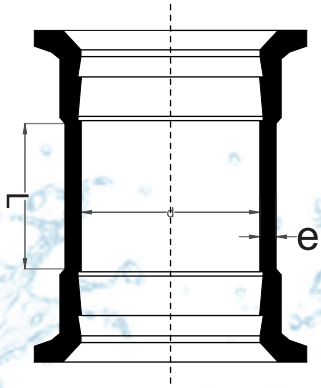
Nominal Size	e	L	C	D
mm	mm	mm	mm	mm
80	7.0	110	110	180
100	7.2	130	125	200
150	7.8	180	160	250
200	8.4	230	190	300
250	9.0	280	225	350
300	9.6	325	255	400
350	10.2	380	290	450
400	10.8	430	320	500
450	11.4	480	355	550
500	12.0	530	385	600
600	13.2	630	450	700
700	14.4	735	515	800
800	15.6	830	580	900
900	16.8	930	645	1000
1000	18.0	1035	710	1100
1100	19.2	1130	775	1200
1200	20.4	1230	840	1300

Flanged Spigot



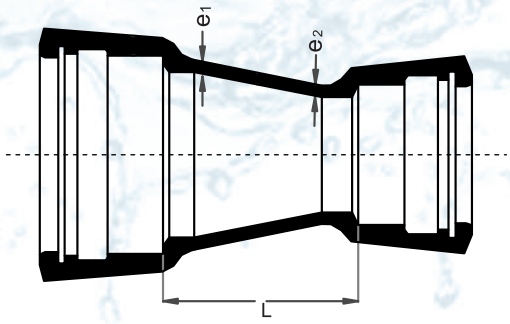
Nominal Dia (DN)	DE	e	L
mm	mm	mm	mm
80	98	7.0	350
100	118	7.2	360
150	170	7.8	380
200	222	8.4	400
250	274	9.0	420
300	326	9.6	440
350	378	10.2	460
400	429	10.8	480
450	480	11.4	500
500	532	12.0	520
600	635	13.2	560
700	738	14.4	600
800	842	15.6	600
900	945	16.8	600
1000	1048	18.0	600
1100	1152	19.2	600
1200	1255	20.4	600

Mechanical Joint Collar



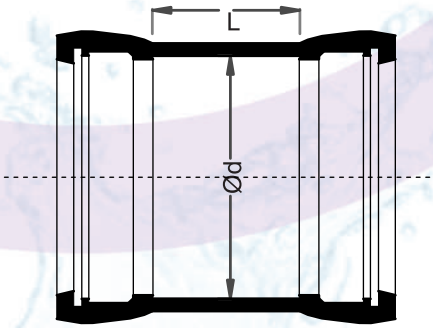
Nominal Dia (DN)	e	L	d
mm	mm	mm	mm
80	7.0	160	109
100	7.2	160	130
150	7.8	165	183
200	8.4	170	235
250	9.0	175	288
300	9.6	180	340
350	10.2	185	393
400	10.8	190	445
450	11.4	195	498
500	12.0	200	550
600	13.2	210	655
700	14.4	220	760
800	15.6	230	865
900	16.8	240	970
1000	18.0	250	1075
1100	19.2	260	1180
1200	20.4	270	1285

Note : Express type MJ Collar is also available.



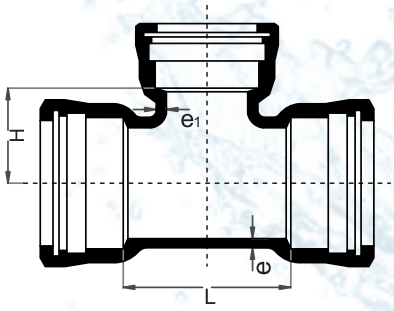
Double Socket Concentric Reducer

Nominal Diameter (DN)		e_1	e_2	L
Larger End	Smaller End			
mm	mm	mm	mm	mm
100	80	7.2	7.0	90
150	80	7.8	7.0	190
150	100	7.8	7.2	150
200	100	8.4	7.2	250
200	150	8.4	7.8	150
250	150	9.0	7.8	250
250	200	9.0	8.4	150
300	150	9.6	7.8	350
300	200	9.6	8.4	250
300	250	9.6	9.0	150
350	200	10.2	8.4	360
350	250	10.2	9.0	260
350	300	10.2	9.6	160
400	250	10.8	9.0	360
400	300	10.8	9.6	260
400	350	10.8	10.2	160
450	350	11.4	10.2	260
450	400	11.4	10.8	160
500	350	12.0	10.2	360
500	400	12.0	10.8	260
600	400	13.2	10.8	460
600	500	13.2	12.0	260
700	500	14.4	12.0	480
700	600	14.4	13.2	280
800	600	15.6	13.2	480
800	700	15.6	14.4	280
900	700	16.8	14.4	480
900	800	16.8	15.6	280
1000	800	18.0	15.6	480
1000	900	18.0	16.8	280
1100	1000	19.2	18.0	280
1200	1000	20.4	18.0	480



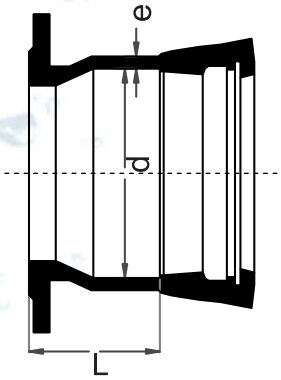
Double Socket Collar

Nominal Dia (DN)	e	L	d
mm	mm	mm	mm
80	7.0	160	109
100	7.2	160	130
150	7.8	165	183
200	8.4	170	235
250	9.0	175	288
300	9.6	180	340
350	10.2	185	393
400	10.8	190	445
450	11.4	195	498
500	12.0	200	550
600	13.2	210	655
700	14.4	220	760
800	15.6	230	865
900	16.8	240	970
1000	18.0	250	1075
1100	19.2	260	1180
1200	20.4	270	1285



All Socket Tee

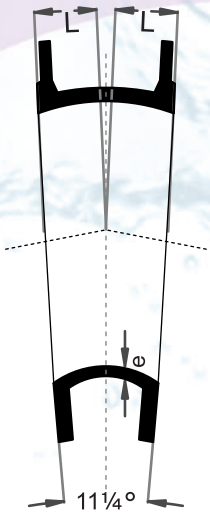
Nominal Diameter (DN)		e	e1	L	H
Body mm	Branch mm	mm	mm	mm	mm
80	80	7.0	7.0	170	85
100	80	7.2	7.0	170	95
100	100	7.2	7.2	190	95
150	100	7.8	7.2	195	120
150	150	7.8	7.8	255	125
200	80	8.4	7.0	175	145
200	100	8.4	7.2	200	145
200	150	8.4	7.8	255	150
200	200	8.4	8.4	315	155
250	80	9.0	7.0	180	170
250	100	9.0	7.2	200	170
250	150	9.0	7.8	260	175
250	200	9.0	8.4	315	180
250	250	9.0	9.0	375	190
300	100	9.6	7.2	205	195
300	150	9.6	7.8	260	200
300	200	9.6	8.4	320	205
300	250	9.6	9.0	380	215
300	300	9.6	9.6	435	220
350	100	10.2	7.2	205	220
350	150	10.2	7.8	265	225
350	200	10.2	8.4	325	230
350	250	10.2	9.0	380	240
350	300	10.2	9.6	440	245
350	350	10.2	10.2	495	250
400	80	10.8	7.0	185	245
400	100	10.8	7.2	210	245
400	150	10.8	7.8	270	250
400	200	10.8	8.4	325	255
400	300	10.8	9.6	440	270
400	400	10.8	10.8	560	280
450	100	11.4	7.2	215	270
450	250	11.4	9.0	385	290
450	450	11.4	11.4	620	310
500	100	12.0	7.2	215	295
500	200	12.0	8.4	330	305
500	400	12.0	10.8	565	330
500	500	12.0	12.0	680	340
600	200	13.2	8.4	340	355
600	400	13.2	10.8	570	380
600	600	13.2	13.2	800	400
700	200	14.4	8.4	345	405
700	400	14.4	10.8	575	430
700	700	14.4	14.4	910	460
800	200	15.6	8.4	350	455
800	400	15.6	10.8	580	480
800	600	15.6	13.2	785	500
800	800	15.6	15.6	990	510
900	200	16.8	8.4	355	505
900	400	16.8	10.8	580	530
900	600	16.8	13.2	785	550
900	900	16.8	16.8	1095	565
1000	200	18.0	8.4	360	555
1000	400	18.0	10.8	580	580
1000	600	18.0	13.2	785	600
1000	1000	18.0	18.0	1200	615
1100	400	19.2	10.8	600	630
1100	600	19.2	13.2	830	650
1200	600	20.4	13.2	840	700
1200	800	20.4	15.6	1070	725
1200	1000	20.4	18.0	1300	745
1200	1200	20.4	20.4	1535	765



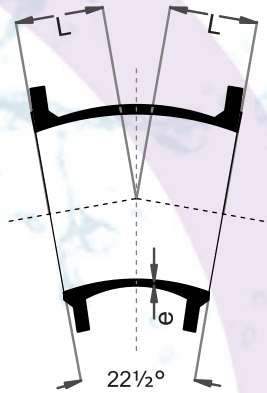
Flanged Socket

Nominal Dia (DN)	e	L	d
mm	mm	mm	mm
80	7.0	130	109
100	7.2	130	130
150	7.8	135	183
200	8.4	140	235
250	9.0	145	288
300	9.6	150	340
350	10.2	155	393
400	10.8	160	445
450	11.4	165	498
500	12.0	170	550
600	13.2	180	655
700	14.4	190	760
800	15.6	200	865
900	16.8	210	970
1000	18.0	220	1075
1100	19.2	230	1180
1200	20.4	240	1285

Double Flanged 11 1/4° Bend

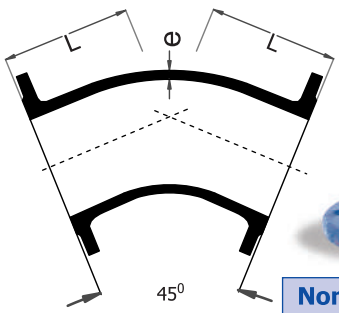


Nominal Size DN mm	e mm	L mm
80	7.0	113
100	7.2	115
125	7.5	111
150	7.8	113
200	8.4	132
250	9.0	165
300	9.6	175
350	10.2	191
400	10.8	205
450	11.4	349
500	12.0	375
600	13.2	426
700	14.4	235
800	15.6	265
900	16.8	290
1000	18.0	310
1100	19.2	265
1200	20.4	275



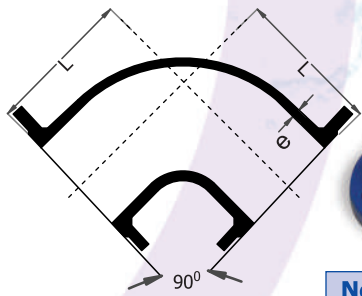
Double Flanged 22 1/2° Bend

Nominal Size DN mm	e mm	L mm
80	7.0	105
100	7.2	110
125	7.5	105
150	7.8	109
200	8.4	131
250	9.0	190
300	9.6	210
350	10.2	210
400	10.8	239
450	11.4	349
500	12.0	375
600	13.2	426
700	14.4	315
800	15.6	350
900	16.8	380
1000	18.0	400
1100	19.2	380
1200	20.4	410



Double Flanged 45° Bend

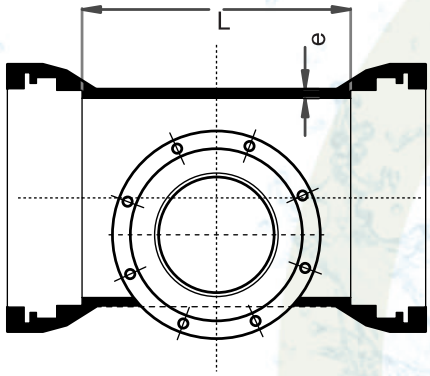
Nominal Size DN mm	e mm	L mm
80	70	130
100	7.2	140
125	7.5	150
150	7.8	160
200	8.4	180
250	9.0	350
300	9.6	400
350	10.2	298
400	10.8	324
450	11.4	350
500	12.0	375
600	13.2	426
700	14.4	478
800	15.6	529
900	16.8	581
1000	18.0	632
1100	19.2	694
1200	20.4	750

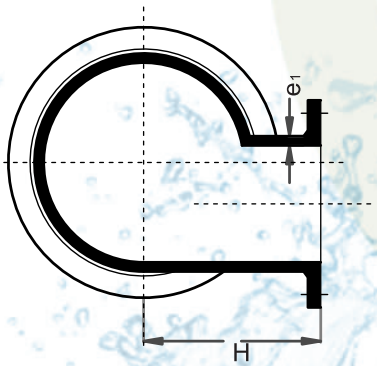


Double Flanged 90° Bend

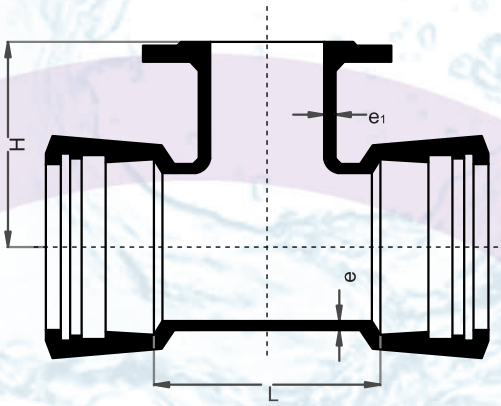
Nominal Size DN mm	e mm	L mm
80	7.0	165
100	7.2	180
125	7.5	200
150	7.8	220
200	8.4	260
250	9.0	350
300	9.6	400
350	10.2	450
400	10.8	500
450	11.4	550
500	12.0	600
600	13.2	700
700	14.4	800
800	15.6	900
900	16.8	1000
1000	18.0	1100
1100	19.2	1235
1200	20.4	1340

Double Socket Level Invert Tee with Flanged Branch



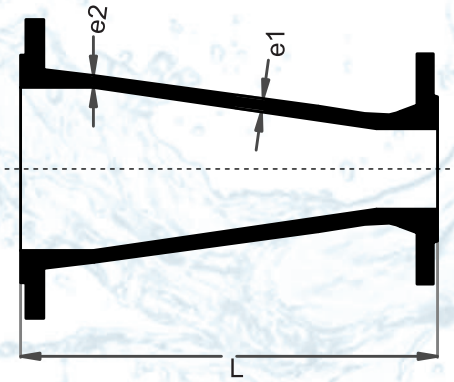


Nominal Diameter (DN)		e	e_1	L	H
Body DN	Branch dn				
mm	mm	mm	mm	mm	mm
100	80	7.2	7.0	170	175
150	80	7.8	7.0	170	205
150	100	7.8	7.2	195	210
200	80	8.4	7.0	175	235
200	100	8.4	7.2	200	240
200	150	8.4	7.8	255	250
250	80	9.0	7.0	180	265
250	100	9.0	7.2	200	270
250	150	9.0	7.8	260	280
250	200	9.0	8.4	315	290
300	80	9.6	7.0	180	295
300	100	9.6	7.2	205	300
300	150	9.6	7.8	260	310
300	200	9.6	8.4	320	320
300	250	9.6	9.0	380	330
350	80	10.2	7.0	185	325
350	100	10.2	7.2	205	330
350	150	10.2	7.8	265	340
350	200	10.2	8.4	325	350
350	250	10.2	9.0	380	360
400	80	10.8	7.0	185	355
400	100	10.8	7.2	210	360
400	150	10.8	7.8	270	370
400	200	10.8	8.4	325	380
400	250	10.8	9.0	385	390
400	300	10.8	9.6	440	400
450	80	11.4	7.0	190	385
450	100	11.4	7.2	215	390
450	150	11.4	7.8	270	400
450	200	11.4	8.4	330	410
450	250	11.4	9.0	385	420
450	300	11.4	9.6	445	430
450	400	11.4	10.8	560	450
500	80	12.0	7.0	195	415
500	100	12.0	7.2	215	420
500	150	12.0	7.8	275	430
500	200	12.0	8.4	330	440
500	250	12.0	9.0	390	450
500	300	12.0	9.6	450	460
500	350	12.0	10.2	505	470
500	400	12.0	10.8	565	480
500	450	12.0	11.4	620	490
600	80	13.2	7.0	200	475
600	100	13.2	7.2	220	480
600	150	13.2	7.8	280	490
600	200	13.2	8.4	340	500
600	250	13.2	9.0	395	510
600	300	13.2	9.6	455	520
600	350	13.2	10.2	510	530
600	400	13.2	10.8	570	540
600	450	13.2	11.4	630	550
600	500	13.2	12.0	685	560
700	80	14.4	7.0	205	505
700	100	14.4	7.2	230	510
700	150	14.4	7.8	285	520
700	200	14.4	8.4	345	525
800	150	15.6	7.8	290	580
800	200	15.6	8.4	350	585
900	150	16.8	7.8	300	640
900	200	16.8	8.4	355	645
1000	150	18.0	7.8	305	700
1000	200	18.0	8.4	360	705
1100	150	19.2	7.8	310	760
1100	200	19.2	8.4	370	765
1200	150	20.4	7.8	315	820
1200	200	20.4	8.4	375	825



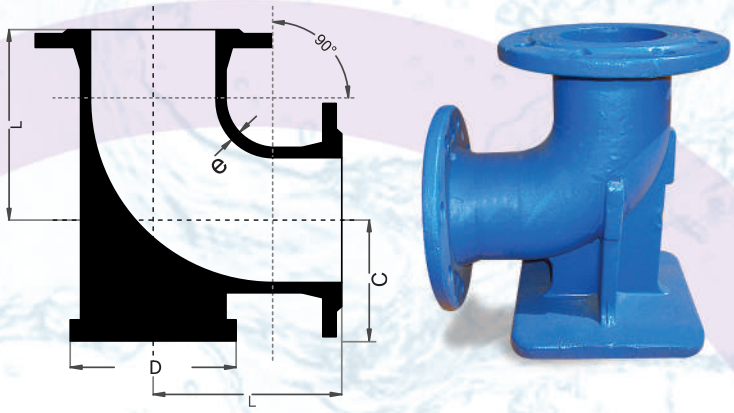
Double Socket Flanged Branch Tee

Nominal Diameter (DN)		e	e_1	L	H
Body mm	Branch mm	mm	mm	mm	mm
80	80	7.0	7.0	170	165
100	80	7.2	7.0	170	175
100	100	7.2	7.2	190	180
150	80	7.8	7.0	170	205
150	100	7.8	7.2	195	210
150	150	7.8	7.8	255	220
200	80	8.4	7.0	175	235
200	100	8.4	7.2	200	240
200	150	8.4	7.8	255	250
200	200	8.4	8.4	315	260
250	80	9.0	7.0	180	265
250	100	9.0	7.2	200	270
250	150	9.0	7.8	260	280
250	200	9.0	8.4	315	290
250	250	9.0	9.0	375	300
300	100	9.6	7.2	205	300
300	200	9.6	8.4	320	320
300	250	9.6	9.0	380	330
300	300	9.6	9.6	435	340
350	100	10.2	7.2	205	330
350	200	10.2	8.4	325	350
350	350	10.2	10.2	495	380
400	80	10.8	7.0	185	355
400	100	10.8	7.2	210	360
400	150	10.8	7.8	270	370
400	200	10.8	8.4	325	380
400	300	10.8	9.6	440	400
400	400	10.8	10.8	560	420
450	100	11.4	7.2	215	390
450	250	11.4	9.0	385	420
450	450	11.4	11.4	620	460
500	100	12.0	7.2	215	420
500	400	12.0	10.8	565	480
500	500	12.0	12.0	680	500
600	200	13.2	8.4	340	500
600	400	13.2	10.8	570	540
600	600	13.2	13.2	800	580
700	200	14.4	8.4	345	525
700	400	14.4	10.8	575	555
700	700	14.4	14.4	925	600
800	200	15.6	8.4	350	585
800	400	15.6	10.8	580	615
800	600	15.6	13.2	1045	645
800	800	15.6	15.6	1045	675
900	200	16.8	8.4	355	645
900	400	16.8	10.8	590	675
900	600	16.8	13.2	1170	705
900	900	16.8	16.8	1170	750
1000	200	18.0	8.4	360	705
1000	400	18.0	10.8	595	735
1000	600	18.0	13.2	1290	765
1000	1000	18.0	18.0	1290	825
1100	400	19.2	10.8	600	795
1100	600	19.2	13.2	830	825
1100	1000	19.2	18.0	1295	885
1200	600	20.4	13.2	840	885
1200	800	20.4	15.6	1070	915
1200	1000	20.4	18.0	1300	945



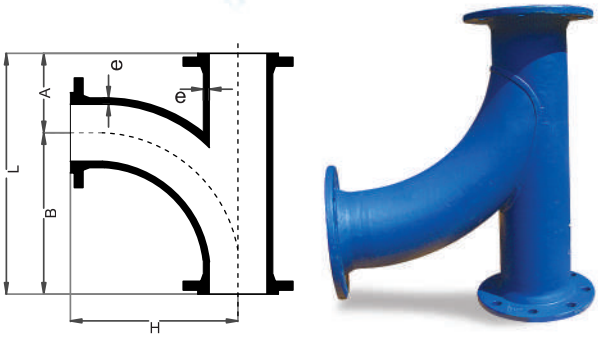
Double Flanged Concentric Tapers

Nominal Diameter (DN)		e_2	e_1	L
Larger End Body	Smaller End Body			
mm	mm	mm	mm	mm
100	80	7.2	7.0	200
125	80	7.5	7.0	180
125	100	7.5	7.2	200
150	80	7.8	7.0	230
150	100	7.8	7.2	300
150	125	7.8	7.5	200
200	80	8.4	7.0	335
200	100	8.4	7.2	290
200	125	8.4	7.5	240
200	150	8.4	7.8	300
250	80	9.0	7.0	440
250	100	9.0	7.2	400
250	125	9.0	7.5	350
250	150	9.0	7.8	295
250	200	9.0	8.4	300
300	80	9.6	7.0	550
300	100	9.6	7.2	510
300	125	9.6	7.5	460
300	150	9.6	7.8	405
300	200	9.6	8.4	300
300	250	9.6	9.0	300
350	80	10.2	7.0	655
350	100	10.2	7.2	615
350	125	10.2	7.5	565
350	150	10.2	7.8	510
350	200	10.2	8.4	410
350	250	10.2	9.0	305
350	300	10.2	9.6	300
400	100	10.8	7.2	720
400	125	10.8	7.5	670
400	150	10.8	7.8	615
400	200	10.8	8.4	510
400	250	10.8	9.0	410
400	300	10.8	9.6	300
400	350	10.8	10.2	300
450	150	11.4	7.8	715
450	200	11.4	8.4	610
450	250	11.4	9.0	510
450	300	11.4	9.6	410
450	350	11.4	10.2	305
450	400	11.4	10.8	300
500	200	12.0	8.4	725
500	250	12.0	9.0	625
500	300	12.0	9.6	520
500	350	12.0	10.2	420
500	400	12.0	10.8	600
600	300	13.2	9.6	730
600	350	13.2	10.2	625
600	400	13.2	10.8	525
600	500	13.2	12.0	600
700	600	14.4	13.2	600
800	700	15.6	14.4	600
900	800	16.8	15.6	600
1000	900	18.0	16.8	600
1100	1000	19.2	18.0	600
1200	1000	20.4	18.0	790



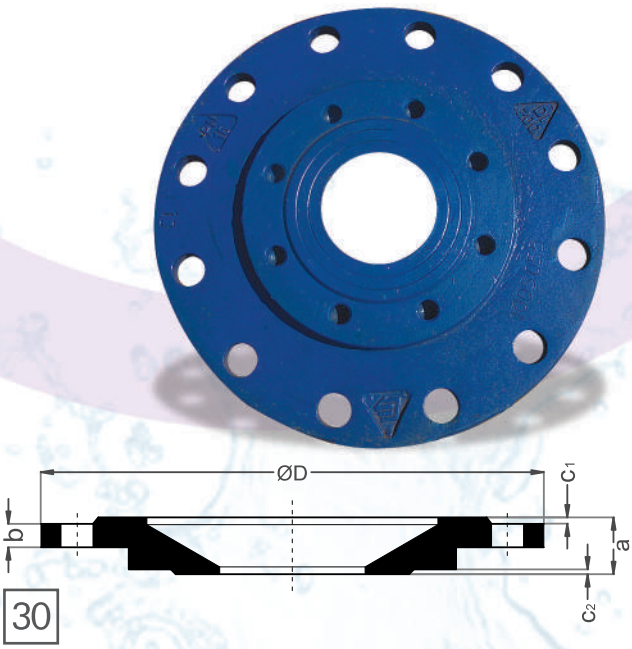
Double Flanged 90° Duck-Foot Bend

Nominal Size (DN) mm	e mm	L mm	C mm	D mm
80	7.0	165	110	180
100	7.2	180	125	200
150	7.8	220	160	250
200	8.4	260	190	300
250	9.0	350	225	350
300	9.6	400	255	400
350	10.2	450	290	450
400	10.8	500	320	500
450	11.4	550	355	550
500	12.0	600	385	600
600	13.2	700	450	700
700	14.4	810	515	800
800	15.6	915	580	900
900	16.8	1020	645	1000
1000	18.0	1130	710	1100
1100	19.2	1235	775	1200
1200	20.4	1340	840	1300



All Flanged Radial Tee

SIZE		e	A	B	H	L
Body DN	Branch dn					
mm	mm	mm	mm	mm	mm	mm
80	80	7.0	165	380	380	545
100	100	7.2	180	400	400	580
150	150	7.8	220	450	450	670
200	200	8.4	260	500	500	760
250	250	9.0	350	550	550	900
300	300	9.6	400	600	600	1000
350	350	10.2	450	650	650	1100
400	400	10.8	500	700	700	1200
450	450	11.4	550	750	750	1300
500	500	12.0	600	800	800	1400
600	600	13.2	700	900	900	1600
700	700	14.4	800	1000	1000	1800
800	800	15.6	900	1100	1100	2000
900	900	16.8	1000	1200	1200	2200
1000	1000	18.0	1100	1300	1300	2400
1100	1100	19.2	1200	1400	1400	2600
1200	1200	20.4	1300	1500	1500	2800

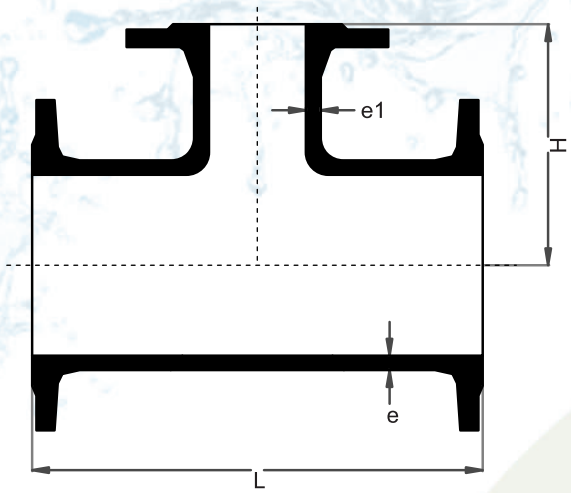


b = 10+0.035DN with a minimum value of 16

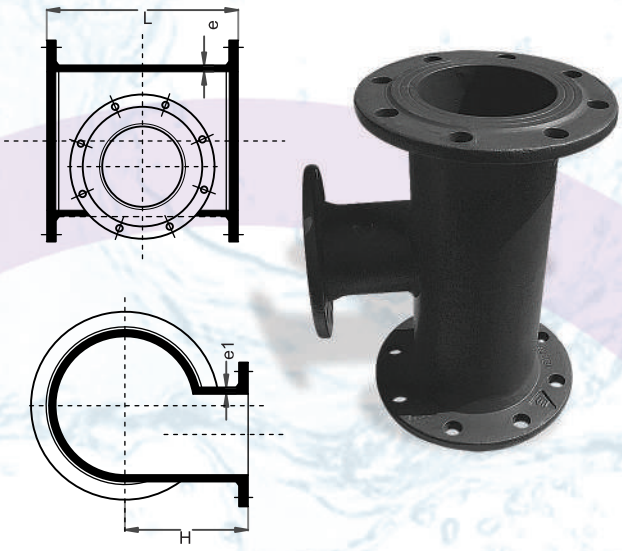
Reducing Flanges, Type PN16

Larger End				Smaller End		
Nominal Dia DN	D	b	C_1	Nominal Dia DN	C_2	a
mm	mm	mm	mm	mm	mm	mm
200	340	17.0	3	80	3	40
200	340	17.0	3	100	3	40
350	520	22.5	4	250	3	54
400	580	24.0	4	250	3	54
400	580	24.0	4	300	4	55
700	910	34.5	5	500	4	67
900	1125	41.50	5	700	5	73
1000	1255	45.00	5	700	5	73
1000	1255	45.00	5	800	5	77

All Flanged Tees

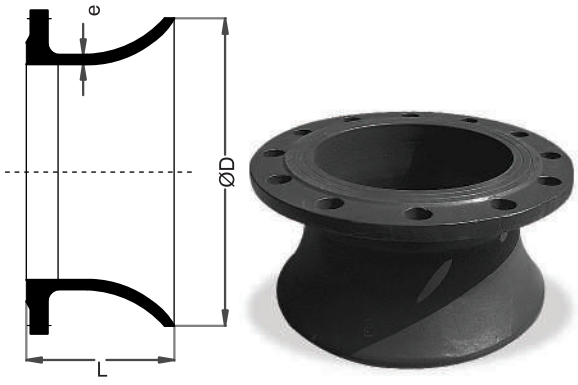


Nominal Diameter		e	e_1	L	H
Body DN	Branch dn				
mm	mm	mm	mm	mm	mm
80	80	7.0	7.0	330	165
100	80	7.2	7.0	360	175
100	100	7.2	7.2	360	180
125	80	7.5	7.0	400	190
125	125	7.5	7.0	400	200
150	80	7.8	7.0	440	205
150	100	7.8	7.2	440	210
150	150	7.8	7.8	440	220
200	80	8.4	7.0	520	235
200	100	8.4	7.2	520	240
200	150	8.4	7.8	520	250
200	200	8.4	8.4	520	260
250	80	9.0	7.0	700	265
250	100	9.0	7.2	700	275
250	150	9.0	7.8	700	300
250	200	9.0	8.4	700	325
250	250	9.0	9.0	700	350
300	80	9.6	7.0	800	290
300	100	9.6	7.2	800	300
300	150	9.6	7.8	800	325
300	200	9.6	8.4	800	350
300	250	9.6	9.0	800	375
300	300	9.6	9.6	800	400
350	80	10.2	7.0	850	325
350	100	10.2	7.2	850	325
350	150	10.2	7.8	850	325
350	200	10.2	8.4	850	325
350	250	10.2	9.0	850	325
350	300	10.2	9.6	850	425
350	350	10.2	10.2	850	425
400	80	10.8	7.0	900	350
400	100	10.8	7.2	900	350
400	150	10.8	7.8	900	350
400	200	10.8	8.4	900	350
400	250	10.8	9.0	900	350
400	300	10.8	9.6	900	450
400	400	10.8	10.8	900	450
450	100	11.4	7.2	950	375
450	150	11.4	7.8	950	375
450	200	11.4	8.4	950	375
450	250	11.4	9.0	950	375
450	300	11.4	9.6	950	475
450	350	11.4	10.2	950	475
450	400	11.4	10.8	950	475
450	450	11.4	11.4	950	475
500	100	12.0	7.2	1000	400
500	150	12.0	7.8	1000	400
500	200	12.0	8.4	1000	400
500	250	12.0	9.0	1000	400
500	300	12.0	9.6	1000	500
500	350	12.0	10.2	1000	500
500	400	12.0	10.8	1000	500
500	500	12.0	12.0	1000	500
600	100	13.2	7.2	1100	450
600	150	13.2	7.8	1100	450
600	200	13.2	8.4	1100	450
600	250	13.2	9.0	1100	450
600	300	13.2	9.6	1100	550
600	350	13.2	10.2	1100	550
600	400	13.2	10.8	1100	550
600	450	13.2	11.4	1100	550
600	500	13.2	12.0	1100	550
600	600	13.2	13.2	1100	550
700	200	14.4	8.4	650	525
700	400	14.4	10.8	870	555
700	700	14.4	14.4	1200	600
800	200	15.6	8.4	690	585
800	400	15.6	10.8	910	615
800	600	15.6	13.2	1350	645
800	800	15.6	15.6	1350	675
900	200	16.8	8.4	730	645
900	400	16.8	10.8	950	675
900	600	16.8	13.2	1500	705
900	900	16.8	16.8	1500	750
1000	200	18.0	8.4	770	705
1000	400	18.0	10.8	990	735
1000	600	18.0	13.2	1650	765
1000	1000	18.0	18.0	1675	825
1100	400	19.2	10.8	980	795
1100	600	19.2	13.2	1210	825
1200	1000	20.4	18.0	1700	945
1200	1200	20.4	20.4	1950	975



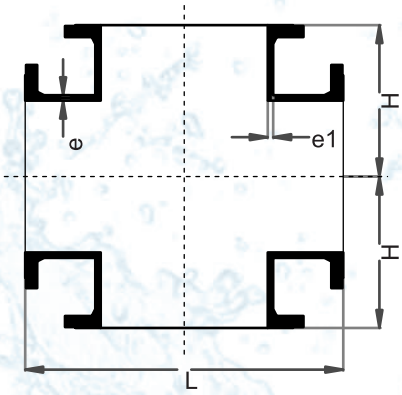
All Flanged Level Invert Tees

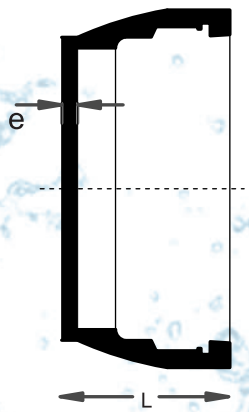
Nominal Diameter		e	e_1	L	H
Body DN	Branch dn				
mm	mm	mm	mm	mm	mm
80	80	7.0	7.0	330	165
100	80	7.2	7.0	360	175
125	80	7.5	7.0	400	190
150	80	7.8	7.0	440	205
150	100	7.8	7.2	440	210
200	80	8.4	7.0	520	235
200	100	8.4	7.2	520	240
200	150	8.4	7.8	520	250
250	80	9.0	7.0	700	265
250	100	9.0	7.2	700	275
250	150	9.0	7.8	700	300
250	200	9.0	8.4	700	325
300	80	9.6	7.0	800	290
300	100	9.6	7.2	800	300
300	150	9.6	7.8	800	325
300	200	9.6	8.4	800	350
300	250	9.6	9.0	800	375
350	80	10.2	7.0	850	325
350	100	10.2	7.2	850	325
350	150	10.2	7.8	850	325
350	200	10.2	8.4	850	325
350	250	10.2	9.0	850	325
350	300	10.2	9.6	850	425
400	80	10.8	7.0	900	350
400	100	10.8	7.2	900	350
400	150	10.8	7.8	900	350
400	200	10.8	8.4	900	350
400	250	10.8	9.0	900	350
400	300	10.8	9.6	900	450
450	100	11.4	7.2	950	375
450	150	11.4	7.8	950	375
450	200	11.4	8.4	950	375
450	250	11.4	9.0	950	375
450	300	11.4	9.6	950	475
450	350	11.4	10.2	950	475
450	400	11.4	10.8	950	475
500	80	12.0	7.0	1000	400
500	100	12.0	7.2	1000	400
500	150	12.0	7.8	1000	400
500	200	12.0	8.4	1000	400
500	250	12.0	9.0	1000	400
500	300	12.0	9.6	1000	500
500	350	12.0	10.2	1000	500
500	400	12.0	10.8	1000	500
500	450	12.0	11.4	1000	500
600	80	13.2	7.0	1100	450
600	100	13.2	7.2	1100	450
600	150	13.2	7.8	1100	450
600	200	13.2	8.4	1100	450
600	250	13.2	9.0	1100	450
600	300	13.2	9.6	1100	550
600	350	13.2	10.2	1100	550
600	400	13.2	10.8	1100	550
600	450	13.2	11.4	1100	550
600	500	13.2	12.0	1100	550
700	150	14.4	7.8	595	520
700	200	14.4	8.4	650	525
800	150	15.6	7.8	635	580
800	200	15.6	8.4	690	585
900	150	16.8	7.8	675	640
900	200	16.8	8.4	730	645
1000	300	18.0	9.6	880	720
1100	400	19.2	10.8	980	795
1100	600	19.2	13.2	1210	825
1200	800	20.4	15.6	1470	915
1200	1000	20.4	18.0	1700	945



Flanged Bell-mouth

Nominal SIZE mm	e mm	L mm	D mm
80	7.0	135	160
100	7.2	140	185
150	7.8	155	245
200	8.4	170	310
250	9.0	190	370
300	9.6	210	435
350	10.2	225	495
400	10.8	245	560
450	11.4	260	620
500	12.0	280	685
600	13.2	300	810
700	14.4	340	945
800	15.6	380	1055
900	16.8	420	1165
1000	18.0	440	1290
1100	19.2	465	1400
1200	20.4	490	1515



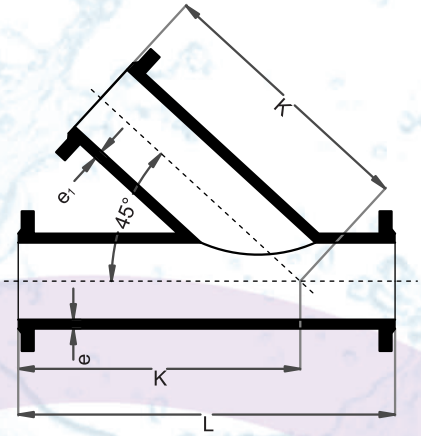


All Flanged Cross

Nominal Diameter		e	e_1	L	H
Body DN	Branch dn				
mm	mm	mm	mm	mm	mm
80	80	7.0	7.0	330	165
100	80	7.2	7.0	360	175
100	100	7.2	7.2	360	180
125	80	7.5	7.0	400	190
125	125	7.5	7.0	400	200
150	80	7.8	7.0	440	205
150	100	7.8	7.2	440	210
150	150	7.8	7.8	440	220
200	80	8.4	7.0	520	235
200	100	8.4	7.2	520	240
200	150	8.4	7.8	520	250
200	200	8.4	8.4	520	260
250	80	9.0	7.0	700	265
250	100	9.0	7.2	700	275
250	150	9.0	7.8	700	300
250	200	9.0	8.4	700	325
250	250	9.0	9.0	700	350
300	80	9.6	7.0	800	290
300	100	9.6	7.2	800	300
300	150	9.6	7.8	800	325
300	200	9.6	8.4	800	350
300	250	9.6	9.0	800	375
300	300	9.6	9.6	800	400
350	100	10.2	7.2	850	325
350	150	10.2	7.8	850	325
350	200	10.2	8.4	850	325
350	250	10.2	9.0	850	325
350	300	10.2	9.6	850	425
350	350	10.2	10.2	850	425
400	100	10.8	7.2	900	350
400	150	10.8	7.8	900	350
400	200	10.8	8.4	900	350
400	250	10.8	9.0	900	350
400	300	10.8	9.6	900	450
400	350	10.8	10.2	900	450
400	400	10.8	10.8	900	450
450	100	11.4	7.2	950	375
450	150	11.4	7.8	950	375
450	200	11.4	8.4	950	375
450	250	11.4	9.0	950	375
450	300	11.4	9.6	950	475
450	350	11.4	10.2	950	475
450	400	11.4	10.8	950	475
450	450	11.4	11.4	950	475
500	100	12.0	7.2	1000	400
500	150	12.0	7.8	1000	400
500	200	12.0	8.4	1000	400
500	250	12.0	9.0	1000	400
500	300	12.0	9.6	1000	500
500	350	12.0	10.2	1000	500
500	400	12.0	10.8	1000	500
500	450	12.0	11.4	1000	500
500	500	12.0	12.0	1000	500
600	100	13.2	7.2	1100	450
600	150	13.2	7.8	1100	450
600	200	13.2	8.4	1100	450
600	250	13.2	9.0	1100	450
600	300	13.2	9.6	1100	550
600	350	13.2	10.2	1100	550
600	400	13.2	10.8	1100	550
600	450	13.2	11.4	1100	550
600	500	13.2	12.0	1100	550
600	600	13.2	13.2	1100	550
700	700	14.4	14.4	1200	600
800	800	15.6	15.6	1350	675
900	900	16.8	16.8	1500	750
1000	1000	18.0	18.0	1650	825
1100	1100	19.2	19.2	1780	890
1200	1200	20.4	20.4	1950	975

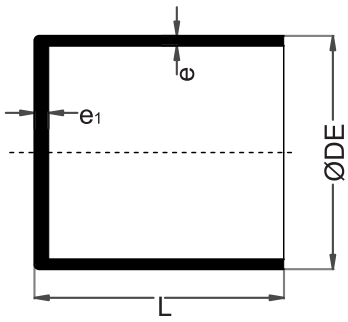
End Caps

SIZE Body DN mm	e mm	L mm
80	18	128
100	18	128
125	18	128
150	18	128
200	18	138
250	20	146
300	23	156
350	24	158
400	25	163
450	26	167
500	27	173
600	30	184
700	31	221
800	33	236
900	35	258
1000	37	270
1100	39	277
1200	41	306



All Flanged 45° Angle Branch

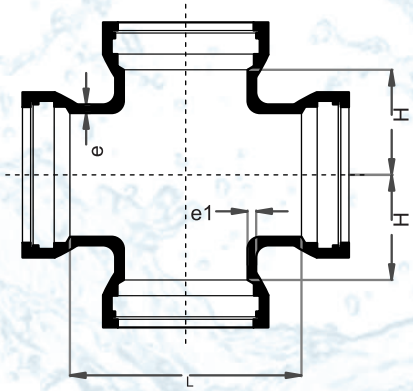
Nominal Diameter		e	e1	K	L
Body DN	Branch dn				
mm	mm	mm	mm	mm	mm
80	80	7.0	7.0	375	500
100	80	7.2	7.0	390	500
100	100	7.2	7.2	405	540
150	80	7.8	7.0	480	590
150	100	7.8	7.2	480	640
150	150	7.8	7.8	480	640
200	80	8.4	7.0	535	635
200	100	8.4	7.2	535	635
200	150	8.4	7.8	560	735
200	200	8.4	8.4	560	735
250	80	9.0	7.0	585	660
250	100	9.0	7.2	610	710
250	150	9.0	7.8	640	830
250	200	9.0	8.4	640	830
250	250	9.0	9.0	640	830
300	80	9.6	7.0	610	685
300	100	9.6	7.2	610	685
300	150	9.6	7.8	660	790
300	200	9.6	8.4	685	865
300	250	9.6	9.0	715	930
300	300	9.6	9.6	715	930
350	100	10.2	7.2	635	685
350	150	10.2	7.8	660	740
350	200	10.2	8.4	710	840
350	250	10.2	9.0	740	880
350	300	10.2	9.6	790	880
350	350	10.2	10.2	790	880
400	100	10.8	7.2	710	760
400	150	10.8	7.8	740	815
400	200	10.8	8.4	760	865
400	250	10.8	9.0	820	970
400	300	10.8	9.6	870	970
400	350	10.8	10.2	870	970
400	400	10.8	10.8	870	970
450	100	11.4	7.2	710	740
450	150	11.4	7.8	760	840
450	200	11.4	8.4	790	890
450	250	11.4	9.0	820	990
450	300	11.4	9.6	900	1040
450	350	11.4	10.2	950	1060
500	150	12.0	7.8	765	790
500	200	12.0	8.4	810	890
500	250	12.0	9.0	840	940
500	300	12.0	9.6	865	990
500	350	12.0	10.2	950	1065
600	150	13.2	7.8	840	890
600	200	13.2	8.4	890	940
600	250	13.2	9.0	915	990
600	300	13.2	9.6	965	1090
700	300	14.4	9.6	1090	1170
800	300	15.6	9.6	1170	1200
900	400	16.8	10.8	1315	1410
1000	400	18.0	10.8	1415	1485
1100	400	19.2	10.8	1515	1560
1100	450	19.2	11.4	1550	1625
1200	450	20.4	11.4	1700	1780
1200	500	20.4	12.0	1750	1880



Plug

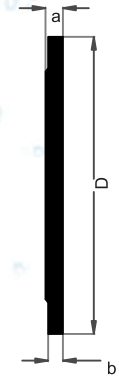
SIZE				
Body DN	DE	e	e1	L
mm	mm	mm	mm	mm
80	98	7.0	18.0	200
100	118	7.2	18.0	200
150	170	7.8	18.0	225
200	222	8.4	18.0	250
250	274	9.0	19.5	250
300	326	9.6	23.0	275
350	378	10.2	24.0	275
400	429	10.8	25.0	275
450	480	11.4	26.0	275
500	532	12.0	27.0	275
600	635	13.2	29.5	300
700	738	14.4	31.0	300
800	842	15.6	33.0	300
900	945	16.8	35.0	325
1000	1048	18.0	37.0	350
1100	1152	19.2	39.0	375
1200	1255	20.4	41.0	400

All Socket Cross



SIZE		e	e_1	L	H
Body DN mm	Branch dn mm	mm	mm	mm	mm
80	80	7.0	7.0	170	85
100	80	7.2	7.0	170	95
100	100	7.2	7.2	190	95
150	150	7.8	7.8	255	125
200	80	8.4	7.0	175	145
200	100	8.4	7.2	200	145
200	150	8.4	7.8	255	150
200	200	8.4	8.4	315	155
250	80	9.0	7.0	180	170
250	100	9.0	7.2	200	170
250	150	9.0	7.8	260	175
250	200	9.0	8.4	315	180
250	250	9.0	9.0	375	190
300	80	9.6	7.0	180	195
300	100	9.6	7.2	205	195
300	150	9.6	7.8	260	200
300	200	9.6	8.4	320	205
300	250	9.6	9.0	380	215
300	300	9.6	9.6	435	220
350	100	10.2	7.2	205	220
350	150	10.2	7.8	265	225
350	200	10.2	8.4	325	230
350	250	10.2	9.0	380	240
350	300	10.2	9.6	440	245
350	350	10.2	10.2	495	250
400	100	10.8	7.2	210	245
400	150	10.8	7.8	270	250
400	200	10.8	8.4	325	255
400	250	10.8	9.0	385	265
400	300	10.8	9.6	440	270
400	400	10.8	10.8	560	280
500	100	12.0	7.2	215	295
500	150	12.0	7.8	275	300
500	200	12.0	8.4	330	305
500	250	12.0	9.0	390	315
500	300	12.0	9.6	450	320
500	400	12.0	10.8	565	330
500	500	12.0	12.0	680	340
600	200	13.2	8.4	340	355
600	400	13.2	10.8	570	380
600	600	13.2	13.2	800	400
700	200	14.4	8.4	345	405
700	400	14.4	10.8	575	430
700	600	14.4	13.2	810	450
700	700	14.4	14.4	925	460
800	200	15.6	8.4	350	455
800	400	15.6	10.8	580	480
800	600	15.6	13.2	815	500
800	800	15.6	15.6	1045	525
900	200	16.8	8.4	355	505
900	400	16.8	10.8	590	530
900	600	16.8	13.2	820	550
900	800	16.8	15.6	1050	575
900	900	16.8	16.8	1170	585
1000	200	18.0	8.4	360	555
1000	400	18.0	10.8	595	580
1000	600	18.0	13.2	825	600
1000	800	18.0	15.6	1060	625
1000	1000	18.0	18.0	1290	645
1100	400	19.2	10.8	600	630
1100	600	19.2	13.2	830	650
1100	800	19.2	15.6	1065	675
1100	1000	19.2	18.0	1295	695
1100	1100	19.2	19.2	1410	705
1200	600	20.4	13.2	840	700
1200	800	20.4	15.6	1070	725
1200	1000	20.4	18.0	1300	745
1200	1200	20.4	20.4	1535	765

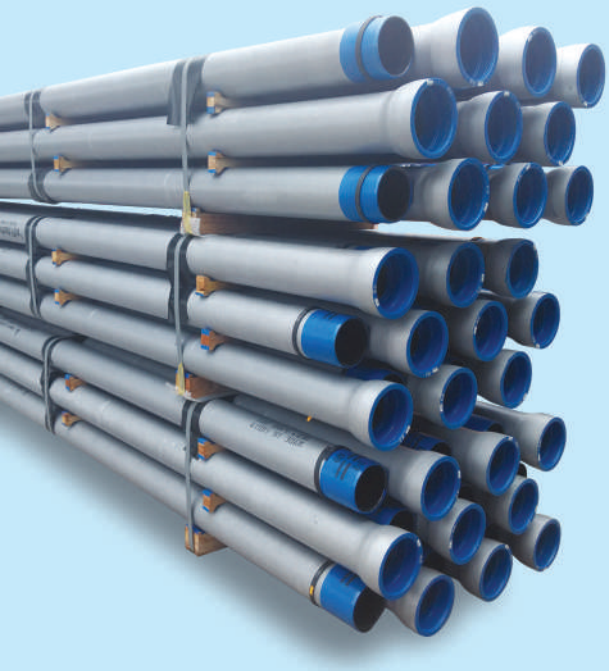
Blank Flanges, Type PN16



(80-600 mm)

(700-1200 mm)

DN mm	D mm	a mm	b mm	c mm
80	200	19.0	16.0	3
100	220	19.0	16.0	3
125	250	19.0	16.0	3
150	285	19.0	16.0	3
200	340	20.0	17.0	3
250	400	22.0	19.0	3
300	455	24.5	20.5	4
350	520	26.5	22.5	4
400	580	28.0	24.0	4
450	640	30.0	26.0	4
500	715	31.5	27.5	4
600	840	36.0	31.0	5
700	910	39.5	34.5	5
800	1025	43.0	38.0	5
900	1125	46.5	41.5	5
1000	1255	50.0	45.0	5
1100	1355	53.5	48.5	5
1200	1485	57.0	52.0	5



External Protection

1. Protection system for pipes

a) Metallic Zinc or Zinc Aluminium alloy coating with following options:

- Metallic Zinc coating having a mass of 130gm/m^2 or 200 gm/m^2 or 400 gm/m^2.
- Zinc Aluminium alloy coating having a mass of 200 gm/m^2 or 400 gm/m^2.

The Metallic Zinc or Zinc Aluminium alloy coating is covered with a finishing layer of bitumen or Epoxy.

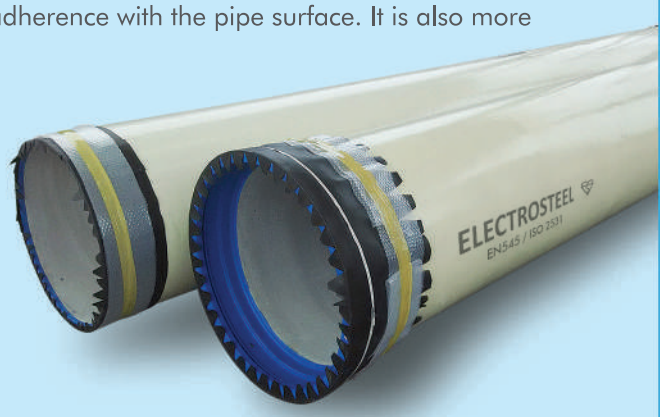
b) Aluminium pigmented Bitumen Aluminium pigmented Bitumen - Normally applied over Zinc inner coating

c) Epoxy coating : Normally applied over metallic coating as a finishing coat. Compared to normal bitumen coated pipes it offers:

- More resistance to external galvanic/soil corrosion in aggressive soil.
- More resistance to external chemical (acid, alkali, organic) attack.
- Higher scratch resistance. So more resistant to coating damage during transportation/Handling /laying.
- The coating comes in attractive blue/green (for water) or red (for sewerage) colour. Hence offers much better look and aesthetics.

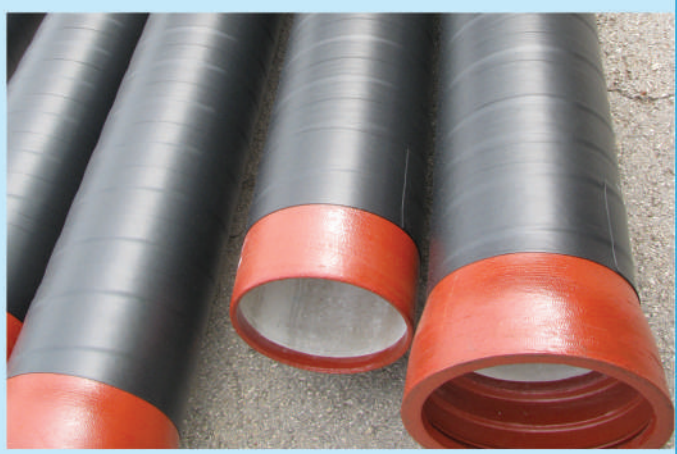
d) Polyethylene Sleeving : Loose Polyethylene encasement is very effective for protection of Ductile Iron Pipes and Fittings in corrosive environments and widely practiced in USA, Europe and Australia. Investigation of many field installations, where loose polyethylene encasement has been used as protection for Cast Iron and Ductile Iron pipelines indicates a high degree of protection even in the highly corrosive soils. The dielectric capability of polyethylene provides shielding for Ductile Iron Pipes and Fittings from stray direct current at most levels encountered in the field.

e) Polyurethane Coating: Polyurethane Coating is normally factory applied on prepared pipe surface. It is a factory applied coating system with better resistance to external galvanic/ soil corrosion in aggressive soil. It has high impact strength, high scratch resistance. and good adherence with the pipe surface. It is also more



resistant to external chemical (acid, alkali , organic) attack offering better service life in aggressive external condition .

f) PE tape Wrapping: In highly aggressive soil conditions, additional external protection in the form of a spirally applied anti-corrosion mastic tape may be required. The tape wrap provides high electrical resistance and excellent corrosion protection in highly aggressive environments. The pipe is wrapped from just behind the socket to just prior to the spigot insertion marks. Wrapping can be provided with either a 25mm or 55% overlap. After jointing the jointing area is also wrapped.



Soil Corrosivity	Typical Ground Conditions Pipes	Protection System Pipes
Slight to moderately aggressive	*Soil resistivity above 2500 ohm.cm *Soil resistivity between 1500 and 2500 ohm.cm without water table	Metallic Zinc(130 to 200gms/ m^2 min.) with Bitumen or Epoxy as finishing layer
Aggressive	*Soil resistivity between 1500 & 2500 ohm.cm with water table *Soil resistivity between 500 and 1500 ohm.cm without water table	* Metallic Zinc-Aluminium alloy (400gms/m^2) or * Metallic Zinc(200gms/m^2 min.) with Bitumen or Epoxy as finishing layer, PE sleeving recommended
Highly aggressive	*Soil resistivity below 500 ohm.cm without water table *Soil resistivity below 1500 ohm.cm with water table *Ground with light chemical contamination *Stray electrical currents	Coating for Aggressive soil plus tape wrap 25mm overlap) Alternately Polyeurethane (coating (Min. 750 micron)
Special condition	*Soil resistivity below 500 ohm.cm with water table *Ground containing clinker, bricks, flints etc.likely to cause mechanical damage *Ground with heavy chemical contamination *Tidal water e.g. estuaries, shorelines	Coating for Aggressive soil plus tape wrap (55% overlap) or Polyeurethane coating (Min. 1000 micron)

Note : The above table is only for guidance. User should decide the type of coating depending on prevailing site condition.

2. Protection system for fittings

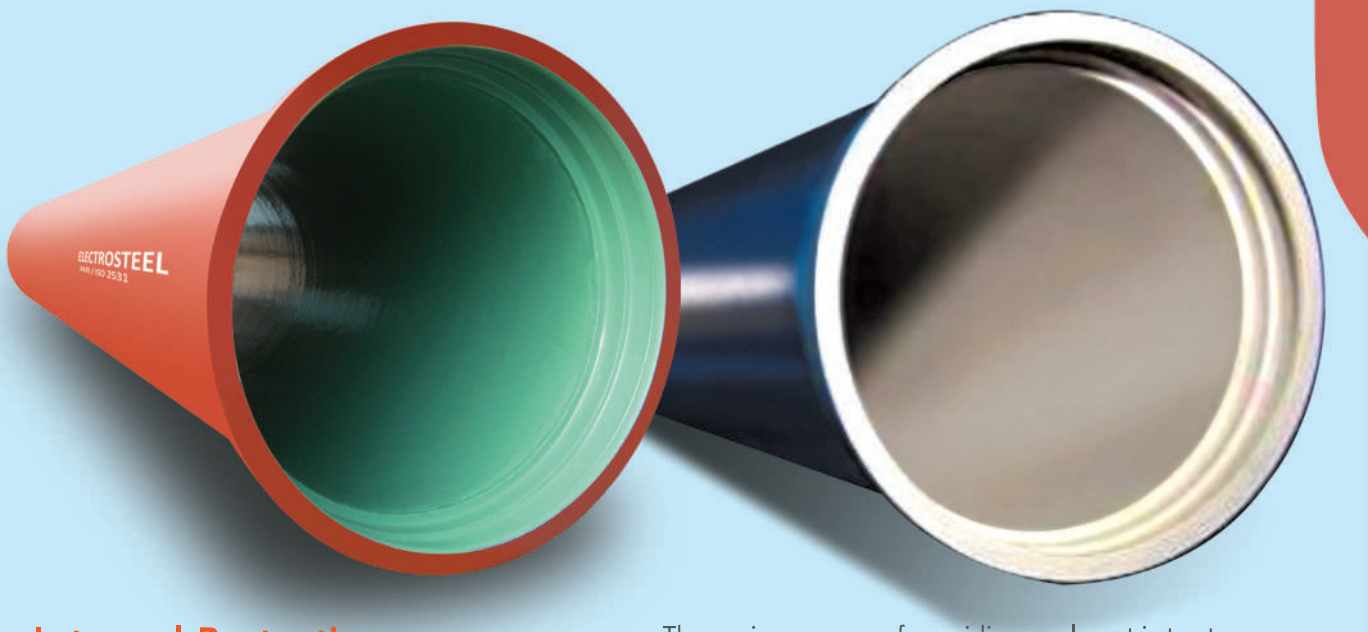
a) Zinc rich paint and finishing layer of bituminous paint or liquid epoxy
b) External polyethylene sleeving
c) Fusion Bonded Epoxy Coating
d) Polyurethane Coating

Fusion Bonded Epoxy Coating

FBE coating is applied in a state-of-the-art automated facility to coat DI fittings with powdered epoxy by fusion bonding process. This inert coating in attractive colours is suited for aggressive soil condition.

Advantage

- Gives high Gloss and smooth coatings with excellent adhesion
- Difficult shapes can be coated evenly,
- Provides enhanced corrosion restraint properties
- A choice of Blue or Red colour for water or sewage applications is available
- Film thickness of 250 micron, can be specified as per EN:14901
- Higher film thickness (above 250 micron) can also be applied as per customer requirement.



Internal Protection

1. Protection system for pipes

a) Cement Mortar Linings

Pipes are generally supplied with centrifugally applied cement mortar lining. This lining creates a mildly alkaline environment at the internal metal surface and protects the pipe from corrosion and tuberculation.

The different types of cement Lining offered are:

- Blast Furnace slag cement
- Sulphate resistant cement
- High Alumina Cement for sewage pipes

Water Characteristics	Portland Cement	Sulfate Resisting Cement	High Alumina Cement
Min value of pH	6	5.5	4
Max, content (mg/L)$C0^2$	7	15	No limit
Sulfate ($S0_4^-$)	400	3000	No limit
Magnesium (Mg^{++})	100	500	No limit
Ammonium (NH_4^+)	30	30	No limit

Advantages of Cement Mortar Lining (CML)

- Centrifugally applied CML provides a higher Hazen William's C value of 140 compared to 100 for bare metallic pipes.
- Reduces frictional head loss and pumping cost.
- CML passivates the pipe wall against corrosion through the alkaline reaction of cement.
- CML prevents pitting and tuberculation of pipes
- CML helps to maintain the same for area and coefficient of friction over a long period of time.

b) Seal coat on cement mortar lining

Seal coats if specified are applied on the inside cement mortar lined surface of D.I. Pipes. Mainly two types of seal are offered :

- Bituminous seal coat
- Epoxy seal coat

The main purpose of providing seal coat is to stop leaching of cement compounds from the linings, affecting the water's pH and causing alkalinity to increase.

c) Ceramic Epoxy

Ceramic epoxy lining is a specialized lining which offers a hard and stable surface with high abrasion resistance. Mainly used for sewage conveyance or ash slurry conveyance or for conveying corrosive fluids. It is sold in our brand name 'Electrotuf'.

d) Polyurethane lining

PU internal lining consists of two-component, solvent-free, 100% solid polyurethane material, which has very good corrosion resistance and wear resistance property. Because of its smooth surface it has excellent smoothness offering very little resistance to water flow which saves pumping cost. It has good impact resistance and surface adherence. It also shows high resistance to internal chemical attack.

Sl	Fluid Condition	Lining for Pipes
1	Potable Water/ Raw water with negative Langelier Index (alkalinity between 25 and 250 ppm $CaCO_3$) and pH between 5.5 and 13 content in the input water.	Cement Mortar Lining with Blast Furnace Slag Cement or Sulphate resistant Cement, depending on sulphate
2	Domestic Sewage High Sulphate content > 3%	Sulphate Resisting Cement Lining
3	Very Soft Water with negative Langelier Index (alkalinity below 25 ppm $CaCO_3$).	Sulphate Resisting Cement Lining or Blast Furnace Slag Cement with Seal Coat (Preferably with epoxy).
4	Sewage and Industrial Effluent having pH Minimum 3 to max 13 with aggressive CO_2, Sulphates> 3000 mg/l, Magnesium >500 mg/l, and Ammonium >30 mg/l	High Alumina Cement Mortar Lining
5	Sea Water and Ash Slurry	High Alumina Cement Mortar Lining

2. Protection system for fittings

a) Cement Mortar Lining

By agreement between manufacturer and purchaser, any one of the lining may be applied depending on the type of liquid transported:

- Blast furnace slag cement mortar
- Sulphate resistant cement mortar
- High alumina cement mortar. If required by the customer, Fittings with bituminous or epoxy seal coat over cement mortar is also supplied.

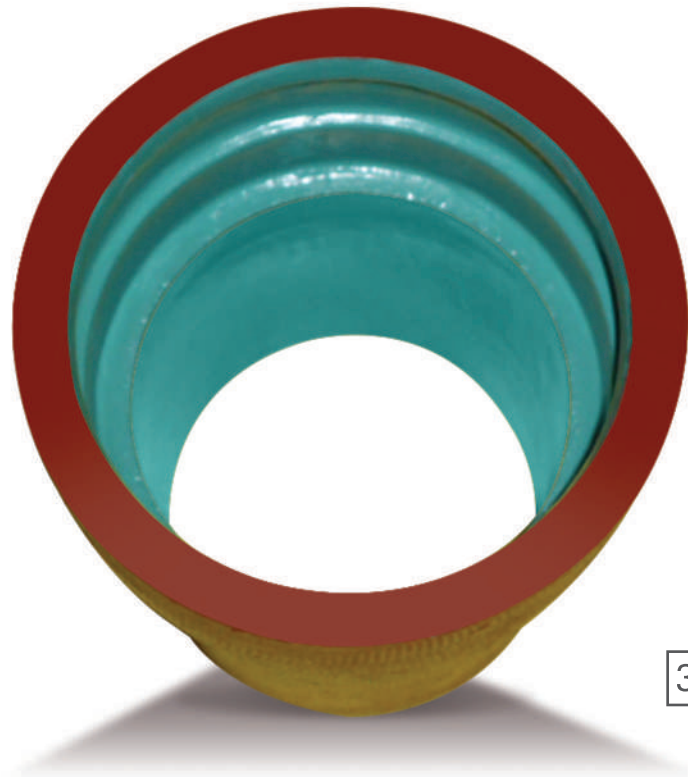
b) Fusion Bonded Epoxy

- Normally Fusion bonded epoxy is applied both on the outer and inner surface of the fittings

c) Ceramic Epoxy

- Ceramic epoxy lining is also applied inside fittings which are to be used with ceramic epoxy lined pipes.

All material coming in contact with potable water are certified by various approving agencies like WRAS, DWI, ACS, HY etc.



Relevant Standards

Please note that the recommendations in this catalog only highlights the important points of the standards. Customers should study the following standards thoroughly for the selection specification, installation and testing. They must also refer to our User Guide for details regarding do's and dont's, handling, laying and installation.

Sl	Standard	Description
1	EN 545	Ductile iron pipes, fittings, accessories and their joints for water pipelines requirements and test methods.
2	ISO 2531	Ductile iron pipes, fittings, accessories and their joints for water or gas applications.
3	EN 598	Ductile iron pipes, fittings, accessories and their joints for sewerage application-requirements and test methods.
4	ISO 7186	Ductile iron products for sewerage applications.
5	ISO 8179	Ductile iron pipes: external zinc coating. Part 1: Metallic Zinc with finishing layer. Part 2: Zinc rich paint with finishing layer.
6	ISO 4179	Ductile iron pipes for pressure and non-pressure pipelines - centrifugal cement mortar lining-General requirements.
7	EN 681 -1	Elastomeric seals - materials requirements for pipe joint seals used in water and drainage applications. Part-1 : Vulcanized rubber
8	ISO 4633	Rubber seals-joint rings for water supply, drainage and sewerage pipelines-specification for materials.
9	BS 6076	Specification for tubular polyethylene film for use as protective sleeving for buried iron pipes and fittings.
10	ISO 8180	Ductile iron pipes-polyethylene sleeving.
11	BS 8010	Pipelines on land: design, construction and installation. Section 2.1: Ductile iron.
12	ISO 10802	Ductile iron pipelines - hydrostatic testing after installation.
13	ISO 10803	Design method for ductile iron pipes.
14	EN 1092	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Part 2: Cast iron flanges.
15	EN 1514	Flanges and their joints. Dimension of gaskets for PN-designated flanges. Part 1: Non-metallic flat gaskets with or without inserts. Part 2 : Spiral bound gaskets for use with steel flanges. Part 3 : Non-metallic PTFE envelope gaskets. Part 4: Corrugated, flat or grooved metallic and filled metallic gaskets for use with steel flanges.
16	ISO 7005	Metallic flanges - Cast iron flanges.
17	AWWA C151	Ductile Iron Pipe, Centrifugal ly Cast, for water.
18	AWWA C600	Installation of Ductile Iron Water Mains and their Appurtenances.

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