

Ductile Iron Pipes & Fittings

Introduction

Technical Note

TN 001



ACMC

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Australia China Metal Corporation Pty Ltd

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The advice contained herein is purely for guidance and whilst we take care Australia China Metal Corporation Pty. Ltd. accepts no liability for products specified or installed by persons without the necessary skill, experience or appropriate qualifications.

Manufacturing

The following tables summarise the manufacturing, products, production capacity and the technical standards:

Name of Manufacturer	Site	Number of employees
Xinxing Ductile Iron Pipes Co., Ltd	Shangluoyang Village, Wu'an, Hebei, China	10,568

Product

Type	Sizes available	Description	Jointing details	Pressure classes
Ductile Iron Pipes	DN80-3000mm	ISO2531;EN545	T-type, K-type Self-Anchored Joint	PN10,PN16,PN25,PN35
Ductile Iron Fittings	DN80-3000mm	ISO2531;EN545	T-type, K-type Self-Anchored Joint	PN10,PN16,PN25,PN35
Rubber Ring	DN80-3000mm	EPDM ISO4633		

Capacity

	Location	Capacity
Pipes	Wu'an ;Wuhu;Shijiazhuang	100,000 Tonnes / month
Fittings	Taojiang, Shanxi 7445	4600 Tonnes / month

Technical Standards

Product	Technical standards applicable
Ductile Iron Pipes	ISO2531-1998;EN545
Ductile Iron Fittings	ISO2531-1998;EN545
EPDM Rubber Rings	ISO4633
Bolts & Nuts	ISO4016,ISO4014,ISO4032
Flanges	ISO2531,BS4504

Technical Standards

All pipe and fittings are produced in accordance with ISO2531-1998/ EN545:2006 and relevant standards, for potable water. Other International Standards are used and quoted where applicable.

Allowable Pressures AS/NZS 2280 and ISO Standards

The differences in definition terminology between AS/NZS 2280 and ISO2531-1998/ EN545:2006 standards are shown below:-

AS/NZS 2280	EN545
Allowable Operating Pressure AOP	Allowable Operating Pressure PFA
Maximum Allowable Operating Pressure MAOP	Allowable Maximum Operating Pressure PMA
Allowable site test pressure ASTP	Allowable Test Pressure PEA
Nominal Pressure PN	See note 1
Nominal Size DN	Nominal Size DN

Note 1 EN545 defines PN as a dimensionless number meaning that all equipment of the same DN and the same PN has compatible mating dimensions. The Australian Standard definition of PN is 10 x Allowable Operating Pressure.

The only definition that differs is the PN definition; all other definitions are the same.

- AS2280 specifies the requirements for pipe sizes of DN 100 to DN 750.
- ISO Standards specifies the requirements for pipe sizes of DN 40 to DN 2000.
- Pipe sizes larger than DN 2000 may be specified to suit the application.

In the tables below the Australian Standard definition of PN is used. Examples of the combination of PN/joint types and wall thickness are detailed:

Under DN1000 mm pipe

Pipeline pressure class	Joint Type	Wall thickness class (K)
PN16	T-type Push-on Joint	K9
PN21	T-type Push-on Joint	K9
PN35	T-type Push-on Joint	K10

Above DN 1000mm pipe

Pipeline pressure class	Joint Type	Wall thickness class (K)
PN16	T-type Push-on Joint	K9
PN21	T-type Push-on Joint	K9
PN35	T-type Push-on Joint	K10
PN40	T-type Push-on Joint	K10

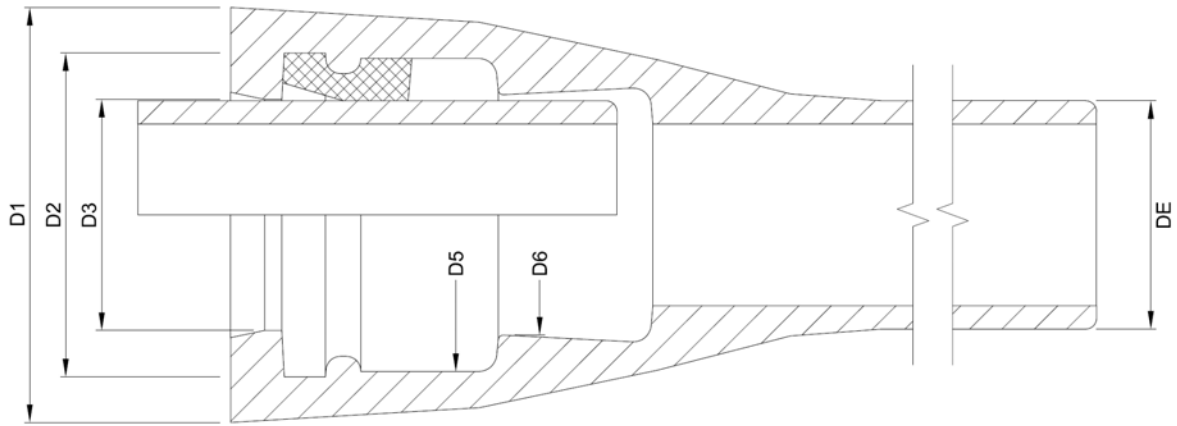
Production offered is up to DN 3000 are available upon request.

Ductile iron fittings comply with a minimum allowable operating pressure equivalent to PN35; higher allowable operating pressures for fittings may be specified.

Typical Pipe Wall thicknesses supplied by ACMC are shown.

DN	WALL THICKNESS(mm)				SPIGOT OD(mm)		STANDARD WEIGHT(kg)			
	STANDARD K12 Pipe	ISO Min. K12	STANDARD K10 pipe	ISO Min. K10		Tolerance	6M K12	8.15M K12	6M K10	8.15M K10
600	13.2	11.3	11	9.1	635	+1/4.0	1150	/	971	/
700	14.4	12.4	12	10	738	+1/-4.2	1464	/	1237	/
1200	20.4	17.9	17	14.5	1255	+1/-5.0	3585	4784	3034	4037

Note that the standard wall thicknesses are in excess of the ISO Design Standards and exceed all requirements of AS 2280.



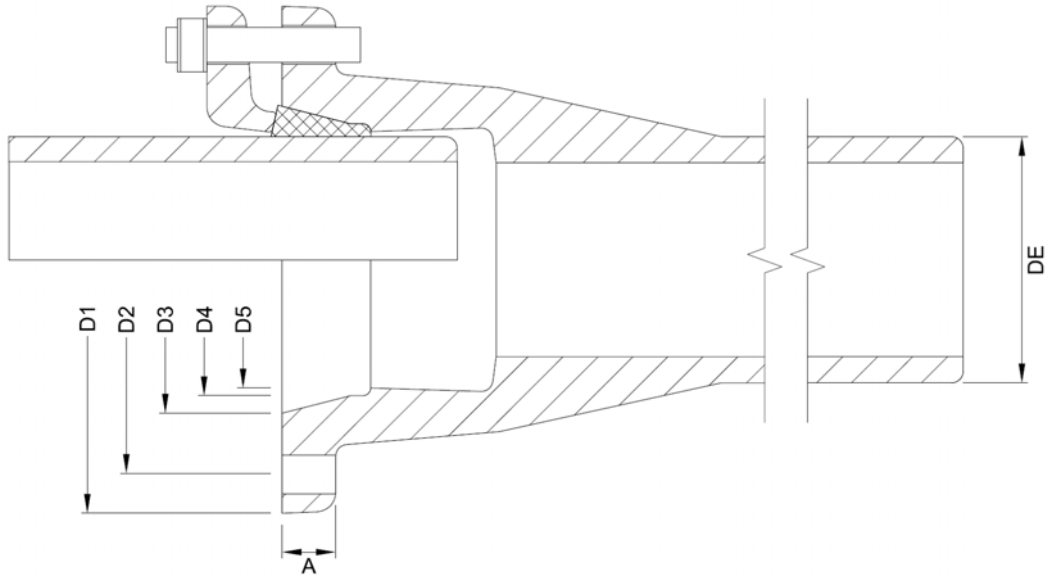
Typical Pipe and Socket dimensions with tolerances DN80- DN1200 T-type Joint

T-type joint dimension :

Unit: mm

DN	DE		D1	D2		D3		D5		D6	
500	532	+1 -3.8	604	568	+2.4 -1	534.5	+2.4 -1	562.6	+2.4 -1	539.4	±3
600	635	+1 -4	713	673.4	+2.7 -1	637.5	+2.7 -1	668	+2.7 -1	642.6	
700	738	+1 -4.2	824	788	+3.5 -1	740.5	+3.5 -1	779.3	+3.5 -1	745.8	±3.5
800	842	+1 -4.5	943	894	+3.8 -1	844.5	+3.8 -1	885.9	+3.8 -1	850	±3.8
900	945	+1 -4.8	1052	1000	+4.1 -1	947.5	+4.1 -1	991.3	+4.1 -1	953.2	±4.1
1000	1048	+1 -5	1158	1105	+4.4 -1	1050.5	+4.4 -1	1097.1	+4.4 -1	1056.4	±4.4
1100	1152	+1 -5.2	1267	1211	+4.7 -1	1155	+4.7 -1	1202.5	+4.7 -1	1160.2	±4.7
1200	1255	+1 -5.0	1377	1317	+5 0	1258	+5 0	1308	+5 0	1264	±5
1400	1462	+1 -5.5	1610	1529	+5.6 0	1465	+5.6 0	1509	+5.6 0	1471	±5.6
1500	1565	+1 -5.5	1710	1635	+5 0	1570	+5 0	1615	+5 0	1575	±5

K-type, mechanical joint dimension, comply with the following drawing and table



K-type mechanical joint

Unit: mm

DN	DE		D1	D2	D3	D4		D5		A
500	532	+1	667	621	566	548	±1.5	536	+3	25
600	635	-3	773	727	669	651		639	-1	26
700	738		892	838	780	758	±2	743		28
800	842	+1	999	942	884	862		847	+3.5	29
900	945	-4	1123	1057	987	965		950	-2	31
1000	1048	+1	1231	1160	1090	1068		1054		32
1100	1152	-5	1338	1272	1194	1172		1158	+3.5	33
1200	1255	+1	1444	1378	1297	1275	1261	-3	35	
1400	1462	+1	1657	1591	1504	1482	±2.5	1469	+4	38
1500	1565	-6	1766	1700	1608	1586		1573	-3	40

Characteristics of ductile iron pipe and fittings

Type of Casting		Minimum tensile strength MPa
		DN80-2600
Centrifugally Iron pipe	Ductile	420
Fittings		400

Joint leak tightness

Tests of leak tightness for internal pressure and external pressure are performed and comply with ISO2531/EN545.

Working hydraulic tests are carried out piece by piece on all pipes and fittings.

Rubber Rings

EPDM rubber gaskets are supplied in accordance with either ISO4633 and requirements for potable water or AS1646 - 2007

Nuts & Bolts

Nuts and bolts are supplied in accordance with ISO4016 (Grade 4.8), ISO4014 (Grade 8.8), ISO4032.

Nuts and bolts can be supplied in accordance with Australian Standards AS1111.1 & 1112.1.-2000.

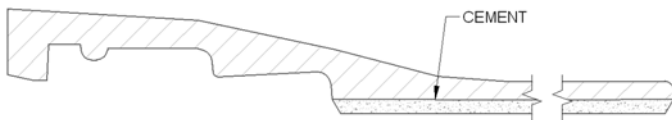
Flanges

Flanges are supplied in accordance with ISO2531-1998, or can be supplied in accordance with Australian Standard AS 4087-2004.

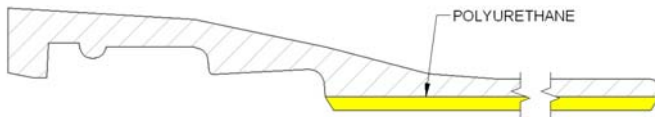
Coatings and Linings for Pipes and Fittings

Internal lining

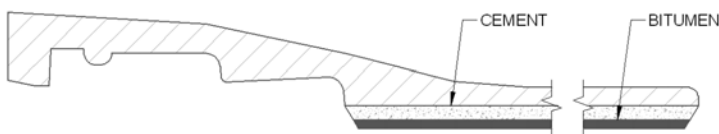
1. Ordinary Portland cement coating mortar in accordance with ISO 4179:2005.



2. Polyurethane coating in accordance with EN 15189



3. Cement + nontoxic bitumen coating

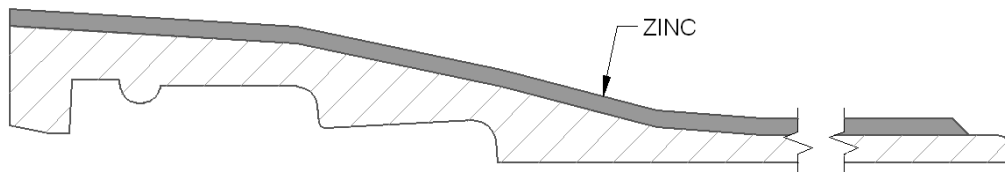


External coatings

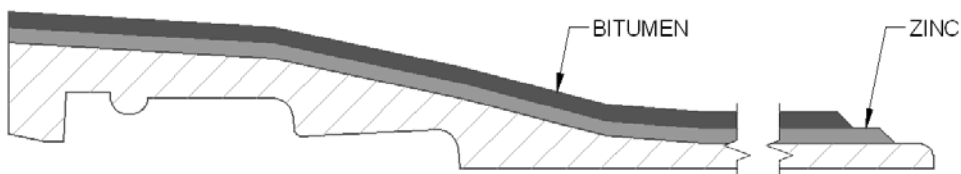
The standard external coating is zinc applied as a substrate layer for both ductile iron pipe and fittings, with bitumen paint or anti-corrosion paints compatible with zinc, as the finishing layer.

The metallic zinc coating complies with ISO 8179. AS/NZS 2280 and ASTM Standards no longer require the zinc application, recognising the excellent anti-corrosion properties of Ductile Iron. The ISO standards shall require this zinc lining.

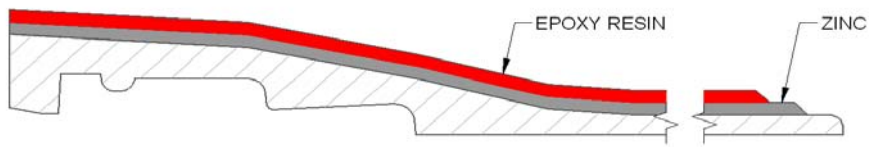
1. Zinc coating



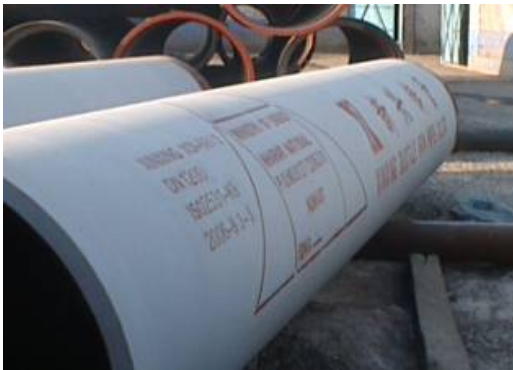
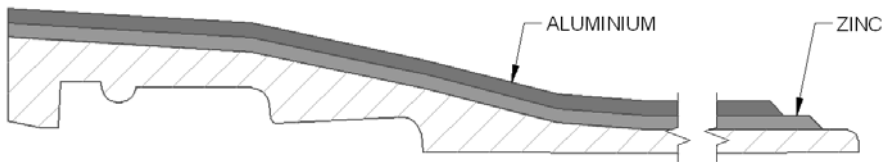
2. Zinc + bitumen coating



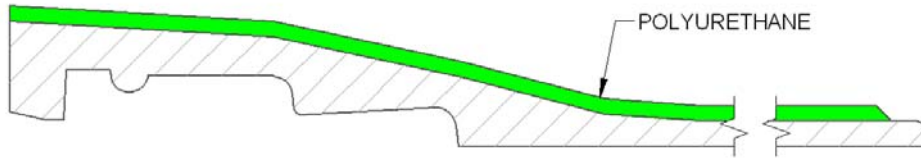
3. Zinc + epoxy resin



4. Zinc + aluminium coating



5. Polyurethane coating



Coating Performance and Standards

The coating and linings for pipe and fittings supplied by ACMC are in accordance with Clauses 4.4 and 4.5 of EN 545:2006(E) and Annexures D and E of the Standard.

Polyurethane coating is in accordance with EN 15189.

The following tables state the minimum requirement that have been specified in the EN Standards or adopted by the factory. Alternative coating and linings specifications may be supplied depending on the external and internal conditions of use.

In the following tables the GB/T references are the factory generated Inspection & Test Plans (ITPs)

Zinc with bitumen coating

Inspection Item	Requirement	Standard for inspection
Thickness of the zinc coating / μm	≥ 70	EN 545:2006
Thickness of the bitumen coating / μm	≥ 100	GB/T 1764-79
Adhesive force/Level	2	GB/T 1720-79
Flexibility/mm	2	GB/T 1731-93
Impact strength /kg.cm	40	GB/T 1732-93
Acid resistance (10% sulphuric acid, 4h)	No foaming, no separation of coating.	GB/T 1763-79
Alkali resistance (10% sodium hydroxide, 4h)	No foaming, no separation of coating.	GB/T 1763-79

Zinc with epoxy resin coating

Inspection Item		Requirement	Standard for inspection
Fineness / μm		≤ 40	GB / T 1724-79
Viscosity / s		30 ~ 120	GB / T 1723-79
Solid components / %		87	GB / T 1725-79
Coating thickness/ μm		1000	GB/T 1764-79
Hardening time	Surface dry	Minutes	20°C240 , 60°C20 , 140°C5
	Hard dry	Hours	48
	Solid dry	Hours	168
Hardness H		4	GB / T 6739-86
Impact strength / kg.cm		≥ 40	GB / T 1732-79
Adhesive force / Level		1	GB / T 1720-79
Water resistance (tap water) 25°C,72h		No change	GB / T 1733-93
Acid resistance (25% sulphuric acid) 168h		No foaming, no falling-off	GB / T 1763-79
Alkali resistance (25% sodium hydroxide) 168h		No change	GB / T 1763-79
Salt water resistance (3% sodium chloride) 1440h		No change	GB / T 1763-79
Gasoline resistance (120 #) 168h		No obvious change	GB / T 1734-93

Aluminium coating

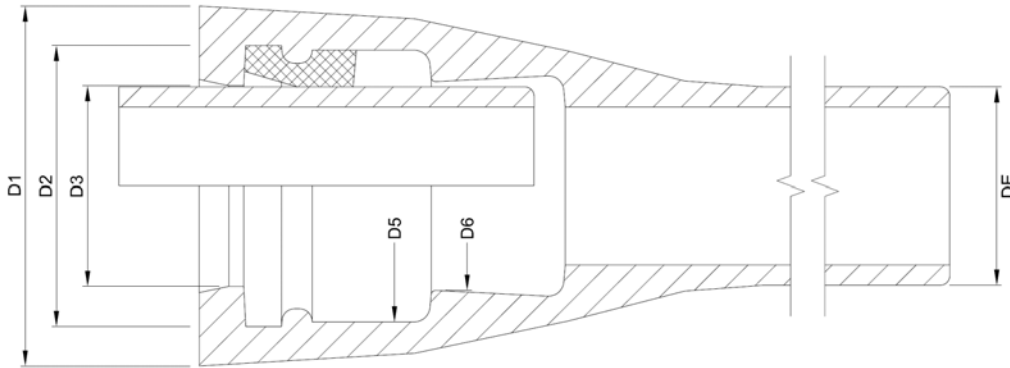
Inspection item	Requirements	Standard for inspection
Appearance	Silver grey	
Thickness	100 micrometers (average)	SSPC-PA2
Adhesive force	Level 1 ~ 2	DIN EN ISO2409:1994
Flexibility	3.2mm steel bar, no crack	ASTM D 522-93A
Weathering resistance	Xenon lamp 500h, silver grey, no cracking, no peeling	ASTM G155-05a (xenon lamp)
Degree of the retentivity of reflectivity	(500h) : 80%	ASTM D2824
Salt-fog resistance	1000h, silver grey, no crack, no foaming	ASTM B117
Water resistance	60d, silver grey, no crack, no foaming	ASTM D 2939

Polyurethane coating

Inspection item	Requirements	Standard for inspection
coating thickness/ μm	1000~2000	
Impact strength J	20	ASTM D 2794-93
Adhesive force to ductile iron (drawing-apart method) Mpa	13.1	ASTM D 4541-95
Adhesive force to steel (drawing-apart method) Mpa	20	ASTM G 8-96
Cathodic dis-bonding (65, 48h) mm	6.0	ISO 7619-86
Hardness (Shore D)	82	ASTM D 522-93
Flexibility mm	13.0	ASTM B 117-95
Salt-fog resistance (1000h)	Coating in good condition	ASTM G 53-95
Anti-ultraviolet light aging (336h)	Coating in good condition	ASTM D 543-95
10% Hydrochloric acid (90d)	Coating in good condition	ASTM D 543-95
10% sulphuric acid (90d)	Coating in good condition	ASTM D 543-95
30% sodium hydroxide (90d)	Coating in good condition	ASTM D 543-95
Water resistance (40 \square , 90d)	Coating in good condition	ASTM D 870-92
Wear resistance (1000g, 1000 revolutions) mg	30.9	ASTM D 4060-95
Water vapour permeability $\text{mg}/\text{cm}^2 \cdot 24\text{h}$	2.118	ASTM 196-95
Water absorption %	1.907	ASTM D 570-95
Volume resistivity $\Omega \cdot \text{m}$	3.2×10^{13}	ASTM D 257-93
Electric strength mv/m	33.2	ASTM D 149-95

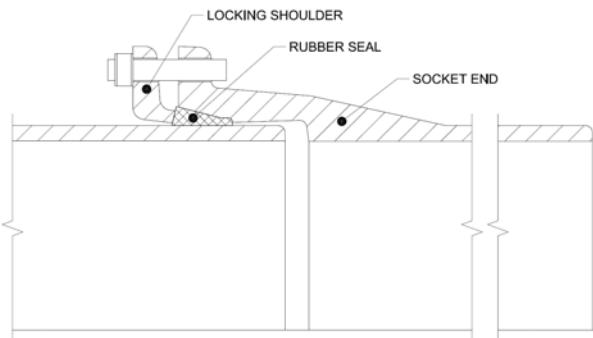
Joint Types

T-type Flexible Joints



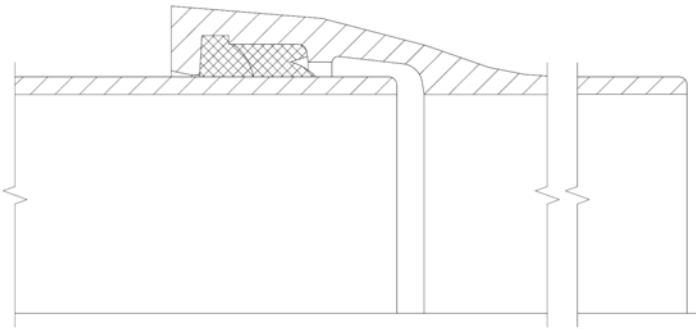
DN 80 to DN 1400 conventional rubber ring joint

KFM Type Self Restrained Dismantling Joint



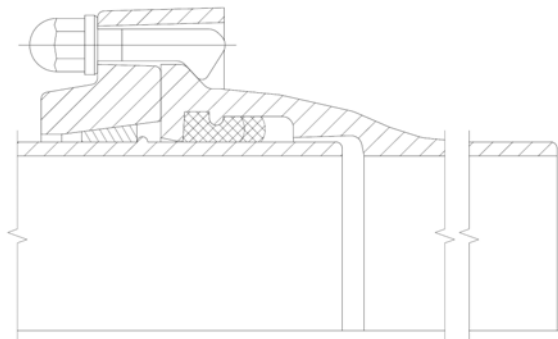
- DN 1600 and above flexible joint.

2GS Joints



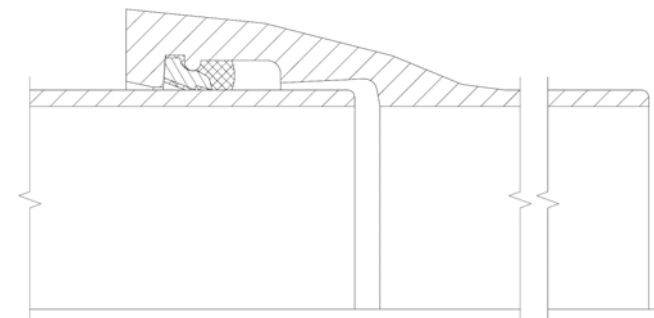
- Another form of flexible joint for DN 80 – DN 1400.

K Type Self Anchored Joint



- Replaces the need for anchor blocks
- Uses include construction of rivers, creek crossings, vertical bends, and dual parallel pipelines.
- Suitable for all pipe diameters

SIT Self-anchoring Type Joint



- Self anchoring Joints for pipe sizes less than DN 1600.