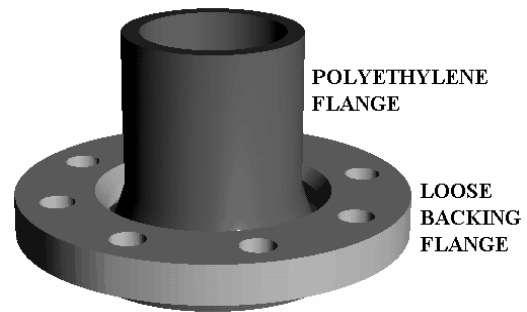


Flange Connections: Assembly Notes

For transition from polyethylene (PE) pipe to flanged ancillary equipment such as valves and pumps or to pipes made of another material, a PE flange adapter with metal backing ring is usually used. PE stub flange with fitted backing ring is fusion joined to PE pipe end and then connected to a mating flange or flange adapter.



PE stub flanges are manufactured to mating dimensions specified in ISO 9624 and are pressure rated. Typical dimensions of PE stub flanges are given in Table 1 based on specifications of ISO 9624, AS/NZS 4129 and DIN 16963.4.

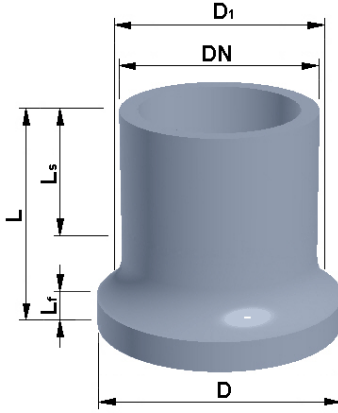
Full-face PE stub flanges should not be mated with raised-face metallic flanges; an insertion flange should be used at the interface, to prevent excessive bending moment in the flange.

Metal backing rings (or flanges) are made in compliance with dimension specifications of various standards, most used in New Zealand being AS 2129 and AS/NZS 4331.1. Metal backing rings are also pressure rated. Dimensions of backing flanges of various pressure ratings, materials and dimension specifications are listed in AS/NZS 4331.1, AS 2129, AS 4087, ANSI 150 and PIPA Guidelines POP007.

Steel backing flanges and fasteners are plated (galvanised) or protected with polymeric coating; alternatively stainless steel flanges and fasteners can be used. For information, basic dimensions of steel flanges used in most applications are listed in Tables 2-5. For hydrant connections in New Zealand, flanges of dimensions given in Table 6 are usually used.

For lower pressure polyethylene systems (under 0.7 MPa) typically a **gasket** is not required unless either of mating surfaces is damaged or there are special requirements to the joint – the serrated surface on the stub flange face is usually adequate. For higher pressure systems gaskets may be required and should be used for polyethylene – non-polyethylene connections. Gasket material shall be suitable for the flange, the fluid and the environment; commonly gaskets are made of natural rubber, polychloroprene or neoprene. Gaskets are usually 3-5 mm in thickness, of medium hardness, and are available in full face and drop-in styles. Full face style gaskets are usually recommended, especially for larger size pipelines. The sealing gaskets shall be clean and free of creases.

Prior to flange joint assembly the mating flanges must be in true alignment and butted square to each other – tightening misaligned flanges can cause leakage or flange failure. Mating faces shall be clean, free of contamination or damage. The fusion joint between PE pipe and flange shall be allowed to cool to the ambient temperature before tightening the flange connection (ensure that the metal backing flange is placed over the PE flange before the welding). The gasket shall be centred properly between the mating faces.


Table 1. Polyethylene stub flanges

Nominal pipe size, DN, mm	D _{min.} [*] , mm	D ₁ , mm	L _{s min.} , mm, for		SDR11 (PN16 for PE100 or PN12.5 for PE80)		SDR17 (PN10 for PE100 or PN8 for PE80)	
			electrofusion (EF) fitting ^{**}	butt welding	L _{f min.} , mm	L _{for EF min.} , mm	L _{f min.} , mm	L _{for EF min.} , mm
20	45	27	37	25	7	60		
25	58	33	40	25	9	67	9	67
32	68	40	44	25	10	72	10	72
40	78	50	49	25	11	80	11	80
50	88	61	55	25	12	87	12	87
63	102	75	63	25	14	99	14	99
75	122	89	70	25	16	108	16	108
90	138	105	79	28	17	118	17	118
110	158	125	82	32	18	124	18	124
125	158	132	87	35	25	136	18	129
140	188	155	92	38	25	141	18	134
160	212	175	98	42	25	149	18	142
180	212	180	105	46	30	161	20	151
200	268	232	112	50	32	172	24	164
225	268	235	120	55	32	180	24	172
250	320	285	129	60	35	194	25	184
280	320	291	150	75	35	215	25	205
315	370	335	150	75	35	219	25	209
355	430	373	164	75	40	241	30	231
400	482	427	179	75	46	265	33	252
450	585	514	195	100	60	299	46	285

* D_{max} is usually defined by bolting arrangements.

** Spigotted stub flanges (for electrofusion fittings) may be used for butt welding as well.

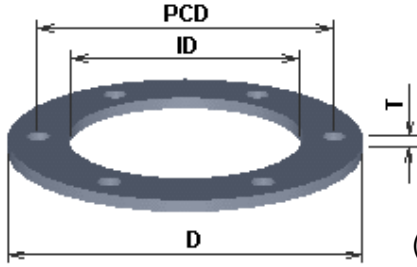


Table 2. Steel backing flanges to AS2129, Table D
(Pressure rating at temperatures -50°C to +100°C: 700 kPa)

Nominal pipe OD, mm	Flange size, mm	D, mm	ID, mm	T, mm	PCD, mm	Bolt hole number and diameter, mm	Bolt size
20	15	95	28	6	67	4×14	M12
25	20	100	34	6	73	4×14	M12
32	25	115	42	7	83	4×14	M12
40	32	120	51	8	87	4×14	M12
50	40	135	62	9	98	4×14	M12
63	50	150	78	10	114	4×18	M16
75	65	165	92	10	127	4×18	M16
90	80	185	108	10	146	4×18	M16
110	100	215	128	10	178	4×18	M16
125	100	215	135	10	178	4×18	M16
125	125	255	140	13	210	8×18	M16
140	125	255	158	13	210	8×18	M16
160	150	280	178	13	235	8×18	M16
180	150	280	188	13	235	8×18	M16
200	200	335	235	13	292	8×18	M16
225	200	335	238	13	292	8×18	M16
250	250	405	288	16	356	8×22	M20
280	250	405	294	16	356	8×22	M20
315	300	455	338	19	406	12×22	M20
355	350	525	376	22	470	12×26	M24
400	400	580	430	22	521	12×26	M24
450	450	640	470	25	584	12×26	M24

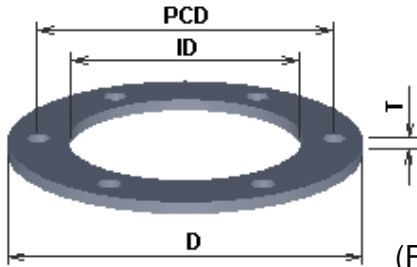


Table 3. Steel backing flanges to AS2129, Table E
(Pressure rating at temperatures -50 °C to +100 °C: 1400 kPa)

Nominal pipe OD, mm	Flange size, mm	D, mm	ID, mm	T, mm	PCD, mm	Bolt hole number and diameter, mm	Bolt size
20	15	95	28	6	67	4×14	M12
25	20	100	34	6	73	4×14	M12
32	25	115	42	7	83	4×14	M12
40	32	120	51	8	87	4×14	M12
50	40	135	62	9	98	4×14	M12
63	50	150	78	10	114	4×18	M16
75	65	165	92	10	127	4×18	M16
90	80	185	108	11	146	4×18	M16
110	100	215	128	13	178	8×18	M16
125	100	215	135	13	178	8×18	M16
125	125	255	140	14	210	8×18	M16
140	125	255	158	14	210	8×18	M16
160	150	280	178	17	235	8×22	M20
180	150	280	188	17	235	8×22	M20
200	200	335	235	19	292	8×22	M20
225	200	335	238	19	292	8×22	M20
250	250	405	288	22	356	12×22	M20
280	250	405	294	22	356	12×22	M20
315	300	455	338	25	406	12×26	M24
355	350	525	376	29	470	12×26	M24
400	400	580	430	32	521	12×26	M24
450	450	640	470	35	584	12×26	M24

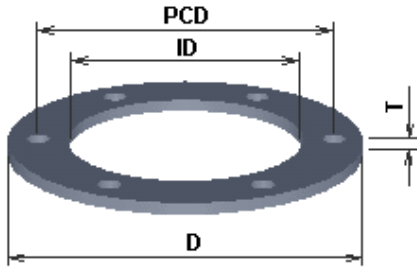


Table 4.
PN10 Steel backing flanges to AS/NZS 4331.1, Table 10

Nominal pipe OD, mm	Flange size, mm	D, mm	ID, mm	T, mm	PCD, mm	Bolt hole number and diameter, mm	Bolt size
20	15	340	235	24	295	8×22	M20
25	20						
32	25						
40	32						
50	40						
63	50						
75	65						
90	80						
110	100						
125	100						
140	125						
160	150						
180	150						
200	200	340	235	24	295	8×22	M20
225	200	340	238	24	295	8×22	M20
250	250	395	288	26	350	12×22	M20
280	250	395	294	26	350	12×22	M20
315	300	445	338	28	400	12×22	M20
355	350	505	376	30	460	16×22	M20
400	400	565	430	32	515	16×26	M24
450	450	615	470	35	565	20×26	M24
450	500	670	517	38	620	20×26	M24

Use PN16 (refer Table 5)

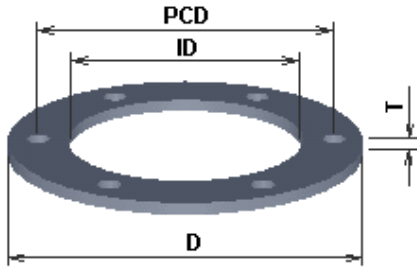


Table 5.
PN16 Steel backing flanges to AS/NZS 4331.1, Table 11

Nominal pipe OD, mm	Flange size, mm	D, mm	ID, mm	T, mm	PCD, mm	Bolt hole number and diameter, mm	Bolt size
20	15	95	28	14	65	4×14	M12
25	20	105	34	16	75	4×14	M12
32	25	115	42	16	85	4×14	M12
40	32	140	51	18	100	4×18	M16
50	40	150	62	18	110	4×18	M16
63	50	165	78	20	125	4×18	M16
75	65	185	92	20	145	8×18	M16
90	80	200	108	20	160	8×18	M16
110	100	220	128	22	180	8×18	M16
125	100	220	135	22	180	8×18	M16
140	125	250	158	22	210	8×18	M16
160	150	285	178	24	240	8×22	M20
180	150	285	188	24	240	8×22	M20
200	200	340	235	26	295	12×22	M20
225	200	340	238	26	295	12×22	M20
250	250	405	288	28	355	12×26	M24
280	250	405	294	28	355	12×26	M24
315	300	460	338	32	410	12×26	M24
355	350	520	376	35	470	16×26	M24
400	400	580	430	38	525	16×29.5	M27
450	450	640	470	42	585	20×29.5	M27

Table 6.
Steel backing flanges for hydrant connections (PN16)

Nominal pipe OD, mm	Flange size, mm	D, mm	ID, mm	T, mm	PCD, mm	Bolt hole number and diameter, mm	Bolt size
90	80 HYD	203	28	19	165	4×18	M16

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Mating flanges are **fastened** with bolts and nuts or threaded studs and nuts. Materials used for fasteners shall have adequate tensile strength and corrosion resistance. Flat washers should be used between the nut and the metal backing flange. Flat washers are also recommended to be used between bolt heads and metal backing flange. Bolts/studs shall span the entire width of the flange connection and include sufficient thread length (beyond the joint width and washer) to fully engage the nut. Before fitting, the fasteners should be lubricated with a non-fluid lubricant grease.

Initially, the flange connection components should be fitted together loosely, all fasteners hand tightened. Alignment shall be re-checked and adjusted, if necessary.

Flange fasteners shall be tightened to an even torque load, value of which depends on flange and bolt sizes. The use of a torque wrench is strongly recommended. Typical bolting torques for standard flanges on SDR11 and SDR17 PE80 and PE100 pipes are shown in Table 7.

Table 7. Typical bolting torques for standard flanges *

Nominal pipe OD, mm	Flange size, mm	Bolting	Torque, Nm, ±10%
63	50	M16×4	35
90	80	M16×8	35
125	100	M16×8	35
180	150	M20×8	60
225	200	M20×12	80
250	250	M24×12	100
280	250	M24×12	100
315	300	M24×12	120
355	350	M24×16	150
400	400	M27×16	200
450	450	M27×20	250

* Source: Polyethylene Pipe Systems, WRC, UK (online)

The fasteners must be progressively and uniformly tightened by turning the nut in a diagonally opposite sequence (examples of bolt tightening sequences are shown Fig. 1).

The nuts shall be tightened in increments of not more than 20% of the final torque or 20 Nm (whichever is smaller) in the above pattern till final tightening torque is reached. The increments should be reduced to 12-13 Nm when connecting to flanges of brittle materials such as cast iron.

Uniform sequenced retightening of the fasteners to the same final torque is recommended after about an hour to compensate for compression setting of PE flange and gasket. For high pressure or critical pipelines, another retightening after 24 hours may be advisable.

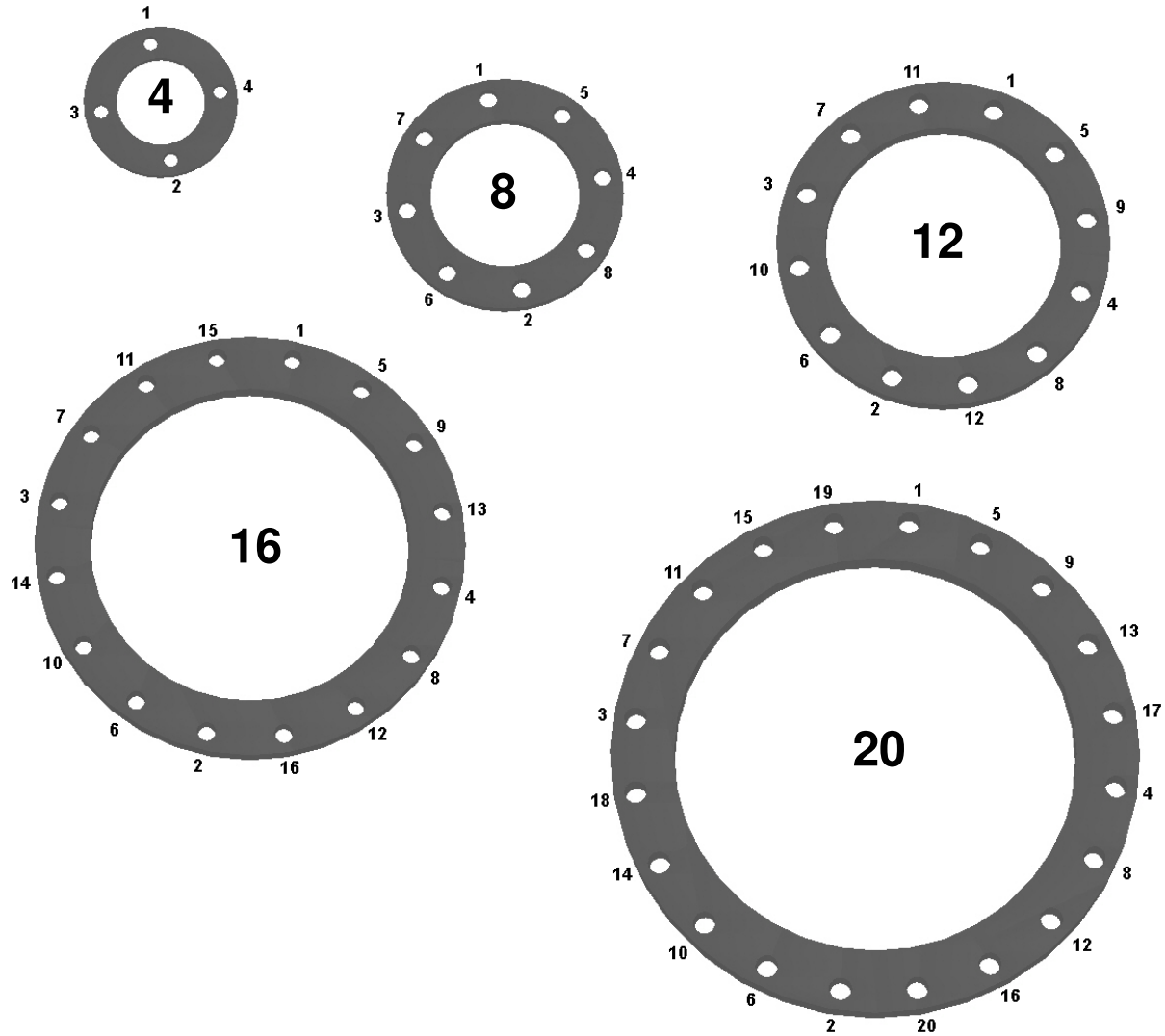


Figure 1. Bolt tightening sequences

Since PE pipe systems are end-load bearing, care must be taken to prevent pullout of any non end-load bearing joints where connection is made to a pipe of another material. Care also shall be taken to avoid bending stresses on the flange connection. Heavy ancillary equipment such as valves or hydrants shall be properly supported by a special foundation or surrounding stable compacted bedding. Angular deflection of the above grade PE pipelines near the flange joint shall be prevented, e.g. by clamping the pipe outside the joint to a proper structural support.