

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 flange adapter fitted with backing ring is fusion joined to PE pipe end and then connected to a mating flange or backing ring.

PE flange adapters are manufactured to mating dimensions specified in ISO 9624, AS/NZS 4129:2020, Table G1, and are pressure rated. Typical dimensions are given in Table 1.

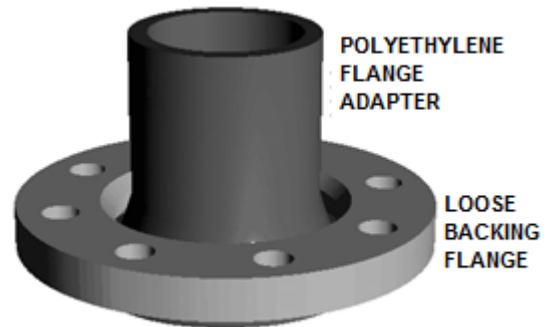
Full-face PE stub flanges should not be mated with raised-face metallic flanges; an insertion flange should be used at the interface, to prevent excessive bending moment in the flange.

Metal backing rings (or flanges) are made in compliance with dimension specifications of various standards, most used in New Zealand being AS 2129, AS/NZS 4087 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/NZS 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 2-7. Flanges of dimensions given in Table 8 are usually used for hydrant connections in New Zealand.

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 flanged 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 adapter 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 adapter before the welding). The gasket shall be centred properly between the mating faces.



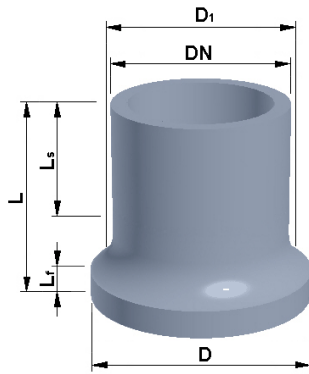


Table 1. Polyethylene flange adapters
(mating dimensions to ISO 9624, spigot dimensions to ISO 4427-3 and ISO 4437-3;
typical PE100 flange face thickness and adapter length)

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)	
			electrofusion (EF) fitting ***	butt welding	L _{f min.} ****, mm	L **, mm
16	40	22	41		7	85
20	45	27	41		7	85
25	58	33	41		9	85
32	68	40	44		10	85
40	78	50	49		11	85
50	88	61	55		12	85
63	102	75	63	16	14	95
75	122	89	70	19	16	125
90	138	105	79	22	17	140
110	158	125	82	28	18	160
125	158	132	87	32	25	170
140	188	155	92	35	25	200
160	212	175	98	40	25	200
180	212	180	105	45	30	200
200	268	232	112	50	32	200
225	268	235	120	55	32	200
250	320	285	129	60	35	220
280	320	291	150	70	35	230
315	370	335	150	80	35	240
355	430	373	164	90	40	260
400	482	427	179	95	46	290
450	585	514	195	60	60	335
500	585	530	212	60	60	350
560	685	615	235	60	60	365
630	685	642	255	60	60	385
710	800	737			60	400
800	905	840			65	400
900	1005	944				
1000	1110	1047				
1200	1330	1245				

* The actual value of D should be as high as possible to ensure fitness for purpose of the assembly (may be defined by bolting arrangements).
 ** Flange adapter overall length typical for electrofusion fitting welding; varies between different manufacturers.
 *** Flange adapters for electrofusion fittings with spigot diameter and wall thickness matching those of the corresponding pipe may be used for butt welding as well.
 **** Typical values for full face flange adapters; AS/NZS 4129 requires that flange thickness shall be determined through type testing (by itself or in combination with validated finite element analysis), taking into account the operating parameters and PE material properties.

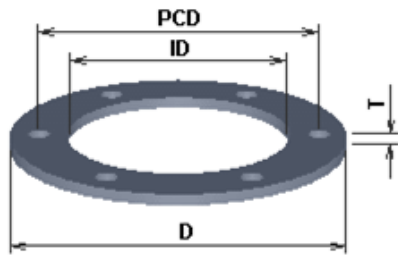


Table 2. Plate steel backing flanges to AS2129, Table D
 (Pressure rating at temperatures -50°C to +100°C: **700 kPa**)

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	158	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
500	500	705	533	29	641	16×26	M24
560	550	760	618	29	699	16×30	M27
630	600	825	645	32	756	16×30	M27
710	700	910	740	35	845	20×30	M27
800	800	1060	843	41	984	20×36	M33
900	900	1175	947	48	1092	24×36	M33
1000	1000	1255	1050	51	1175	24×36	M33
1200	1200	1490	1260	60	1410	32×36	M33

* Based on AS/NZS 4129:2020, Table G1

** Based on ISO 9624

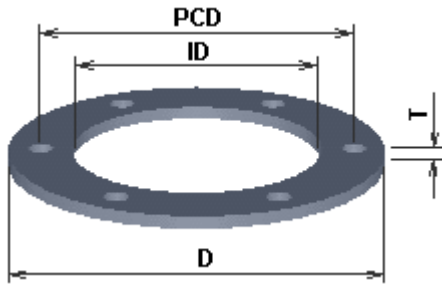


Table 3. Plate steel backing flanges to AS2129, Table E
 (Pressure rating at temperatures -50°C to +100°C: **1400 kPa**)

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	158	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	16×26	M24
500	500	705	533	38	641	16×26	M24
560	550	760	618	44	699	16×30	M27
630	600	825	645	48	756	16×33	M30
710	700	910	740	51	845	20×33	M30
800	800	1060	843	54	984	20×36	M33
900	900	1175	947	64	1092	24×36	M33
1000	1000	1255	1050	67	1175	24×39	M36
1200	1200	1490	1260	79	1410	32×39	M36

* Based on AS/NZS 4129:2020, Table G1

** Based on ISO 9624

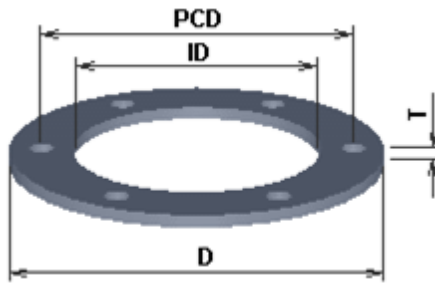


Table 4.
PN16 Steel backing flanges to AS/NZS 4087, Fig. B7

Nominal pipe OD, mm	Flange size *, mm	D, mm	ID **, mm	T, mm	PCD, mm	Bolt hole number and diameter, mm	Bolt size
63	50	150	78	11	114	4×18	M16
75	65	165	92	11	127	4×18	M16
90	80	185	108	11	146	4×18	M16
110	100	215	128	13	178	4×18	M16
125	–						
160	150	280	178	13	235	8×18	M16
180	–						
200	200	335	235	19	292	8×18	M16
225	225	370	238	19	324	8×18	M16
250	250	405	288	19	356	8×22	M20
280	–						
315	300	455	338	23	406	12×22	M20
355	350	525	376	30	470	12×26	M24
400	400	580	430	30	521	12×26	M24
450	450	640	470	30	584	12×26	M24
500	500	705	533	38	641	16×26	M24
560	–						
630	600	825	645	48	756	16×30	M27
710	700	910	740	56	845	20×30	M27
800	800	1060	843	56	984	20×36	M33
900	900	1175	947	66	1092	24×36	M33
1000	1000	1255	1050	66	1175	24×36	M33
1200	1200	1490	1260	76	1410	32×36	M33

* Based on AS/NZS 4129:2020, Table G1

** Based on ISO 9624

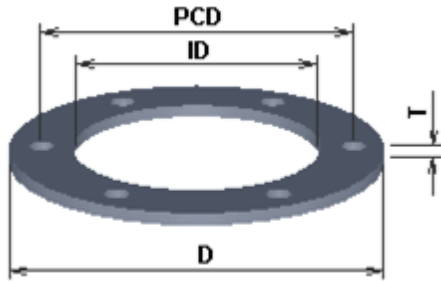


Table 5.
PN21 Steel backing flanges to AS/NZS 4087, Fig. B8

Nominal pipe OD, mm	Flange size *, mm	D, mm	ID **, mm	T, mm	PCD, mm	Bolt hole number and diameter, mm	Bolt size
63	50	165	78	15	127	4×18	M16
75	65	185	92	15	146	8×18	M16
90	80	205	108	15	165	8×18	M16
110	100	230	128	19	191	8×18	M16
125	–						
160	150	305	178	24	260	12×22	M20
180	–						
200	200	370	235	24	324	12×22	M20
225	225	405	238	30	356	12×26	M24
250	250	430	288	30	381	12×26	M24
280	–						
315	300	490	338	30	438	16×26	M24
355	350	550	376	30	495	16×30	M27
400	400	610	430	38	552	20×30	M27
450	450	675	470	38	610	20×33	M30
500	500	735	533	48	673	24×33	M30
560	–						
630	600	850	645	58	781	24×36	M33
710	700	935	740	58	857	24×36	M33
800	800	1060	843	68	984	28×36	M33
900	900	1185	947	68	1105	32×39	M36
1000	1000	1275	1050	78	1194	36×39	M36
1200	1200	1530	1260	88	1441	40×42	M39

* Based on AS/NZS 4129:2020, Table G1

** Based on ISO 9624

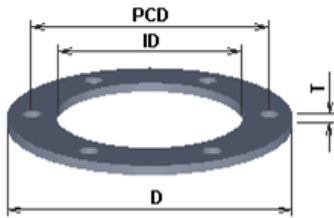


Table 6.
PN10 Steel backing flanges to AS/NZS 4331.1, Table 10

Nominal pipe OD, mm	Flange size *, mm	D, mm	ID **, mm	T, mm	PCD, mm	Bolt hole number and diameter, mm	Bolt size
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
500	500	670	533	38	620	20×26	M24
560	600	780	618	42	725	20×29.5	M27
630	600	780	645	42	725	20×29.5	M27
710	700	895	740		840	24×29.5	M27
800	800	1015	843		950	24×32.5	M30
900	900	1115	947		1050	28×32.5	M30
1000	1000	1230	1050		1160	28×35.5	M33
1200	1200	1455	1260		1380	32×39	M36

* Based on AS/NZS 4129:2020, Table G1

** Based on ISO 9624

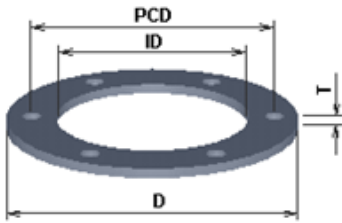


Table 7.
PN16 Steel backing flanges to AS/NZS 4331.1, Table 11

Nominal pipe OD, mm	Flange size *, mm	D, mm	ID **, mm	T, mm	PCD, mm	Bolt hole number and diameter, mm	Bolt size
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
500	500	715	533	46	650	20×32.5	M30
560	600	840	618	52	770	20×35.5	M33
630	600	840	645	52	770	20×35.5	M33
710	700	910	740	60	840	24×35.5	M33
800	800	1025	843	68	950	24×39	M36
900	900	1125	947	76	1050	28×39	M36
1000	1000	1255	1050	84	1170	28×42	M39
1200	1200	1485	1260	98	1390	32×48	M45

* Based on AS/NZS 4129:2020, Table G1

** Based on ISO 9624

Table 8.
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	108	19	165	4×18	M16

* Based on ISO 9624

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 (it is recommended that misalignment does not exceed 3 mm).

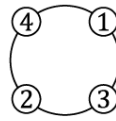
The fasteners must be progressively and uniformly tightened by turning the nut in a diagonally opposite sequence – crisscross pattern (recommended by ISO 9624 bolting pattern is shown to the right).

The nuts shall be tightened in increments, usually in the range 20-40% 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.

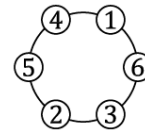
Flange fasteners shall be tightened to an even torque load, value of which depends on flange and bolt sizes. The use of a torque wrench is strongly recommended. Typical bolting torques for standard flanges on SDR11 and SDR17 PE80 and PE100 pipes are shown in Table 9.

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 is advisable.

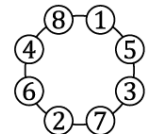
Since PE pipe systems are end-load bearing, care must be taken to prevent pullout of any non end-load bearing joints where connection is made to a pipe of another material. Care also shall be taken to avoid bending stresses on the flange connection. Heavy ancillary equipment such as valves or hydrants 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.



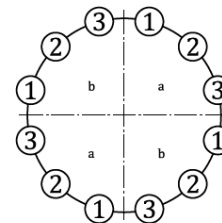
4 Bolts



6 Bolts



8 Bolts



12 Bolts or more

Key
 a First Quadrant.
 b Second Quadrant.

Table 9.
Typical bolting torques for standard flanges *

Nominal pipe OD, mm	Flange size, mm	Torque, Nm
63	50	35
90	80	35
110	100	40
125	100	40
140	125	60
160	150	70
180	150	70
200	200	80
225	200	80
250	250	100
280	250	100
315	300	120
355	350	150
400	400	200
450	450	200
500	500	250
560	600	300
630	600	300
710	700	300
800	800	400
900	900	440
1000	1000	525
1200	1200	525

* Full face flange-to-flange connections (various online sources)