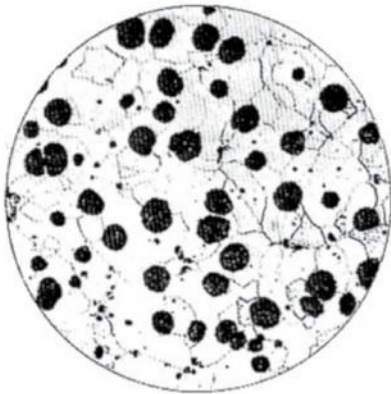

Ductile Iron Pipe Fittings

MS1919 / BS EN 545 / BS EN 598 / ISO 2531
DN 80 to DN 2000

DUCTILE IRON AND ITS ADVANTAGES

GRAY CAST IRON VS DUCTILE IRON

Ductile iron, also known as spheroidal iron and nodular iron, is characterized by the presence of spheroidal graphite in the resultant castings. It is a modern material superior to gray cast iron, the type of iron which has been extensively used for centuries. The 'ductility' of this new iron is achieved through the unique carbon configuration which is present in the form of spheroidal or nodular graphite. In gray cast iron, also known as flake graphite iron, carbon appears in the form of graphite flakes, which causes the metal to be brittle.



Ductile Iron

Graphite shows as isolated spheroids in a continuous matrix



Gray Cast Iron

Graphite shows as a semi-continuous network of flakes

The spheroid has the capacity to absorb stress and pressure under severe shock, also allowing plastic deformation; the flake has two obvious weak points where stress concentration occurs, it becomes to fracture.

In additional, as the chemical composition of ductile cast iron is almost the same as that of gray cast iron i.e. high concentrations of carbon and silicon, ductile cast iron possesses both the anti-corrosiveness of cast iron and also a strength similar to steel.

PROPERTIES & ADVANTAGES OF DUCTILE IRON PIPE

• High tensile strength • High yield strength • High impact resistance • High elongation (ductility) • High fatigue resistance • Resistance to handling / transportation damage • Resistance to second cover damage • Simple to join having agreed joint deflection • Resists longitudinal joint withdrawal • Proven and cost effective internal and external corrosion protection • Impermeable to gas and organic contaminant • Imported back-fill not normally required • Full range of ductile iron fittings available • Easy pipe location when buried • Low skill level for jointing • Under pressure connections are not complicated • Resistant to stray current effect due to electrical discontinuity at joints.

Mechanical Properties

Type of Casting	Tensile Strength	Elongation		Hardness	Hydrostatic Test Pressure at Works			
		DN80 -1000	DN1100 -1200		DN80 - 300	DN350 - 600	DN700 - 1000	DN1100 - 1200
Pipes centrifugally casted	420 MPA min	10% min	7% min	230 HB max	50 bar	40 bar	32 bar	25 bar
Pipes not centrifugally casted			5% min	250 HB max	25 bar	16 bar	10 bar	10 bar
Fittings								

Coating and Lining

Coating	Pipes and Fittings			
	DN80 -300	DN350 -600	DN700 -1000	DN1100 -1200
External Zinc Coated with Bitumen Finish	First Coating Zinc Coating	Mean mass of zinc per unit area not less than 130g/m ²		
	Second Coating Bitumen Paint	Mean minimum thickness not less than 70 µm Local minimum thickness not less than 50 µm		
	3.5 (-1.5)	5.0 (-2.0)	6.0 (-2.5)	9.0 (-3.0)
Internal Cement Mortar Lined*	* Nominal Value with Limit Deviation in bracket			

Tolerances on Wall Thickness

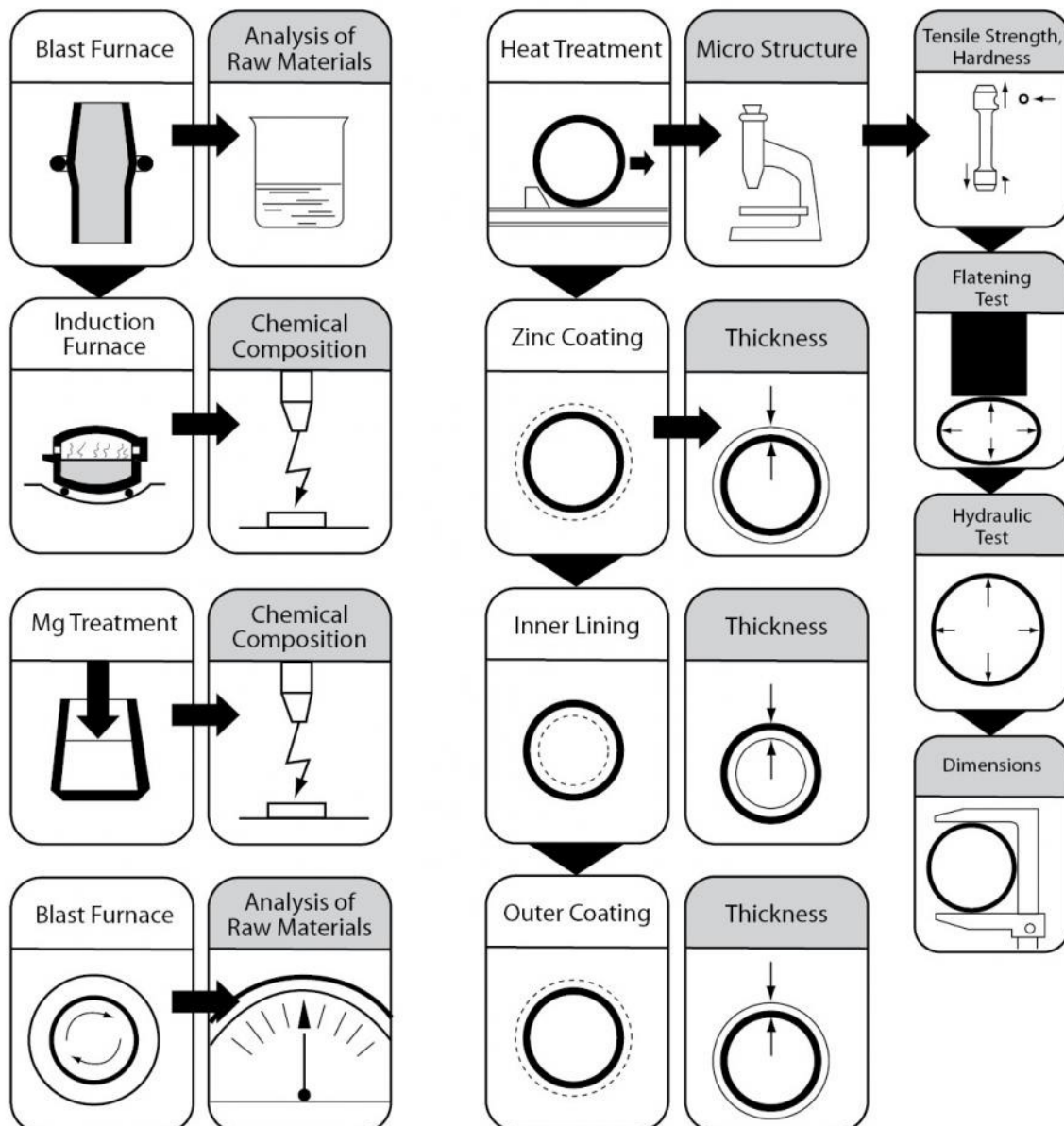
Type of Casting	Nominal Iron wall thickness e	Limit deviation on the nominal wall thickness
Pipes centrifugally casted	6.0	-1.3
	> 6.0	-(1.3+0.001 DN)
Pipes not centrifugally casted	7.0	-2.3
and Fittings	> 7.0	-(2.3+0.001 DN)

Tolerances on Length

Type of Casting	Limit deviations mm
Socket and spigot pipes (full length or shortened)	- 30 + 70
Fittings for socketed joints	± 20
Pipes and Fittings for flanged joints	± 10

Pipe Material	Cast Iron Pipe	Ductile Iron Pipe	Steel Pipe	PVC Pipe	Asbestos Pipe
Tensile Strength kg/mm ²	Over 20	Over 42	Over 40	Over 5.3	2 - 2.3
Bending Strength kg/mm ²	Over 34	Over 50	Over 40	Over 8.10	2 - 3
Elongation %	-	Over 10	Over 18	50 - 150	-
Elastic Coefficiency kg/mm ²	1.2×10^4	1.7×10^4	2.4×10^4	$2.7 - 3 \times 10^2$	2.1×10^3
Hardness	Below 230 BHN	Below 230 BHN	Below 140 BHN	R 115 Rockwell	35 - 40 BHN
Poisson's Ration	0.25	0.28	0.3	0.37	0.18 - 0.25
Impact value kg m/cm ²	Izod below 0.5	Charpy over 0.713	Charpy 1.5	Charpy 0.007 - 0.1	-
Specific Gravity	7.15	7.15	7.85	1.43	2.1
Thermal Expansion Coefficient	1.0×10^{-5}	1.0×10^{-5}	1.1×10^{-5}	6.8×10^{-5}	$0.6 - 0.8 \times 10^{-5}$

MANUFACTURING PROCESS



Thickness for Pipes and Fittings

The thickness of pipes and fittings has been calculated as a function of the nominal size DN by using the formula:

$$e = K(0.5 + 0.001DN)$$

with the following values for K.

K=9 for pipes, thus

$$e = 4.5 + 0.009DN$$

K=14 for tees, thus

$$e = 7 + 0.014DN$$

K=12 for other fittings, thus

$$e = 6 + 0.012DN$$

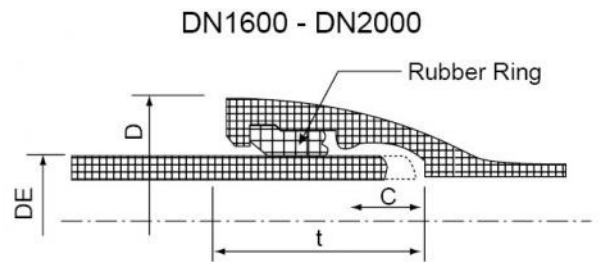
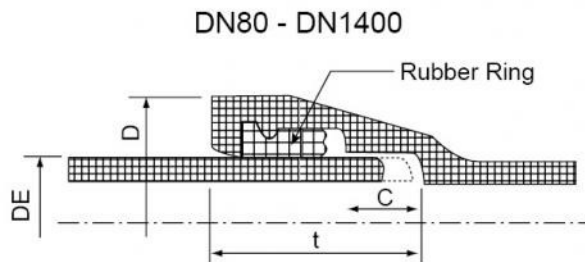
The thickness of the pipes has been limited to 6mm and fitting to 7mm.

Dimensions in millimeters (mm)

NOMINAL DIAMETER DN	WALL THICKNESS		
	K=9	K=12	K=14
80	6.0	7.0	8.1
100	6.1	7.2	8.4
150	6.3	7.8	9.1
200	6.4	8.4	9.8
250	6.8	9.0	10.5
300	7.2	9.6	11.2
350	7.7	10.2	11.9
400	8.1	10.8	12.6
450	8.6	11.4	13.3
500	9.0	12.0	14.0
600	9.9	13.2	15.4
700	10.8	14.4	16.8
800	11.7	15.6	18.2
900	12.6	16.8	19.6
1000	13.5	18.0	21.0
1200	15.3	20.4	23.8
1400	17.1	22.8	26.6
1600	18.9	25.2	29.4
1800	20.7	27.6	32.2
2000	22.5	30.0	35.0

JOINT

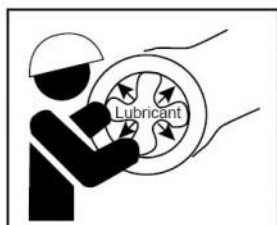
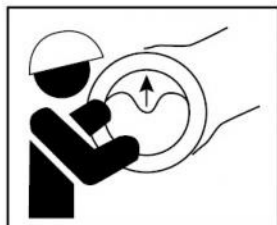
Push-on joint T Type



* Maximum angular deflection ≤ DN300=5° ; >DN300=4°

JOINT

Push-on joint T Type

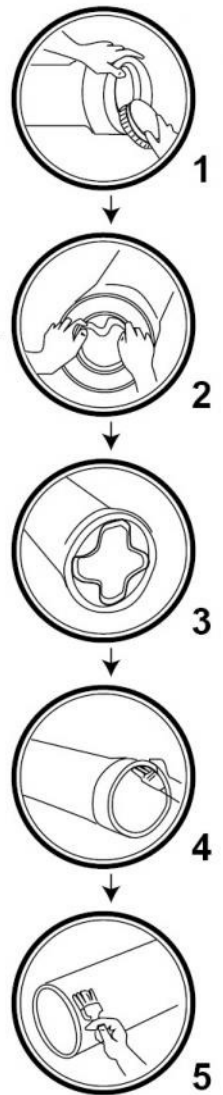


Dimensions in millimeters (mm)

NOMINAL DIAMETER DN	mm			C (Allowable Spigot Withdrawal)		Mass Rubber Ring kg
	DE	D	t	NO deflection mm	FULL deflection mm	
80	98	142	84	38	30	0.13
100	118	163	88	38	28	0.16
150	170	217	94	38	23	0.22
200	222	278	100	38	18	0.37
250	274	336	105	38	14	0.48
300	326	393	110	38	9	0.68
350	378	448	110	38	11	0.78
400	429	500	110	38	7	1.1
450	480	550	120	38	4	1.3
500	532	604	120	40	2	1.6
600	635	713	120	45	1	2.3
700	738	824	150	40	0	4.0
800	842	943	160	40	0	5.2
900	945	1052	175	43	0	6.5
1000	1048	1158	185	46	0	8.0
1200	1255	1377	215	50	0	13.3
1400	1462	1632	215	54	0	17.5
1600	1668	1850	265	66	0	21.6
1800	1875	2049	275	78	0	28.5
2000	2082	2231	-	-	-	-

Preparation for Joint

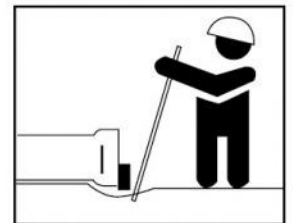
- 1) • Thoroughly clean spigot and interior of socket of joint. Apply a thin film of lubricant to gasket bulb seating area inside socket.
 - Clean gasket and insert into socket with the square section gasket heel in the retaining groove and the gasket bulb towards the back of the socket.
- 2) • The insertion of gasket DN80-DN700 is facilitated by folding the gasket as shown by looping into a heart shape with the gasket bulb towards the back of the socket.
- 3) • For DN800-DN1200 it is preferable to loop the gasket into the shape of cross for insertion.
 - Apply radial pressure to the gasket at the heart-shaped loops (or cross loops) to force it into place.
- 4-5) • Apply a thin film of lubricant to inside surface of the gasket and to outside surface of spigot for a distance of about 50mm for pipe sizes up to and including DN600 and 120mm for pipe sizes DN700 and above.



Joint Assembly

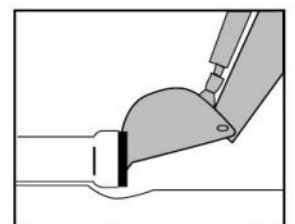
a) Crowbar - DN80 & DN100

- Prepare and lubricate the joint area and place pipe in position ready for jointing.
- Push against the end of the pipe socket face with a crowbar or lever to complete the joint.



b) Assembly Using Digger Bucket - DN80 & DN1200

- This method minimise the time required to make a joint and is widely used.
- Prepare and lubricate the joint area and place pipe in position ready for jointing.
- Place a wooden batten between the pipe and digger bucket.
- Push slowly and steadily untill the joint is made to the correct insertion depth.



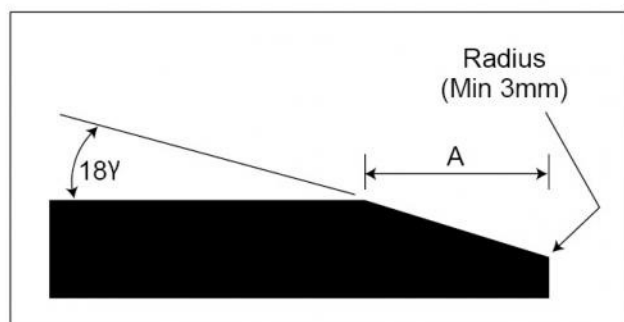
Pipe Cutting

Ductile iron pipes can be cut by a number of methods.

Where flexible joints are to be made, the cut ends must be trimmed with a file or grinder to remove the burr formed during cutting and a chamfer must be provided.

- **A Power Driven Abrasive Disc** is one of the most widely used method for cutting ductile iron pipe. It has the advantage of being suitable for all sizes. There is no need for adjustment to suit pipe or attach machinery to the pipe. The abrasive disc are fitted to suitable hand held power tools usually driven by compressed air or small internal combustion engines.
- It is important when ordering abrasive disc cutting equipment to state that it is for use with ductile iron pipe and to ensure that the disc type and size and the spindle speed of the equipment are compatible.
- **Semi-Rotary Wheel Type Cutters** are available, ranging from the standard chain link cutters to more sophisticated tools employing a rigid hinged frame. With this type of equipment it is important to ensure that wheels specifically designed for use with ductile iron are employed. This type of cutter is normally used on pipes the smaller diameters.
- **Rotary and Orbital Pipe Cutters**, using cutting tools of the simple lathe to milling saw type respectively, are available throughout the diameter range. Whichever type of cutter is employed the machine is attached to the pipe and the cutting tool is driven around the pipe by means of gears on a chain link track. The orbital type cutters have the advantages on the larger size of ductile iron pipe in that they are capable of accommodating the ovalities which are sometimes present. Some are also capable of forming the chamfer in the same operation. These type of machine are usually driven mechanically, e.g. by compressed air motor-although for pipes in the smaller diameters a hand-operated windlass may be employed. In machines using lathe type cutting tools. The cutter heads must have 7° front rake.
- **Reciprocating Power Saws** may also be used for cutting ductile iron pipe. These tools are usually electrically driven and for this reason they are principally used in depots or workshops where a power supply is available.

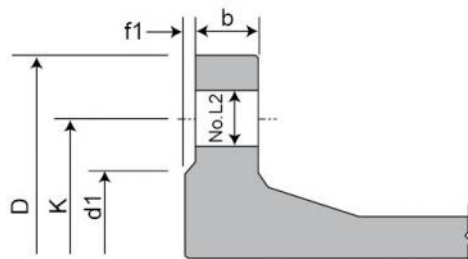
Ensure the spigot is properly chamfered. If it is a cut pipe it is essential to remake the chamfer and ensure that there is a radius to prevent the spigot from displacing the gasket.



Chamfer Details

Nominal Size DN	A	
	MIN mm	MAX mm
80	10	14
100	10	14
150	10	14
200	10	14
250	10	14
300	10	14
350	10	14
400	12	16
450	12	16
500	14	18
600	14	18
700	16	20
800	16	20
900	18	22
1000	20	24
1100	22	26
1200	24	28
1400	28	32
1600	32	36

Dimension of Flange



PN10 Flange

Dimensions in millimeters (mm)

NOMINAL DIAMETER DN	d ₁	D	b	f ₁	K	L ₂	BOLT		MASS (kg)
							Size	No.	
80	132	200	16.0	3	160	19	M16	8	2.9
100	156	220	16.0	3	180	19	M16	8	3.3
150	211	285	16.0	3	240	23	M20	8	5.1
200	266	340	17.0	3	295	23	M20	8	7.1
250	319	400	19.0	3	350	23	M20	12	9.9
300	370	455	20.5	4	400	23	M20	12	12.9
350	429	505	20.5	4	460	23	M20	16	14.7
400	480	565	20.5	4	515	28	M24	16	17.7
450	530	615	21.5	4	565	28	M24	20	20.2
500	582	670	22.5	4	620	28	M24	20	24.3
600	682	780	25.0	5	725	31	M27	20	33.7
700	794	895	27.5	5	840	31	M27	24	46.3
800	901	1015	30.0	5	950	34	M30	24	62.1
900	1001	1115	32.5	5	1050	34	M30	28	73.0
1000	1112	1230	35.0	5	1160	37	M33	28	92.9
1200	1328	1455	40.0	5	1380	40	M36	32	138.0
1400	1530	1675	41.0	5	1590	43	M39	36	174.7
1600	1750	1915	44.0	5	1820	49	M45	40	241.8
1800	1950	2115	47.0	5	2020	49	M45	44	281.9
2000	2150	2325	50.0	5	2230	49	M45	48	336.5

PN16 Flange

Dimensions in millimeters (mm)

NOMINAL DIAMETER DN	d ₁	D	b	f ₁	K	L ₂	BOLT		MASS (kg)
							Size	No.	
80	132	200	16.0	3	160	19	M16	8	2.9
100	156	220	16.0	3	180	19	M16	8	3.3
150	211	285	16.0	3	240	23	M20	8	5.1
200	266	340	17.0	3	295	23	M20	12	6.9
250	319	405	19.0	3	355	28	M24	12	9.6
300	370	460	20.5	4	410	28	M24	12	12.6
350	429	520	22.5	4	470	28	M24	16	17.4
400	480	580	24.0	4	525	31	M27	16	22.2
450	548	640	26.0	4	585	31	M27	20	28.1
500	609	715	27.5	4	650	34	M30	20	37.7
600	720	840	31.0	5	770	37	M33	20	57.4
700	794	910	34.5	5	840	37	M33	24	62.0
800	901	1025	38.0	5	950	40	M36	24	77.0
900	1001	1125	41.5	5	1050	40	M36	28	92.0
1000	1112	1255	45.0	5	1170	43	M39	28	127.4
1200	1328	1485	52.0	5	1390	49	M45	32	192.9
1400	1530	1685	55.0	5	1590	49	M45	36	231.5
1600	1750	1930	60.0	5	1820	56	M52	40	331.1
1800	1950	2130	65.0	5	2020	56	M52	44	393.7
2000	2150	2345	70.0	5	2230	62	M62	48	474.5

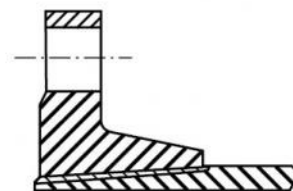
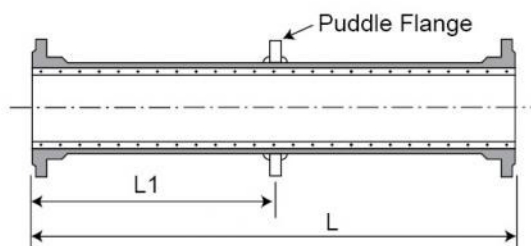
PN25 Flange

Dimensions in millimeters (mm)

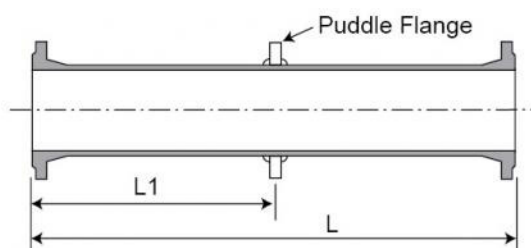
NOMINAL DIAMETER DN	d ₁	D	b	f ₁	K	L ₂	BOLT		MASS (kg)
							Size	No.	
80	132	200	16.0	3	160	19	M16	8	2.9
100	156	235	16.0	3	190	23	M20	8	3.8
150	211	300	17.0	3	250	28	M24	8	6.1
200	274	360	19.0	3	310	28	M24	12	8.9
250	330	425	21.5	3	370	31	M27	12	13.2
300	389	485	23.5	4	430	31	M27	16	18.0
350	448	555	26.0	4	490	34	M30	16	25.3
400	503	620	28.0	4	550	37	M33	16	33.2
450	548	670	30.5	4	600	37	M33	20	39.0
500	609	730	32.5	4	660	37	M33	20	48.3
600	720	845	37.0	5	770	40	M36	20	69.2

Flanged Pipes

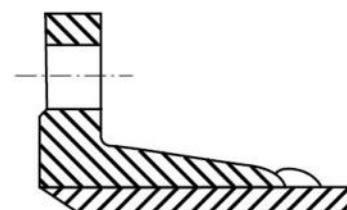
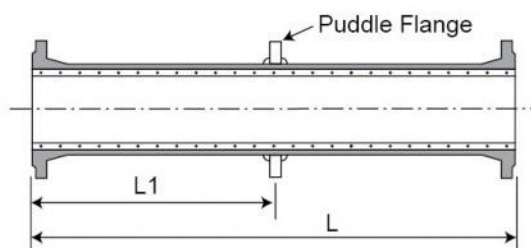
Flanged pipes with
screwed-on flanges, k9, k12
DN80 - DN600
 L, L_1 to be specified



Flanged pipes with
cast-on flanges, k12
DN1200 - DN2000
 $L \leq 4000\text{mm}$



Flanged pipes with
welded-on flanges, k9
DN80 - DN1000
 L, L_1 to be specified



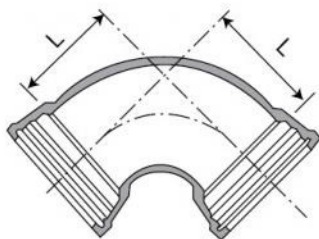
Nominal Diameter DN	Body				Mass kg			
	k=9		k=12		Flange, each			Puddle Flange
	e mm	kg/m	e mm	kg/m	PN10	PN16	PN25	
80	6.0	12.2	7.0	14.1	2.9	2.9	2.9	1.9
100	6.1	15.1	7.2	17.7	3.3	3.3	3.8	2.1
150	6.3	22.8	7.8	28.0	5.1	5.1	6.1	2.8
200	6.4	30.6	8.4	39.7	7.1	6.9	8.9	4.0
250	6.8	40.2	9.0	52.8	9.9	9.6	13.2	5.7
300	7.2	50.8	9.6	67.3	12.9	12.6	18.0	6.3
350	7.7	63.2	10.2	83.1	14.7	17.4	25.3	8.1
400	8.1	75.5	10.8	100.0	17.7	22.2	33.2	10.7
450	8.5	91.2	11.4	118.3	20.2	28.1	39.0	12.3
500	9.0	104.3	12.0	138.2	24.3	37.7	48.3	13.9
600	9.9	137.1	13.2	181.8	33.7	57.4	69.2	18.2
700	10.8	173.9	14.4	230.8	46.3	58.0	-	26.2
800	11.7	215.2	15.6	285.5	62.1	77.0	-	34.7
900	12.6	260.2	16.8	345.4	73.0	92.0	-	41.0
1000	13.5	309.3	18.0	410.6	92.9	127.4	-	51.7
1200	15.3	420.1	20.4	557.8	138.0	192.9	-	77.1
1400	17.1	547.2	22.8	726.8	174.7	231.5	-	90.0
1600	18.9	690.3	25.2	916.9	241.8	331.1	-	110.0
1800	20.7	850.1	27.6	1129.3	281.9	393.7	-	125.0
2000	22.5	1026.3	30.0	1363.4	336.5	474.5	-	145.0

Fittings

Double Socket Bend

T Type

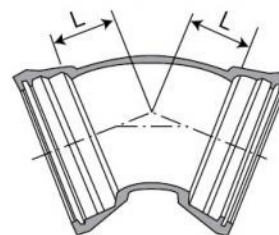
Double Socket 90° Bend



K=12 Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	100	7.1
100	120	9.2
150	170	16.8
200	220	28.0
250	270	42.5
300	320	63.5
350	370	83.0
400	420	113.0
450	470	143.0
500	520	183.0
600	620	273.0
700	720	455.0
800	820	605.0
900	920	813.0
1000	1020	1045.0

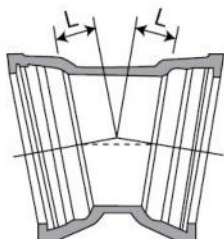
Double Socket 45° Bend



K=12 Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	55	6.3
100	65	7.9
150	85	13.5
200	110	22.0
250	130	32.5
300	150	49.0
350	175	61.0
400	195	82.5
450	220	103.0
500	240	130.0
600	286	191.0
700	330	282.0
800	370	378.0
900	415	496.0
1000	460	635.0

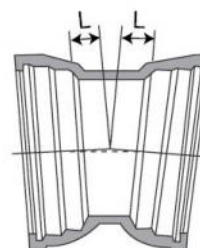
Double Socket 22½° Bend



K=12 Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	40	5.9
100	40	7.3
150	55	12.0
200	65	18.8
250	75	27.0
300	85	41.0
350	95	50.0
400	110	66.0
450	120	81.5
500	130	103.0
600	150	147.0
700	175	217.0
800	195	287.0
900	220	373.0
1000	240	470.0

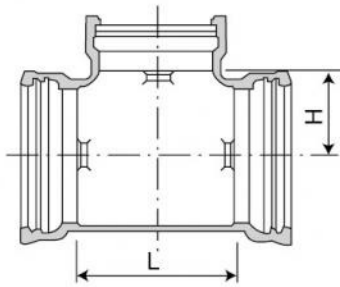
Double Socket 11¼° Bend



K=12 Dimensions in millimeters (mm)

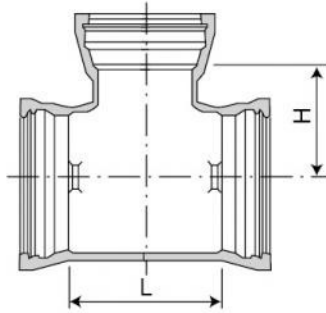
Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	30	5.6
100	30	6.9
150	35	11.2
200	40	11.7
250	50	24.5
300	55	37.0
350	60	44.0
400	65	58.0
450	70	81.5
500	75	90.0
600	85	126.0
700	95	181.0
800	110	239.0
900	120	305.0
1000	130	381.0

T Type



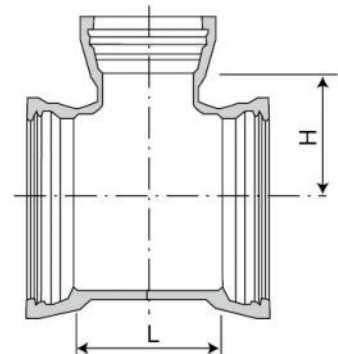
DN 80 to DN 250

All Socket Tee



DN 300 to DN 600

NORWARDS
tested through time



DN 700 to DN 900

K=14 Dimensions in millimeters (mm)

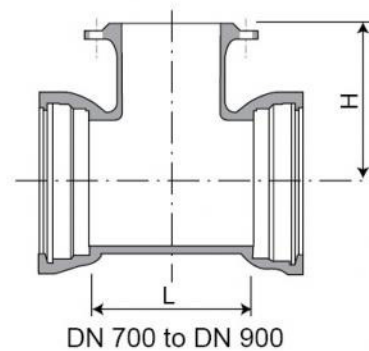
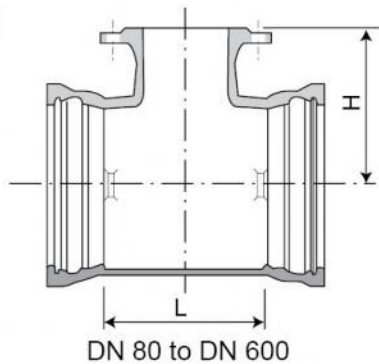
Nominal Diameter		LENGTH		MASS (kg) T Type
DN	dn	L	H	
80	80	170	85	10.9
100	80	170	95	12.6
100	100	190	95	13.8
150	80	170	120	18.1
150	100	195	120	19.5
150	150	255	125	23.0
200	80	175	145	25.5
200	100	200	145	27.0
200	150	255	150	31.5
200	200	315	155	37.5
250	80	200	210	35.5
250	100	200	210	36.0
250	150	315	220	45.0
250	200	315	220	48.0
250	250	375	230	55.0
300	80	220	235	48.0
300	100	205	235	49.0
300	150	260	245	60.0
300	200	320	245	62.0
300	250	375	250	74.5
300	300	435	260	79.5
350	80	225	260	57.0
350	100	205	260	57.0
350	150	325	270	70.5
350	200	325	270	90.5
350	250	375	275	96.0
350	300	440	285	98.0
350	350	495	290	100.0
400	80	225	290	72.5
400	100	210	285	73.0
400	150	325	295	88.5
400	200	325	295	91.0
400	250	375	300	116.0
400	300	440	310	126.0
400	350	495	315	127.0
400	400	560	320	133.0
450	80	230	315	86.0
450	100	215	320	87.5
450	150	330	320	105.0
450	200	330	320	108.0
450	250	375	325	138.0
450	300	445	335	146.0
450	350	495	340	161.0
450	400	560	345	169.0
450	450	620	350	171.0
500	80	230	345	105.0
500	100	215	345	106.0
500	150	330	345	127.0
500	200	330	345	129.0
500	250	380	350	170.0
500	300	450	360	167.0

K=14 Dimensions in millimeters (mm)

Nominal Diameter		LENGTH		MASS (kg) T Type
DN	dn	L	H	
500	350	500	365	184.0
500	400	565	370	188.0
500	450	620	375	206.0
500	500	680	380	219.0
600	80	355	400	167.0
600	100	340	395	168.0
600	150	285	395	170.0
600	200	340	395	172.0
600	250	380	400	205.0
600	300	455	410	211.0
600	350	500	415	229.0
600	400	570	420	247.0
600	450	620	425	280.0
600	500	685	430	296.0
600	600	800	440	322.0
700	100	345	455	279.0
700	150	345	445	283.0
700	200	345	445	289.0
700	250	415	420	306.0
700	300	460	460	326.0
700	350	530	425	342.0
700	400	575	470	361.0
700	450	640	435	381.0
700	500	650	480	411.0
700	600	810	490	461.0
700	700	925	500	536.0
800	100	350	495	341.0
800	150	350	495	347.0
800	200	350	495	353.0
800	250	420	470	375.0
800	300	465	510	399.0
800	350	535	480	418.0
800	400	580	520	439.0
800	450	645	490	463.0
800	500	815	530	472.0
800	600	1045	540	629.0
800	700	1045	550	665.0
800	800	1045	565	701.0
900	100	355	545	446.0
900	150	355	545	450.0
900	200	355	545	458.0
900	250	425	535	482.0
900	300	590	570	509.0
900	350	540	535	532.0
900	400	590	570	556.0
900	450	650	535	582.0
900	500	820	590	610.0
900	600	820	590	833.0
900	700	1050	615	878.0
900	800	1170	615	903.0
900	900	1170	625	944.0

Double Socket Tee With Flanged Branch

T Type



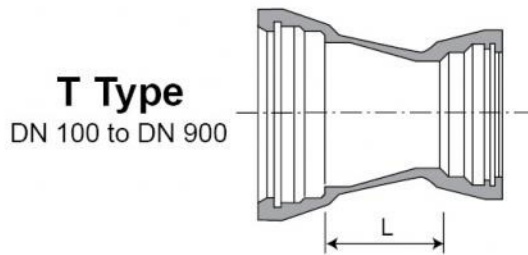
K=14 Dimensions in millimeters (mm)

Nominal Diameter		LENGTH		MASS (kg)
DN	dn	L	H	T Type
80	80	170	165	12.6
100	80	170	175	14.3
100	100	190	180	15.9
150	80	170	205	19.7
150	100	195	210	21.5
150	150	255	220	26.5
200	80	175	235	27.0
200	100	200	245	29.0
200	150	255	250	35.0
200	200	315	260	41.5
250	80	200	270	37.0
250	100	200	270	38.0
250	150	255	280	48.5
250	200	315	290	52.0
250	250	375	300	61.0
300	80	205	300	49.5
300	100	205	300	51.0
300	150	260	310	63.0
300	200	320	320	66.5
300	250	375	330	75.0
300	300	435	340	88.0
350	80	205	330	58.5
350	100	205	330	59.5
350	150	260	340	74.0
350	200	325	350	77.0
350	250	375	360	102.0
350	300	435	370	108.0
350	350	495	380	114.0
400	80	210	360	74.0
400	100	210	360	75.0
400	150	265	370	91.5
400	200	325	380	95.5
400	250	375	390	128.0
400	300	435	400	138.0
400	350	495	410	146.0
400	400	560	420	152.0
450	80	215	395	88.0
450	100	215	395	89.0
450	150	270	400	108.0
450	200	325	410	112.0
450	250	375	420	140.0
450	300	455	430	149.0
450	350	495	440	169.0
450	400	560	450	181.0
450	450	620	460	196.0
500	80	215	420	107.0
500	100	215	420	108.0
500	150	275	430	130.0
500	200	330	440	133.0
500	250	380	450	165.0
500	300	450	460	171.0
500	350	500	470	195.0
500	400	565	480	205.0

K=14 Dimensions in millimeters (mm)

Nominal Diameter		LENGTH		MASS (kg)
DN	dn	L	H	T Type
500	450	620	490	212.0
500	500	680	500	247.0
600	80	220	480	168.0
600	100	220	480	169.0
600	150	285	490	172.0
600	200	340	500	171.0
600	250	380	510	218.0
600	300	455	520	216.0
600	350	500	530	243.0
600	400	570	540	263.0
600	450	620	550	293.0
600	500	685	560	309.0
600	600	800	580	366.0
700	80	345	525	276.0
700	100	345	525	278.0
700	150	345	525	292.0
700	200	345	525	242.0
700	250	415	525	313.0
700	300	460	540	300.0
700	350	530	545	355.0
700	400	575	555	325.0
700	450	640	580	402.0
700	500	690	570	400.0
700	600	810	585	445.0
700	700	925	600	475.0
800	80	360	440	304.0
800	100	350	585	304.0
800	150	350	585	308.0
800	200	350	585	311.0
800	250	420	575	382.0
800	300	580	600	371.0
800	350	535	600	431.0
800	400	580	615	403.0
800	450	645	630	483.0
800	500	815	630	515.0
800	600	815	645	605.0
800	700	1045	660	635.0
800	800	1045	675	642.0
900	80	370	490	436.0
900	100	355	630	378.0
900	150	355	640	381.0
900	200	355	645	384.0
900	250	425	635	489.0
900	300	590	660	455.0
900	350	540	660	546.0
900	400	590	675	495.0
900	450	650	690	602.0
900	500	820	690	681.0
900	600	1170	705	774.0
900	700	1170	720	803.0
900	800	1170	735	823.0
900	900	1170	750	838.0

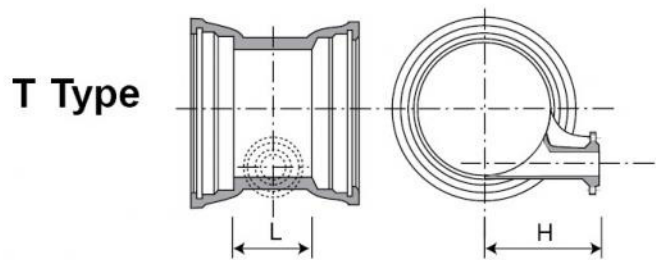
Double Socket Taper



K=12 Dimensions in millimeters (mm)

Nominal Diameter		LENGTH	MASS (kg)
DN	dn	L	
100	80	90	6.6
150	80	190	10.9
150	100	150	10.8
200	100	250	17.0
200	150	150	16.4
250	150	250	24.5
250	200	150	23.5
300	150	350	35.5
300	200	250	34.5
300	250	150	33.0
350	200	360	45.5
350	250	260	44.0
350	300	160	43.0
400	200	460	61.5
400	250	360	59.5
400	300	360	58.0
400	350	160	53.0
450	250	460	76.0
450	300	360	75.0
450	350	260	69.5
450	400	160	66.0
500	250	560	96.5
500	300	460	95.5
500	350	360	90.5
500	400	260	86.5
500	450	160	86.5
600	300	660	144.0
600	350	560	138.0
600	400	460	133.0
600	450	360	127.0
600	500	260	121.0
700	350	800	235.0
700	400	700	231.0
700	450	600	224.0
700	500	480	215.0
700	600	280	196.0
800	400	870	303.0
800	450	770	295.0
800	500	670	288.0
800	600	480	270.0
800	700	280	280.0
900	450	940	396.0
900	500	840	388.0
900	600	640	365.0
900	700	480	384.0
900	800	280	355.0

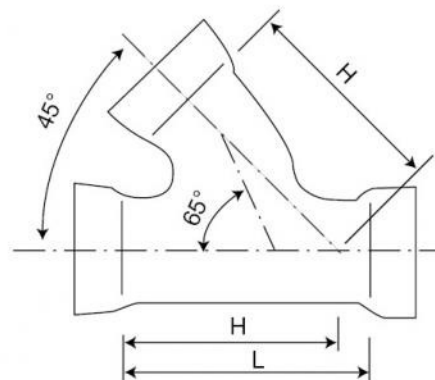
Double Socket Level Invert Tee With Flanged Branch



K=14 Dimensions in millimeters (mm)

Nominal Diameter		LENGTH		MASS (kg)
DN	dn	L	H	
200	80	245	250	27.5
250	80	275	275	37.5
300	80	255	300	50.0
350	100	280	325	60.5
400	100	280	350	76.0
450	100	285	375	90.0
500	100	290	400	108.0
600	100	295	450	171.0
700	150	360	500	296.0
700	200	360	500	300.0
800	150	365	550	360.0
800	200	365	550	364.0
900	150	370	600	467.0
900	200	370	600	471.0

T Type 45° All Socket Angle Branch

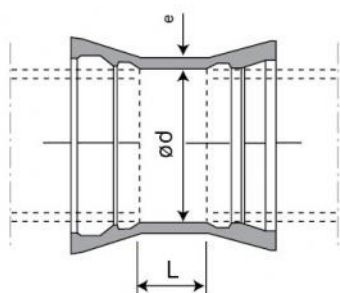


K=14 Dimensions in millimeters (mm)

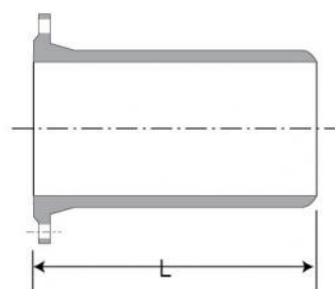
Nominal Diameter		LENGTH		MASS (kg)
DN	dn	L	H	
80	80	500	375	19.0
100	100	540	405	25.5
150	150	640	480	45.5
200	200	735	560	71.5
250	250	830	640	106.0
300	300	930	715	151.0
350	350	880	790	169.0
400	400	970	870	209.0
450	450	1060	950	281.0
500	500	1140	1025	347.0
600	600	1310	1180	511.0
700	700	1250	1280	929.0
800	800	1380	1410	1235.0
900	900	1510	1530	1611.0

T Type

Collar



Flanged Spigot



K=12 Dimensions in millimeters (mm)

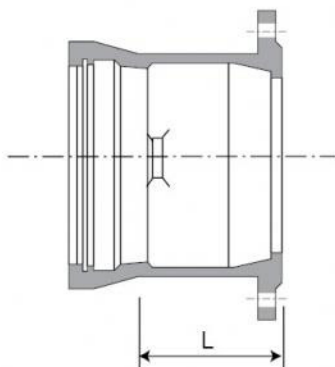
Nominal Diameter	Thickness	Diameter	LENGTH	MASS
DN	e	d	L	(kg)
80	7	109	125	9.3
100	7.2	130	125	12.2
150	7.8	183	130	18.0
200	8.4	235	140	25.0
250	9	288	155	33.0
300	9.6	340	160	43.0
350	10.2	393	180	58.0
400	10.8	445	200	72.0
450	11.4	498	210	80.0
500	12	550	215	105.0
600	13.2	655	250	147.0
700	14.4	760	270	192.0
800	15.6	865	280	251.0
900	16.8	970	320	317.0

K=12 Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	350	7.8
100	360	9.6
150	380	15.6
200	400	22.5
250	420	31.5
300	440	42.0
350	460	55.0
400	480	70.0
450	500	86.0
500	520	109.0
600	560	159.0
700	600	194.0
800	600	245.0
900	600	295.0

Flanged Socket

DN 80 to DN 900

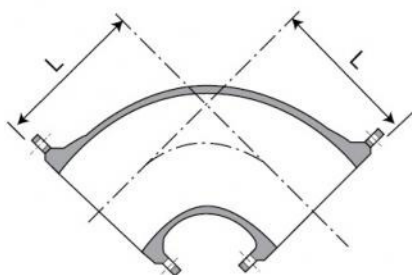


K=12 Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	130	7.3
100	130	8.7
150	135	13.6
200	140	19.7
250	145	27.5
300	150	36.5
350	155	48.0
400	160	60.0
450	165	75.5
500	170	93.0
600	180	135.0
700	190	159.0
800	200	208.0
900	210	258.0

Double Flanged Bend

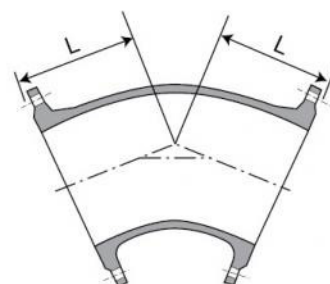
Double Flanged 90° Bend



K=12 Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	165	9.6
100	180	11.9
150	220	20.0
200	260	30.5
250	350	49.0
300	400	69.0
350	450	96.0
400	500	126.0
450	550	160.0
500	600	210.0
600	700	324.0
700	800	416.0
800	900	571.0
900	1000	745.0
1000	1100	990.0

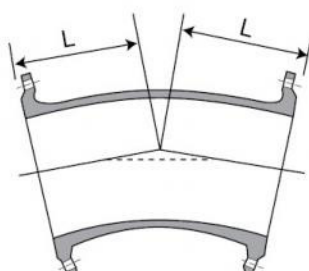
Double Flanged 45° Bend



K=12 Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	130	9.3
100	140	11.3
150	160	18.5
200	180	27.0
250	350	54.0
300	400	76.0
350	298	82.0
400	325	106.0
450	349	132.0
500	375	174.0
600	425	264.0
700	480	326.0
800	530	442.0
900	580	567.0
1000	630	751.0

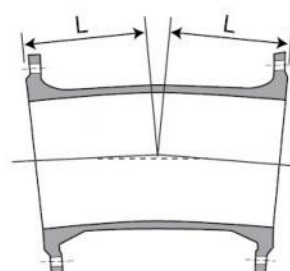
Double Flanged 22½° Bend



K=12 Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	130	9.2
100	140	11.5
150	160	18.6
200	180	27.0
250	350	54.5
300	400	77.5
350	298	83.0
400	324	107.0
450	349	135.0
500	375	176.0
600	426	267.8
700	478	329.2
800	529	447.0
900	581	577.2
1000	632	760.0

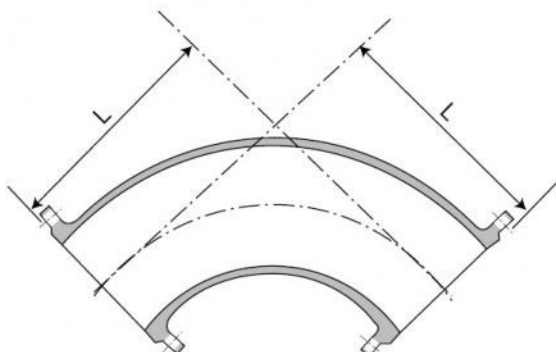
Double Flanged 11¼° Bend



K=12 Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS
DN	L	(kg)
80	130	9.2
100	140	11.5
150	160	18.6
200	180	27.5
250	350	55.0
300	400	78.0
350	298	83.5
400	324	108.0
450	349	135.0
500	375	177.0
600	426	268.0
700	478	331.2
800	529	449.0
900	581	576.4
1000	632	764.0

Double Flanged 90° Long Radius Bend

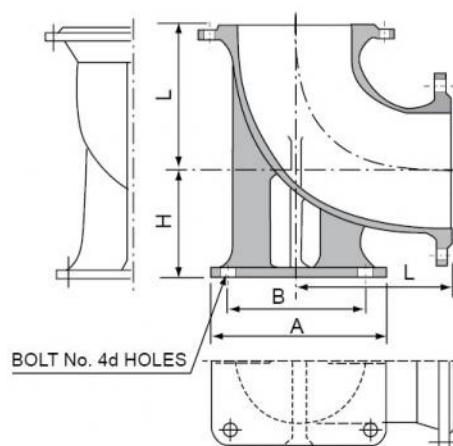


K=12

Dimensions in millimeters (mm)

Nominal Diameter	LENGTH	MASS (kg)
DN	L	
80	380	13.8
100	400	18.0
150	450	30.0
200	500	45.4
250	550	65.0
300	600	89.5
350	650	121.0
400	700	157.0
450	750	184.0
500	800	252.0
600	900	377.0

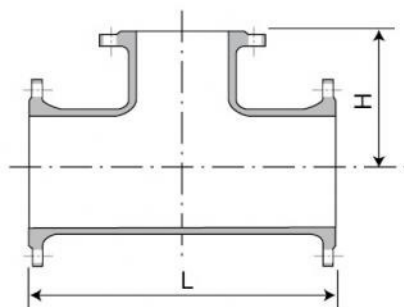
Double Flanged 90° Duckfoot Bend



K=12

Dimensions in millimeters (mm)

NOMINAL DIAMETER	LENGTH	LENGTH	LENGTH	LENGTH	Hole Diameter	MASS
DN	L	H	A	B	d	(kg)
80	165	110	180	120	19	14.0
100	180	125	200	130	23	17.7
150	220	160	250	165	28	30.0
200	260	190	300	215	28	46.0
250	350	225	350	250	31	75.0
300	400	255	400	300	31	105.0
350	450	290	450	350	34	145.0
400	500	320	500	390	37	189.0
450	550	355	550	440	37	246.0
500	600	385	600	490	37	313.0
600	700	450	700	580	40	481.0
700	800	515	800	680	43	586.0
800	900	580	900	770	49	798.0
900	1000	645	1000	870	49	1050.0
1000	1100	710	1100	960	56	1380.0



All Flanged Tee

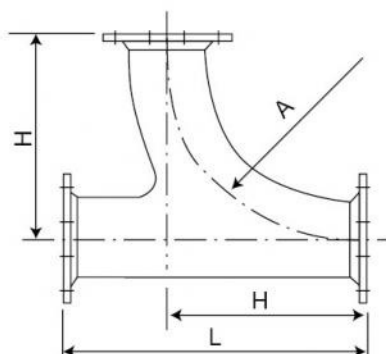
K=14 Dimensions in millimeters (mm)

Nominal Diameter		LENGTH		MASS (kg)
DN	dn	L	H	
80	80	330	165	15.6
100	50	360	175	18.0
100	80	360	175	18.4
100	100	360	180	19.3
150	50	440	200	27.5
150	80	440	205	28.5
150	100	440	210	29.5
150	150	440	220	32.5
200	80	520	235	41.5
200	100	520	240	42.0
200	150	520	250	45.5
200	200	520	260	49.0
250	50	700	255	63.0
250	80	700	265	64.8
250	100	700	275	67.0
250	150	700	300	70.0
250	200	700	325	75.0
250	250	700	350	81.0
300	80	800	290	91.0
300	100	800	300	93.0
300	150	800	325	95.0
300	200	800	350	101.0
300	250	800	375	106.0
300	300	800	400	115.0
350	80	850	325	120.0
350	100	850	325	122.0
350	150	850	325	123.0
350	200	850	325	128.0
350	250	850	325	132.0
350	300	850	425	144.0
350	350	850	425	150.0
400	80	900	350	152.0
400	100	900	350	154.0
400	150	900	350	155.0
400	200	900	350	159.0
400	250	900	350	161.0
400	300	900	450	173.0
400	350	900	450	183.0
400	400	900	450	190.0
450	80	950	375	187.0
450	100	950	375	188.0
450	150	950	375	190.0
450	200	950	375	193.0
450	250	950	375	197.0
450	300	950	475	213.0
450	350	950	475	221.0
450	400	950	475	229.0
450	450	950	475	237.0
500	80	1000	400	237.0
500	100	1000	400	241.0
500	150	1000	400	241.0
500	200	1000	400	245.0
500	250	1000	400	246.0

K=14 Dimensions in millimeters (mm)

Nominal Diameter		LENGTH		MASS (kg)
DN	dn	L	H	
500	300	1000	500	258.0
500	350	1000	500	268.0
500	400	1000	500	276.0
500	450	1000	500	290.0
500	500	1000	500	297.0
600	80	1100	450	339.0
600	100	1100	450	340.0
600	150	1100	450	352.0
600	200	1100	450	358.0
600	250	1100	450	358.0
600	300	1100	550	369.0
600	350	1100	550	376.0
600	400	1100	550	387.0
600	450	1100	550	404.0
600	500	1100	550	408.0
600	600	1100	550	434.0
700	100	540	510	282.0
700	150	595	515	283.0
700	200	650	525	298.0
700	250	705	530	320.0
700	300	760	540	342.0
700	350	830	555	363.0
700	400	870	555	379.0
700	450	920	560	401.0
700	500	980	570	448.0
700	600	1200	585	523.0
700	700	1200	600	534.0
800	100	580	570	372.0
800	150	585	575	376.0
800	200	690	585	384.0
800	250	770	585	414.0
800	300	800	600	435.0
800	350	880	600	461.0
800	400	910	615	478.0
800	450	980	615	508.0
800	500	1020	630	538.0
800	600	1350	645	678.0
800	700	1350	660	706.0
800	800	1350	675	715.0
900	100	620	630	473.0
900	150	675	635	477.0
900	200	730	645	482.0
900	250	820	645	522.0
900	300	840	660	550.0
900	350	930	655	576.0
900	400	950	675	591.0
900	450	1030	680	630.0
900	500	1060	690	662.0
900	600	1500	705	860.0
900	700	1500	720	901.0
900	800	1500	735	913.0
900	900	1500	750	924.0

90° All Flanged Radial Tee



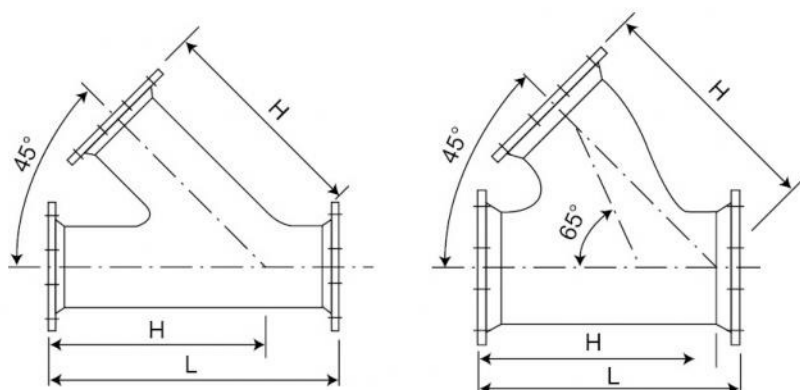
90° All Flanged Radial Tee

K=14

Dimensions in millimeters (mm)

Nominal Diameter		LENGTH			MASS (kg)
DN	dn	L	H	A	PN16
80	80	545	380	330	23.0
100	100	580	400	340	29.5
150	150	670	450	385	47.9
200	200	760	500	430	71.6
250	250	900	550	475	104.8
300	300	1000	600	515	144.5
350	350	1100	650	560	203.4
400	400	1200	700	605	263.1
450	450	1300	750	650	332.0
500	500	1400	800	690	421.9
600	600	1600	900	780	623.7

45° All Flanged Angle Branch



DN 80 to DN 300

DN 350 to DN 600

45° All Flanged Angle Branch

K=14

Dimensions in millimeters (mm)

Nominal Diameter		LENGTH		MASS (kg)
DN	dn	L	H	PN16
80	80	500	375	21.0
100	100	540	405	27.0
150	150	650	480	46.4
200	200	735	560	70.1
250	250	830	640	103.8
300	300	930	715	145.5
350	350	880	790	167.4
400	400	970	870	204.1
450	450	1060	950	277.0
500	500	1140	1025	350.9
600	600	1310	1180	540.7

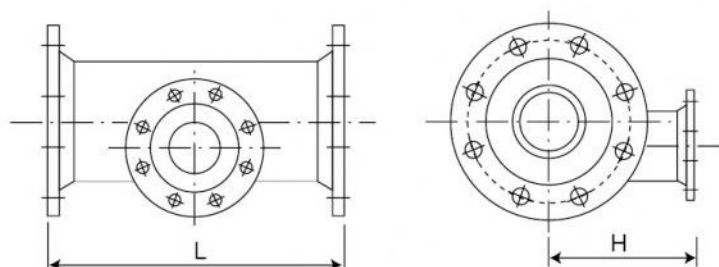
All Flanged Level Invert Tee

K=14

Dimensions in millimeters (mm)

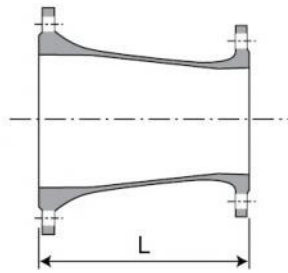
Nominal Diameter		LENGTH		MASS (kg)
DN	dn	L	H	PN16
100	80	360	195	19.5
150	80	440	220	29.5
200	80	520	250	42.5
200	100	520	250	43.5
250	80	700	275	54.0
250	100	700	275	68.5
300	80	800	305	92.0
300	100	800	305	95.5
300	150	800	305	99.0
350	80	850	340	121.0
350	100	850	340	123.0
350	150	850	340	128.0
400	80	900	365	153.0
400	100	900	365	156.0
400	150	900	365	162.0
400	200	900	365	167.0
450	80	950	380	188.0
450	100	950	380	189.0
450	150	950	380	197.0
450	200	950	380	202.0
500	80	1000	400	237.0
500	100	1000	400	241.0
500	150	1000	400	248.0
500	200	1000	400	255.0
600	80	1100	435	350.0
600	100	1100	435	351.0
600	150	1100	435	360.0
600	200	1100	435	370.0
700	150	600	500	262.0
700	200	650	500	268.0
800	150	670	540	379.0
800	200	690	540	388.0
900	150	720	580	481.0
900	200	730	580	513.0

All Flanged Level Invert Tee

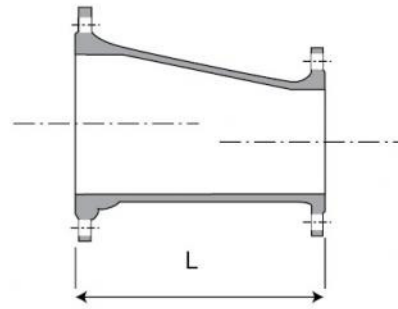


Double Flanged Taper

Concentric Type



Flat Type

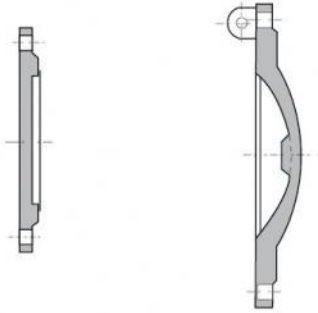


K=12

Dimensions in millimeters (mm)

Nominal Diameter		LENGTH	MASS
DN	dn	L	(kg)
80	50	200	6.0
100	50	200	6.0
100	80	200	9.3
150	80	400	12.0
150	100	300	15.0
200	100	600	27.0
200	150	300	21.5
250	150	600	38.0
250	200	300	29.5
300	100	700	50.5
300	150	650	46.0
300	200	600	51.0
300	250	300	39.5
350	200	650	60.5
350	250	600	67.0
350	300	300	52.0
400	200	700	71.0
400	250	650	77.0
400	300	600	84.0
400	350	300	67.0
450	250	700	87.5
450	300	650	95.0
450	350	600	104.5
450	400	300	81.0
500	250	700	114.0
500	300	700	111.0
500	350	650	121.0
500	400	600	130.0
500	450	300	102.0
600	300	800	171.0
600	350	750	167.0
600	400	700	164.0
600	450	650	175.0
600	500	600	190.0
700	350	900	225.0
700	400	800	212.0
700	450	750	213.0
700	500	700	208.0
700	600	600	236.0
800	400	1000	293.0
800	450	900	286.0
800	500	800	284.0
800	600	700	275.0
800	700	600	285.0
900	450	1100	380.0
900	500	1000	370.0
900	600	800	360.0
900	700	700	333.0
900	800	600	352.0

Blank Flange (PN16)

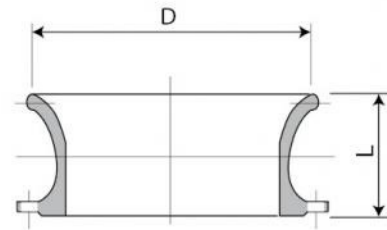


DN 80 to DN 300 DN 350 to DN 1000

Dimensions in millimeters (mm)

Nominal Diameter DN	MASS (kg)
80	3.5
100	4.3
150	7.2
200	10.8
250	16.6
300	23.5
350	33.5
400	44.5
450	63.5
500	77.0
600	121.0
700	156.0
800	218.0
900	286.0
1000	387.0

Flange Bellmouth



K=12

Dimensions in millimeters (mm)

Nominal Diameter DN	L	D	MASS (kg)
80	130	150	5.2
100	135	175	6.2
150	150	230	10.1
200	170	290	14.7
250	183	345	20.5
300	205	405	28.5
350	220	460	38.0
400	240	520	49.5
450	255	575	62.0
500	275	635	80.0
600	310	750	120.0
700	345	865	146.0
800	380	980	197.0
900	415	1095	250.0
1000	450	1210	331.0

T Type Joint Accessories

Rubber Gasket



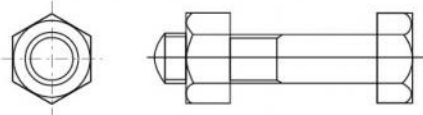
DN 80 to DN 1400



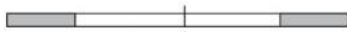
DN 1600 to DN 2000

Flange Joint Accessories

Mild Steel Bolts and Nuts



Rubber Gasket for Raised Faced Flange

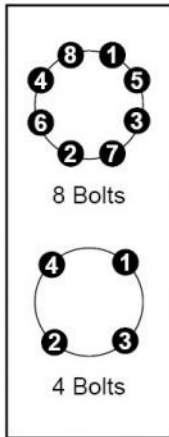


Mild Steel Bolts and Nuts

Dimensions in millimeters (mm)

Nominal Diameter DN	PN10 Flange		PN16 Flange		PN25 Flange	
	Size and Length	No. of Bolts	Size and Length	No. of Bolts	Size and Length	No. of Bolts
80	M16x65	8	M16x65	8	M16x65	8
100	M16x65	8	M16x65	8	M20x70	8
150	M20x70	8	M20x70	8	M24x80	8
200	M20x70	8	M20x70	12	M24x80	12
250	M20x80	12	M24x85	12	M27x90	12
300	M20x80	12	M24x85	12	M27x90	16
350	M20x80	16	M24x85	16	M30x110	16
400	M24x85	16	M27x100	16	M33x120	16
450	M24x85	20	M27x100	20	M33x120	20
500	M24x85	20	M30x110	20	M33x120	20
600	M27x100	20	M33x120	20	M36x140	20
700	M27x100	24	M33x120	24	-	-
800	M30x110	24	M36x140	24	-	-
900	M30x120	28	M36x140	28	-	-
1000	M33x130	28	M39x150	28	-	-
1200	M36x140	32	M45x170	32	-	-
1400	M39x150	36	M45x180	36	-	-
1600	M45x160	40	M52x190	40	-	-
1800	M45x160	44	M52x200	44	-	-
2000	M45x170	48	M56x230	48	-	-

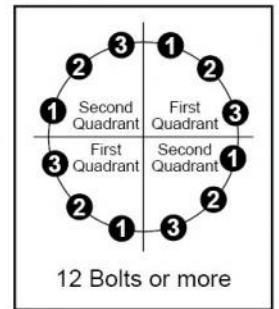
Bolt Tightening Sequence



- Use only 3mm thick, one piece, 80 hardness synthetic rubber gasket and to suit flange rating.
- Hold gasket in correct position on clean flange face until flanges meet.
- Use only undamaged rust free bolts, nuts and washers.
- Lubricate bolt threads and all mating surface of nuts, washers and flanges using an automotive grade of oil or grease.
- Tighten the bolts in the sequence shown until full torque is achieved.
- Check and, if necessary, re-tighten bolts immediately before pressure testing.

For sizes having 12 or more bolts, it is recommended that two jointers work simultaneously on diametrically opposed bolts tightening first nut in first quadrant then first nut in second quadrant returning to second nut in first quadrant and so on.

It is important that sufficient number of circuits are carried out to achieved the specified torque on every bolt.



Universal Coupling

Universal Coupling Dimension

Dimensions in millimeters (mm)

Pipe Nominal Bore (mm)	Pipe / OD		Coupling Size			Bolts	
	Min. (mm)	Max. (mm)	A	B	C	Size	No.
80	88.9	99	70	133	203	M16x150	4
100	114	126	70	133	229	M16x150	4
150	168	179	70	133	279	M16x150	4
200	219	234	83	152	356	M16x180	4
250	273	286	83	152	415	M16x180	6
300	324	334	83	152	480	M16x180	6

Suitable for various outside diameter pipes within permissible range.

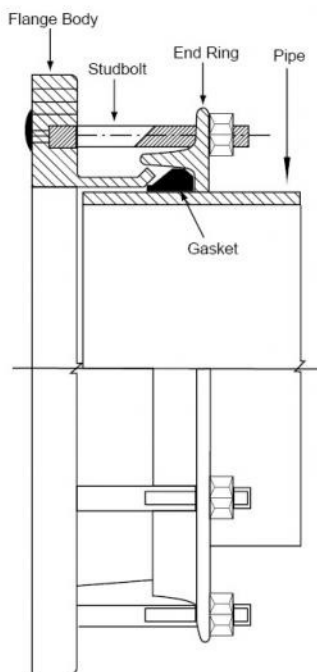
Universal Flange Adaptor

Universal Flange Adaptor Dimension

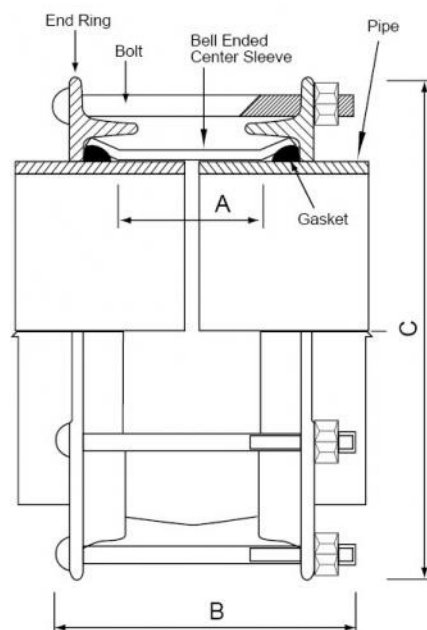
Dimensions in millimeters (mm)

Pipe Nominal Bore (mm)	Pipe / OD		Flange Hole Details		Maining Flange Connection Pipe / OD will Connect to Flange BS 4504 (1969)
	Min. (mm)	Max. (mm)	No.	Size (mm)	
80	88.9	99	8	19	80mm (PN10, PN16)
100	114	126	8	19	100mm (PN10, PN16)
150	168	179	8	19	150mm (PN10, PN16)
200	219	234	16	22	200mm (PN10, PN16)
250	273	286	12	26	250mm (PN10, PN16)
300	324	334	12	26	300mm (PN10, PN16)

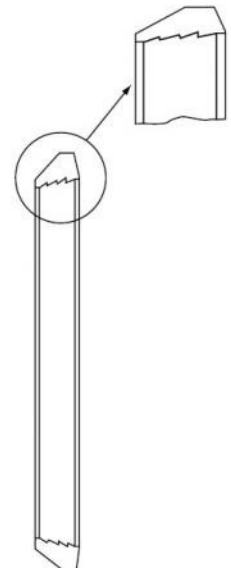
Suitable for various diameter pipes within permissible range.



Universal Flange Adaptor
(For DN80 to DN300)



Universal Coupling
(For DN80 to DN300)



Rubber Gasket for
Universal Coupling and
Universal Flange Adaptor