DUCTILE IRON PIPES

COMPANY PROFILE

GCF started in 1983 with a reputable brand name in the field of Ductile Iron Pipeline Products. Based in Egypt, GCF is a prominent supplier of DI Pipes, fittings and Valves serving a broad variety of water and sewage applications. Whether it is a water pipeline, a water treatment plant, or a pumping station, GCF brand stands out as one of satisfaction over the years. Our product mix includes Pipe fittings and Mechanical Joints up to DN 2600, Butterfly Valves up to DN 1800, Gate Valves up to DN 1800, Non Return Valve up to DN 1500 and Air valves up to DN 200.

The product mix that GCF offers with a commitment to an in depth knowledge of our customers' requirements has enabled us to acquire their confidence with a continuously increased market share. GCF not only offers a range of products but offers solutions to water and sewage companies, municipalities, civil and electromechanical contractors alike.

GCF client list spreads all along the Middle East, North African and South Europe Region. From Egypt to Libya, Iraq, KSA, UAE, Oman, Algeria, Jordan, Turkey, Italy, Greece, GCF brand stand out as brand of quality excellence. The distinctive location where GCF has its manufacturing facility makes it within few days of delivery to any market in MENA region and a free import taxation privilege.

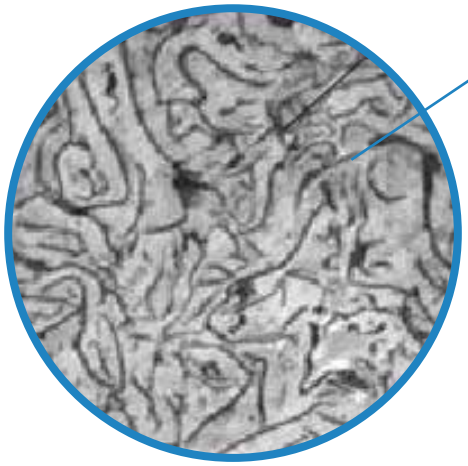
ABOUT DUCTILE IRON PIPES

What is Ductile Iron?

Ductile Iron is an iron/carbon/silicon alloy. With the addition of magnesium to the molten metal alloy, the graphite forms in spheres rather than flakes. This transformation eliminates the brittleness experienced in the grey cast iron and the desired characteristics of ductile iron are obtained. Ductile Iron combines the good mechanical properties of Steel (ductility, strength, toughness) and the good corrosion resistance of cast iron.

Comparison between microstructure of Grey Cast Iron and Ductile Cast Iron

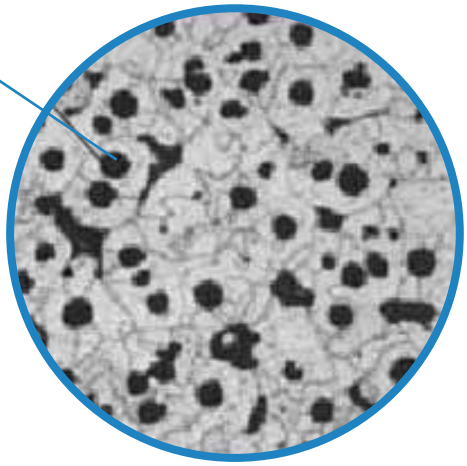
Photo 1



Gray cast iron

Black Lead

Photo 2



Ductile cast iron

Why Ductile Iron Pipe?

Design and performance

- Ductile Iron offers a good combination of the superior mechanical properties of steel and better corrosion resistance properties than cast iron.
- It is far superior to alternative piping material (Plastics and concretes) and provides the most economic piping solution when service life time, durability and reliability are taken into consideration.
- Ductile Iron is designed to withstand the most severe operating and environmental conditions.
- It is also the preferred pipe material during handling and installation. It withstands the most demanding operating conditions; (surge pressure, water hammer, increased operating pressure due to rise in demand).
- DI pipes can also withstand extreme high and low temperatures without any result in any brittleness as opposed to other alternative materials like plastics whose properties are heavily influenced by temperature variation.

DUCTILE IRON PIPES

Transportation & Handling

Ductile iron pipes are strong enough to resist damage during road transportation or handling by cranes or forklifts in sea ports and at site. The superior properties of DI Pipes can withstand a toughest of storage conditions without any damages.

Installation

It is the most suitable pipe in deep trenches, rocky trenches, and areas of shifting, and unstable soils. DI Pipes accommodate ground movement and limit longitudinal stresses and the jointing system is capable of angular deflection and axial withdrawal.

Corrosion Protection

DI pipes have superior protection on the outside surface. The pipes are covered in Zinc and followed by bitumen and the inside is lined with cement lining. There are other options for protection depending on the aggressiveness of the soil and water that will be discussed in more detail. The pipes are usually wrapped in PE sleeves providing a highly protected pipe against corrosion.

Minimal Maintenance

DI pipes require the least maintenance among all other alternative materials. It is the preferred piping material in heavy congested cities and in heavy traffic roads where maintenance jobs of pipes become a difficult mission.

Superior Mechanical & Physical Properties

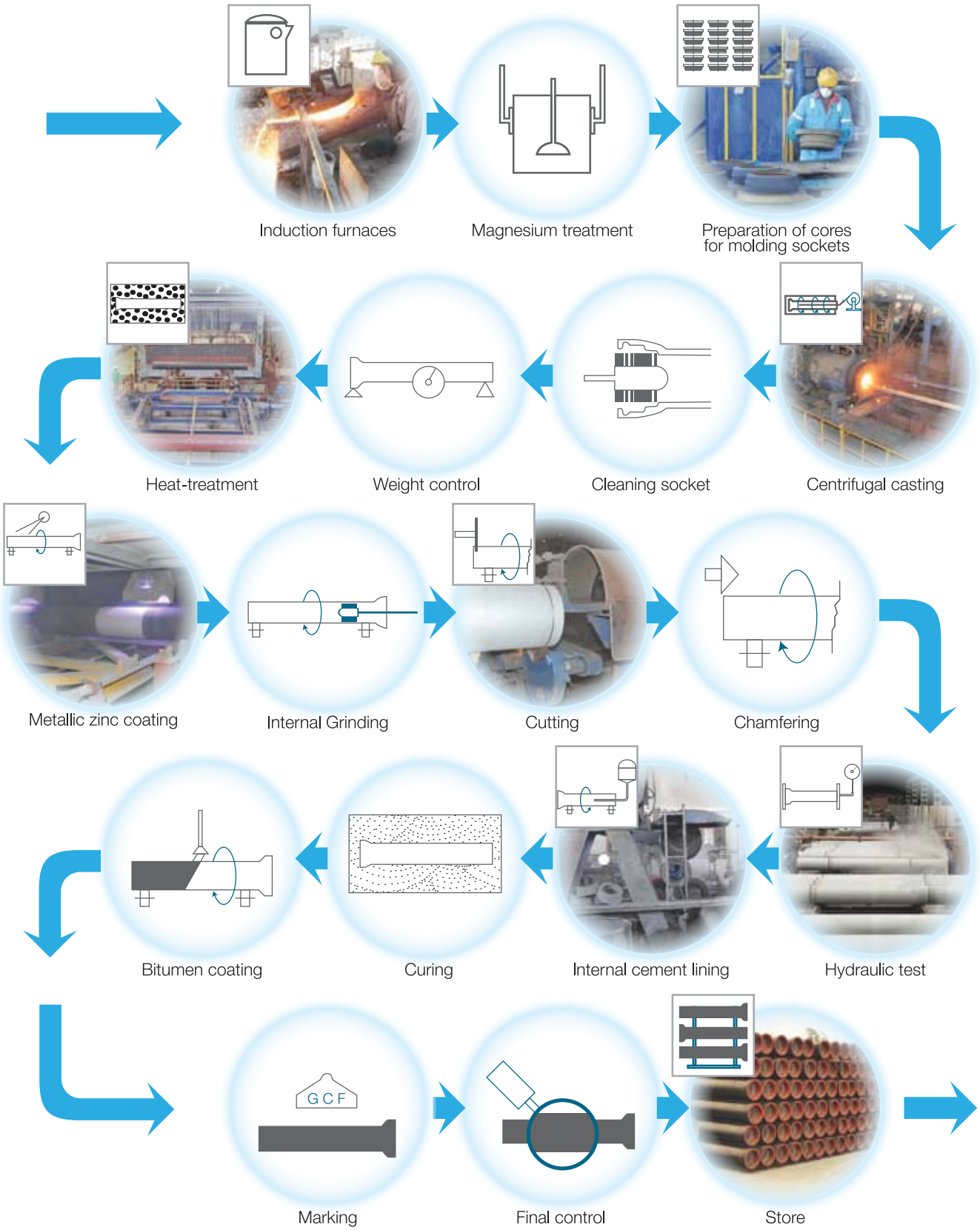
Tensile Strength	Min. 420 MPa
Elongation after fracture	Min 10% (7% for 1200mm)
Yield Stress	Min 300 Mpa**
Hardness	Max 230 HB
Bending Strength	Min 200 Mpa

** Min 270Mpa is allowed if elongation exceeds 12%

The following physical properties are for guidance only and are not provided by any known DI pipes standards

Density	7050 Kg/m3
Modulus of Elasticity	170,000 Mpa
Bursting Strength	Min Factor of Safety 8
Poisson's ratio	0.27
Hazen William Value (C)	140

DUCTILE IRON PIPE MANUFACTURING PROCESS



QUALITY INSPECTION


CARBON EQUIVALENT


CHEMICAL ANALYSIS


MICROSTRUCTURE ANALYSIS


TEMPERATURE CONTROL


THICKNESS CONTROL


RING TEST


ZINC COATING MASS


HYDRAULIC TESTING MACHINE


CEMENT LINING THICKNESS


BITUMEN COATING THICKNESS


SPIGOT OUTER DIAMETER


SOCKET INNER DIAMETER


TENSILE AND ELONGATION


HARDNESS TESTING


IMPACT RESISTANCE

DUCTILE IRON PIPES PRODUCTION

Size
From DN 100 to DN 1200

Effective Length
6.0 Meters

Wall Thickness
K class and C-Class as per ISO 2531 and EN 545

Joint Type
Pipes are joined by socket spigot arrangement where sockets are Push on T-Tyton joint type that can adjust angular deflection as per the following table

Size	DN 100–200	DN 250–350	DN 400-600	DN 700- 800	DN 900- 1200
Angular Deflection	5^0	4^0	3^0	2^0	1.5^0

Standards
- ISO 2531 / EN 545 for water applications
- ISO 7186 / EN 598 for Sewage applications
- ISO 4179 for internal lining
- ISO 8179 for external painting
- ISO 4633 for rubber gaskets

APPROVALS

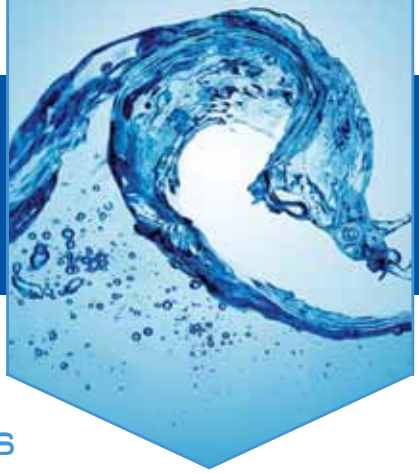
PIPE PROPERTIES

Weight and Volume of Pipes

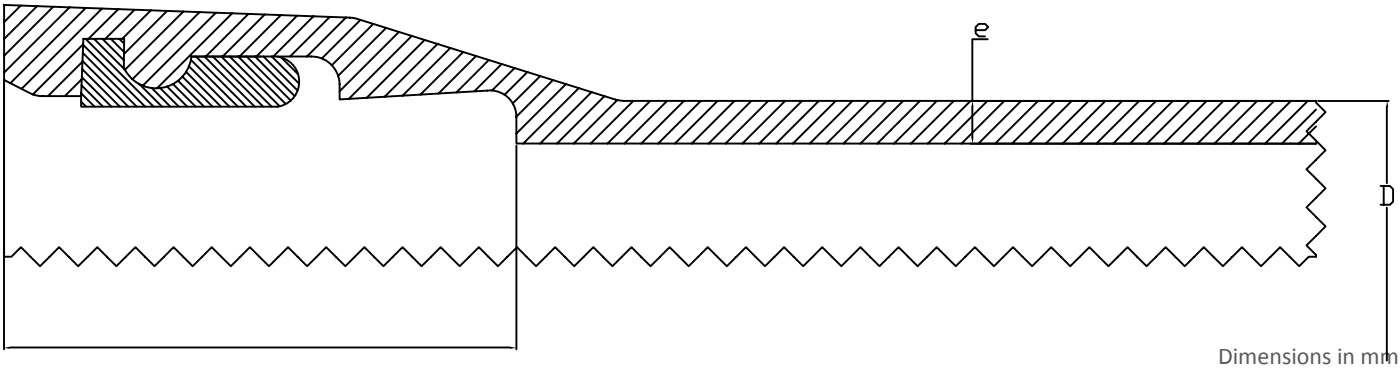
Effective Length 6.0meters

Size (mm)	Nominal Weight K9 (Kg)	Pressure class		Unit Volume (M3)
		Preferred class	Nominal Weight (Kg)	
DN 100	94	C40	70.8	0.12
DN 150	144	C40	106.1	0.26
DN 200	191	C40	146.1	0.38
DN 250	255	C40	210.5	0.58
DN 300	323	C40	282.2	0.80
DN 350	403	C30	335.0	1.05
DN 400	482	C30	394.4	1.35
DN 450	575	C30	470.0	1.65
DN 500	669	C30	565.8	2.05
DN 600	882	C30	783.7	2.83
DN 700	1126	C25	932.0	3.80
DN 800	1394	C25	1165.0	4.95
DN 900	1691	C25	1447.0	6.20
DN 1000	2017	C25	1760.0	7.55
DN 1200	2758	C25	2482.0	10.8

Weight and Volume figures are approximate and are for guidance purposes only



Pipe Dimensions and Test Pressures



Dimensions in mm

Size	External Dia. (D)	Tol. On (D)	K9 Nom Thickness (e)	K9 Min Thickness (e)	Test press. (bar)	Pressure class		
						Preferred Class	Nominal Thickness	Min Thickness
100	118	+1/-2.8	6.0	4.7	50	C40	4.4	3.0
150	170	+1/-2.9	6.0	4.7	50	C40	4.5	3.0
200	222	+1/-3.0	6.3	4.8	50	C40	4.7	3.1
250	274	+1/-3.1	6.8	5.3	50	C40	5.5	3.9
300	326	+1/-3.3	7.2	5.6	50	C40	6.2	4.6
350	378	+1/-3.4	7.7	6.1	40	C30	6.3	4.7
400	429	+1/-3.5	8.1	6.4	40	C30	6.5	4.8
450	480	+1/-3.6	8.6	6.9	40	C30	6.9	5.1
500	532	+1/-3.8	9.0	7.2	40	C30	7.5	5.6
600	635	+1/-4.0	9.9	8.0	40	C30	8.7	6.7
700	738	+1/-4.3	10.8	8.8	32	C25	8.8	6.8
800	832	+1/-4.5	11.7	9.6	32	C25	9.6	7.5
900	945	+1/-4.8	12.6	10.4	32	C25	10.6	8.4
1000	1048	+1/-5.0	13.5	11.2	32	C25	11.6	9.3
1200	1255	+1/-5.8	15.3	12.8	25	C25	13.6	11.1

K9 dimensions as per ISO 2531: 1998
C Class dimensions as per EN 545: 2010

INTERNAL LINING OF DUCTILE IRON PIPES

DI Pipes are typically lined with cement mortar lining (CML) as per ISO 4179. There are different cement mortar linings provided in DI Pipes. The type of lining depends on the aggressiveness of raw and potable water. Factors characterizing the aggressiveness of raw and potable water are:

- pH, Sulfates , Magnesium, Ammonium, and Aggressive CO2

The cement lining in the DI Pipes provides the following benefits

- Centrifugal Cement lining provides a C Value of 140 which provides a low friction medium for the water therefore lower head loss and lower pumping cost are associated with the CML of DI pipes
- Prevents pitting of the iron wall and protects the pipe from corrosion.
- Offers a non-toxic medium for potable water.
- Using high alumina cement will withstand aggressive sewage and industrial waste for prolonged periods of time.

Types of Internal lining:

Standard lining for drinking water

Standard lining for drinking water is sulphate resistant cement (SRC), blast furnace cement or Portland cement..

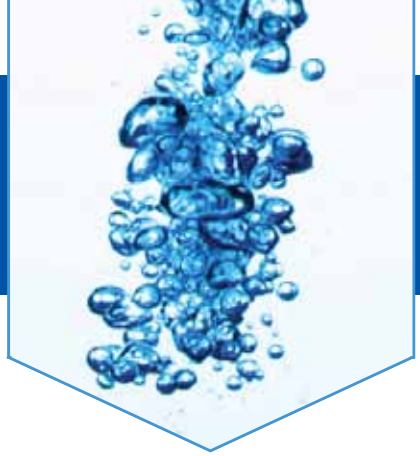
Lining for sewage and industrial pipelines

EN 598 specifies internal lining for sewage applications. However, high alumina cement (HAC) is recommended for Sewage water and industrial effluents with low pH values and high levels of sulphates, magnesium, ammonium and CO2.

Thickness of Lining

Dimensions in mm

Nominal Size	GCF		ISO 4179		
	Nominal Thickness	Min. at one point	Nominal Thickness	Min. at one point	Max crack width
DN 100 to 300	4.0	2.5	3.0	2.0	0.8
DN 350 to 600	5.0	3.0	5.0	3.0	0.8
DN 700 to 1200	6.0	3.5	6.0	3.5	1.0



EXTERNAL COATING

Protective Coating shall be applied to all pipes in accordance with ISO 81791- and with EN545. The coating shall comprise either one of the following:

1- Metallic Zinc Spray with a mass of 130g/m2 (ISO 8179) or 200g/m2 (EN 545)
2- Zinc Aluminum alloy (85% Zinc - 15% Al) with a mass of 400g/m2

The metallic zinc is followed by a layer of bitumen top coat of not less than 70 microns average thickness and 50 microns at any given point.
In case of Zinc Aluminum alloy, the Zinc Aluminum is normally followed by epoxy top coat. Epoxy can be red top coat or blue top coat or any color that suits the application.

Depending on soil resistivity the protection system is to be applied. For lesser aggressive soil resistivity Metallic Zinc 130 g/m2 followed by bituminous top coat will be sufficient. For more aggressive soils Zinc Al alloy 400g/m2 followed by epoxy top coat is preferred.

Protective coating for sewage pipes are usually Zinc spray followed by red epoxy although black bitumen is also applied.