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steel, tube and pipe

Ductile Iron Pipe and Fittings

We supply technical advice to ensure the right solution for specific projects

We work very closely with Engineers and Contractors

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About Robor

A world-class manufacturer

Established in 1922, Robor is a world-class South African manufacturer and supplier of welded steel tube and pipe, cold formed steel profiles and associated value added products. We have built a reputation on quality products, a customer-centric philosophy, and a focus on perfecting service levels.

As one of the largest steel tube and pipe manufacturers in Southern Africa, Robor is active in most industries, including mining, transport – rail and road, construction, engineering, manufacturing, agriculture, energy, water and automotive. We also have the capability to manufacture specialized items suited to the unique requirements of these markets.

A culture of innovation and service excellence

Robor's reputation and expertise have enabled the company to cement its place in local and global markets. A top priority for Robor is product innovation and service enhancement. Robor has added Ductile Iron pipe and fittings to its product range due to the extensive benefits they can add to any water solution projects undertaken by Engineers, Municipalities, Contractors and Water Authorities. Benefits of ductile iron pipe include corrosion resistance, long life, and ease of laying and cost.

To date Robor have supplied more than 100km of Ductile Iron Pipe in Southern Africa, ranging from DN80 to DN700 pipe sizes.

Value added services

Robor is ISO 9001 accredited, ensuring high quality production standards in every phase of the manufacturing process. Through constant product innovation and service enhancement, Robor strives to continually improve its product and service offerings.

Our Ductile Iron Pipe complies with ISO:2531, BSEN545 and BSEN598 standards, accredited with ISO 9001 and ISO 14001 certification at the manufacturers facilities.

The manufacturer has BSI, Kitemark licenses and also has DWi (UK Drinking water inspectorate) approval and certification.

Why Specify Ductile Iron Piping? *

Summary

In most parts of the developed and undeveloped world Ductile Iron has for decades been the favoured piping material.

The product is favored by Engineers, Municipalities, Water Authorities and Contractors for properties such as corrosion resistance, maintenance-free, long life, robustness, ease of laying, no comebacks and overall economy of contract.

Due to lack of product range and application information, Ductile Iron piping is currently not well known in South Africa.

Robustness

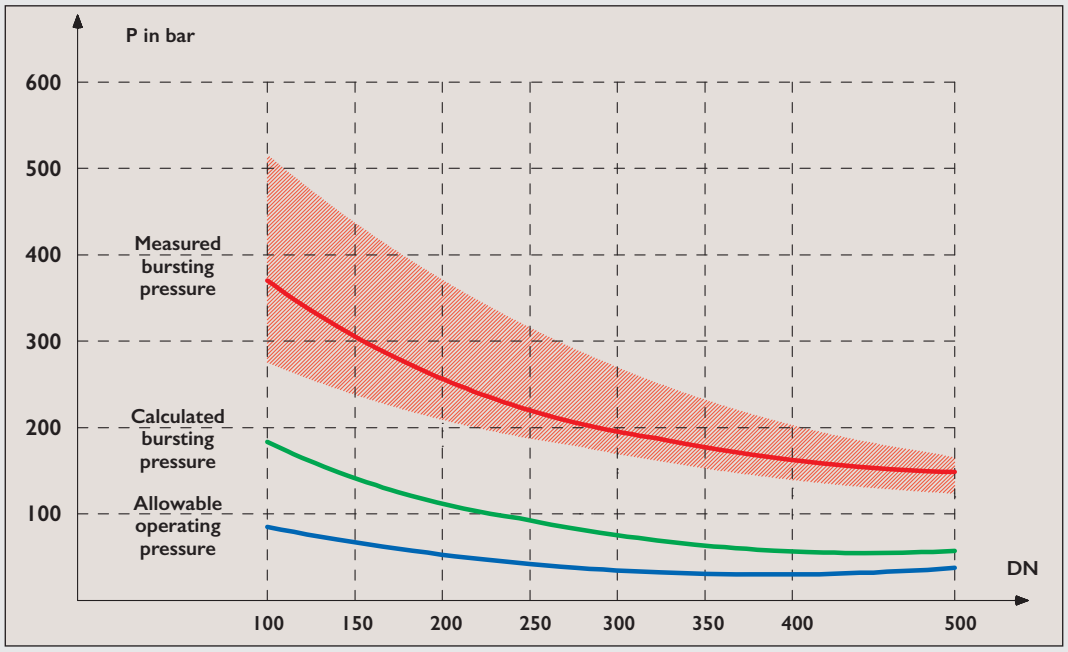
Ductile Iron Piping is the most robust pipe on the market and is exceptionally well suited to the uniqueness of South African installation conditions. It is generally accepted that it is not possible for the site engineer to supervise each and every individual construction action taking place on a site. With the robustness of Ductile Iron piping it is his guarantee against pipe failures because of improperly constructed pipe beddings, backfill which was not properly compacted or pipe jointing that leaks.

Safety Margins

All piping systems have built in safety margins.
Only Ductile Iron has a large enough margin
that could effectively cope with totally unforeseen circumstances.

The following graph illustrates the safety margin of
Ductile Iron Pipes with regards to internal water pressure ratings.

K9 Pipes Operating Pressures Versus Bursting Pressures



* Refers to article presented at the WISA 2000 Biennial Conference, Sun City South Africa, 28 May – 1 June 2000.

As an example, a DN 500 pipe is designed to withstand a maximum permissible pressure of 32 bar. In reality bursting tests carried out on these pipes show that bursting pressures close to 130 bar are obtained, i.e. an effective safety factor of 4.

The resistance to unforeseen external loads is another special attribute of Ductile Iron Pipes. This not only allows the pipe to be laid in rocky or heaving soil but affords a large margin of safety when future construction machinery and traffic loads have to be accommodated.

As a bonus a safety feature is that Ductile Iron is one of the most difficult pipes to which illegal water connections could be made.

Mechanical Properties

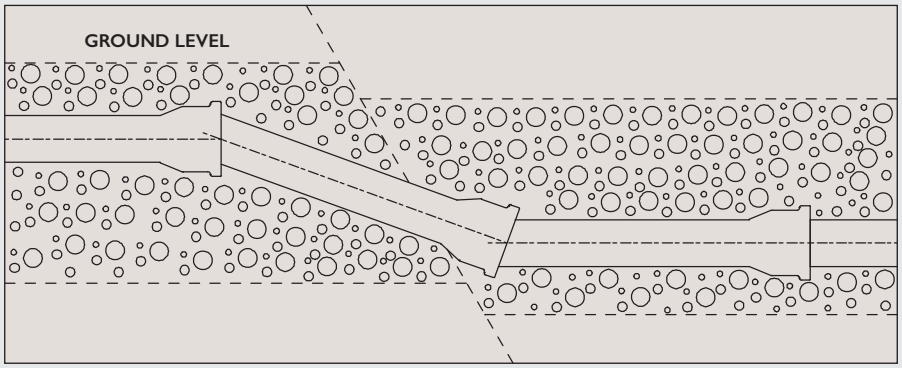
The materials Ductile Iron and Steel have a major advantage over synthetic pipe materials, as they do not deteriorate with age.

Ductile iron again has an advantage over steel because of its unique corrosion resistance, which ensures a long and useful life span.

The linear coefficient of thermal expansion of the Ductile Iron is 11 x 10 m/m/°C, a value virtually identical to that of the cement mortar lining 12 x 10 m/m/°C, thus eliminating the risk of crack formation through differential thermal expansion.

Ground Movement

Ductile Iron Pipes can accommodate the greatest amount of ground movement of all types of pipe materials. This is due to the angular deflection that the joints can undergo without leaking, combined with the mechanical strength of the pipe itself.



Ease of Laying

The robustness of the pipe together with the push-fit joint makes Ductile Iron one of the easiest pipelines to lay.

All that is generally required is a back actor to dig the trench, lower the pipe into the trench and with the back of the bucket, push the spigot end into the socket to achieve an absolute watertight joint.

The pipe is ideal for South-African conditions since apart from foreman and the machine operator, local labour can be used to level the trench and assist with the laying and backfill. The sealing of the joint is extremely reliable. Destructive tests have shown that the joint never leaks or bursts. The joint furthermore has a very good resistance to internal vacuum conditions.

The Cost Factor

Ductile Iron Pipes never require:

- Cathodic protection systems
- On-site welding and reinstatement of linings and coatings.

The cost requirements for Ductile Iron Pipes are less than for any other pipe material as far as the following is concerned:

- The importation or construction of pipe beddings.
- Selection or compaction of backfill
- On-site repair work of coating and lining caused through handling.

Further substantial savings can be achieved by laying Ductile Iron Pipes to follow horizontal or vertical curves and thereby omitting the cost of pipe bends and anchor blocks.

Technical Specifications

Type of Pipe and Pipe Classes

Type of Pipe	Ductile Iron Pipe • With socket & Spigot ends suitable for Push-on-Joint • With Plain ends • With Restrained joint • With Flanged joint
Class of Pipe	C20, C25, C30, C40, C50, C64, C100, Class K7 & K9, BS EN 598 – Pressure class
Size Range	DN 80mm to DN 2200mm
Standard Length	5.5m / 6.0m
Conforming Specifications	ISO 2531 ISO 7186 BS EN 545: 2010 and EN 545: 2006 BS EN 598

Wall Thickness

DIMENSIONAL DETAILS

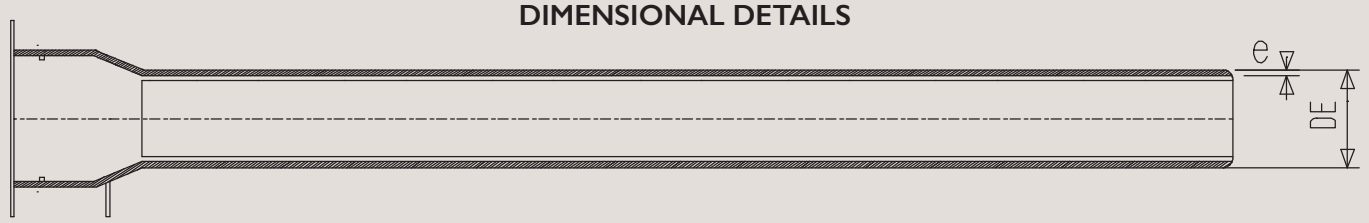


Table 1: Nominal thickness chart for various classes of push on joint Ductile Iron Pipes.

DN (mm)	EXTERNAL DIAMETER DE (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	6.5	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 / -3.1				**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	8.4	10.8
800	842	+1 / -4.5	8.1	**9.6**	11.1	14.0	16.9	21.0		10.4	9.1	11.7
900	945	+1 / -4.8	8.9	**10.6**	12.3	15.5	18.8	23.4		11.2	9.8	12.6
1000	1048	+1 / -5.0	9.8	**11.6**	13.4	17.1	20.7			12.0	10.5	13.5
1100	1152	+1 / -5.8	10.6	**12.6**	14.7	18.7	22.7			14.4	11.2	14.4
1200	1255	+1 / -6.0	11.4	**13.6**	15.8	20.2				15.3	11.9	15.3
1400	1462	+1 / -6.6	13.1	**15.7**	18.2					17.1		17.1
1500	1565	+1 / -7.0	13.9	**16.7**	19.4					17.9		18.0
1600	1668	+1 / -7.4	14.8	**17.7**	20.6					18.9		18.9
1800	1875	+1 / -8.2	16.4	**19.7**	23.0					20.7		20.7
2000	2082	+1 / -9.0	18.1	**21.8**	25.4					22.5		22.5
2200	2288	+1 / -	19.8	**23.8**								24.3

Pressure Rating

Allowable Pressure for Ductile Iron Pipes with Push on Joints						
DN (mm)	Class K9			Class C		
	PFA	PMA	PEA	PFA	PMA	PEA
80	64	77	96	40	48	53
100	64	77	96	40	48	53
150	64	77	96	40	48	53
200	62	74	79	40	48	53
250	54	65	70	40	48	53
300	49	59	64	40	48	53
350	45	54	59	30	36	41
400	42	51	56	30	36	41
450	40	48	53	30	36	41
500	38	46	51	30	36	41
600	36	43	48	30	36	41
700	34	41	46	25	30	35
750	33	39	44	25	30	35
800	32	38	43	25	30	35
900	31	37	43	25	30	35
1000	30	36	41	25	30	35

PFA (Allowable Operating Pressure): Internal pressure, excluding a surge, that a component withstands in permanent service.

PMA (Allowable Maximum Operating Pressure): Maximum internal pressure, including a surge, that a component can safely withstand in service.

PEA (Allowable Test Pressure): Maximum hydrostatic site test pressure that a newly installed component can withstand for a relatively short duration, when either fixed above ground level or laid backfilled underground, in order to measure the integrity and leak tightness of the pipe.

Internal Lining

Ductile Iron pipes installed in water systems today are normally provided with a cement mortar lining. Use of cement lining of the pipe avoids tuberculation by creating a high pH at the pipe wall, and ultimately by providing a physical barrier to the flow water to contact with the pipewall. Further, these linings are also smooth, which results in high flow coefficients with Haizen-William's 'C' as 140. In the case of sewerage applications, suitable lining will provide corrosive resistance to septic transformation (cycle of Sulphates Sulphuric acid) to avoid severe corrosion to the pipe wall. The advantage of internal cement mortar lining is:

- Internal Protection of pipe wall against fluid aggressiveness
- Improvement and performance of pipe flow characteristics
- For potable water pipelines, assurance of keeping water quality within specified limits.
- Withstand against corrosion due to septic transformations. Various types of lining applied for Ductile Iron Pipes and its applications are:

Description	Common Uses	Conforming to
Portland Cement/ Blast Furnace Cement	Drinking water of (pH : 6.0 9.0) (Sulphates ≤ 100 mg/ litre) (Manganese ≤ 500 mg/ litre) (Ammonium ≤ 30 mg / litre)	ISO: 4179/ BS:EN:545
Sulphate Resistance Cement (C_3A up to 3%)	Raw Water / Sea Water / Non-Septic sewers (pH > 5.5) (Sulphates ≤ 3000 mg/ litre) (Manganese ≤ 500 mg/ litre) (Ammonium ≤ 30 mg/litre)	ISO: 4179/ BS:EN:545
High Alumina Cement	Septic sewers/ Acids/ Alkali Waters/ Pickling Brine/ Sea Water (pH > 5.5) (Sulphates ≤ 3000 mg/ litre) (Manganese ≤ 500 mg/ litre) (Ammonium ≤ 30 mg/litre)	ISO: 4179/ BS:EN:545

Thickness and surface condition

The surface of the cement mortar lining shall be uniform and smooth. Trowel marks, protrusion of sand grains and surface texture inherent to the method of manufacture are acceptable. However, there shall 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 shall be as per ISO 2531: 1998 / BSEN 545:2006 and ISO 4179 as given in Table below:

DN	Nominal Thickness, mm
80 – 300	3
350 – 600	5
700 – 1200	6
1400 to 1600	9

External Coating

Corrosion Resistance of Ductile Iron

Intrinsic corrosion resistance of Ductile Iron in various corrosive soils is at least as good, is often better than that of Cast Iron, as there is not much variation chemically between the two materials. When subjected to corrosion, the nodular graphite of ductile iron pipes forms corrosion by products that adhere firmly to the unattacked metal, which provides a barrier against further corrosion. In addition, uniform spreading of spheroidal graphite of ductile iron results in less susceptibility to deep localized pitting than that of gray iron pipe, which is important in evaluating its relative resistance to failure by perforation. Due to rubber gasket jointing, ductile iron pipes are electrically discontinuous. As a result, long line corrosion current, which is dependent on exposure of a single electrical unit to varying soil conditions, cannot develop. Additionally, any accumulation of stray current is limited to short electrical units and usually is of little significance in developing corrosion.

Type of coating	Standard Reference
Metallic Zinc Coating (130 g/m2) with finish layer of Bitumen / Blue Epoxy / Red Epoxy	BS EN 545:2006
Metallic Zinc Coating (200 g/m2) with finish layer of Bitumen / Blue Epoxy / Red Epoxy	BS EN 545:2010
Alloy of Zinc and Aluminium (400 g/m2) with finish layer of Bitumen / Blue Epoxy / Red Epoxy	BS EN 545:2010
Polyurethane Coating	BS EN 15189
Polyethylene Sleeving	ISO 8180

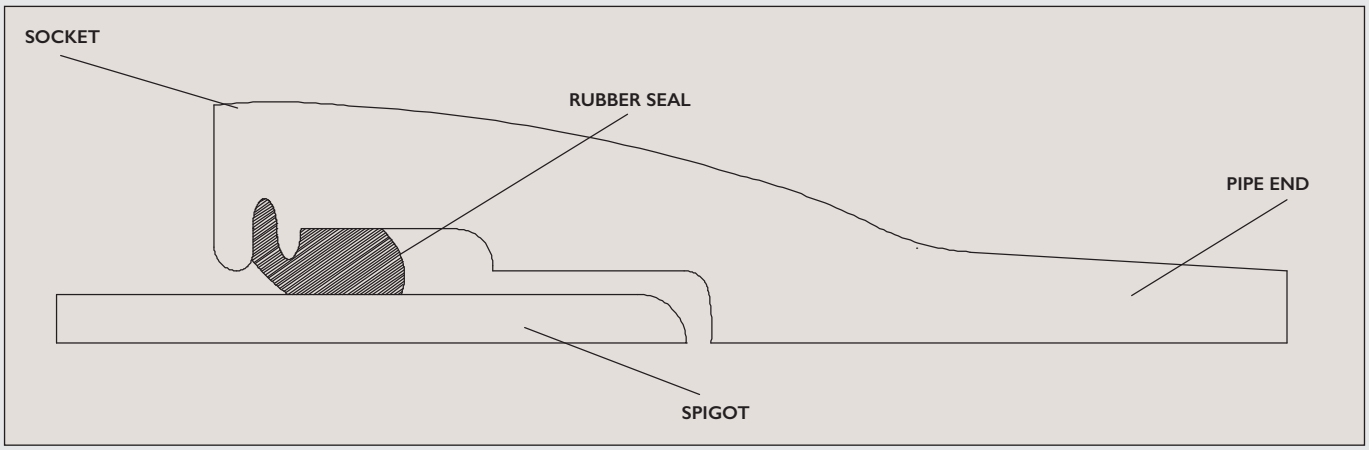
Standard Zinc coating with bitumenous paint

All Ductile Iron pipes are supplied with standard external coating of zinc spray (applied by spraying the molten zinc) and applying "pore seal coat" of bituminous paint (by spraying or brushing). The minimum amount of zinc metal will be 130 g/m2. Pore seal coat average thickness will be 70 microns (with local minimum of 50 microns).

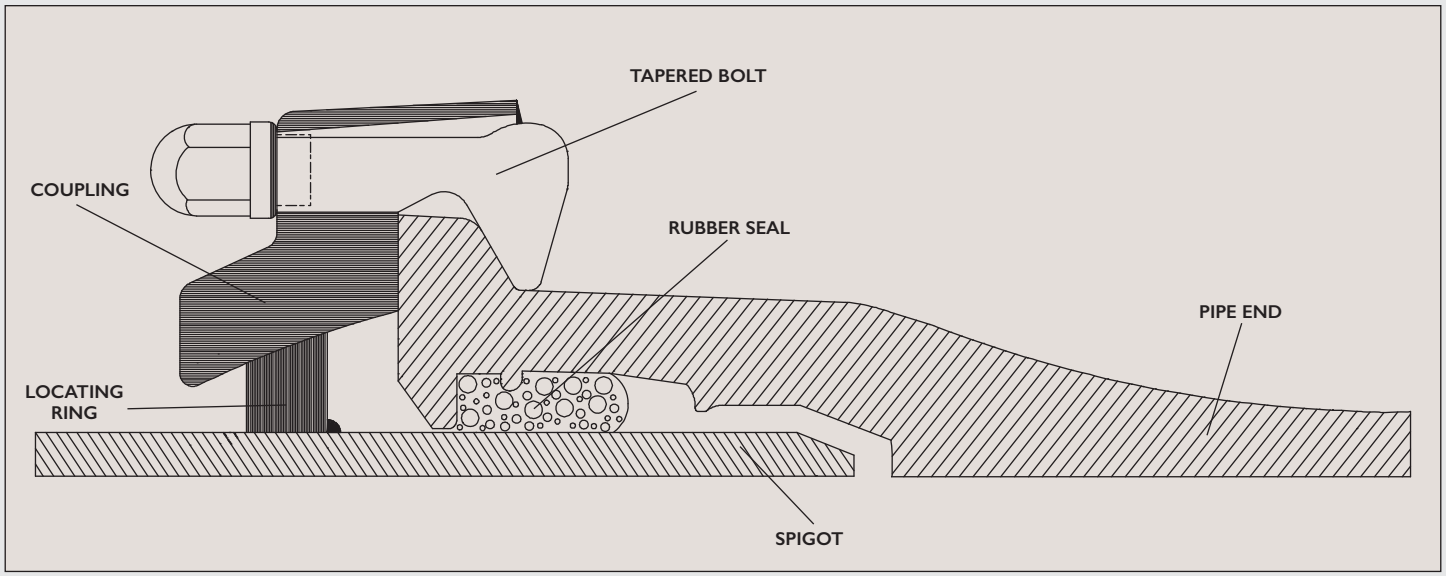
The zinc based coating acts bymeans of two complementary mechanisms to uniformly protect the pipe surface. In the first one, uniform corrosion of the zinc metal generates a stable protection layer of zinc salts (zinc carbonates, zinc oxychlorides etc) over the pipe surface. The role of "pore seal coat " is that it limits the exchanges of zinc metal with the surrounding soils and allows a slow transformation of zinc into insoluble zinc salts. The transformation of the zinc metal into a highly coherent layer of stable zinc salts may take several years, depending on soil conditions, temperature etc. In the second mechanism (which in time usually occurs first), the galvanic action of zinc-iron electrochemical element leads to self-healing of coating damages. On a damaged zone on zinc clad pipe, the damaged zone becomes cathodic to the rest of the pipe and is progressively covered by zinc corrosion products. This self-healing mechanism is fairly rapid as the iron/zinc electrochemical element has a high activity.

Types of Pipes

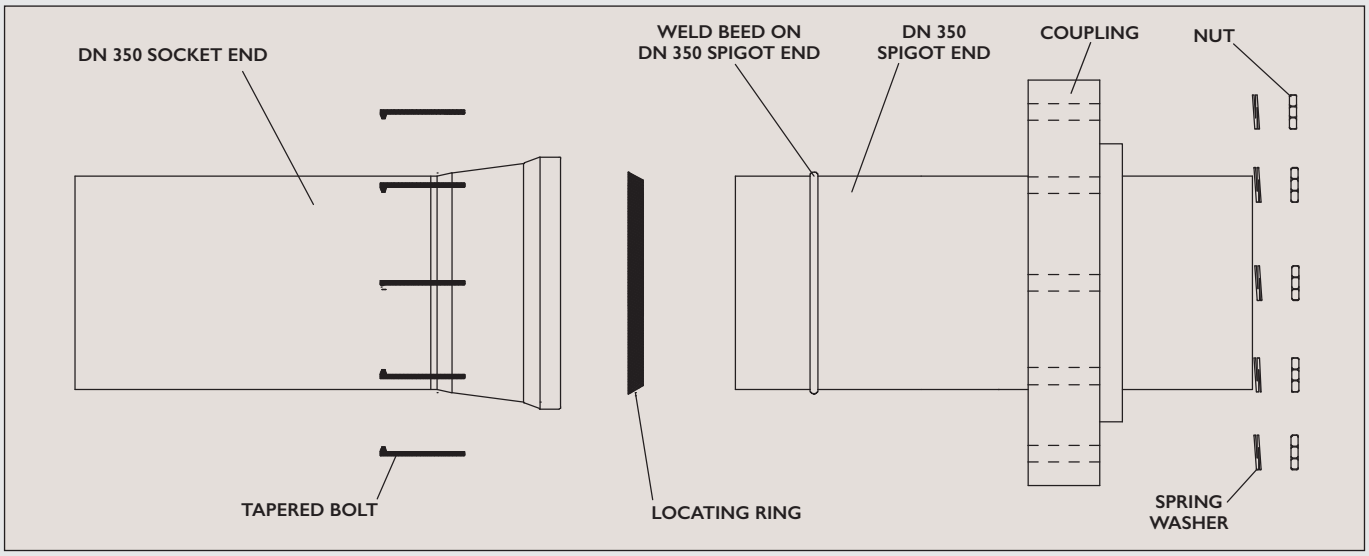
Push-on-Joint



Restrained Joints



Restraint joint assembly method



Fittings

Ductile Iron fittings are manufactured in accordance with EN 545, EN 598 and ISO 2531. The fittings can either have the following internal and external specifications.

- Lined internally cement, with a external bitumen coating
- Fusion bond epoxy coating inside and outside

Flange specification on fittings is either PN16, PN25 or PN40
Type of fittings:

- Double socket bends [90°, 45°, 22,5°, 11,25° degrees]
- Flange bends [90°, 45°, 22,5°, 11,25° degrees]
- Socketed or Flange Tees for Air valves [equal and unequal]
- Socketed or Flange Invert Tees for Scour Valves [equal and unequal]
- Reducers Flanged or socketed.
- Flanged pipes with or without Puddle Anchor Flanges.
- Concentric tapers
- Dismantling Joints

Robor Services

We work very closely with Engineers and contractors and we can offer the following services free of charge to our clients.

- Technical advice regarding the right solution for the specific project.
- Detailed Quality Control document, which will include independent Third Party inspection report, if required.
- Independent third party inspection by SGS Bureau or Lloyds at the manufacturer.
- Regular progress reports on manufacturing and delivery to site.
- Inspection at Port to ensure that the pipe is correctly unpacked from the containers or break-bulk shipment.
- Assist with the stacking of the pipes on site.
- Training to contactors on how to handle repairs and installation of the Ductile Iron Pipe.

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Ductile Iron Pipe and Fittings

Summary of things to consider when ordering Ductile Iron Pipe

Specification

Class of Pipe

- What is the pressure rating required?
- Determine wall thickness of pipe
- • Class K
  • Class C

Conveyance

- What fluid is conveyed in the Pipe? (PH Level)
- Determine the internal cement mortar lining
- • Drinking Water
  • Raw Water
  • Septic Sewers/ Alkali Water

Corrosion Protection

- What type of external coating is required?
- Determine corrosion protection and soil resistivity
- • Zinc Coating
  • Zinc Aluminium
  • Polyurethane
  • Polyethylene Sleeving

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