ALMARC®

PTFE/PFA LINED SYSTEMS

LINED SYSTEMS FOR THE PROCESS INDUSTRIES

QAI Certification ISO 9001:2015 — SAC Accredited Certification Body QS-2011-18

bizSAFE 3

THE CORROSION EXPERT

FLANGE & VALVE SAFETY SHIELD

FLEXIBLE HOSE SYSTEMS

ETFE ROTOMOULDING

RICHTER Process Pumps & Valves

www.almarc.com.sg

COMPANY PROFILE

Singapore Factory

Malaysia Factory

ALMARC Engineering Pte Ltd, manufacturer of PTFE/PFA Lined Piping System, provides specialised solutions for corrosion problems and high purity applications in the chemical, pharmaceutical, electronic, process & marine industries through collaboration with various European manufacturers.

ALMARC Engineering manufacturing facilities was audited and approved for supply to major Pharmaceuticals, Petrochemical and chemical Process Industries for PTFE/PFA lined pipes and fittings, PTFE lined flexible hoses and Customised PFA lined fittings to suit process conditions.

Equipped with 3D modelling software, our specialist is able to design customised PFA lined fittings to suit challenging applications.

Our Production Team collaborate closely with customers to ensure that the products meet with specified requirements and together with our highly skilled technicians ensure the prompt delivery fo the highest quality of products.

Our Overseas Working Partners

United Kingdom

- Full Range of Lined Pipes & Fittings
- Sampling Systems
- PTFE Expansion Bellow
- Lined Swing/ Poppet Check Valve

Germany

- Lined Valves & Pumps

Belgium

- SS Braided PTFE Convoluted Hose
- Silicone Hose
- Smoothflex Hose
- Various Fittings and Customised

United States

- Flange & Valve Safety Shields

TABLE OF CONTENTS

ALMARC

Lining Materials 4
Standard Specifications 5
Service Application Ratings 6
Products
ANSI 150 Flanges 7
Lined Pipes 8
Lined Elbows 9
Lined Equal Tees 10
Lined Reducing Tees 11
Lined Customized Tees 12
Lined Pipe Reducers 13
Lined Instrument Tees 14
Lined Crosses 15
Lined Blinds & Laterals 16
Lined Flange Reducers 17
Spacers 18
Fitments 19
Dip Pipes 20
Stud Bolts & Liner Thickness 21
Installation 22

Chemical Resistance Guide 26
ETFE Rotomoulding 29
XTRAFLEX - Hoses 30
PTFE Bellow 37

RICHTER

Pumps 38
Process Pumps 39
Process Valves 41

CRP

Sampling Systems 45
CTSG - Sight Glass 47
WPCV - Wafer Poppet Check Valve 48
FPCV - Flanged Poppet Check Valve 49
STCV - Swing Check Valve 50

RAMCO

Safety Shields 51
Acid and Base Alert System 52

PTFE/PFA LINED PIPES

PVDF LINED PIPES

PP LINED PIPES

ETFE LINED VESSEL

POLYTETRAFLOUROETHYLENE (PTFE)

Polytetrafluoroethylene or PTFE, with its carbon chains completely fluorinated is inert to an exhaustive range of industrial chemicals. It's non-stick characteristic, which resists the build up of deposits, reduces clogging problems and is better for handling sticky resins and foodstuffs. Generally, limitation for use is molten alkali metals (such as metallic sodium), fluorine and the strong fluorinating agents.

PERFLUOROALKOXY (PFA)

Perfluoroalkoxy or PFA is a perfluoropolymer, which has essentially the same chemical resistance as PTFE has added moulding properties ideal for lining complex shapes. PFA is extensively used in Ultra-Pure applications. It has excellent creep resistance at high temperatures with good flame resistance and reasonably tough at low temperatures. PFA can be used in combination with PTE lined pipe for handling most chemical fluids.

POLYVINYLIDENE FLUORIDE (PVDF)

Polyvinylidene Fluoride, or PVDF is a crystalline fluorinated polymer, which is able to resist most inorganic acids and bases such as aliphatic and aromatic hydrocarbons and particularly for the halogens, bromine and chlorine. Its better elongation property is suitable for thermal cycling up to its temperature limit. PVDF has good abrasion and permeation resistance but being partially fluorinated, its chemical resistance is limited by temperature and concentration of the fluid.

POLYPROPYLENE COPOLYMER (PP)

Polypropylene Copolymer, or PP, is an inexpensive heat stabilise copolymer with good mechanical and chemical properties. It is ideal as a general purpose lining material for pipe, fittings and special fabrications normally used for water treatment, hot effluent lines, pickling and plating.

• Properties

	PTFE	PFA	PVDF	PP
Specific Weight g/cm³	2.14 - 2.19	2.12 - 2.17	1.75 - 1.78	0.9 - 0.92
Elongation %	200 - 400	300 - 400	10 - 300	10 - 600
Tensile Strength Mpa	20 - 40	27 - 32	40 - 50	20 - 40
Melting Point °C	327 - 342	300 - 310	165 - 178	158 - 167
Thermal Conductance W/m2h °C	9.65	7.38	9.09	4.54

Note: *For PP and PVDF Lined Piping Systems please contact us at* ***sales@almarc.com.sg*** *for more information.*

ETHYLENE TETRAFLUOROETHYLENE (ETFE)

Ethylene Tetrafluoroethylene or ETFE is a fluorine-based high performance coating that is designed to provide high resistance to corrosion. It has a very high melting point with further excellent chemical and electrical properties. ETFE at operating temperature (from -185°C to 150°C) are used in full vacuum because of the excellent adhesion to the wall of the coated piece.

STANDARD SPECIFICATIONS

Item	Standards
LINED PIPES & FITTINGS	ASTM F1545
LINERS	PTFE: ASTM D1457, D4895
	PFA: ASTM D3307
	PVDF: ASTM D3222
	PP: D4101

Steel	Size	Material	Standards	Note
PIPE	¾" - 4"	C Steel, Sch 40	ASTM A106 Gr B/API 5L/ A587, B36.10	Stub End Flanges
	6" - 8"	C Steel, Sch 40	ASTM A106 Gr B/API 5L/ B36.10	Fixed/Loose Flanges
	10" - 12"	Steel, Sch 30	ASTM A106 Gr B/API 5L/ B36.10	Fixed/Loose Flanges
FLANGES	½" - 12"	Carbon Steel	ANSI 150 lb, ASTM A105, B16.5	
ELBOWS	¾" - 3"	Carbon Steel	A234 Gr WPB, B16.9 (Long Radius)	Loose Flanges
	4" - 8"	Carbon Steel	A234 Gr WPB, B16.28 (Short Radius)	Loose Flanges
	10" - 12"	Carbon Steel	A234 Gr WPB, B16.28 (Short Radius)	Fixed Flanges
TEES	¾" - 8"	Carbon Steel	ASTM A 106 Gr B / API 5L, B36.10	Loose Flanges
	10" - 12"	Carbon Steel	ASTM A 106 Gr B/ API 5L, A234 Gr WPB, ANSI B16.9	Fixed Flanges
INSTR TEES	1" - 12"	Carbon Steel	ASTM A106 Gr B/API 5L/ Main Body Low Carbon	Loose Flanges
			AB-EH36 / ST52-3	
CON & ECC RED	1" - 12"	Carbon Steel	A234 Gr WPB, ANSI B16.9	Fixed/Loose Flanges
RED FLGS	1" - 12"	Carbon Steel	AB-EH36 / ST52-3/ ASTM A 106 Gr B/ API 5L	Drilled Bolt Holes
SPACERS	1" - 12"	Carbon Steel	ANSI B16.5	
STEEL FINISH	Slag-Blast to SA2.5 and apply:			
	One coat of Sigmaprime 200 to 40 microns DFT &			
	One coat of SigmaCover 456 (BS381C637) Medium Sea Grey to 80 microns DFT			
TEST	Pipes & Fittings are subjected to a 10,000VDC Holiday Test & 29BarG Hydrostatic Test in Accordance to ASTM F1545 Standard			
PACKING	Wooden protection covers are fitted onto finished items which should be removed only prior to installation at site			

Temperature	Max Pressure (#150)	Max Pressure (#300)
38 °C (100 °F)	17.2 barg (250 psig)	31.0 barg (450 psig)
68 °C (150 °F)	16.7 barg (242 psig)	28.6 barg (415 psig)
93 °C (200 °F)	16.2 barg (235 psig)	26.9 barg (390 psig)
149 °C (300 °F)	14.8 barg (215 psig)	23.8 barg (345 psig)
204 °C (400 °F)	13.8 barg (200 psig)	20.3 barg (295 psig)
260 °C (500 °F)	11.7 barg (170 psig)	16.7 barg (245 psig)

Item	Linear Tolerances	Angular Tolerances
Pipes < 315mm	+1mm / -3mm	+ / - 0.5°
Pipes 315 - 1000mm	+2mm / -4mm	+ / - 0.5°
Pipes 1000 - 6000mm	+3mm / -5mm	+ / - 0.5°
Fittings 1" - 4"	+1mm / -3mm	+ / - 0.5°
Fittings 6" - 8"	+2mm / -4mm	+ / - 0.5°
Fittings 10" - 12"	+3mm / -5mm	+ / - 0.5°

SERVICE APPLICATION RATINGS

The graphs below show (i) the pressure / temperature performance curve for ALMARC's lined pipe and fittings.

Vacuum performance of ALMARC heavy duty PTFE & PFA lined piping systems.

½" NB (DN15) - 8" NB (DN200) suitable for use under full vacuum to 200 °C.

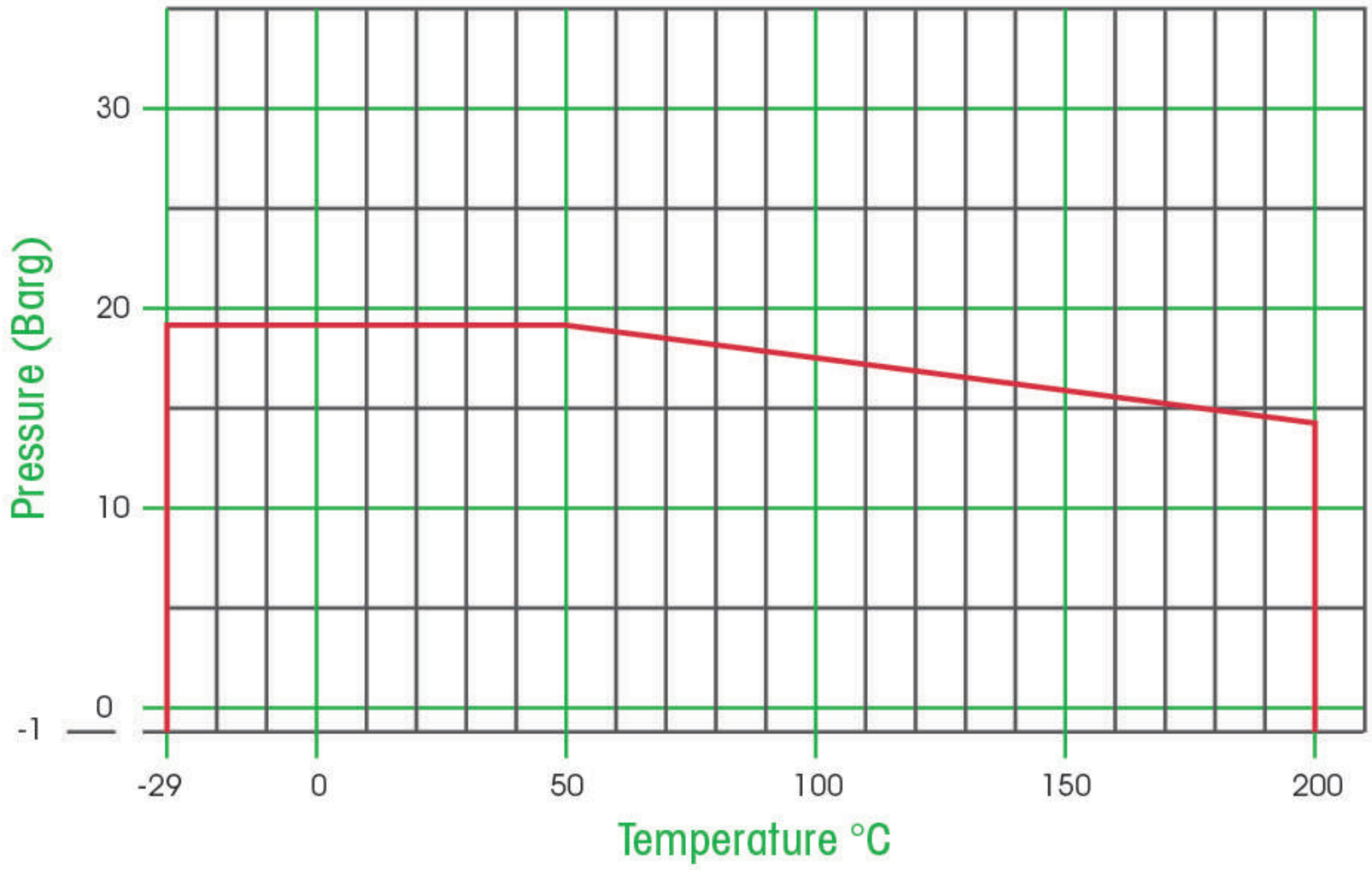
10" NB (DN250) - 12" NB (DN300) suitable for use under full vacuum to 150 °C.

14" NB (DN350) Suitable for use under full vacuum to 50 °C.

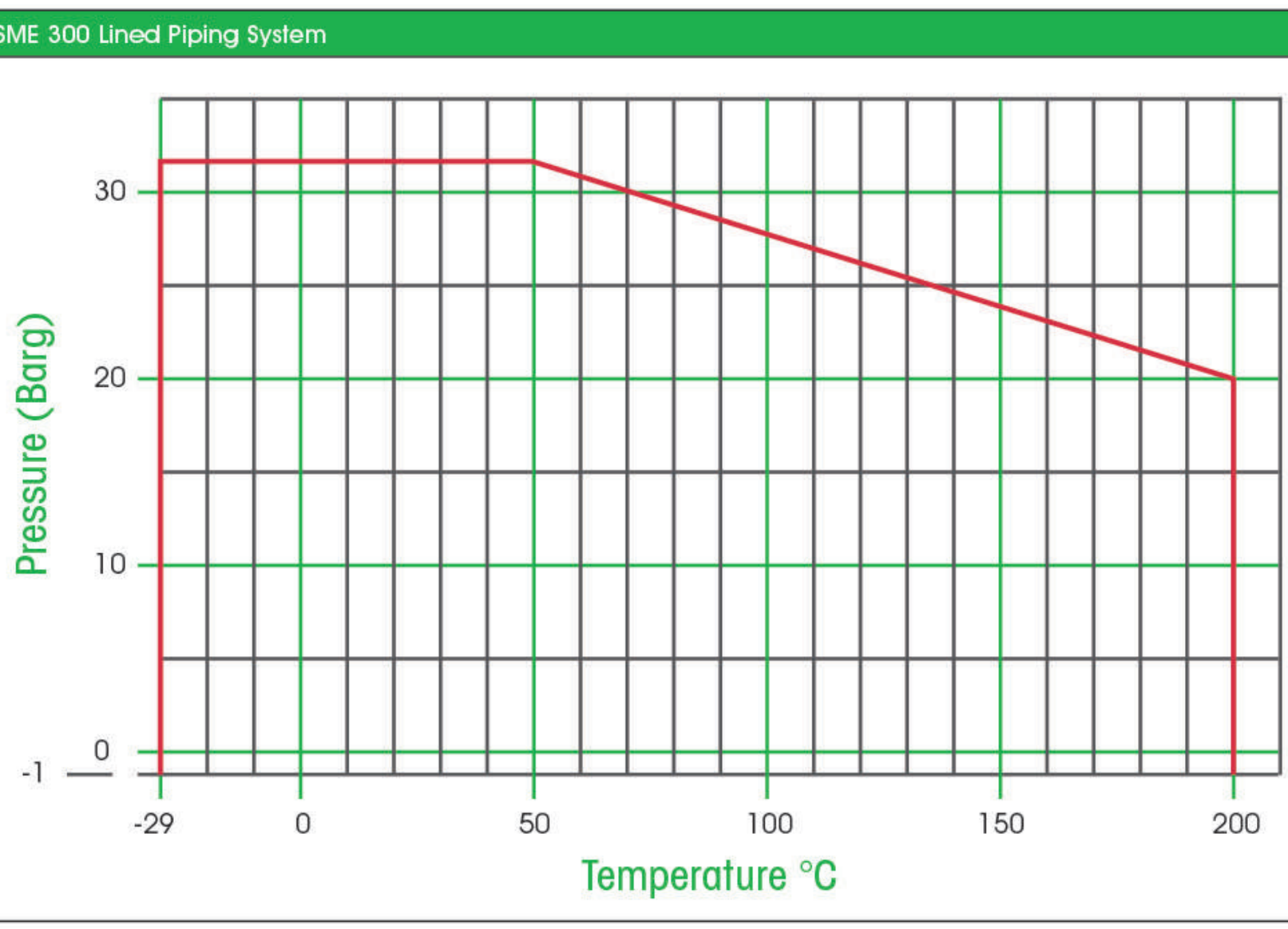
0.05 bar per 10° increase in temperature between 150 °C and 200 °C. Which means -

0.85 barg (150 mbar abs.) at 180 °C and - 0.75 barg (250 mbar abs.) at 200 °C

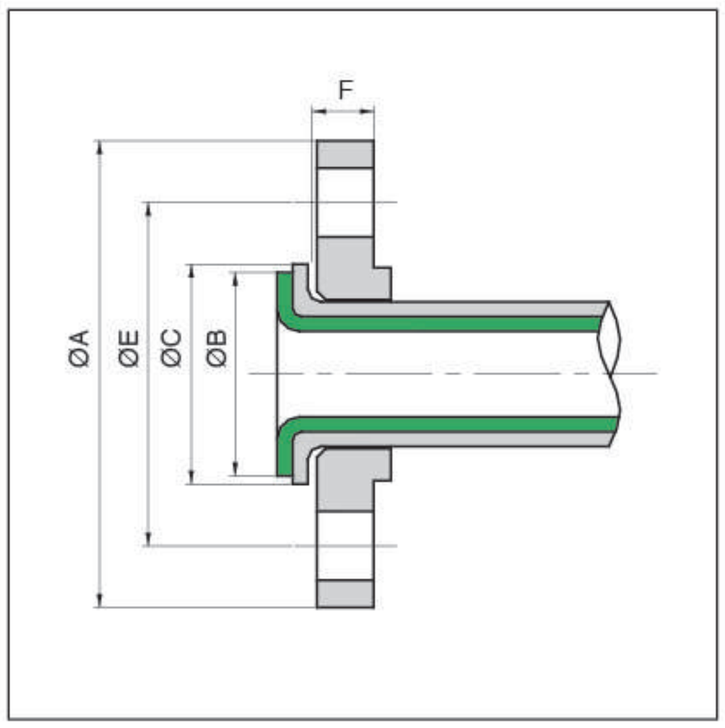
ASME 150 Lined Piping System



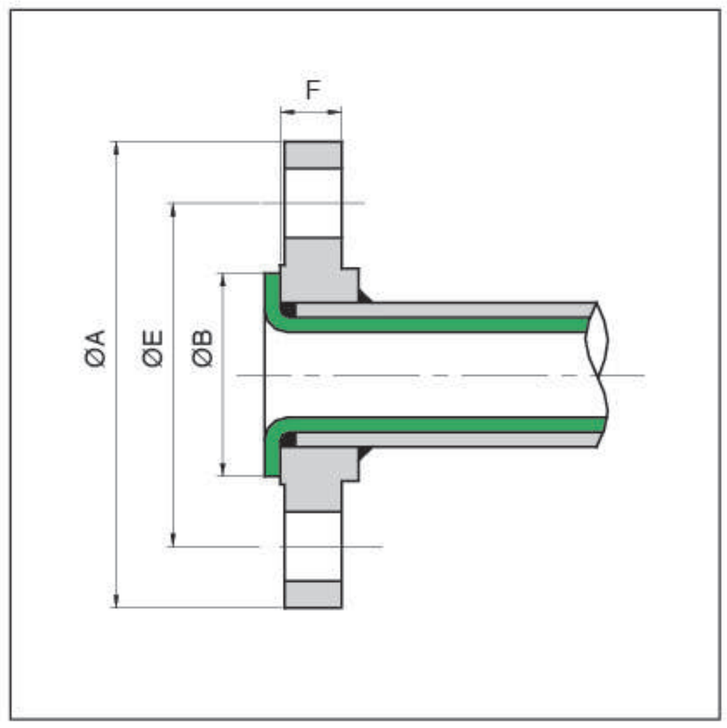
ASME 300 Lined Piping System



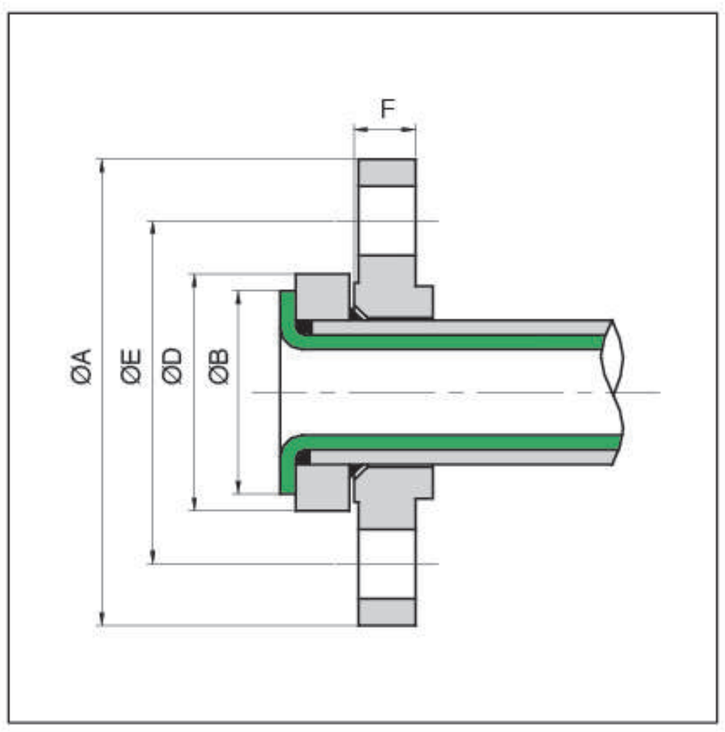
ANSI 150 FLANGES



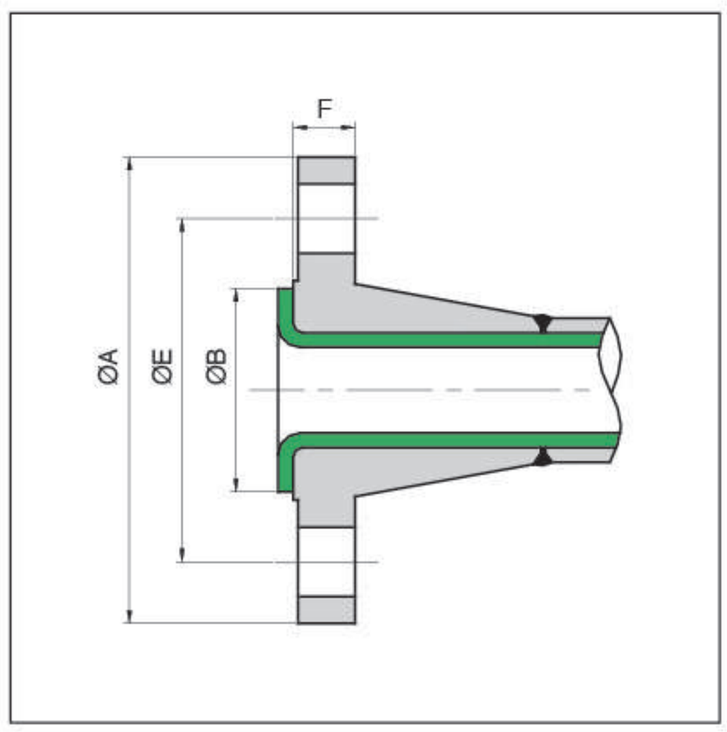
Stub End Flange



Fixed Flange



Collar Flange

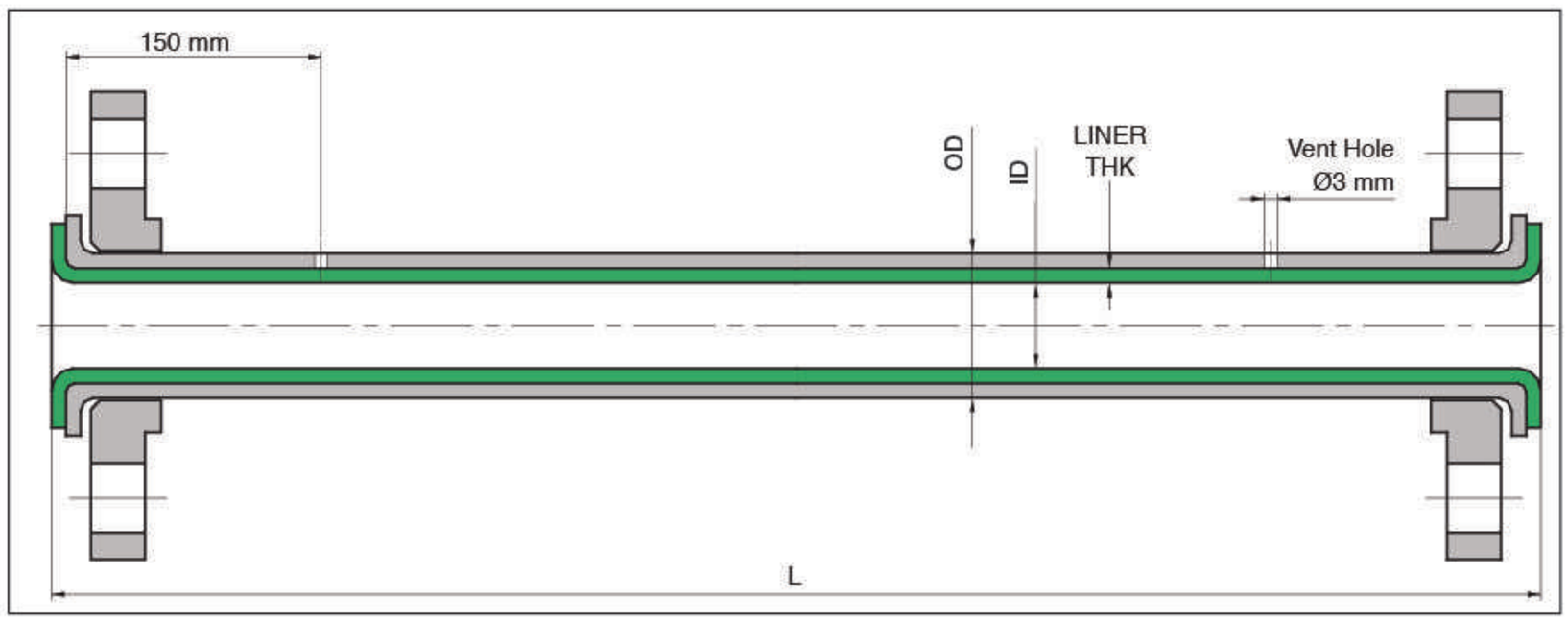


Weld Neck Flange

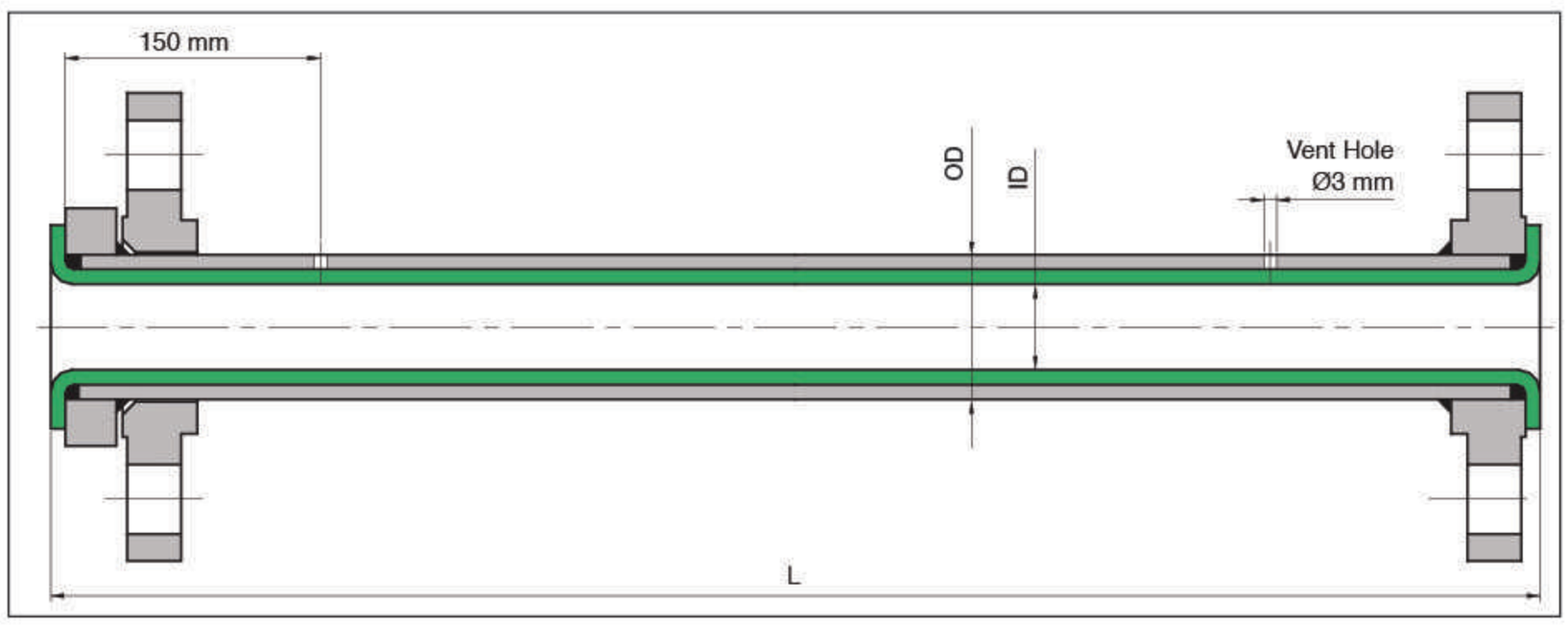
NB #150	A mm	B mm	C mm	D mm	E mm	F mm	Holes No	Holes Dia	Thd UNC
½"	89	32		42	60.3	11.1	4	16	½"
¾"	99	40		52	69.0	12.7	4	16	½"
1"	108	48	51	60	79.4	14.3	4	16	½"
1½"	127	69	72	73	98.4	17.5	4	16	½"
2"	152	88	90	92	120.6	19.0	4	20	⅝"
3"	191	118	125	127	152.4	23.8	4	20	⅝"
4"	229	151	155	157	190.5	23.8	8	20	⅝"
6"	279	204		216	241.3	25.4 8	8	23	¾"
8"	343	256		270	298.4	28.6	8	23	¾"
10"	406	312		324	361.9	30.2	12	26	⅞"
12"	493	366		381	431.8	32.7	12	26	⅞"

STEEL	SIZE	MATERIAL	STANDARDS
FLANGES	1" - 12"	Carbon Steel	ANSI 150 lb, ASTM A105, B16.5

Stainless steel / other material on request.



Stub-End Flange



Fixed / Loose Flange

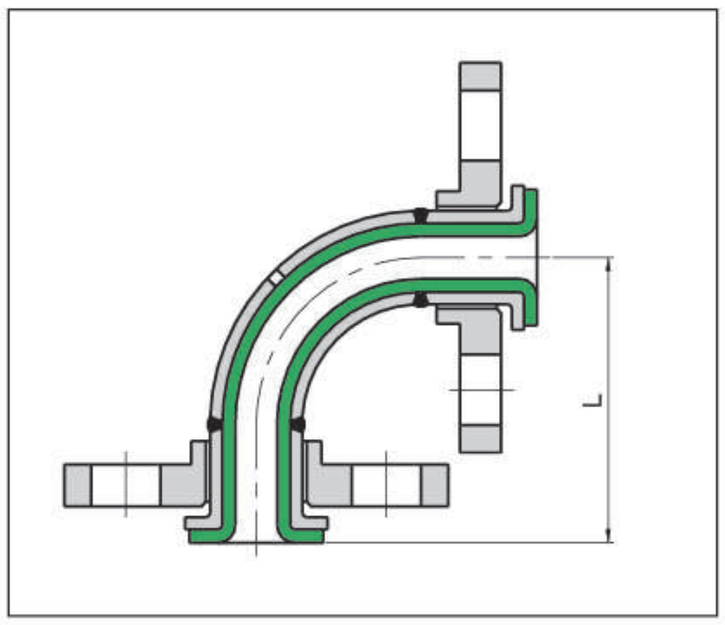
Dimension base on Sch 40 Pipe (1" to 8") Sch 30 (10" to 12")

NB #150	L min (mm) Fix/Lse	Stb-End	L max mm	OD mm	ID mm	Liner Thickness	Wt Kg/m	Flg Wt (Pair) Fix/Lse	Stb-End
½"	90		6000	26.7	16.9	2	2	1.3	
¾"	90		6000	26.7	16.9	2	2	1.3	
1"	90	85	6000	33.4	20.0	3.3	2	2.1	1.8
1½"	110	85	6000	48.3	34.3	3.3	5	3.2	3.0
2"	120	105	6000	60.3	45.9	3.3	7	5.1	4.7
3"	140	160	6000	88.9	70.9	3.5	14	9.3	8.8
4"	150	170	6000	114.3	93.9	4.2	19	12.9	12.1
6"	160		6000	168.3	143.5	5.3	34	17.8	
8"	180		6000	219.1	190.3	6.2	53	28.2	
10"	210		6000	273.0	243.5	7	64	38.5	
12"	230		3000	323.8	291.0	8	65	60.9	

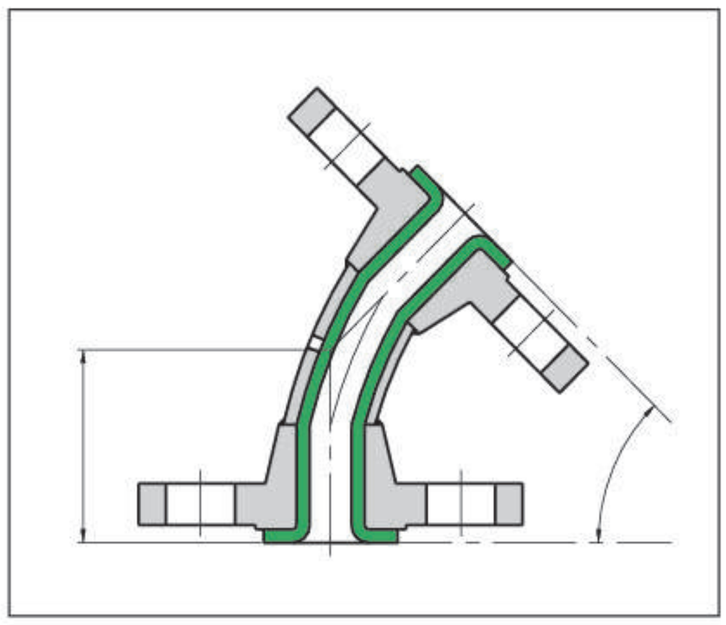
STEEL	SIZE	MATERIAL	STANDARDS	NOTE
PIPE	1" - 4"	C Steel, Sch 40	ASTM A106 Gr B / API 5L / A587, B36.10	Stub End Flgs
	6" - 8"	C Steel, Sch 40	ASTM A106 Gr B / API 5L / B36.10	Fixed / Loose Flgs
	10" - 12"	C Steel, Sch 30	ASTM A106 Gr B / API 5L / B36.10	Fixed / Loose Flgs

Stainless steel / other material on request.

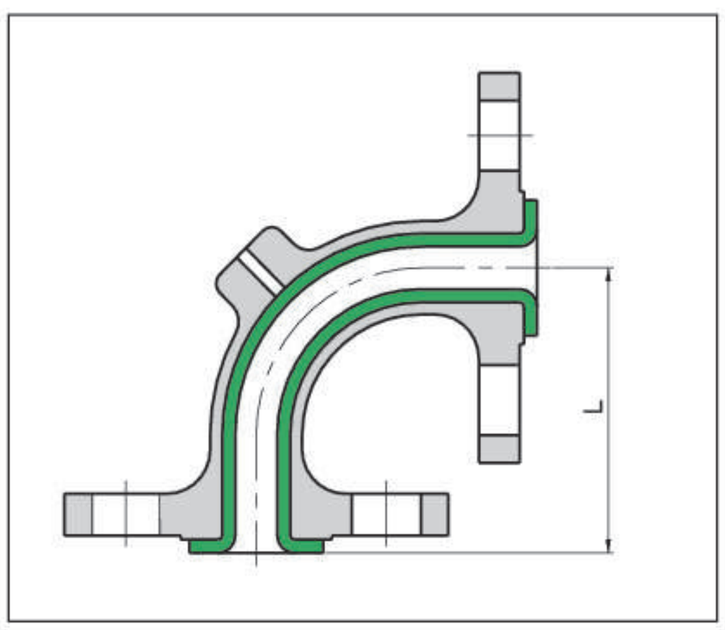
LINED ELBOWS



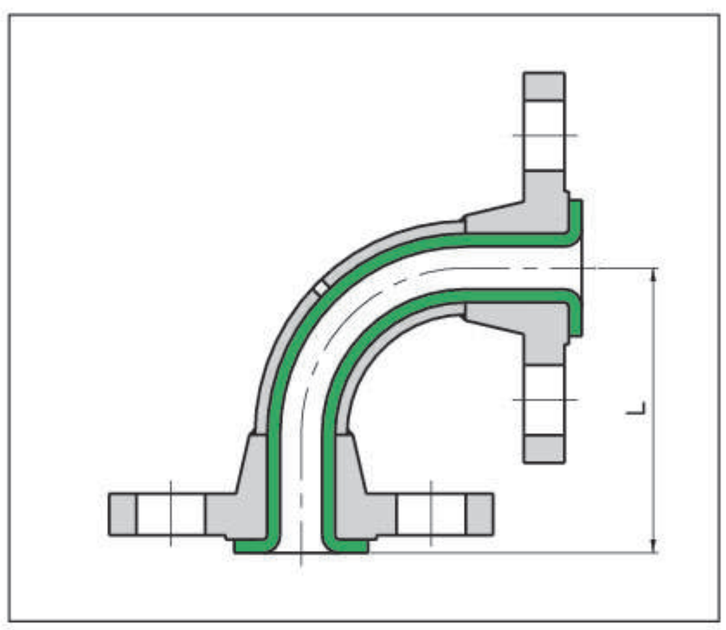
90° Stub-End Elbow



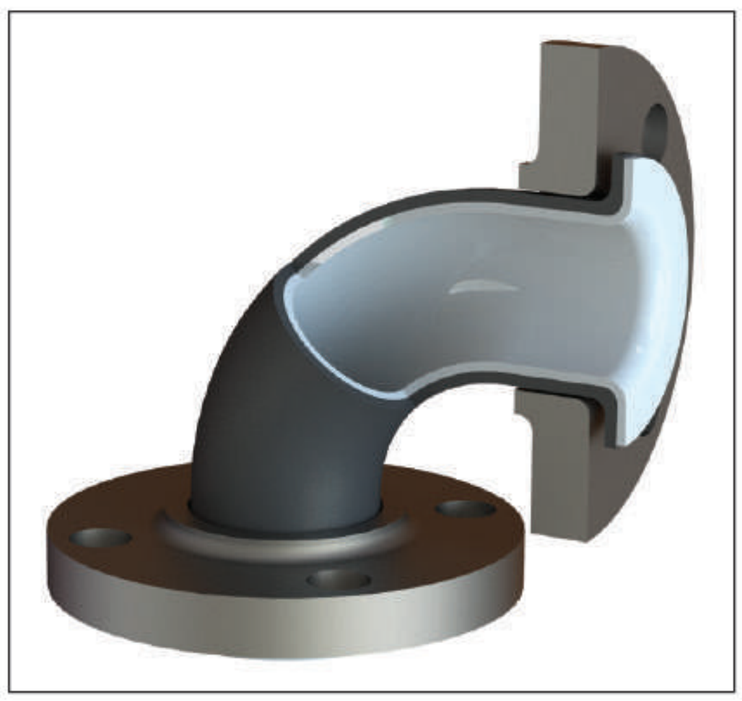
60°/45°/30° Steel Elbow



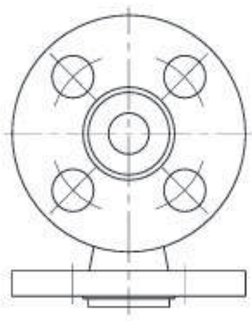
90° Cast Steel Elbow



90° Steel Elbow



Orientation of Fixed Flange
for 1" to 3" Sizes

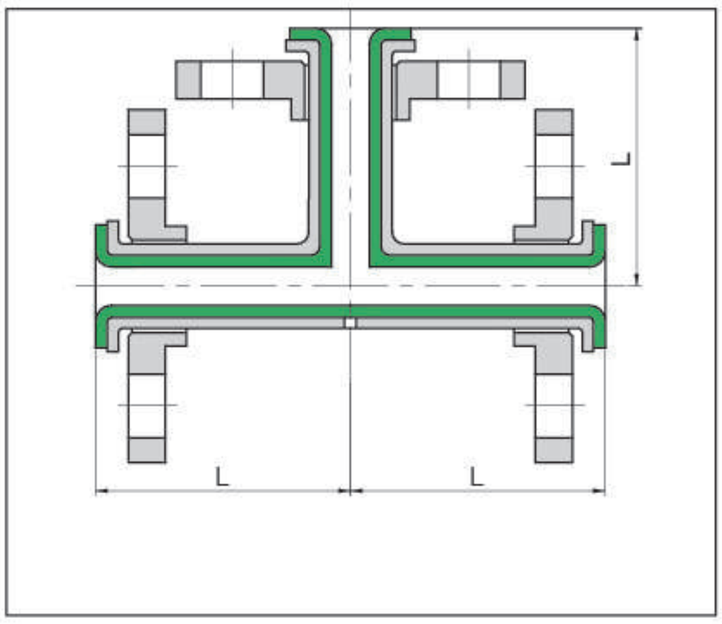


NB	L (mm)				Weight (kg)			
#150	a=90°	a=45°	a=60°	a=30°	a=90°	a=45°	a=60°	a=30°
½"	65	44	52	40	1.0	0.9	0.9	0.9
¾"	75	44	72	59	1.4	1.3	1.3	1.3
1"	89	44	98	77	2.2	2.1	2.1	2.1
1½"	102	57	92	78	3.8	3.4	3.5	3.2
2"	114	64	110	86	5.9	5.3	5.5	5.1
3"	140	76	110	75	11.5	10.0	10.5	9.5
4"	165	102	135	90	16.7	14.2	15.1	13.4
6"	203	127	180	110	26.6	21.2	22.9	19.4
8"	229	140	235	140	44.3	34.7	37.9	31.6
10"	279	165			62.4	48.4		
12"	305	190			86.3	70.7		

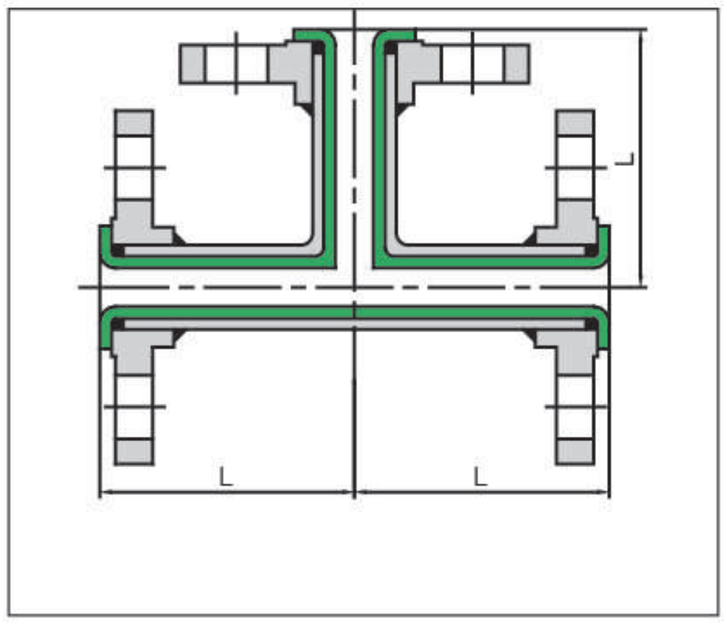
STEEL	SIZE	MATERIAL	STANDARDS	NOTE
ELBOWS & TEES	1" - 12"	Cast Steel	ASTM A216 Grade WCB	Fixed Flgs
	1" - 8"	Carbon Steel	A234 Gr WPB, B16.9 (Long Radius)	Fixed / Loose Flgs
	10" - 12"	Carbon Steel	A234 Gr WPB, B16.28 (Short Radius)	Fixed / Loose Flgs

Stainless steel / other material on request.

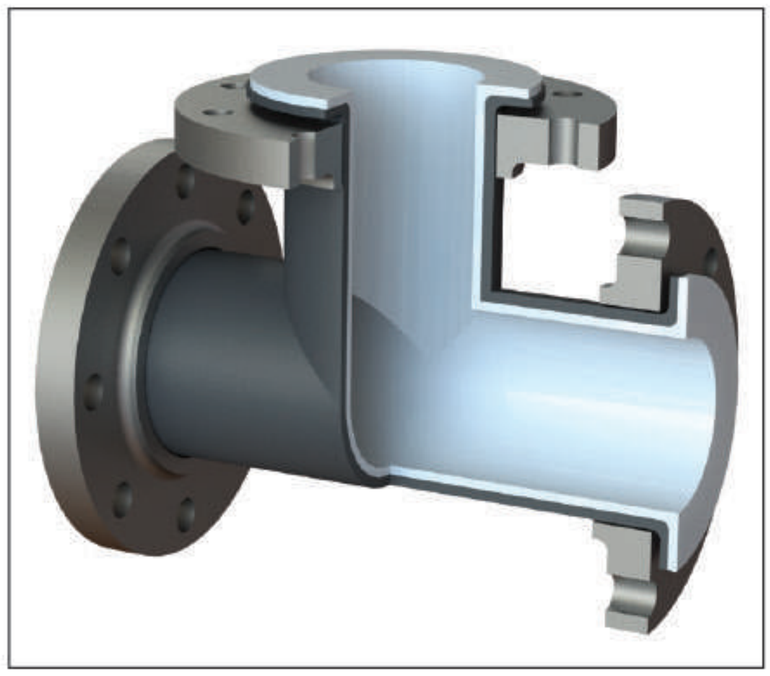
LINED EQUAL TEES

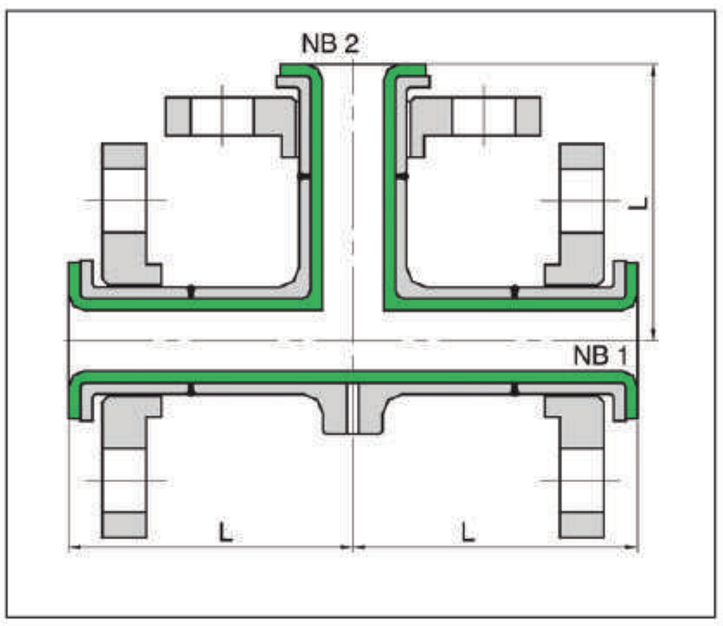


Stub-End Equal Tee, LF

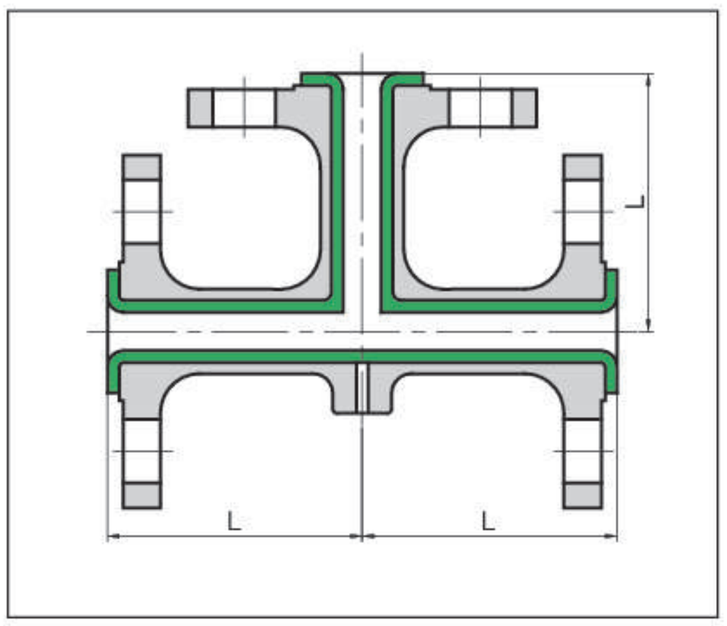


Equal Tee, FF





Steel Equal Tee, LF



Cast Steel Equal Tee, FF

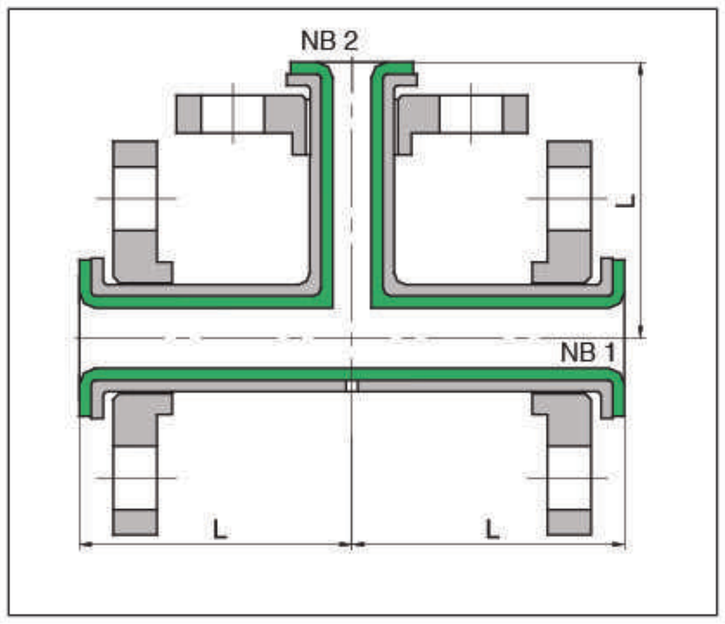
NB #150	L mm	Wt kg
½"	65	1.6
¾"	75	2.2
1"	89	3.5
1½"	102	5.9
2"	114	9.2
3"	140	17.9
4"	165	26.1
6"	203	41.7
8"	229	68.8
10"	279	96.8
12"	305	132

STEEL	SIZE	MATERIAL	STANDARDS	NOTE
ELBOWS & TEES	1" - 3"	Cast Steel	ASTM A216 Grade WCB	Fixed Flgs
OTHER TEES	½" - 4"	Carbon Steel	ASTM A 106 Gr B / API 5L, B36.10	Fixed / Loose Flgs
	6" - 12"	Carbon Steel	ASTM A 106 Gr B / API 5L, A234 Gr WPB, B19.9	Fixed / Loose Flgs

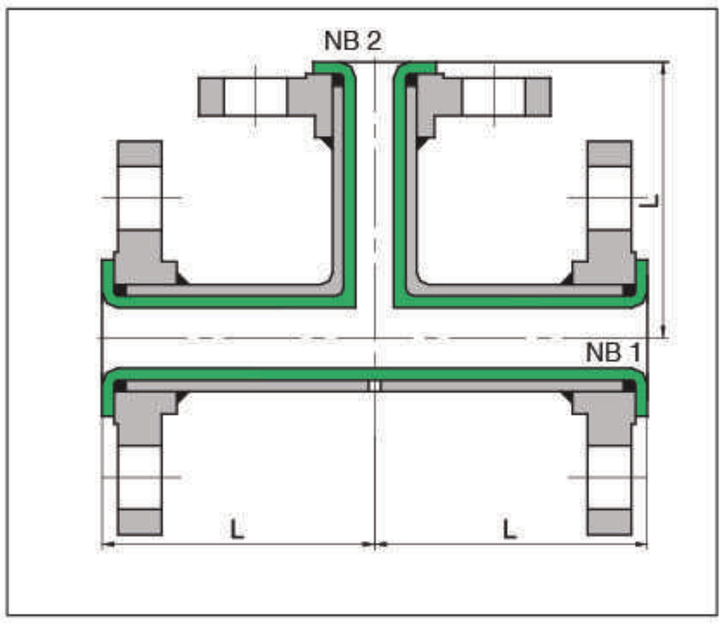
Stainless steel / other material on request.

ALMARC
PTFE/PFA LINED SYSTEMS

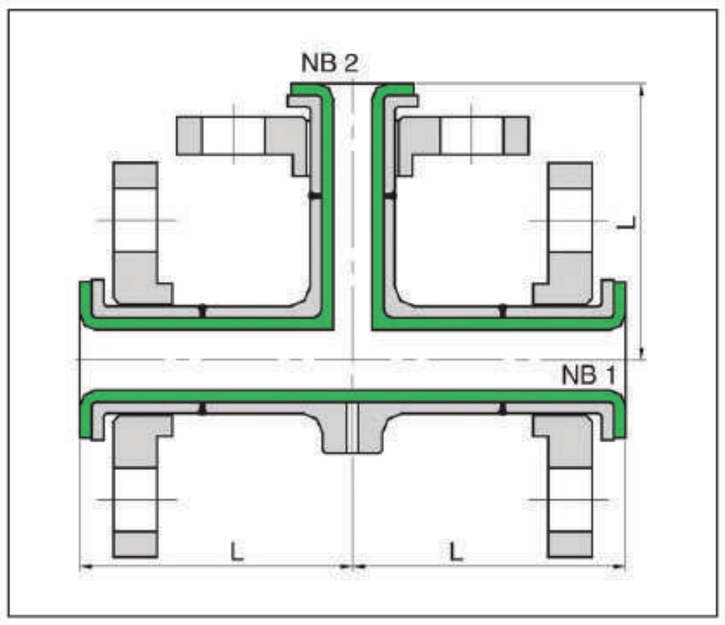
LINED REDUCING TEES



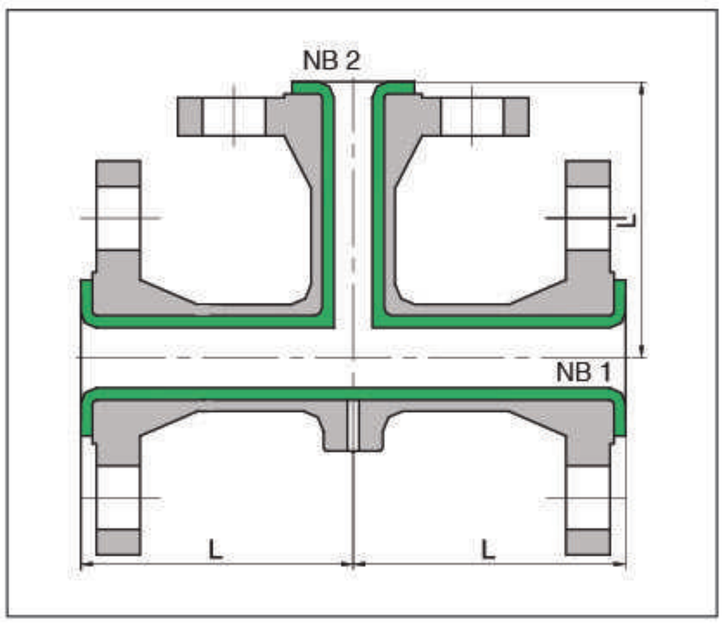
Stub-End Red Tee, LF



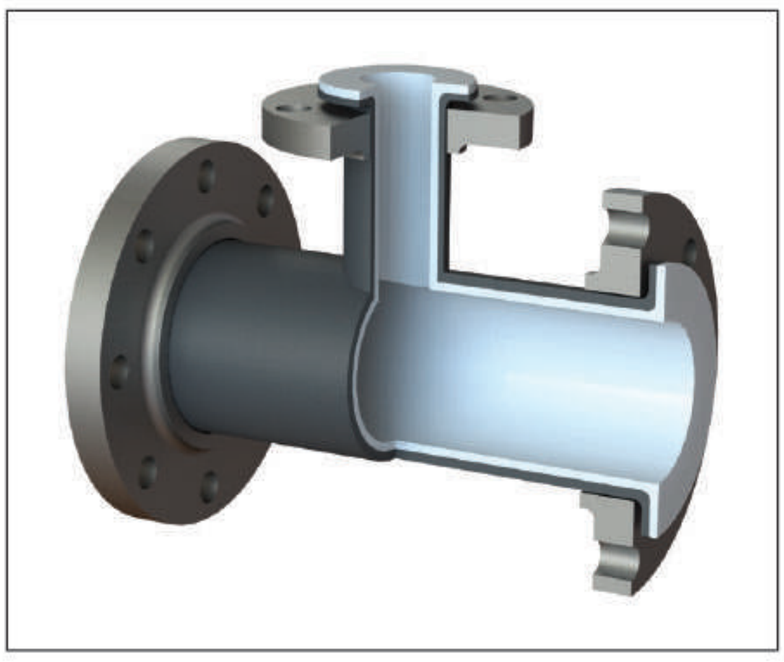
Red Tee, FF



Steel Red Tee, LF



Cast Steel Red Tee, FF



NB1 #150	NB2 #150	L mm	Wt Kg
¾"	½"	75	2.0
1"	½"	89	2.9
	¾"	89	3.1
1½"	½"	102	4.6
	¾"	102	4.8
	1"	102	5.2
2"	½"	114	6.8
	¾"	114	7.0
	1"	114	7.4
	1½"	114	8.2
3"	1"	140	13.5
	1½"	140	14.3
	2"	140	15.4
4"	1"	165	19.3
	1½"	165	20.2
	2"	165	21.2
	3"	165	23.9

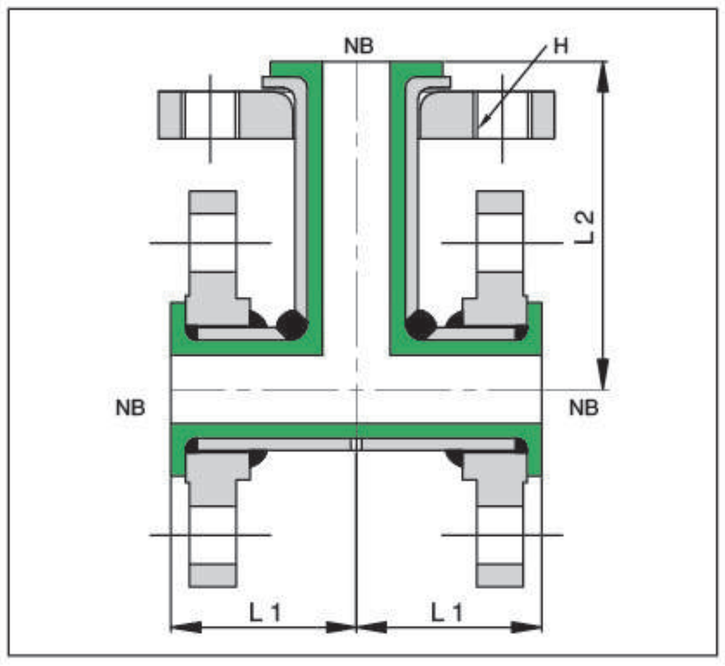
NB1 #150	NB2 #150	L mm	Wt Kg
6"	1"	203	30.8
	1½"	203	31.7
	2"	203	32.8
	3"	203	35.6
	4"	203	37.9
8"	1"	229	50.7
	1½"	229	51.6
	2"	229	52.7
	3"	229	55.5
	4"	229	57.8
	6"	229	61.7
10"	4"	279	78.8
	6"	279	83.0
	8"	279	90.6
12"	4"	305	104
	6"	305	108
	8"	305	115
	10"	305	122

STEEL	SIZE	MATERIAL	STANDARDS	NOTE
ELBOWS & TEES	1" - 12"	Cast Steel	ASTM A216 Grade WCB	Fixed Flgs
OTHER TEES	1" - 12"	Carbon Steel	ASTM A 106 Gr B / API 5L, B36.10	Fixed / Loose Flgs
	1" - 12"	Carbon Steel	ASTM A 106 Gr B / API 5L, A234 Gr WPB, B19.9	Fixed / Loose Flgs

Stainless steel / other material on request.

ALMARC
PTFE/PFA LINED SYSTEMS

LINED CUSTOMIZED TEE

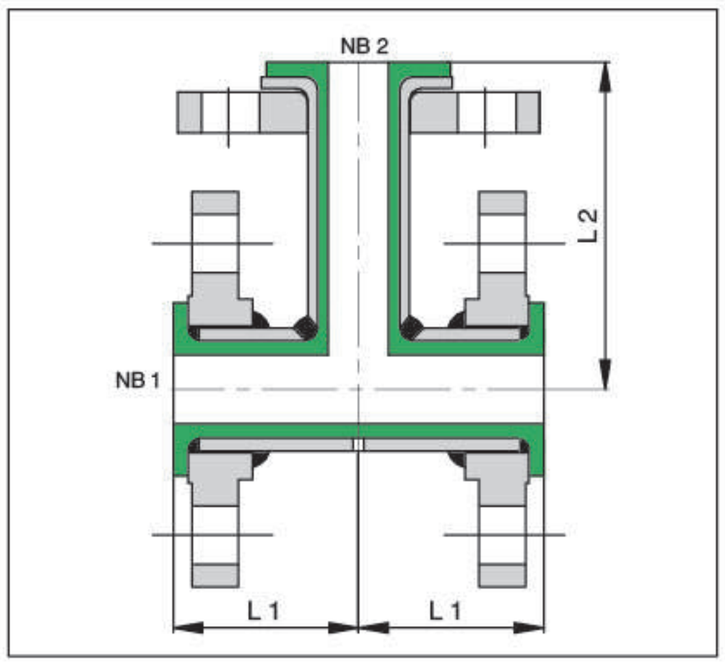


Equal Customized Tee
Fixed/Loosed Flange

NB #150	L1 mm	L2 mm	Wt Kg	H UNC
½"	45	63	1.5	½"
¾"	50	75	2.0	½"
1"	50	89	3.3	½"
1" - 1½"	65	102	5.6	½"
2"	80	114	8.7	⅝"
3"	105	140	17.0	⅝"
4"	120	165	24.7	⅝"
6"	140	203	39.6	¾"
8"	180	229	65.3	¾"
10"	215	279	91.9	⅞"
12"	240	305	125.4	⅞"

* Threated.

In applications where there are space constrains.
Note* Customised Fabrications.



Reducing Customized Tee
Fixed/Loosed Flange

NB1 #150	NB2 #150	L1 mm	L2 mm	Wt Kg
¾"	½"	50	75	1.9
1"	½"	50	89	2.7
	¾"	50	89	2.9
1" - ½"	½"	65	102	3.7
	¾"	65	102	4.5
	1"	65	102	4.9
2"	½"	80	114	6.4
	¾"	80	114	6.6
	1"	80	114	7.0
	1" - 1½"	80	114	7.7
3"	1"	105	140	12.8
	1" - 1½"	105	140	13.5
	2"	105	140	14.6
4"	1"	120	165	18.3
	1" - 1½"	120	165	15.2
	2"	120	165	16.2
	3"	120	165	22.7
6"	1"	140	203	29.2
	1" - 1½"	140	203	30.1
	2"	140	203	31.1
	3"	140	203	33.8
	4"	140	203	32.9

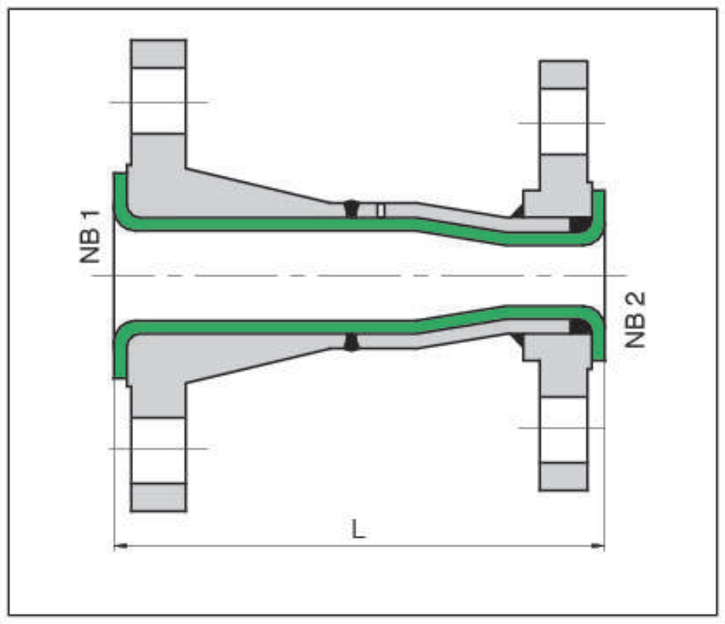
NB1 #150	NB2 #150	L1 mm	L2 mm	Wt Kg
8"	2"	180	229	50.0
	3"	180	229	52.7
	4"	180	229	57.3
	6"	180	229	58.6
10"	2"	215	279	68.8
	3"	215	279	71.0
	4"	215	279	74.8
	6"	215	279	78.8
	8"	215	279	86.0
12"	2"	240	305	89.3
	3"	240	305	94.0
	4"	240	305	99.0
	6"	240	305	102.6
	8"	240	305	109.2
	10"	240	305	115.9

STEEL	SIZE	MATERIAL	STANDARDS	NOTE
Customized TEES	½" - 4"	Carbon Steel	ASTM A 106 Gr B / API 5L, B36.10	Fixed Flgs
	6" - 12"	Carbon Steel	ASTM A 106 Gr B / API 5L, A234 Gr WPB, B19.9	Fixed Flgs

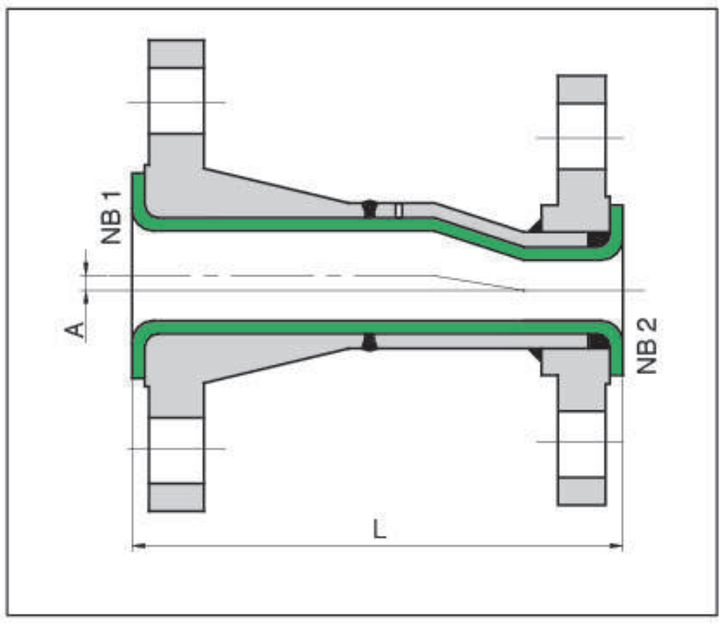
Stainless steel / other material on request.

LINED PIPE REDUCERS

ALMARC
PTFE/PFA LINED SYSTEMS

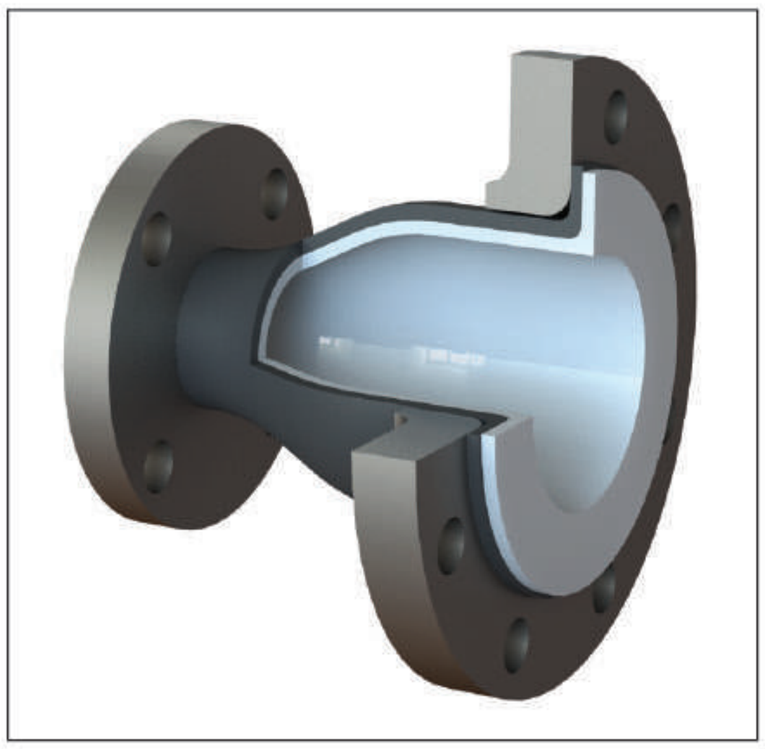


Concentric Red, FF/LF



Eccentric Red, FF/LF

NB1 #150	NB2 #150	L mm	A mm	Wt Kg
1"	½"	114	3.4	1.6
	¾"	114	3.4	1.8
1½"	½"	114	10	2.3
	¾"	114	10	2.5
	1"	114	7.0	2.9
2"	¾"	127	4.6	3.5
	1"	127	13	3.9
	1½"	127	5.7	4.6
3"	1½"	152	20	7.2
	2"	152	14	8.2
4"	1½"	178	32	9.5
	2"	178	26	10.5
	3"	178	13	13.1
6"	3"	229	40	17.6
	4"	229	26	19.9
8"	4"	279	52	28.5
	6"	279	25	32.6
10"	4"	305	76	35.7
	6"	305	52	40.0
	8"	305	27	47.6
12"	6"	356	75	53.1
	8"	356	51	61.2
	10"	356	26	67.7

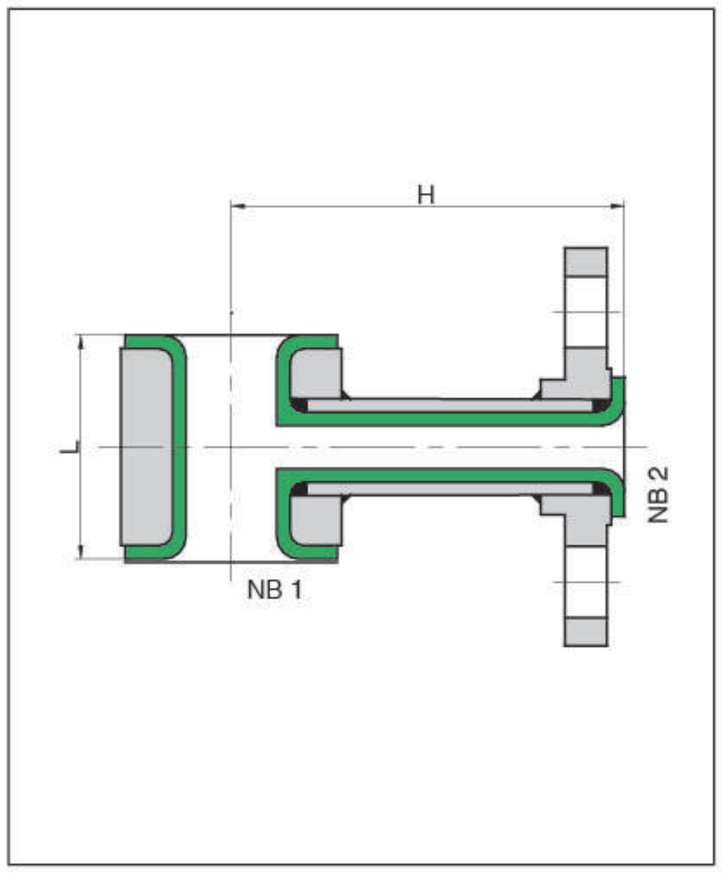


STEEL	SIZE	MATERIAL	STANDARDS	NOTE
CON & ECC RED	1" - 12"	Carbon Steel	A234 Gr WPB, ANSI B16.9	Fixed / Loose Flgs

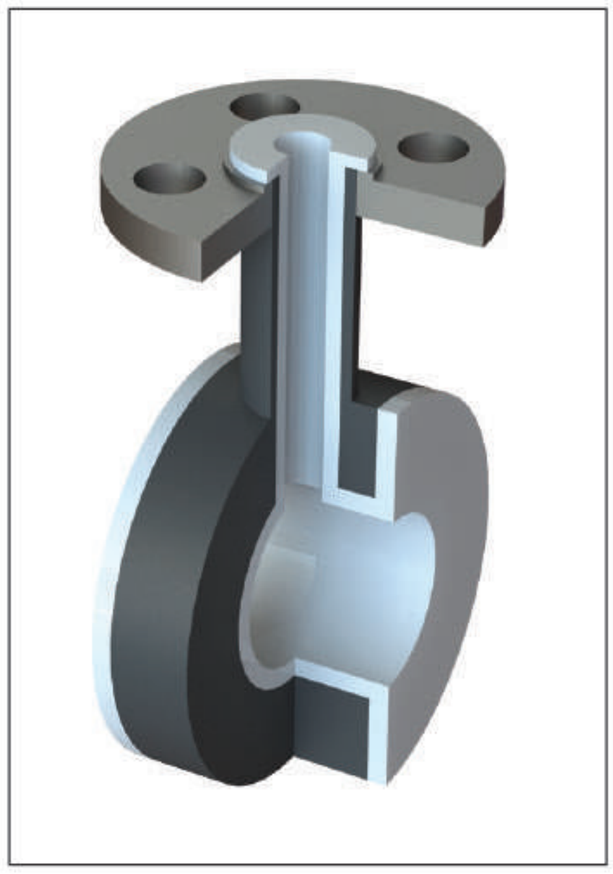
Stainless steel / other material on request.

ALMARC
PTFE/PFA LINED SYSTEMS

LINED INSTRUMENT TEES



Instrument Tee, FF/LF



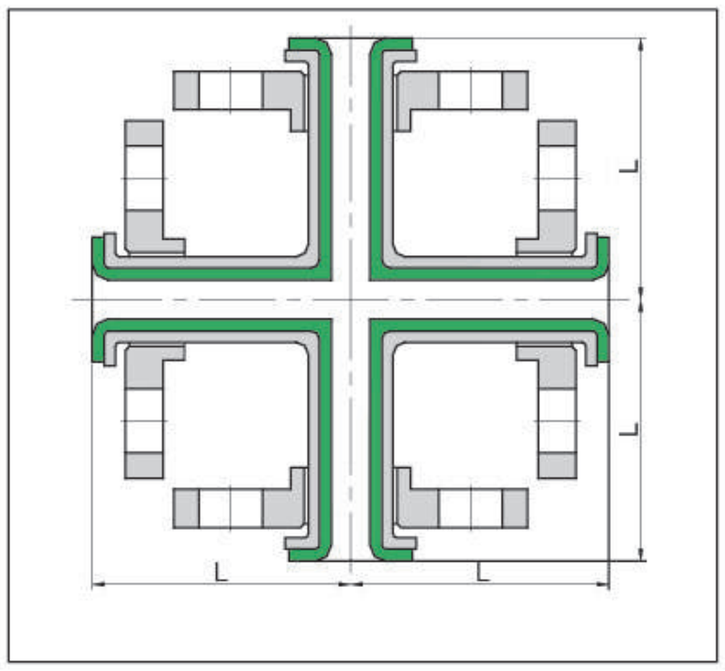
NB1 #150	NB2 #150	L mm	H mm	Wt Kg
1"	½"	50	89	1.9
	¾"	50	89	1.9
	1"	50	89	2.0
1½"	½"	50	102	2.7
	¾"	50	102	2.8
	1"	50	102	3.0
	1½"	75	102	4.6
2"	½"	50	114	4.7
	¾"	50	114	4.8
	1"	50	114	5.0
	1½"	75	114	8.4
	2"	90	114	9.9
3"	½"	50	140	5.7
	¾"	50	140	5.8
	1"	50	140	6.0
	1½"	75	140	11
	2"	90	140	12
	3"	120	140	20
4"	½"	50	165	6.7
	¾"	50	165	6.8
	1"	50	165	7.0
	1½"	75	165	12
	2"	90	165	13

NB1 #150	NB2 #150	L mm	H mm	Wt Kg
6"	½"	50	203	8.9
	¾"	50	203	9.0
	1"	50	203	10
	1½"	75	203	15
	2"	90	203	16
8"	½"	50	229	10
	¾"	50	229	10
	1"	50	229	10
	1½"	75	229	16
	2"	90	229	17
10"	1"	50	279	24
	1½"	75	279	26
	2"	90	279	27
12"	1"	50	305	29
	1½"	75	305	30
	2"	90	305	30

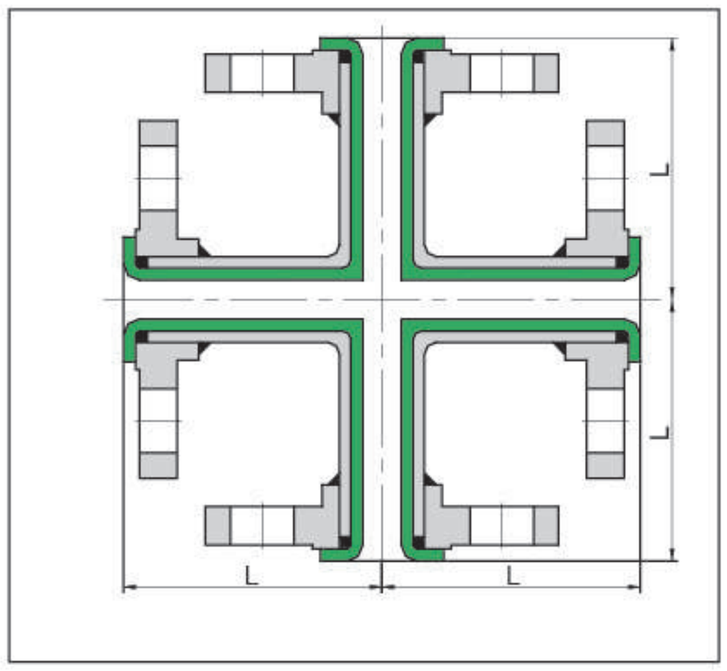
STEEL	SIZE	MATERIAL	STANDARDS	NOTE
INSTR TEES	1" - 12"	Carbon Steel	ASTM A106 Gr B / API 5L / Main Body Low Carbon AB-EH36 / ST52-3	Fixed / Loose Flgs

Stainless steel / other material on request.

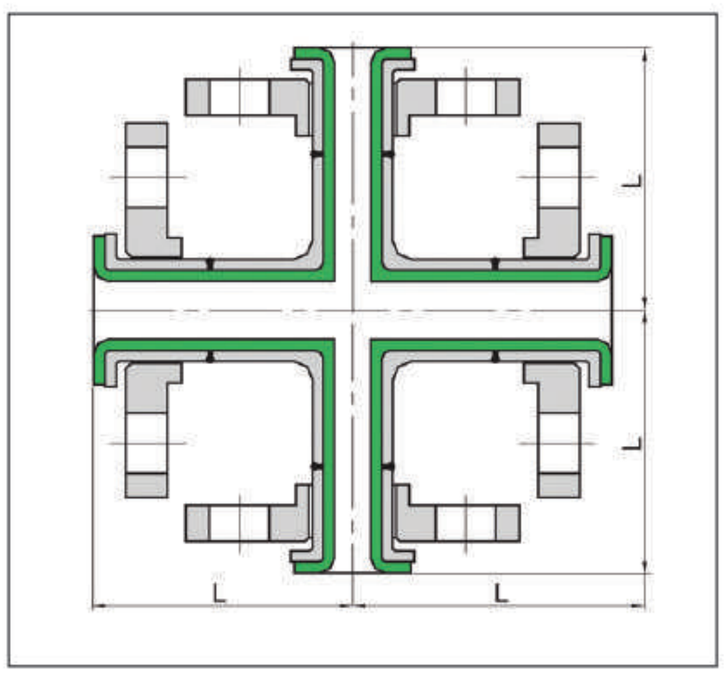
LINED CROSSES

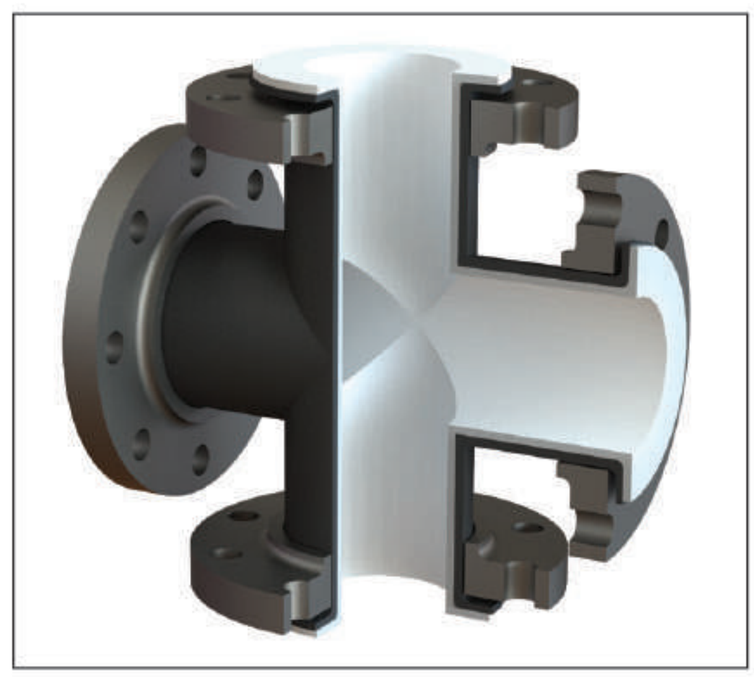


Equal Cross, LF



Equal Cross, FF





Steel Equal Cross, LF

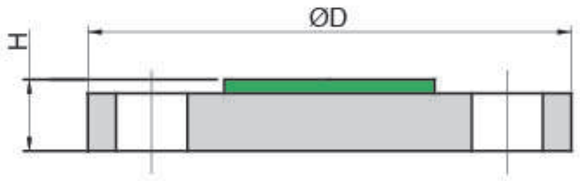
NB #150	L mm	Wt kg
½"	65	2.1
¾"	75	2.9
1"	89	4.6
1½"	102	7.8
2"	114	12.1
3"	140	23.6
4"	165	34.2
6"	203	53.9
8"	229	88.2
10"	279	124
12"	305	169

STEEL	SIZE	MATERIAL	STANDARDS	NOTE
ELBOWS & TEES	1" - 12"	Cast Steel	ASTM A216 Grade WCB	Fixed Flgs
OTHER TEES	1½" - 4"	Carbon Steel	ASTM A 106 Gr B / API 5L, B36.10	Fixed / Loose Flgs
	6" - 12"	Carbon Steel	ASTM A 106 Gr B / API 5L, A234 Gr WPB, B19.9	Fixed / Loose Flgs

Stainless steel / other material on request.

ALMARC
PTFE/PFA LINED SYSTEMS

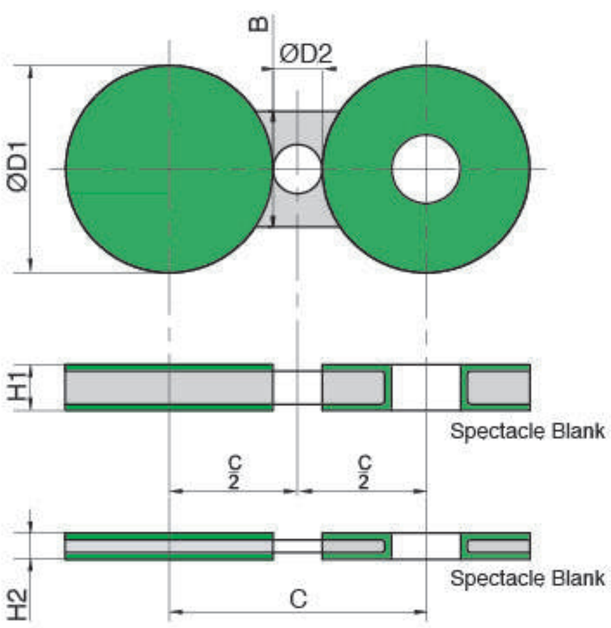
LINED BLINDS & LATERALS



Blind Flange

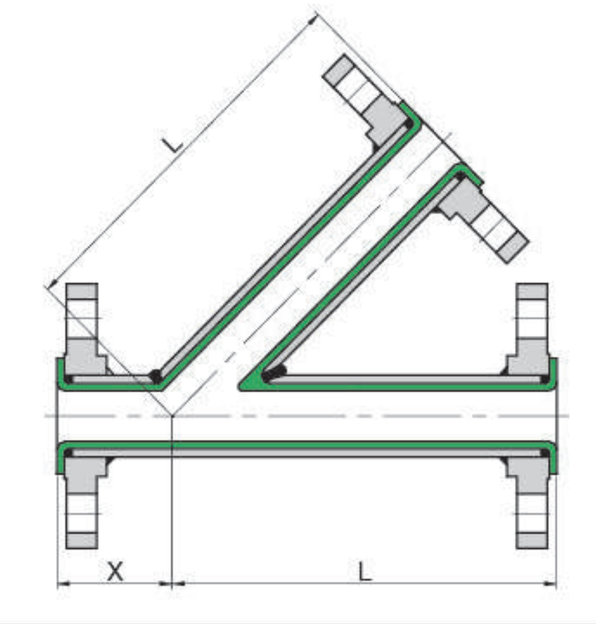
NB #150	D mm	H mm	Wt kg
½"	89	16	0.3
¾"	98	18	0.5
1"	108	19	0.9
1½"	127	20	1.3
2"	152	24	2.4
3"	190	29	4.9
4"	229	29	6.9
6"	279	30	11
8"	343	34	19
10"	406	36	28
12"	482	38	45

Materials	
Flange	ASTM A105
PTFE	ASTM D1457



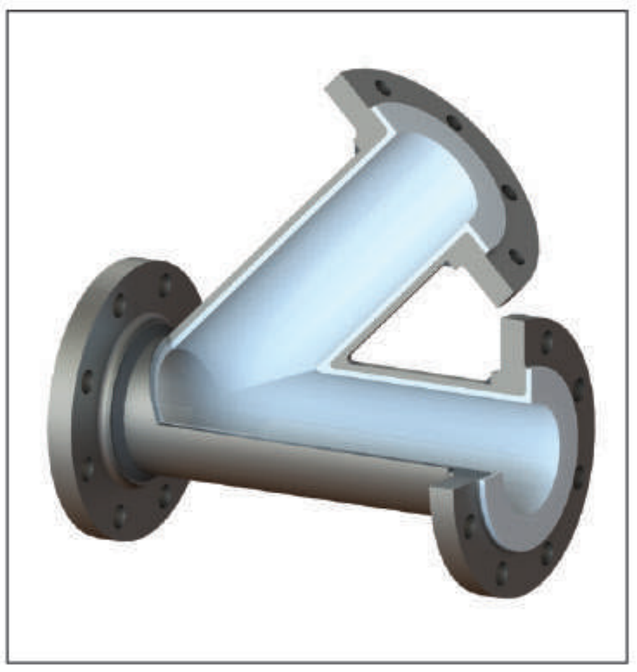
Spectacle Blind *Carbon Steel Body*

NB #150	D1 mm	D2 mm	B mm	C mm	H1 mm	Wt kg	H2 mm
½"	44	16	35	60	14	0.2	8
¾"	53	16	35	70	14	0.2	8
1"	63	16	35	78	14	0.3	8
1½"	82	16	50	98	14	0.4	8
2"	101	19	50	121	14	0.6	8
3"	133	19	60	152	14	0.9	8
4"	171	19	50	191	18	1.6	10
6"	219	22	60	241	18	3.7	10
8"	276	22	70	298	21	5.6	
10"	336	26	65	362	21	10.7	
12"	406	26	70	432	23	15.5	



Lateral Tee (45°) Fixed Flange

NB #150	L mm	X mm	Wt kg
1"	146	44	3.7
1½"	178	51	6.5
2"	203	64	10
3"	254	76	21
4"	305	76	31
6"	368	89	52

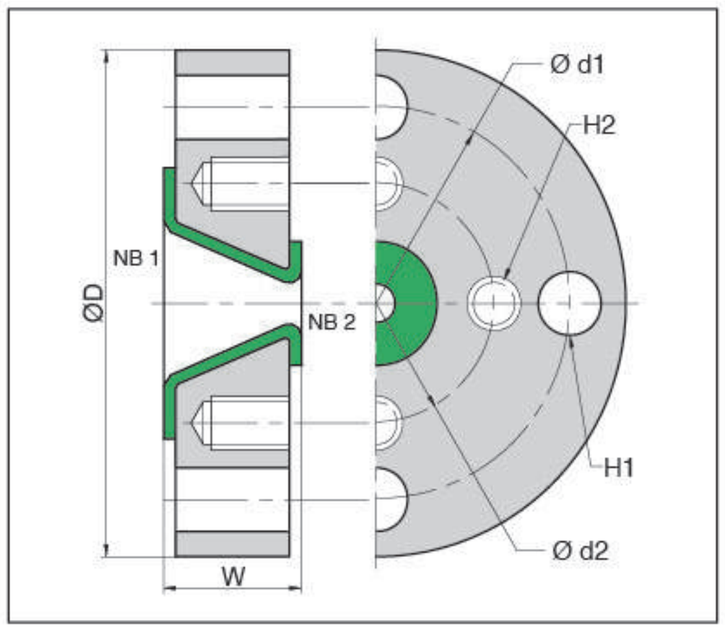


STEEL	SIZE	MATERIAL	STANDARDS	NOTE
ELBOWS & TEES	1" - 3"	Carbon Steel	ASTM A 106 Gr B / API 5L, B36.10	Fixed Flgs
OTHER TEES	1½" - 4"	Carbon Steel	ASTM A 106 Gr B / API 5L, B36.10	Fixed / Loose Flgs
	6" - 12"	Carbon Steel	ASTM A 106 Gr B / API 5L, A234 Gr WPB, B19.9	Fixed / Loose Flgs

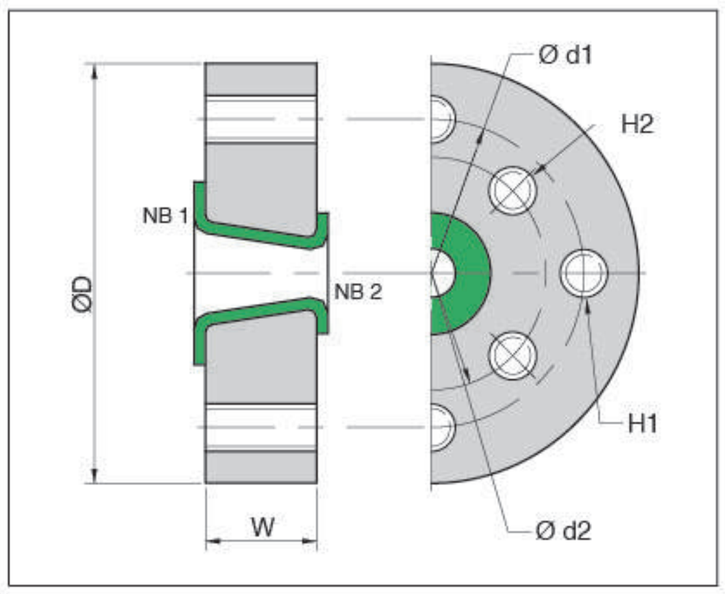
Stainless steel / other material on request.

ALMARC
PTFE/PFA LINED SYSTEMS

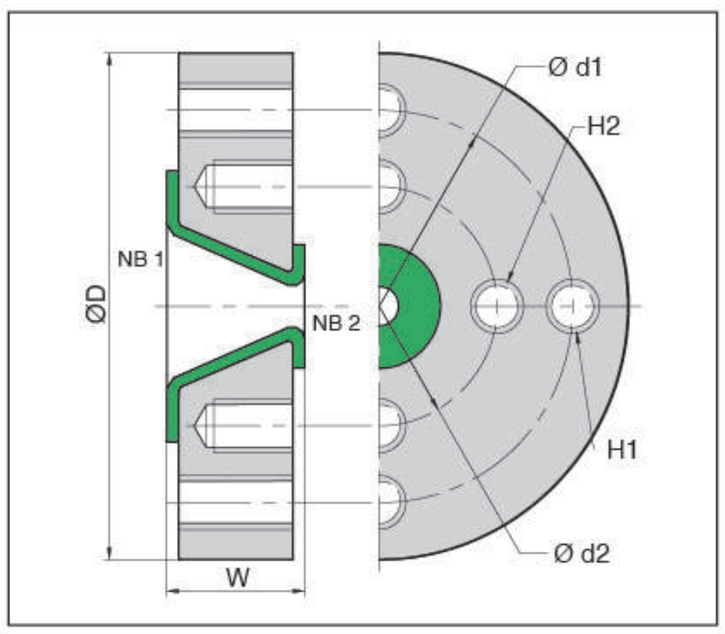
LINED FLANGE REDUCERS



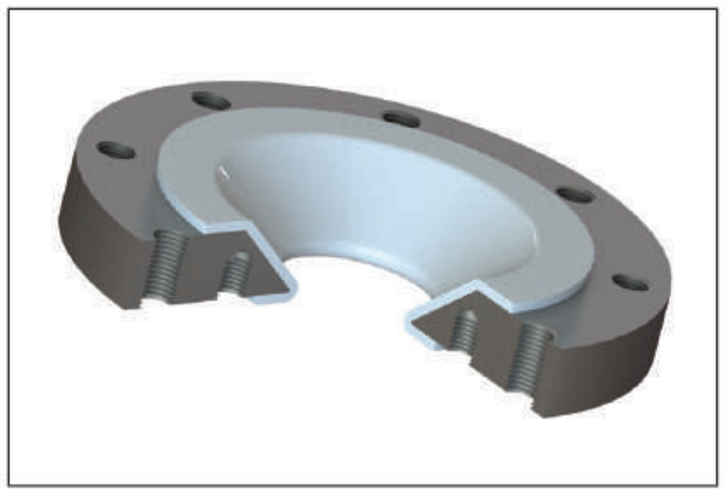
Reducing Flange Type 1



Reducing Flange Type 2



Reducing Flange Type 3

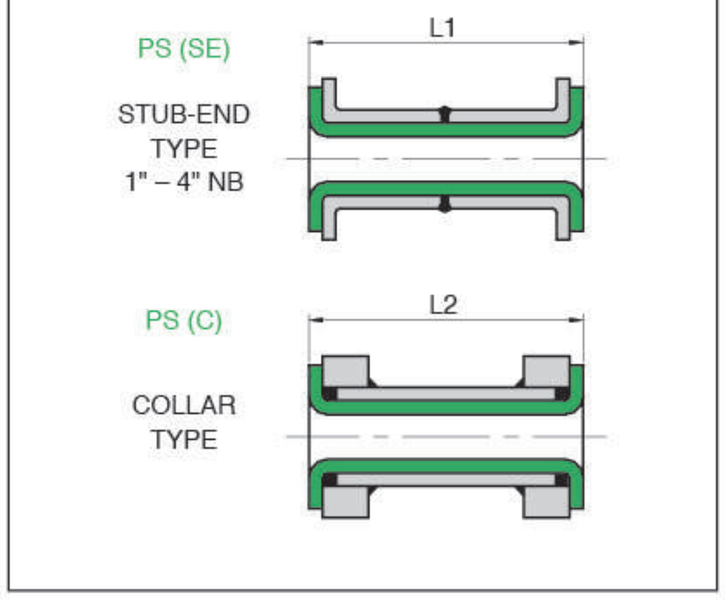


NB1 #150	NB2 #150	D mm	W mm	d1 mm	H1 UNC/mm	d2 mm	H2 UNC/mm	Type	Wt Kg
¾"	½"	98	35	69.8	4x½" UNC	60.3	4x½" UNC	2	1.9
1"	½"	108	35	79.4	4x½" UNC	60.3	4x½" UNC	2	2.1
	¾"	108	35	79.4	4x½" UNC	69.8	4x½" UNC	2	2.0
1½"	½"	127	35	98.4	4x½" UNC	60.3	4x½" UNC	3	4.1
	¾"	127	35	98.4	4x½" UNC	69.8	4x½" UNC	3	4.0
	1"	127	35	98.4	4x½" UNC	79.4	4x½" UNC	2	3.9
2"	½"	152	35	120.6	4x⅝" UNC	60.3	4x½" UNC	3	4.8
	¾"	152	35	120.6	4x⅝" UNC	69.8	4x½" UNC	3	4.8
	1"	152	35	120.6	4x⅝" UNC	79.4	4x½" UNC	3	4.7
	1½"	152	35	120.6	4x⅝" UNC	98.4	4x½" UNC	2	4.5
3"	½"	190	35	152.4	4x19 mm	60.3	4x½" UNC	1	6.7
	¾"	190	35	152.4	4x19 mm	69.8	4x½" UNC	1	6.6
	1"	190	35	152.4	4x19 mm	79.4	4x½" UNC	1	6.5
	1½"	190	35	152.4	4x⅝" UNC	98.4	4x½" UNC	3	6.2
	2"	190	35	152.4	4x⅝" UNC	120.6	4x⅝" UNC	2	6.0
4"	½"	229	45	190.5	8x19 mm	60.3	4x½" UNC	1	11
	¾"	229	45	190.5	8x19 mm	69.8	4x½" UNC	1	11
	1"	229	45	190.5	8x19 mm	79.4	4x½" UNC	1	11
	1½"	229	45	190.5	8x19 mm	98.4	4x½" UNC	1	11
	2"	229	45	190.5	8x⅝" UNC	120.6	4x⅝" UNC	3	10
	3"	229	45	190.5	8x⅝" UNC	152.4	4x⅝" UNC	3	10
6"	1"	279	45	241.3	8x22 mm	79.4	4x½" UNC	1	17
	1½"	279	45	241.3	8x22 mm	98.4	4x½" UNC	1	17
	2"	279	45	241.3	8x22 mm	120.6	4x⅝" UNC	1	17
	3"	279	45	241.3	8x¾" UNC	152.4	4x⅝" UNC	3	16
	4"	279	45	241.3	8x¾" UNC	190.5	8x⅝"" UNC	2	15
8"	1"	343	45	298.4	8x22 mm	79.4	4x½" UNC	1	25
	1½"	343	45	298.4	8x22 mm	98.4	4x½" UNC	1	25
	2"	343	45	298.4	8x22 mm	120.6	4x⅝" UNC	1	25
	3"	343	45	298.4	8x22 mm	152.4	4x⅝" UNC	1	24
	4"	343	45	298.4	8x22 mm	190.5	8x⅝" UNC	1	23
	6"	343	45	298.4	8x¾" UNC	241.3	8x¾" UNC	3	20
10"	1½"	406	45	362.0	12x25.5 mm	98.4	4x½" UNC	1	34
	2"	406	45	362.0	12x25.5 mm	120.6	4x½" UNC	1	34
	3"	406	45	362.0	12x25.5 mm	152.4	4x½" UNC	1	33
	4"	406	45	362.0	12x25.5 mm	190.5	8x⅝" UNC	1	33
	6"	406	45	362.0	12x25.5 mm	241.3	8x¾" UNC	1	30
	8"	406	45	362.0	12x7/8" UNC	298.4	8x¾" UNC	3	27
12"	2"	483	50	431.8	12x25.5 mm	120.6	4x½" UNC	1	55
	3"	483	50	431.8	12x25.5 mm	152.4	4x½" UNC	1	54
	4"	483	50	431.8	12x25.5 mm	190.5	8x⅝" UNC	1	54
	6"	483	50	431.8	12x25.5 mm	241.3	8x¾" UNC	1	49
	8"	483	50	431.8	12x25.5 mm	298.4	8x¾" UNC	1	44
	10"	483	50	431.8	12x⅞" UNC	361.9	12x⅞" UNC	3	43

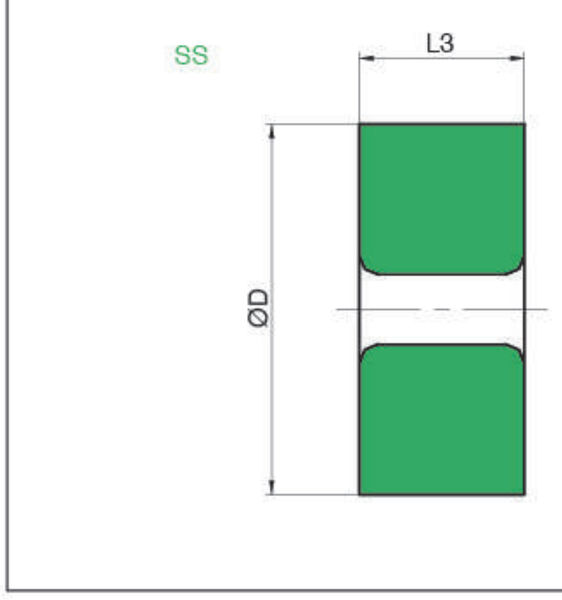
STEEL	SIZE	MATERIAL	STANDARDS	NOTE
RED FLGS	1" - 12"	Carbon Steelt	AB-EH36 / ST52-3 / ASTM A106 Gr B / API 5L	Drilled Bolt Holes

Stainless steel / other material on request.

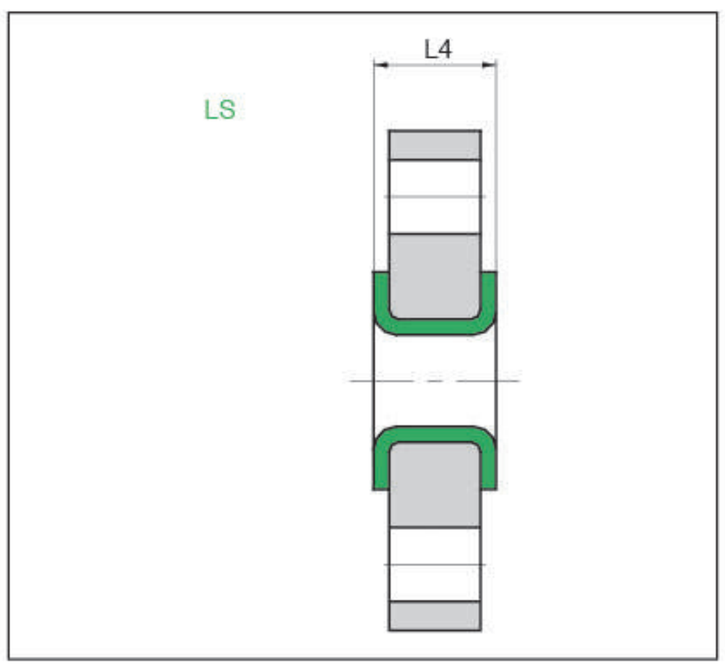
SPACERS



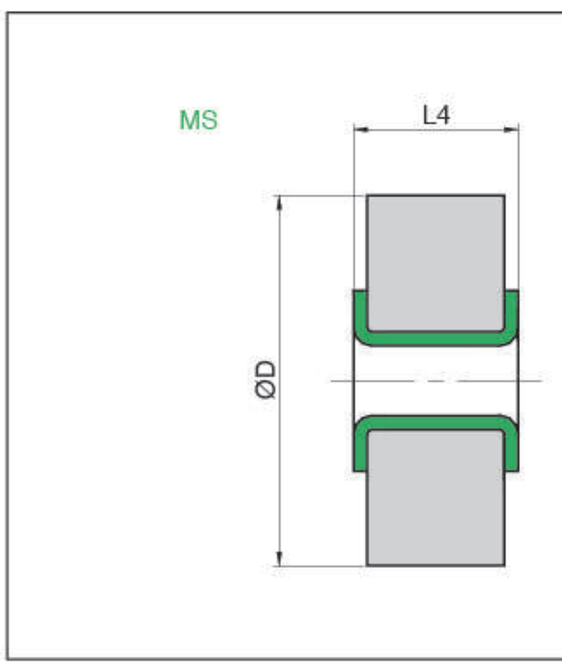
Pipe Spacer



Solid Spacer



Lug Spacer

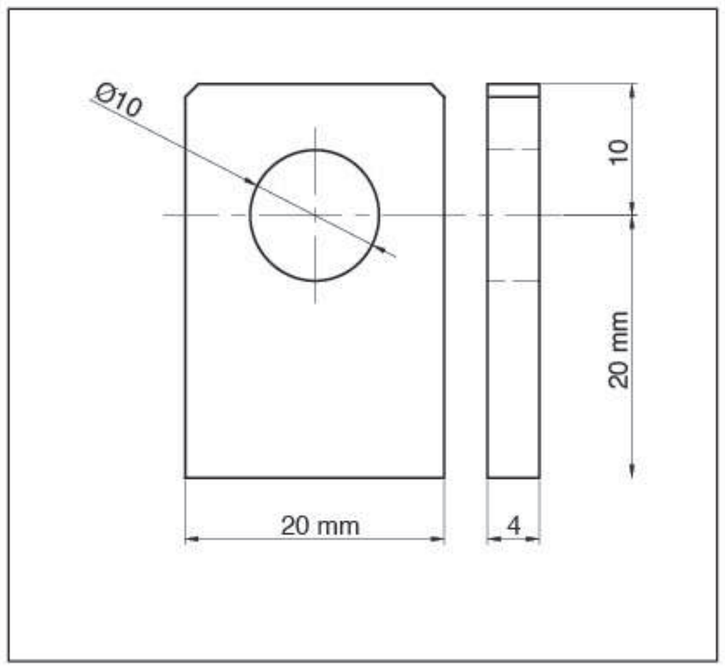


Metal Spacer

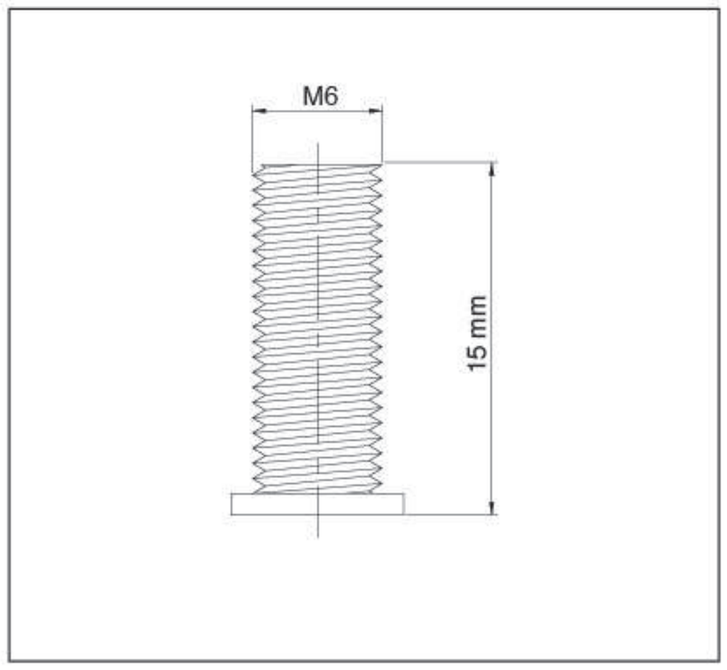
NB	PS(SE)		PS(C)		ØD	SS		LS/MS	
	Min	Max	Min	Max		Min	Max	Min	Max
#150	mm	mm	mm	mm	mm	mm	mm	mm	mm
½"			50	90	44	1	20	15	50
¾"			50	90	54	1	20	15	50
1"	40	90	50	90	64	1	20	15	50
1½"	50	110	60	110	83	1	20	15	60
2"	50	120	60	120	102	1	20	15	60
3"	50	140	60	140	133	1	20	15	60
4"	50	150	60	150	171	1	20	15	60
6"			60	160	219	1	20	20	60
8"			70	180	275	1	20	20	70
10"			70	210	336	1	20	20	70
12"			70	230	405	1	20	20	70

STEEL	SIZE	MATERIAL	STANDARDS
SPACERS	1" - 12"	Carbon Steel	ANSI B16.5

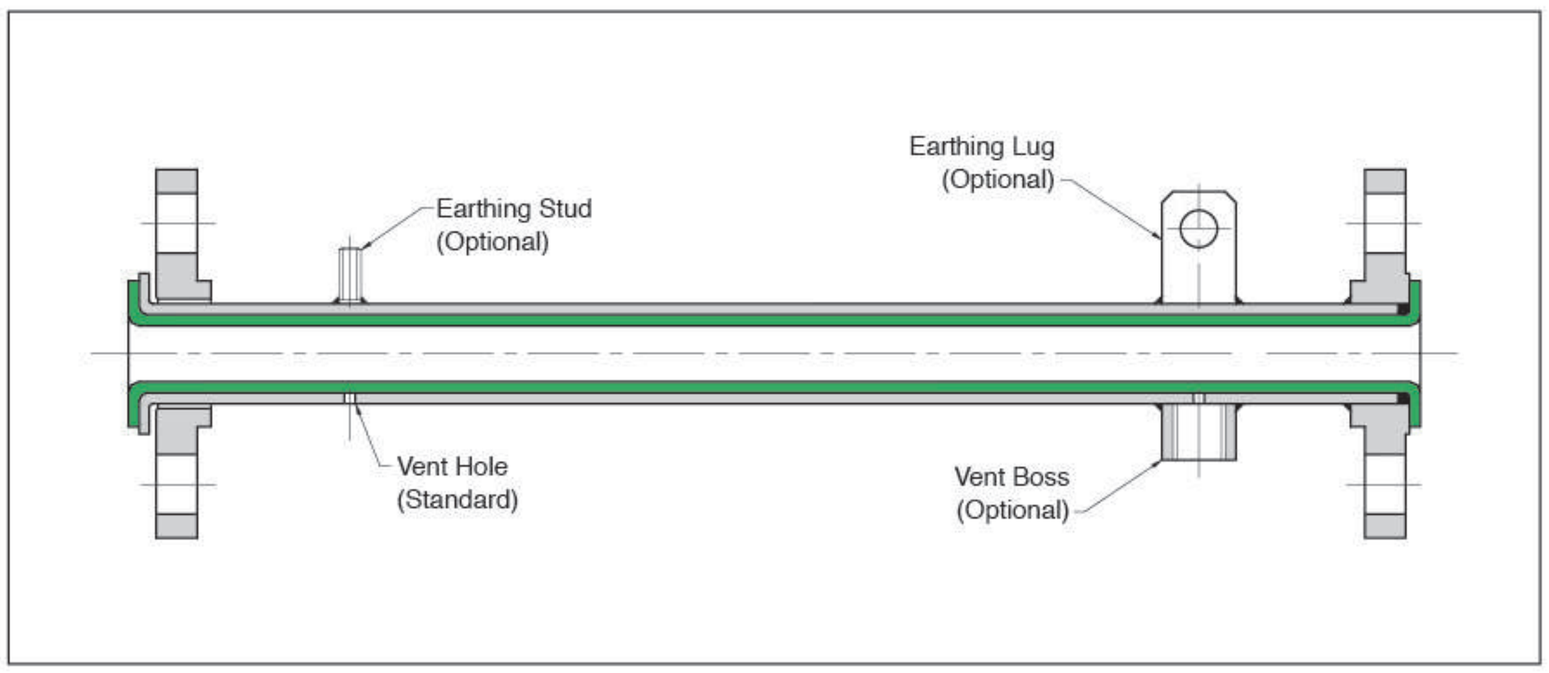
Stainless steel / other material on request.



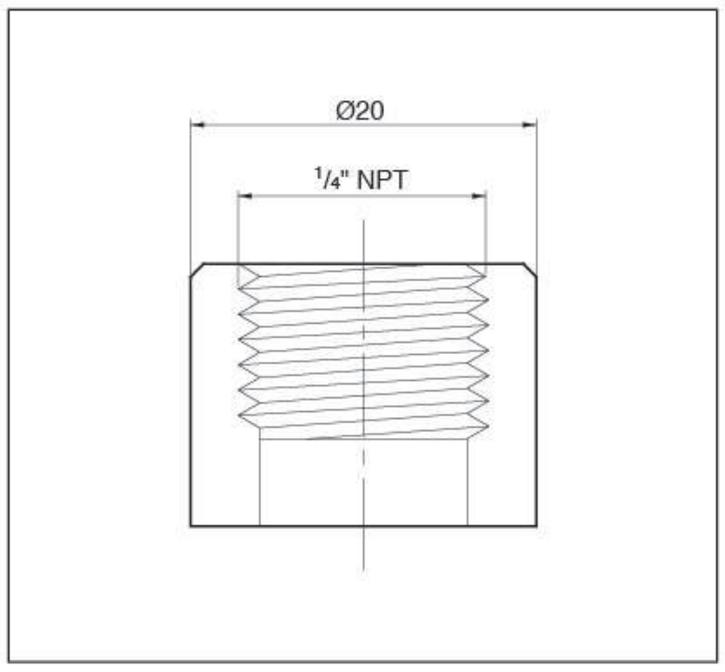
Earthing Lug



Earthing Stud



Pipe Fitments

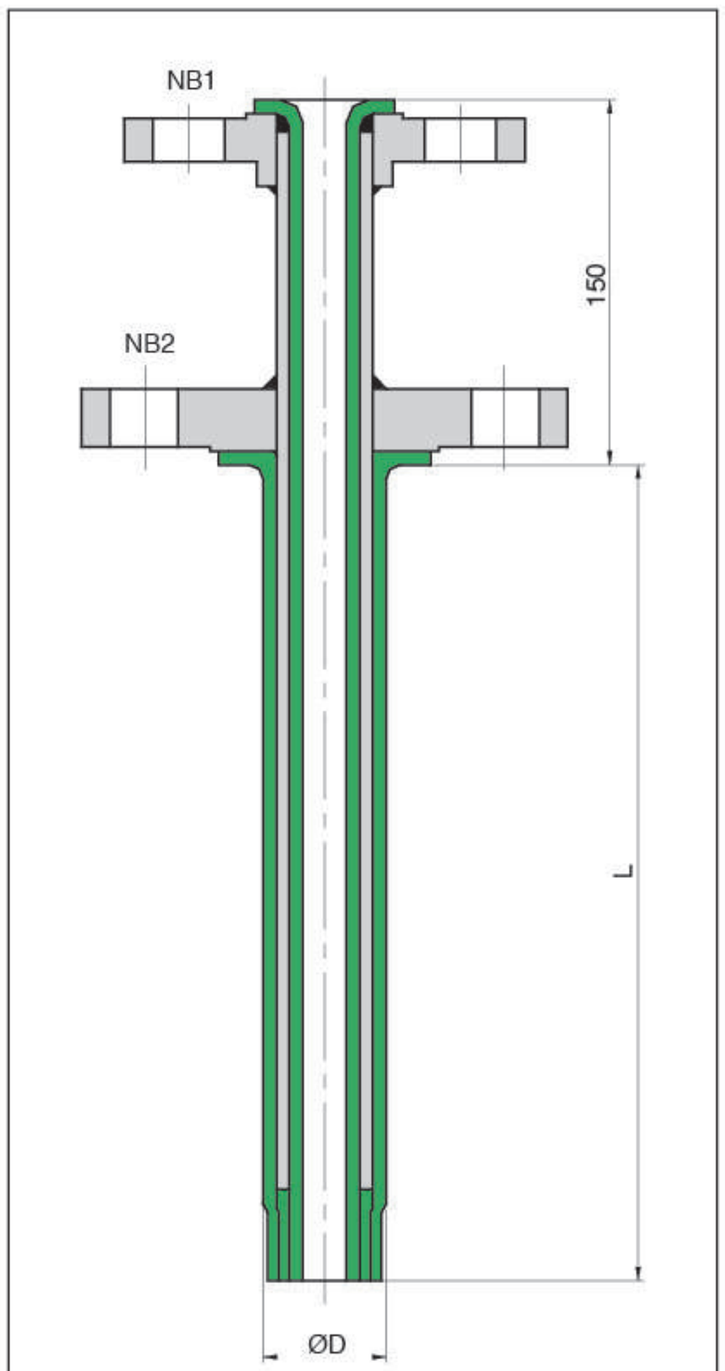


Vent Boss

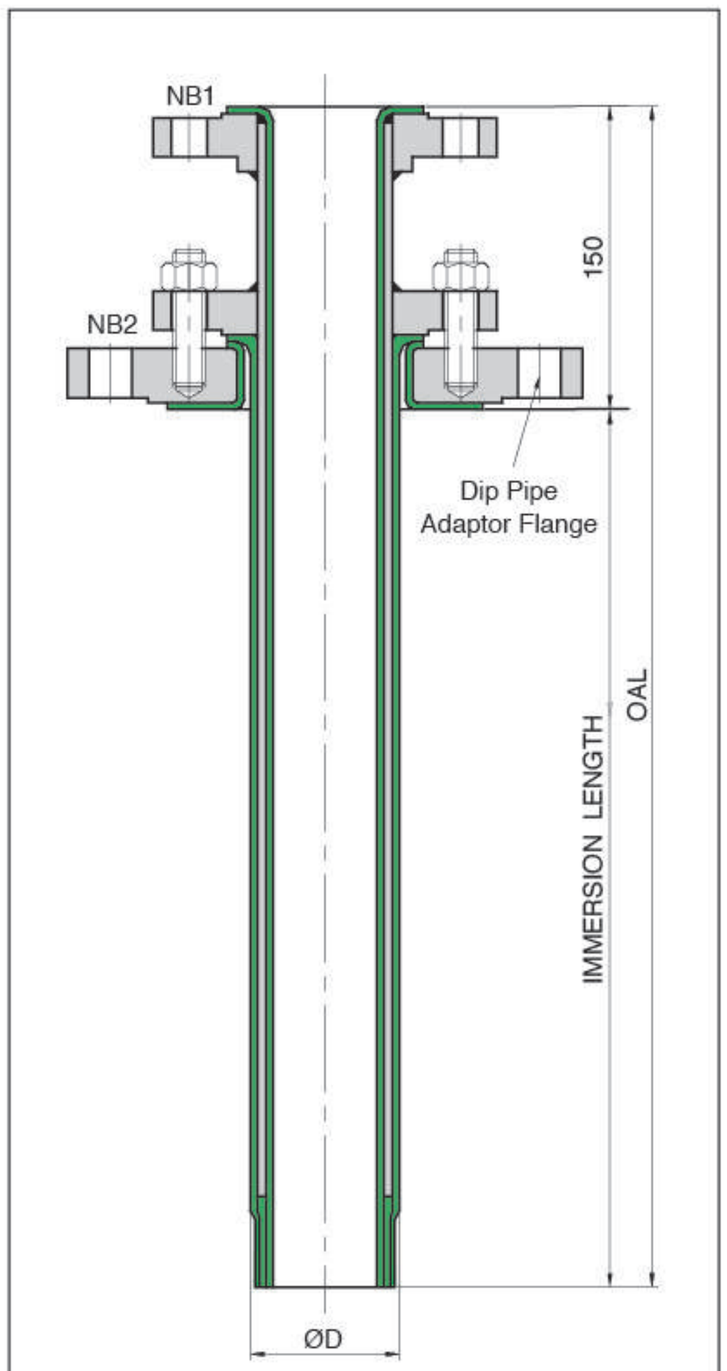
Notes:

1) Vent Holes are drilled on fittings and pipes as standard. One Vent Hole is drilled on steel fittings and on pipes less than 500mm. On pipes longer than 500mm two Vent Holes are drilled 150mm from each end.
2) Vent Bosses are optional fitments. One Vent Boss is fitted in the middle of steel fitting and on pipes less than 500mm long. On pipes longer than 500mm two Vent Bosses are fitted 150mm from each end.
3) Earth Fitments are optional. One Earth Fitment is located on steel fittings and on pipes less than 500mm. On pipes longer than 500mm two earth fitments are fitted 150mm from each end opposite to the vent.

DIP PIPES



Welded Flange Typet



Reducing Flange Type

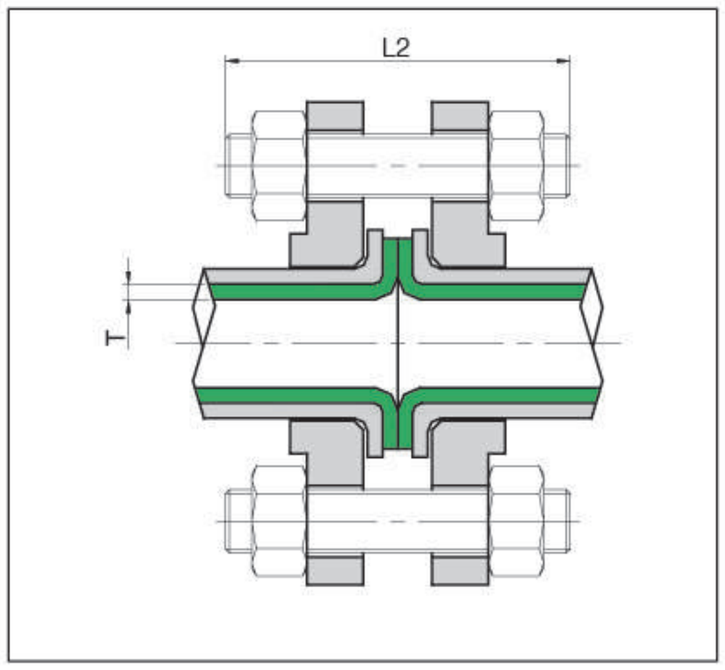
WELDED FLANGE TYPE			
NB1	NB2	D	L max
#150	#150	mm	mm
½"	1"	33	2000
¾"	1"	33	2000
1"	1½"	44	2000
1½"	2"	55	2000
2"	3"	70	2000
3"	4"	100	1500
6"	8"	182	1500
8"	10"	231	1500
10"	12"	286	1500
12"	14"	335	1500

Steel Works - Carbon Steel / other material on request.

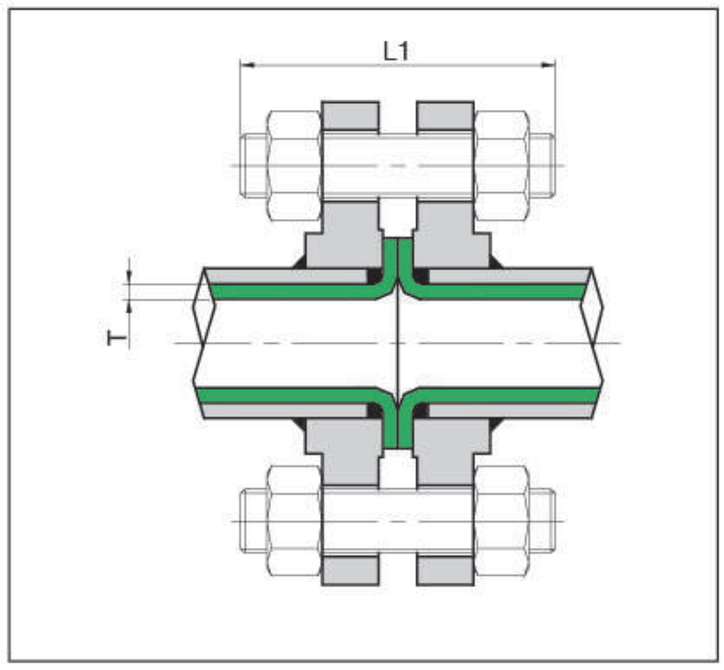
REDUCING FLANGE TYPE			
NB1	NB2	D	L max
#150	#150	mm	mm
½"	1¼"	33	2000
¾"	1¼"	33	2000
1"	2"	44	2000
1½"	2½"	55	2000
2"	4"	70	2000
3"	5"	100	2000
4"	6"	182	2000
6"	10"	231	1500

ALMARC
PTFE/PFA LINED SYSTEMS

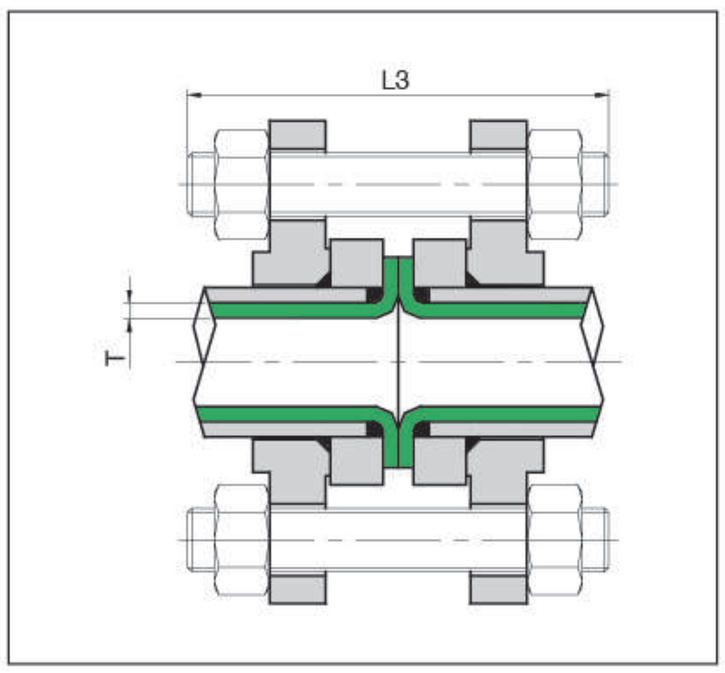
STUD BOLTS & LINER THICKNESS



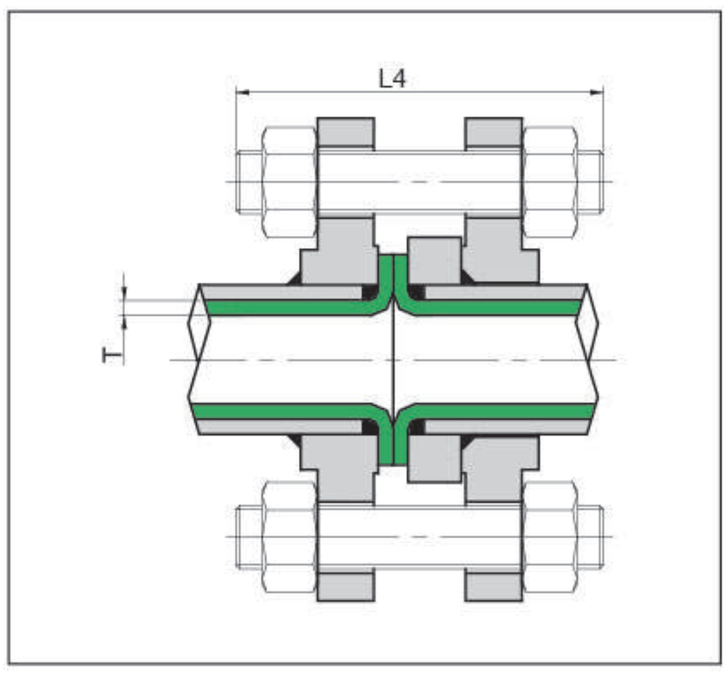
Stub Ends



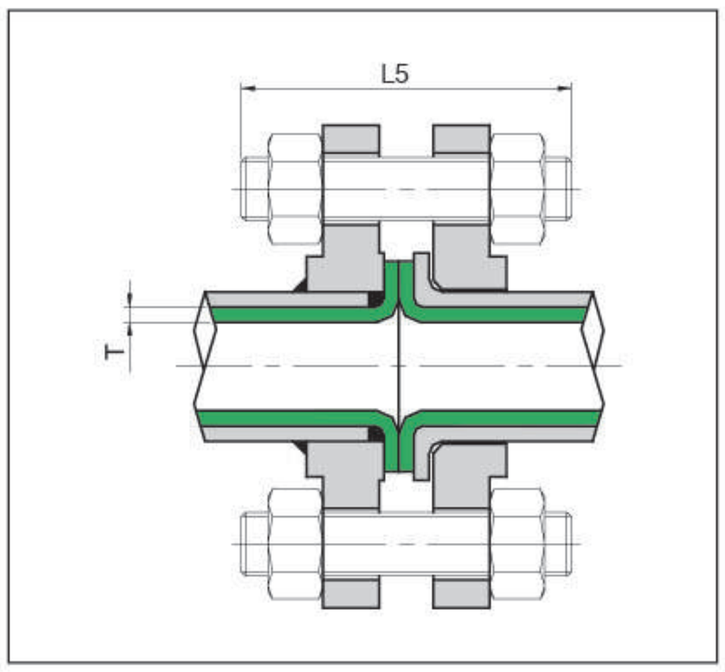
Fixed Ends



Collar Ends



Fixed-Collar Ends



Fixed-Stub Ends

NB #150	L1 mm	L2 mm	L3 mm	L4 mm	L5 mm	Thd UNC	Liner Thickness mm
½"	65		85	75		½"	2
¾"	70		90	80		½"	2
1"	70	75	95	80	75	½"	3.3
1½"	80	85	100	90	85	½"	3.3
2"	90	95	115	100	95	⅝"	3.3
3"	100	105	130	115	115	⅝"	3.5
4"	100	105	130	115	110	⅝"	4.2
6"	115		155	135		¾"	5.3
8"	125		165	145		¾"	6.2
10"	140		185	160		⅞"	7
12"	140		185	165		⅞"	8

Notes:

1) Indicated lengths do not include washer thickness.
2) Bolt lengths are based upon thickness stated in liner specifications, thickness and may vary with duty application or liner supplier.

Precautions

Personnel responsible for installing and maintaining lined pipes and fittings should be trained on proper handling procedures. Lined piping systems may contain hazardous fluids, thus all safety precautions should be observed when working on such systems.

Flange Protection Covers

These covers protect the flared lining and should not be removed until the flanges are ready to be bolted into position. Upon removal of the protection covers great care must be observed not to damage the flare surface during handling. Clean joint surfaces prior to installation.

Hot Work

No hot work such as welding, flame cutting, brazing, etc. should be done on or close to metal pipes where the heat generated would cause damage to the inside liner material.

Flange Bolting

Clean and lubricate stud threads, hand tighten all nuts. Use a torque wrench to tighten nuts to the required torque. Tighten nuts in an even criss-cross sequence. Torque values may vary depending upon bolt, ambient and operating conditions. Use the lowest torque possible to achieve a good seal for the required operating conditions. Increase torque with increasing temperature/pressure conditions. Use lowest torque with cup washers, gaskets joints or in piping which may frequently be disassembled.

Nuts should be re-torque after at least 24 hrs. Torque values should not be exceeded unless necessary to effect a tight seal. Retorque nuts annually. Gaskets are not required unless flanges are mated with a different material e.g. reinforced plastic, reinforced glass, bare metal, ceramic, etc.

Min / Max Nm	1"	1½"	2"	3"	4"	6"	8"	10"	12"
PTFE / PFA	20/34	34 / 75	47/102	54/149	61/170	88/170	129/203	115/271	136/271
PP	41/47	54 / 102	61/149	68/170	81/190	min 163 / max 305		min 190 Nm / max 339 Nm	
PVDF	47/75	68 / 81	68/170	min 102 / max 170		min 163 / max 305			

If a leak occurs loosen the bolt opposite the leaking side slightly and then tighten the bolt on the leaking side by the same amount. This procedure avoids over tightening. If the leak persists, then the flange should be disconnected and the flare seal inspected for damage. Slight scratches can be polished with a fine abrasive paper provided thickness of lining is not reduced excessivley.

Thermal Cycling

Re-torque after the first cycling process and after the system has cooled down to ambient temperature. Do not removed lined pipes, fittings and valve which are above ambient temperature.

Vent Holes

Vents relieve pressure between the liner and pipe wall and also serve to indicate leaks. Ensure that vents are not clogged up. On insulated pipes vents should be extended through and out of the insulation using the optional Vent Boss Fitment. Vents should be periodically inspected. Do not use sharp objects to clean clogged vents!

Permeation

Permeation is the penetration of the fluid molecules through the lining and can be reduced with increased liner thickness and appropriate lining material selection. Permeation will also increase with increase in service temperature.

Creep

This is the deformation of PTFE over time under the influence of applied stress and increases at elevated temperatures.

Low Temperature Service & Storage

Cold temperatures can cause brittleness in PP and PVDF lined components. Heat tracing is recommended in freezing operating conditions.

CHEMICAL RESISTANCE GUIDE

ALMARC PTFE/PFA LINED SYSTEMS

This Chemical Resistance Table serves only as a rough guide for the cost effective selection of the lining material. It does not constitute as a guarantee on the performance of the material for the application. Users should conduct independent research and tests to ascertain the suitability of the material for the particular application.

Fluid	PTFE/PFA	ETFE
Abietic Acid	230	
Acetaldehyde	100	95
Acetamine	230	
Acetic Acid	230	
Acetic Acid, 90% in water	230	
Acetic Acid, 50% in water	230	120
Acetic Acid, 10% in water	230	
Acetic Acid (Glacial)	230	110
Acetic Anhydride	230	150
Aceto Acetic Ester	230	
Aceto Phenone	230	
Acetone	230	65
Acetone, 10% in water	230	
Acetonitrile	230	65
Acetyl Bromide	230	
Acetyl Chloride	230	65
Acetylacetone	230	
Acetylene	230	120
Acetylsalicylic Acid	230	
Acrylonitrile	230	65
Adipic Acid	230	135
Aircraft Fuel (JP4, JP5)	230	
Alkazid Lye	230	
Alkyl Aryl Sulphonates	230	
Allyl Alcohol	230	100
Allyl Chloride	230	100
Alum	230	
Aluminium Acetate, aqueous solution or solid	230	
Aluminium Bromide	230	
Aluminium Chloride, up to 40% in water	230	150
Aluminium Chlorohydrate	230	
Aluminium Fluoride, aqueous solution or solid	230	150
Aluminium Hydroxide	230	150
Aluminium Nitrate, aqueous or solid	230	150
Aluminium Oxychloride	230	150
Aluminium Potassium Sulphate	230	150
Aluminium Sulphate	230	
Alumino Ferric	230	
Ammonium Nitrate	230	
Ammonium Alum, aqueous solution or solid	230	
Ammonia Aqueous	230	110
Ammonia Gaseous	230	
Ammonium Acetate, aqueous solution or solid	230	
Ammonium Bicarbonate	230	
Ammonium Bifluoride, aqueous solution or solid	230	150
Ammonium Bisulphate	230	
Ammonium Bromide, aqueous solution or solid	230	135
Ammonium Carbonate, aqueous soln or solid	230	150
Ammonium Chloride, aqueous solution or solid	230	150
Ammonium Citrate	230	
Ammonium Dichromate, aqueous soln or solid	230	135
Ammonium Fluoride, aqueous soln or solid	230	150
Ammonium Hydroxide	230	150
Ammonium Metaphosphate, aques soln or solid	230	
Ammonium Nitrate, aqueous solution or solid	230	110
Ammonium Persulphate, aqueous soln or solid	230	65
Ammonium Phosphate, aqueous soln or solid	230	150
Ammonium Sulphate	230	150
Ammonium Sulphide, aqueous solution or solid	230	150
Ammonium Thiocyanate, aqueous soln or solid	230	150

Fluid	PTFE/PFA	ETFE
Ammonium Thioglycolate	230	
Ammonium Thiosulphate	230	
Ammonium Fluoride	100	150
Amyl Acetate	230	120
Amyl Alcohol	230	150
Amyl Chloride	230	150
Amyl Nitrate	230	
Aniline	230	110
Aniline Hydrochloride, aqueous solution or solid	230	65
Antimony Trichloride	230	100
Aqua Regia	230	100
Arsenic Acid, aqueous solution	230	150
Ascorbic Acid	230	
Aureo Mycin	230	
Barium Carbonate	230	150
Barium Chloride, aqueous solution or solid	230	150
Barium Hydroxide	230	150
Barium Nitrate, aqueous solution or solid	230	
Barium Sulphate	230	150
Barium Sulphide	230	150
Barytes	230	
Beer	230	
Beet Juice	230	
Benzaldehyde	230	100
Benzene	230 (i,ii)	100
Benzene Sulphonic Acid, aqueous soln or solid	230	100
Benzoic Acid	230 (i,ii)110	135
Benzole Chloride	230	
Benzole Peroxide	230	
Benzyl Alcohol	230	150
Benzyl Chloride	230	150
Benzyl Ether	230	
Benzyl Peroxide	230	
Benzylamine, aqueous solution or liquid	230	
Black Liquor	230	150
Blackcurrant Juice	230	
Bleach	230	100
Borax	230	150
Boric Acid	230	150
Boron Trifluoride	230	
Brandy	230	
Brine	230	150
Bromic Acid, aqueous solution	230	120
Bromine	230	
Bromine Dry Gas	230 (i)	65
Bromine Liquid	230	
Bromine Water	230 (i)	110
Bromobenzene	230	100
Bromoform	230	100
Butadiene	230 (i)	120
Butane	230 (i, ii)	150
Butanol	230	
Butyl Acetate	230	110
Butyl Acrylate	230	110
Butyl Alcohol, aqueous solution or liquid	230	150
Butyl Alcohol Prim	230	150
Butyl Alcohol Sec.	230	150
Butyl Alcohol Tert.	230	150
Butyl Bromide	230 (i)	150
Butyl Chloride	230	150

Notes: Temperatures indicated are in °C Max. "NR" denotes NOT RECOMMENDED.
Index: (i) Sensitive to permeation (ii) Generates electrostatic charges (iii) Antistatic grade not recommended

ALMARC
PTFE/PFA LINED SYSTEMS

CHEMICAL RESISTANCE GUIDE

Fluid	PTFE/PFA	ETFE
Butyl Ether	230	
Butyl Mercaptan	230	150
Butyl Phenol	230	110
Butyl Stearate	230	
Butylamine, aqueous solution or liquid	230	
Butylene-1	230	
Butynediol, aqueous solution or liquid	230	
Butyraldehyde	230	100
Butyric Acid	230	120
Cadmium Sulphate	230	
Calcium Acetate	230	
Calcium Bisulphate, aqueous solution or solid	230	150
Calcium Bisulphite, aqueous solution or solid	230	150
Calcium Bromide, aqueous solution or solid	230	
Calcium Carbonate	230	150
Calcium Chlorate, aqueous solution or solid	230	150
Calcium Chloride, aqueous solution or solid	230	150
Calcium Cyanamide	230	
Calcium Forrmate	230	
Calcium Hydroxide	230	150
Calcium Hypochlorite, aqueous solution or solid	230	150
Calcium Nitrate, aqueous solution or solid	230	150
Calcium Oxide	230	135
Calcium Peroxide	230	
Calcium Phosphate	230	
Calcium Sulphate	230	150
Calcium Sulphite	230	120
Calgon	230	
Calomel	230	
Cane Sugar Juice	230	
Caprolactam	230	
Caprylic Acid	230	100
Carbitol	230	
Carbon Bisulphide	230	
Carbon Dioxide	230	150
Carbon Disulphide	230 (ii)	65
Carbon Monoxide	230	150
Carbon Tetrachloride	230 (ii)	65
Carbonic Acid	230	150
Castor Oil	230	150
Caustic Baryta	230	
Caustic Potash	230	100
Caustic Soda	230	100
Cellosolve	230	150
Cellulose Paint	230	
Cereclor	230	
China Clay	230	
Chloracetic Acid, aqueous solution or pure	230	
Chloral Hydrate	230	100
Chlorinated Brine	230	120
Chlorinated Copperas	230	
Chlorinated Phenol	230	100
Chlorine, 5% in CC14	230 (i)	
Chlorine Dioxide	230	120
Chlorine Gas	230	
Chlorine Liquid	230	
Chlorine Water	230	120
Chloro Benzene	230	100
Chloro Benzyl Chloride	230	65
Chloro6 Hexanol	230	
Chloroacetyl Chloride	230	
Chlorobenzene Sulphonic Acid, aque soln/ pure	230	
Chlorofluorocarbon	230 (i)	
Chloroform	230 (i)	100

Fluid	PTFE/PFA	ETFE
Chlorohydrin	230	65
Chloromethyl Methyl Ether	230	
Chloropicrin	230	
Chlorosulphonic Acid	230	25
Chlorotrimethylsilane	230	
Chrome Alum	230	
Chrome Plating Solutions	230	
Chromic Acid, up to 40% in water	230	
Chromic Acid, 50% in water	230	65
Chromic Alum, aqueous solution or solid	230	
Chromyl Chloride	230	100
Cider	230	
Citric Acid, aqueous solution or solid	230	
Citronella Oil	230	
Coal Gas	230	100
Coal Tar	230	
Cobalt Nitrate	230	
Coconut Oil	230	
Coke Oven Gas	230	
Compressed Air	230	
Copper (I) Chloride	230	150
Copper Acetate	230	
Copper Chloride, aqueous solution or solid	230	
Copper Cyanide	230	150
Copper Fluoride	230	150
Copper Nitrate, aqueous solution or solid	230	150
Copper Oxychloride	230	
Copper Plating Solution	230	
Copper Sulphate	230	150
Corn Oil	230	
Cotton Seed Oil	230	
Creslyic Acid	230	135
Cresol	230	135
Croton Aldehyde	230	100
Crude Oil	230	150
Cuprous Ammonium Formate	230	
Cyanamide	230	
Cyanide Sludge	230	
Cyanoacetic Acid	230	
Cyanogen Chloride	230	
Cyclohexane	230 (ii)	150
Cyclohexanol	230	120
Cyclohexanone	230	150
Cyclohexyl Acetate	230	
1,2 Dibromopropane	230	95
2.5 Dimethyl 1.5 Hexadine	230	
2.6 Dimethyl 4 Heptanol	230	
a, a1 Dichlorotoluene	230	
Decalin	230	120
Decyl Hydride	230	
Demineralised Water	230	
Detergents	230	
Dextrin, aqueous solution or solid	230	150
Diacetone Alcohol	230	100
Dibutyl Ether	230	
Dibutyl Phthalate	230	65
Dibutylamine, aqueous solution or liquid	230	
Dichloro Ethylene	230	65
Dichloroacetic Acid, aqueous solution or liquid	230	65
Dichlorodimethylsilane	230	
Dichloroproprionic Acid	230	65
Diesel Fuel	230	150
Diethanolamine, aqueous solution or liquid	230	
Diethyl Cellosolve	230	150

Notes: Temperatures indicated are in °C Max. "NR" denotes NOT RECOMMENDED.
Index: (i) Sensitive to permeation (ii) Generates electrostatic charges (iii) Antistatic grade not recommended

ALMARC
PTFE/PFA LINED SYSTEMS

CHEMICAL RESISTANCE GUIDE

Fluid	PTFE/PFA	ETFE
Diethyl Ether	230	100
Diethyl Malonate	230	
Diethyl Triamine	230	
Diethylamine, aqueous solution or liquid	230	110
Diglycolic Acid	230	100
Di-isobutylene	230	135
Di-isobutylketone	230	110
Di-isopropylketone	230	
Dimethyl Formamide	230	120
Dimethyl Phthalate	230	100
Dimethylacetamide	230	
Dimethylamine, aqueous solution or gas	230	50
Dimethylaniline	230	135
Dimethylformamide	230	
Dimethylsulphate	230	65
Dimethylsulphoxide	230	100
Dioctyl Phthalate	230	65
Dioxalane	230	
Dioxane	230	65
Diphenyl Oxide	230	
Dipropylene Glycol Monomethyl Ether	230	
Disodic Phosphate, aqueous solution or solid	230	
Distilled Water	230	
Divinylbenzene	230	80
Dyes	230	
Ethyl Cynanocyanate	230	
Epichlor Hydrin	230	65
Epoxy Resins	230	
Epsoms Salts	230	
Esters	230	
Ethanal	230	
Ethanol	230	
Ethanolamine, aqueous solution or liquid	230	
Ether	230	
Ethyl Acetate	230	65
Ethyl Aceto Acetate	230	65
Ethyl Acrylate	230	100
Ethyl Alcohol, aqueous solution or liquid	230	150
Ethyl Chloride	230	150
Ethyl Chloroacetate	230	100
Ethyl Chloroformate	230	
Ethyl Ether	230	
Ethyl Formate	230	
Ethyl Formiate	230	
Ethyl Hexanol	230	
Ethyl Mercaptan	230	
Ethylbenzene	230 (i)	
Ethylene Bromide	230	150
Ethylene Chloride	230	150
Ethylene Chlorohydrin, aqueous solution or liquid	230	65
Ethylene Cyanohydrin	230	
Ethylene Diamine	230	50
Ethylene Dibromide	230	
Ethylene Dichloride	230	
Ethylene Glycol, aqueous solution or liquid	230	150
Ethylene Oxide	230	110
Ethylenediamene, aqueous solution or liquid	230	
Ethylhexyl Acetate, aqueous solution or liquid	230	
Fatty Acids	230	150
Fatty Acids, Sulphonates	230	
Ferric Chloride	230	150
Ferric Hydroxide	230	150
Ferric Nitrate, aqueous solution or liquid	230	150
Ferric Sulphate	230	150

Fluid	PTFE/PFA	ETFE
Fish Oils	230	
Fluoboric Acid, aqueous solution	230	135
Fluorine	230 (i)	40
Fluorosilicic Acid	230	135
Formaldehyde, 37% in water	230	110
Formamide	230	
Formic Acid, aqueous solution or liquid	230	135
Freon	230	110
Fruit Juices	230	
Fuel Oil	230	150
Fumaric Acid	230	95
Fuming Nitric Acid	230 (i, iii)	
Fuming Sulphuric Acid	230 (i, iii)	
Furane	230	65
Furfural	230	100
Furfuryl Alcohol, aqueous solution or solid	230	
Gallic Acid	230	100
Gas Natural	230	150
Gelatine	230	
Geraniol	230	
Gin	230	
Glucose	230	
Glue	230	
Glutamic Acid	230	
Glycerine	230	
Glycine	230	
Glycolic Acid	230	120
H.T.P.	230	
Helium	230	
Heptane	230	150
Hexachloro-Butadine	230	
Hexamethylene Diamine	230	
Hexamethylphosphotriamide	230	
Hexane	230	150
Hexyl Alcohol	230	
Hydrazine, aqueous solution or liquid	230	40
Hydrazine Dihydrochloride, aqueous soln or solid	230	50
Hydrazine Hydrate, aqueous solution or liquid	230	
Hydriodic Acid, aqueous solution	230	150
Hydrobromic Acid, up to 50% in water	230	150
Hydrochloric Acid	230 (i)	150
Hydrocyanic Acid, aqueous solution	230	150
Hydrofluoric Acid, up to 40% in water	230	135
Hydrofluoric Acid, 41 to 100% in water	230 (i, iii)	110
Hydrofluorosilicic Acid	230	150
Hydrogen	230 (i, iii)	150
Hydrogen Chloride	230	
Hydrogen Cyanide	230	150
Hydrogen Fluoride	230 (i)	
Hydrogen Peroxide, 90% in water	230	65
Hydrogen Peroxide, up to 30% in water	230	120
Hydrogen Phosphide	230	65
Hydrogen Sulphide	230	150
Hydroquinone	230	120
Hydroxysuccinic Acid, aqueous solution	230	
Hypochlorous Acid, aqueous solution	230	150
Inks	230	
Iodine, 10% in non-aqueous solvent	230	110
Iodine Gas	230	110
Iodoform	230	110
Iron (II) Chloride, aqueous solution or solid	230	
Iron (II) Sulphate	230	
Iron (III) Chloride, aqueous solution or solid	230	
Iron (III) Sulphate	230	

Notes: Temperatures indicated are in °C Max. "NR" denotes NOT RECOMMENDED.
Index: (i) Sensitive to permeation (ii) Generates electrostatic charges (iii) Antistatic grade not recommended

ALMARC
PTFE/PFA LINED SYSTEMS

CHEMICAL RESISTANCE GUIDE

Fluid	PTFE/PFA	ETFE
Iron (III) Sulphide	230	
Isoamyl Ester	230	
Isobutyl Alcohol	230	135
Isoctane	230	
Isophorone	230	
Isopropyl Alcohol, aqueous solution or liquid	230	
Isopropyl Chloride	230	
Isopropyl Ether	230	
Isopropylbenzene	230	
Jam	230	
Jet Fuel JP4	230	110
Jet Fuel JP5	230	110
Kerosene	230(ii)	
Ketones	230	
Kraft Liquor	230	
Lactic Acid, aqueous solution or pure	230	120
Lanolin	230	
Lard	230	150
Lauric Acid	230	120
Lauroyl Chloride	230	
Laurel Alcohol Mercaptan	230	
Lauryl Chloride	230	135
Lead Acetate	230	150
Lead Chloride	230	
Lead Nitrate, aqueous solution or solid	230	
Lead Perchlorate	230	
Leaded Fuel	230	
Lead-free Petrol	230(ii)	
Lemon Juice	230	
Linoleic Acid	230	135
Linseed Oil	230	150
Liqueurs	230	
Lithium Bromide, aqueous solution or solid	230	120
Lithium Chloride, aqueous solution or solid	230	
Lubricating Oils	230	150
Lyes	230	
Maganese Sulphate	230	
Magnesium Carbonate	230	150
Magnesium Chloride, aqueous solution or solid	230	150
Magnesium Hydroxide	230	150
M-bromotoluene	230	
Mercuric Chloride	230	135
Mercuric Cyanide	230	135
Mercuric Nitrate, aqueous solution or solid	230	135
Mercury	230	135
Methacrylic Acid	230	95
Methane	230 (i)	120
Methane Sulphonic Acid, aqueous solution/ solid	230	110
Methanol	230	
Methyl Acetate	230	
Methyl Acrylate	230	
Methyl Alcohol, aqueous solution or liquid	230	150
Methyl Bromide	230 (i)	150
Methyl Cellosolve	230	150
Methyl Chloride	230 (i)	95
Methyl Chloroacetate	230	8
Methyl Chloroform	230 (i)	65
Methyl Ethyl Ketone	230 (i)	110
Methyl Isobutyl Ketone	230	110

Fluid	PTFE/PFA	ETFE
Methyl Methacrylate	230	80
Methyl Salicylate	230	95
Methyl Sulphuric Acid, aqueous solution or liquid	230	100
Methylamine	230	
Methylene Bromide	230	100
Methylene Chloride	230	100
Methylene Iodide	230	100
Methyltrichlorosilane	230	95
Milk	230	
Mineral Oil	230	150
Molasses	230	
Monochloro Benzene	230	110
Monochloroacetic Acid	230	
Monoethanolamine	230	65
Morpholine	230	65
Naphtha	230 (i)	150
Napthalene	230 (i)	150
Natural Gas	230	
N-Butyl Mercaptan	230	
N Butylamine	230	
Nickel Acetate	230	
Nickel Chloride, aqueous solution or solid	230	150
Nickel Nitrate, aqueous solution or solid	230	150
Nickel Plating Solution	230	
Nickel Sulphate	230	150
Nicotine	230	100
Nicotinic Acid	230	120
Nitric Acid, 11 to 50% in water	230	105
Nitric Acid, up to 10% in water	230	
Nitric Acid Conc	230	120
Nitric Oxide	230	
Nitric/ Hydrofluoric Acid	230	
Nitric/ Sulphuric Acid	230	100
Nitro Benzene	230	150
Nitroethane	230	
Nitrogen	230	150
Nitrogen Dioxide	230	100
Nitroglycerine	230	
Nitromethane	230	100
Nitrotoluene	230	
Nitrous Acid	230	100
Octane	230	150
Octene	230	150
O-Dichlorobenzene	230	
Oil (petroleum)	230	
Oleic Acid	230	135
Oleum (Fuming Sulphuric)	230	50
Olive Oil	230	
Oxalic Acid	230	110
Oxygen	230	150
Ozone	230	100
2-Phenyl Phenol	230	
Palmitic Acid	230	135
Paper Pulp	230	
Paraffin	230	
Paraquat	230	
P-Dibromobenzene	230	
Penicillin	230	
Perchlorethylene	230 (i)	135
Perchloric Acid, 70% in water	230	65
Perchloric Acid, 10% in water	230	110
Perchloromethyl Mercaptan	230	

ALMARC
PTFE/PFA LINED SYSTEMS

CHEMICAL RESISTANCE GUIDE

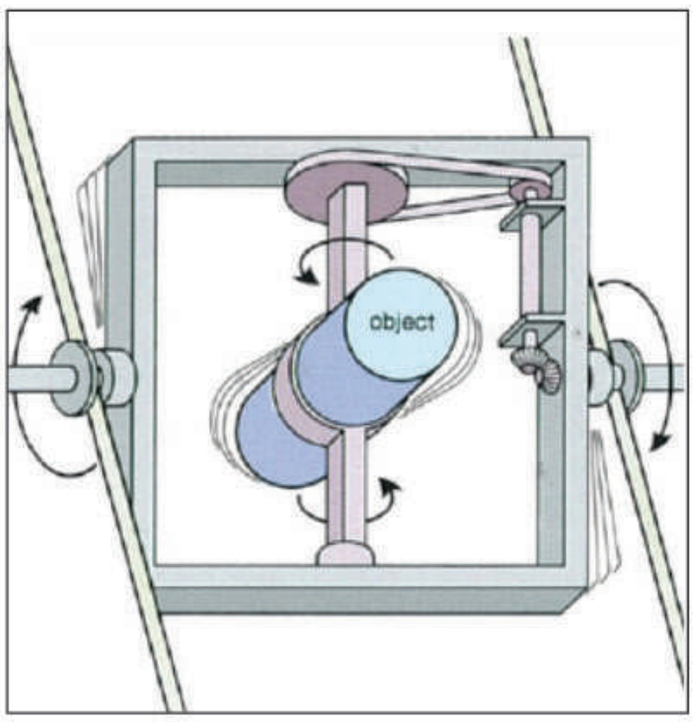
Fluid	PTFE/PFA	ETFE
Petrol Leaded	230	150
Petrol Unleaded	230	150
Phenol	230	100
Phenol, 5% in water	230 (i)	110
Phenolsulphonic Acid	230	100
Phenylhydrazine	230	100
Phenylhydrazine Hydrochloride, aqua soln or solid	230	100
Phosgene	230	100
Phosphoric Acid, 85% in water	230	135
Phosphorous Oxychloride	230	100
Phosphorous Trichloride	230	120
Phosphorus	230	
Phosphorus Pentachloride	230	100
Phosphorus Pentoxide	230	110
Phosphoryl Chloride	230	
Photographic Solutions	230	
Phtalic Acid	230	100
Phtalic Anhydride	230	100
Phthalic	230	
Picric Acid	230	50
Polyethylene Glycol	230	
Polyvinyl Acetate	230	150
Polyvinyl Alcohol	230	150
Polyvinyl Chloride	230	
Potash Alum, aqueous solution or liquid	230	
Potassalumite Chloride	230	
Potassium	230	
Potassium Acetate, aqueous solution or solid	230	
Potassium Bicarbonate, aqueous solution or solid	230	150
Potassium Bisulphate, aqueous solution or solid	230	
Potassium Borate, aqueous solution or solid	230	150
Potassium Bromate, aqueous solution or solid	230	150
Potassium Bromide, aqueous solution or solid	230	150
Potassium Carbonate, aqueous solution or solid	230	150
Potassium Chlorate	230	150
Potassium Chloride, aqueous solution or solid	230	150
Potassium Chromate, aqueous solution or solid	230	150
Potassium Cyanide, aqueous solution or solid	230	150
Potassium Dichromate	230	150
Potassium Ferrocyanide, aqueous soln or solid	230	150
Potassium Fluoride, aqueous solution or solid	230	150
Potassium Hydroxide, over 50% in water	230	100
Potassium Hydroxide, up to 10% in water	230	
Potassium Hypochlorite, aqueous solution	230	135
Potassium Iodide, aqueous solution or solid	230	
Potassium Nitrate, aqueous solution or solid	230	150
Potassium Nitrite	230	
Potassium Perborate	230	135
Potassium Perchlorate	230	100
Potassium Permanganate	230	150
Potassium Persulphate, aqueous solution or solid	230	65
Potassium Sulphate	230	150
Potassium Sulphide	230	150
Propane	230 (i)	135
Propionic Acid	230	100
Propyl Acetate	230	
Propyl Alcohol, aqueous solution or liquid	230	150
Propylamine	230	
Propylene Dibromide	230	100
Propylene Dichloride	230	100
Propylene Glycol, aqueous solution or liquid	230	
Propylene Oxide	230	65
Pyridine	230	65
Pyrogallic Acid, aqueous solution or liquid	230	
Pyrogallol	230	65
Red Phosphorous	230	
Rubber Adhesives	230	
Salicylic Acid	230	120
Salicylic Aldehyde	230	100
Salt Water	230	150
Secondary Amyl Alcohol	230	
Secondary Butyl Alcohol, aqueous soln or liquid	230	
Secondary Butylamine, aqueous solution or liquid	230	
Selenic Acid	230	
Silicon Fluid	230	
Silicon Tetrachloride	230	120
Silver Cyanide	230	150
Silver Nitrate, aqueous solution or solid	230	150
Silver Sulphate	230	
Soap	230	
Sodium	230	
Sodium Acetate, aqueous solution or solid	230	150
Sodium Amalgam	230	
Sodium Benzoate, aqueous solution or solid	230	150
Sodium Bicarbonate	230	150
Sodium Bisulphate, aqueous solution or solid	230	150
Sodium Bisulphite, aqueous solution or solid	230	150
Sodium Bromate, aqueous solution or solid	230	
Sodium Bromide, aqueous solution or solid	230	
Sodium Carbonate, aqueous solution or solid	230	150
Sodium Chlorate, aqueous solution or solid	230	150
Sodium Chloride	230	150
Sodium Chlorite, aqueous solution or solid	230	
Sodium Chromate, aqueous solution or solid	230	150
Sodium Cyanide, aqueous solution or solid	230	150
Sodium Dichromate, aqueous solution or solid	230	100
Sodium Ferrocyanide, aqueous solution or solid	230	150
Sodium Fluoride, aqueous solution or solid	230	150
Sodium Fluosilicate	230	
Sodium Hydrogen Phosphate	230	
Sodium Hydroxide, over 50% in water	230	110
Sodium Hydroxide, up to 10% in water	230	110
Sodium Hypochlorite, 6 to 15% in water	230	150
Sodium Hypochlorite, up to 5% in water	230	
Sodium Hyposulphite	230	150
Sodium Iodide, aqueous solution or solid	230	150
Sodium Nitrate, aqueous solution or solid	230	150
Sodium Nitrite	230	150
Sodium Palmitate	230	
Sodium Perchlorate, aqueous solution or solid	230	65
Sodium Peroxide	230	150
Sodium Phosphate	230	150
Sodium Silicate	230	150
Sodium Sulphate	230	150
Sodium Sulphide	230	150
Sodium Sulphite	230	150
Sodium Thiocyanate, aqueous solution or solid	230	
Sodium Thiosulphate, aqueous solution or solid	230	150
Sour Crude	230	150
Sour Gasoline	230 (ii)	
Stannic Chloride, aqueous solution or solid	230	150
Stannous Chloride, aqueous solution or solid	230	150
Stearic Acid	230	150
Stoddards Solvent	230	135
Succinic Acid	230	135
Sulphamic Acid	230	100
Sulphiric Anhydride	230	
Sulphite Liquor	230	

ALMARC
PTFE/PFA LINED SYSTEMS

CHEMICAL RESISTANCE GUIDE

Fluid	PTFE/PFA	ETFE
Sulphur	230	120
Sulphur Chloride	230	
Sulphur Dichloride	230	
Sulphur Dioxide	230	110
Sulphur Trioxide	230	25
Sulphuretted Hydrogen, aqueous solution	230	
Sulphuric Acid, up to 60% in water	230	150
Sulphuric Acid, 98% in water	230(iii)	150
Sulphurous Acid	230	110
Sulphuryl Chloride	230	
Sulphuryl Fluoride	230	
1.1 - Tetrabromo 2.2. Ethane	230	
Tall Oil	230	150
Tannic Acid	230	135
Tartaric Acid, aqueous solution or solid	230	135
Tert-Butylamine	230	
Tertiary Butyl Alcohol, aqueous solution or liquid	230	
Tertiary Butylamine, aqueous solution or liquid	230	
Tetra Hydro Furan	230	
Tetra Methyl Ammonium Hydroxide 50%	230	100
Tetrachloroethane	230	
Tetrachlorophenol	230	100
Tetraethyl Lead	230(ii)	150
Tetrahydrofuran, aqueous solution or liquid	230	100
Tetrain	230	
Tetramethylammonium Hydroxide, <10% in water	230	
Tetramethylurea	230	
Thioglycol	230	
Thioglycolic Acid	230	
Thionyl Chloride	230	100
Thiophosphoryl Chloride	230	
Titanium Tetrachloride	230	100
Toluene	230(i, ii)	120
Toluene Sulphonyl Chloride	230	
Town Gas	230	
Trans-Diphenylethylene	230	

Fluid	PTFE/PFA	ETFE
Tributyl Phosphate	230	65
Trichloro Acetic Acid, from 50% in water to pure	230	100
Trichloro-1, 1, 2, Ethane	230 (i)	
Trichlorobenzene	230	
Trichloroethylene	230 (i)	135
Trichlorophenol	230	100
Tricresyl Phosphate	230	
Triethanolamine, aqueous solution or liquid	230	
Triethyl Phosphate	230	
Triethylamine	230	110
Trifluoroacetic Acid	230	
Trifluoroacetic Acid, 50% in water	230	
Trimethylamine, aqueous solution or gas	230	
Turpentine	230	135
Urea, aqueous solution or solid	230	135
Urine	230	
Varsol	230	135
Vegetable Oils	230	
Vinegar	230	
Vinyl Acetate	230	135
Vinyl Chloride	230 (i)	65
Vinylidene Chloride	230 (i)	
Water	230	150
Water Salt	230	
Whisky	230	
White Spirit	230	
Wines	230	
Xylene	230 (i)	120
Yeast	230	
Zinc Acetate, aqueous solution or solid	230	120
Zinc Bromide, aqueous solution or solid	230	
Zinc Chloride, aqueous solution or solid	230	150
Zinc Nitrate, aqueous solution or solid	230	150
Zinc Plating Solutions	230	
Zinc Sulphate	230	150
Zinc Sulphide	230	150



ETFE ROTOMOULDING

ALMARC ENGINEERING PTE LTD Singapore is able to provide ETFE Rotomoulding services that is done in our manufacturing facility in Singapore. The main advantage of Rotomoulding is that it is a seamless lining without welding joints.

The Rotomoulding Process

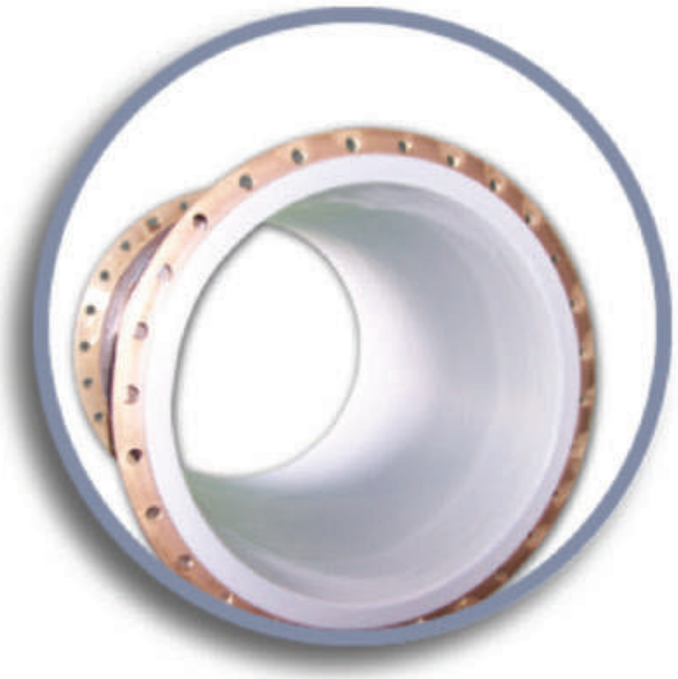
The computer-controlled machine developed is a significant improvement in the standard rotomoulding lining for ETFE. The development is centered around a special computer controlled machine tool that is able to ensure an even temperature of about 430°C to generate.

The object is clamped in a holder which rotates around two axes. More objects of a different size or shape can be processed at the same time. The object is then subjected to a certain rotary motion, and a specific temperature profile for the entire duration of the process. A special computer controls and monitors the entire process. The input data and the individual stages of the processing are extensively documented. This documentation also allows a comparison between the set points and actual values for all individual items. A significantly larger number of processing stages can be performed using the computer, compared to the manual operation of other methods. Rotomoulding can be used for any shape and complexity. Therefore, a uniform coating is achieved without any problems on the eccentric components, such as adapters, fitting pieces, branching, curved pieces, pumps and valves, flow meters, and on with a size of 1.90 x 1.90 meters.

Processing of ETFE

ETFE is a fluorine-based high performance coating that is designed to provide high resistance to corrosion.

ETFE has a very high melting point with further excellent chemical and electrical properties. Also, ETFE at operating temperature (from -185°C to 150°C) are used in full vacuum because of the excellent adhesion to the wall of the coated piece.



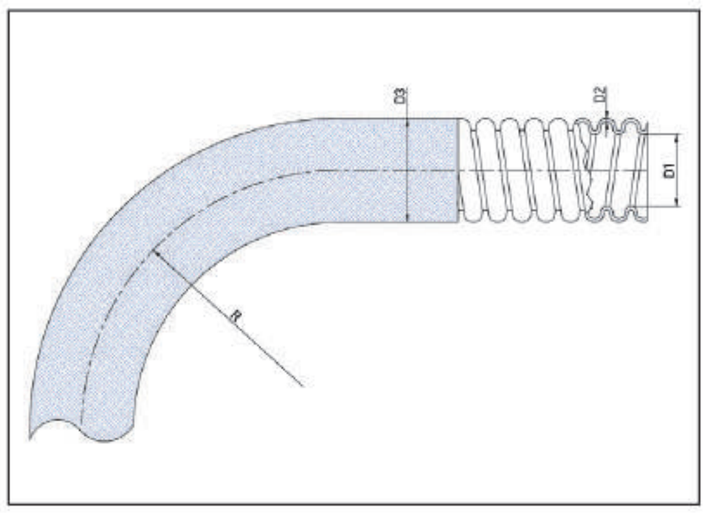
The tensile strength of ETFE is 42N/mm (6100 psi).

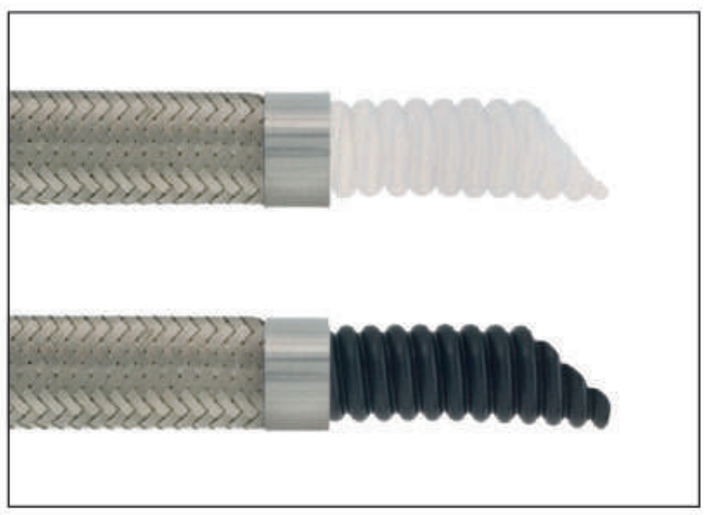
Min Properties	ETFE
Specific Weight (g/cm^3)	1.74
Max. Elongation (%)	350 - 450
Tensile Strength (MPa)	40 - 54
Rockwell Hardness	R50 - R58
Melting Point (°C)	220

ALMARC
PTFE/PFA LINED SYSTEMS

Xtraflex

Type TCMB1 Convoluted Teflon® hose with stainless steel braid – medium wall





Construction:
A helically convoluted PTFE (polytetrafluorethylene) inner tube, medium wall, with an outer cover of AISI304 high tensile stainless steel braid.

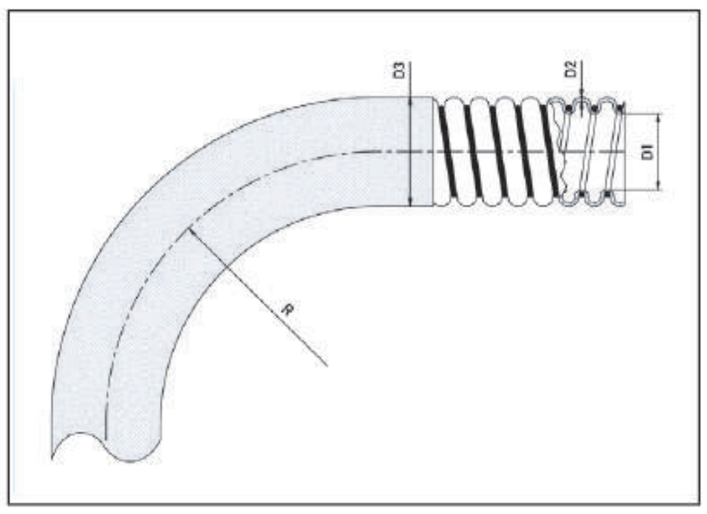
Fittings:
Hose fittings with PTFE tail
Hose fittings with Hydraulic tail
Industrial fittings
Industrial fittings with PTFE lining

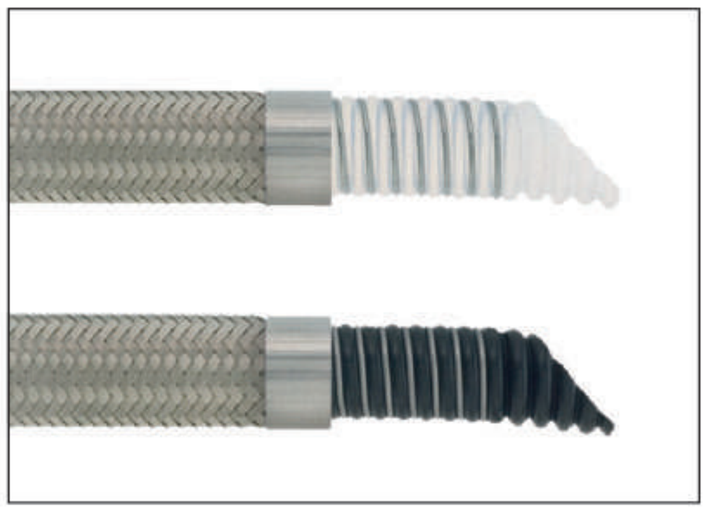
Typical Applications:
TCMB1 should be specified when pressures or vacuum are applied. Recommended on all tafted flange assemblies.

TEMP. –70°C +260°C

Size	D1 min.	D1 max.	D2 mm	D3 min.	D3 max.	R mm	WP Bar20°C	BP Bar20°C	Vacuum mbar20°C	Lmax m	Wt gr/m	Ref. virgin	Ref. Antistatic
1/4"	5.5	6.9	0.52	9.9	11.5	25	35	170	744	20	80	TCMB1006	TCAMB1006
3/8"	8.5	10.5	0.62	13.2	14.7	25	35	170	744	20	123	TCMB1010	TCAMB1010
1/2"	11.6	13.6	0.82	12.9	14.4	25	50	250	887	20	140	TCMB1012	TCAMB1012
5/8"	15.1	16.4	0.88	16.2	17.5	35	35	170	887	20	160	TCMB1016	TCAMB1016
3/4"	19.5	20.5	1.00	28.6	31.4	55	60	290	887	20	390	TCMB1020	TCAMB1020
1"	24.5	25.5	1.10	34.2	38.2	85	40	210	887	20	540	TCMB1025	TCAMB1025
1 1/4"	31.5	32.5	1.15	41.9	46.1	100	45	210	887	20	680	TCMB1032	TCAMB1032
1 1/2"	36.5	37.5	1.45	47.2	49.9	120	40	175	887	20	1110	TCMB1040	TCAMB1040
1 3/4"	44.5	45.5	1.45	55.8	61.4	135	25	135	887	20	1650	TCMB1045	TCAMB1045
2"	49.5	50.5	1.50	60.5	66.7	165	25	135	887	20	1710	TCMB1050	TCAMB1050
2 1/2"	62.5	63.5	1.60	80.9	89.1	230	14	60	887	20	2140	TCMB1065	TCAMB1065
3"	73.5	74.5	1.60	90.4	99.6	260	12	65	887	20	3310	TCMB1080	TCAMB1080
4"	94.5	99.5	1.82	121.1	127.5	300	10	40	887	20	4050	TCMB1100	TCAMB1100
6"	150	154	2.5	179.0	189	520	6	24	554	12	5550	TCMB1150	TCAMB1150

Type TCMW1B1 Convoluted Teflon® hose with vacuum wire and stainless steel braid – medium wall





Construction:
A helically convoluted PTFE (Polytetrafluorethylene) suction / pressure hose, medium wall, with external vacuum wire and high tensile stainless steel braid.
The hose has very good vacuum and kink resistance.

Fittings:
Hose fittings with PTFE tail
Hose fittings with Hydraulic tail
Industrial fittings
Industrial fittings with PTFE lining

Typical Aspplications:
TCMW1B1 should be specified for steam applications or when high vacuum hose applications are required. Generally excellent mechanical strength.

TEMP. –70°C +260°C

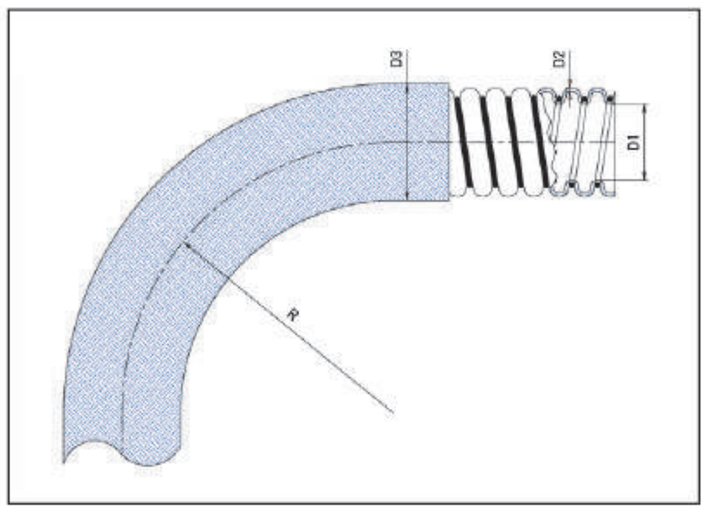
Size	D1 min.	D1 max.	D2 mm	D3 min.	D3 max.	R mm	WP Bar20°C	BP Bar20°C	Vacuum mbar20°C	Lmax m	Wt gr/m	Ref. virgin	Ref. Antistatic
1/4"	5.5	9.9	0.52	9.9	11.5	25	35	170	744	10	150	TCMW1B1006	TCAMW1B1006
3/8"	8.5	10.5	0.62	13.2	14.7	25	35	170	744	10	203	TCMW1B1010	TCAMW1B1010
1/2"	11.6	16.9	0.82	12.9	14.4	25	35	170	947	10	220	TCMW1B1012	TCAMW1B1012
5/8"	15.1	16.4	0.88	16.2	17.5	35	35	170	947	10	320	TCMW1B1016	TCAMW1B1016
3/4"	19.5	20.5	1.00	28.6	31.4	55	60	290	947	10	540	TCMW1B1020	TCAMW1B1020
1"	24.5	25.5	1.10	34.2	38.2	85	40	210	947	10	890	TCMW1B1025	TCAMW1B1025
1 1/4"	31.5	32.5	1.15	41.9	46.1	100	45	210	947	10	1180	TCMW1B1032	TCAMW1B1032
1 1/2"	36.5	37.5	1.45	47.2	49.9	120	40	175	947	10	1710	TCMW1B1040	TCAMW1B1040
1 3/4"	44.5	45.5	1.45	55.8	61.4	135	25	135	947	10	2450	TCMW1B1045	TCAMW1B1045
2"	49.5	50.5	1.50	60.5	66.7	165	25	135	947	10	2610	TCMW1B1050	TCAMW1B1050
2 1/2"	62.5	63.5	1.60	80.9	89.1	230	12	60	947	10	3440	TCMW1B1065	TCAMW1B1065
3"	73.5	74.5	1.60	90.4	99.6	260	14	65	947	10	4710	TCMW1B1080	TCAMW1B1080
4"	94.5	99.5	1.82	121.1	127.5	300	10	40	947	10	5550	TCMW1B1100	TCAMW1B1100
6"	150	154	2.5	179.0	189	520	6	24	554	10	6750	TCMW1B1150	TCAMW1B1150

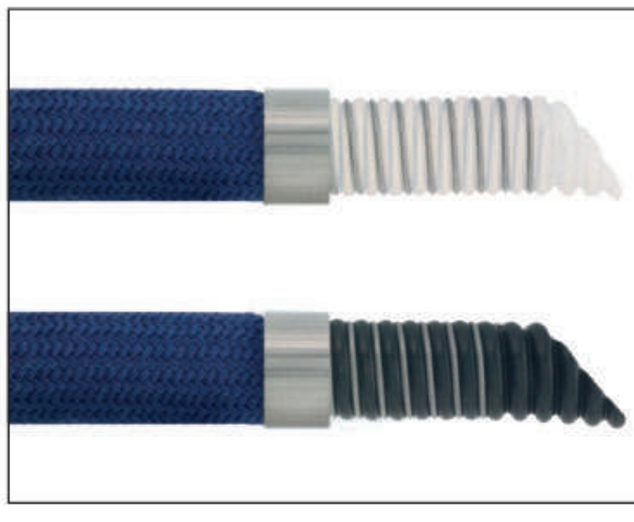
Teflon® is a registred trademark of Dupont.

ALMARC
PTFE/PFA LINED SYSTEMS

Xtraflex

Type TCMW1B6 Convoluted Teflon® hose with vacuum wire and polypropylene braid – medium wall





Construction:
A helically convoluted PTFE (polytetrafluorethylene) suction / pressure hose, medium wall, with external vacuum wire and polypropylene yarn braid.

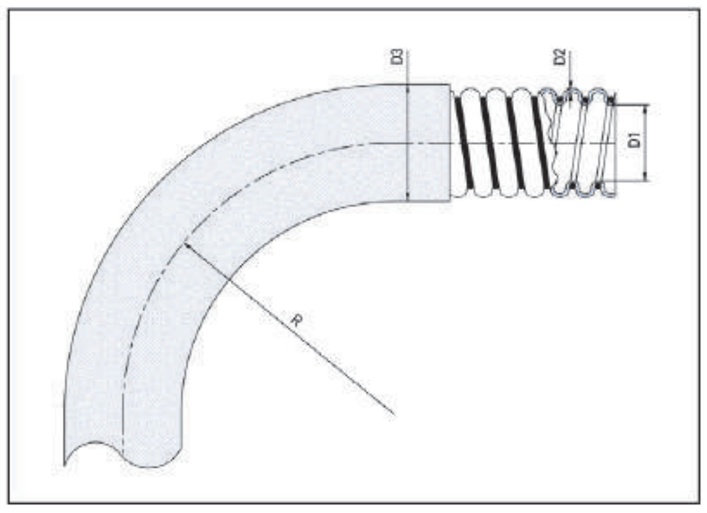
Fittings:
Hose fittings with PTFE tail
Hose fittings with Hydraulic tail
Industrial fittings
Industrial fittings with PTFE lining

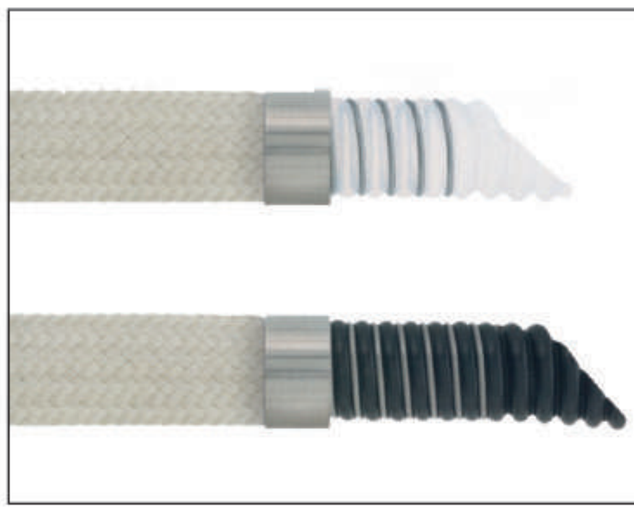
Typical Applications:
TCMW1B6 should be specified where vibrations or frequent handling are applied in combination with vacuum.

TEMP. –70°C +90°C

Size	D1 min.	D1 max.	D2 mm	D3 min.	D3 max.	R mm	WP Bar20°C	BP Bar20°C	Vacuum mbar20°C	Lmax m	Wt gr/m	Ref. virgin	Ref. Antistatic
½"	11.6	13.6	0.82	21.4	23.4	50	10	40	887	10	210	TCMW1B6012	TCAMW1B6012
5/8"	15.1	16.4	0.88	26.3	28.2	65	10	40	887	10	400	TCMW1B6016	TCAMW1B6016
¾"	19.5	20.5	1.00	31.1	33.9	55	10	40	887	10	490	TCMW1B6020	TCAMW1B6020
1"	24.5	25.5	1.10	36.7	40.7	85	10	40	887	10	810	TCMW1B6025	TCAMW1B6025
1¼"	31.5	32.5	1.15	44.4	48.6	100	10	40	887	10	1070	TCMW1B6032	TCAMW1B6032
1½"	36.5	37.5	1.45	49.7	52.4	120	10	40	887	10	1310	TCMW1B6040	TCAMW1B6040
1¾"	44.5	45.5	1.45	58.3	63.9	135	10	40	887	10	1850	TCMW1B6045	TCAMW1B6045
2"	49.5	50.5	1.50	62.5	69.2	165	10	40	887	10	2050	TCMW1B6050	TCAMW1B6050
2½"	62.5	63.5	1.60	83.4	91.6	230	7	28	887	10	3440	TCMW1B6065	TCAMW1B6065
3"	73.5	74.5	1.60	92.9	102.2	260	6	24	887	10	5710	TCMW1B6080	TCAMW1B6080

Type TCMW1B9 Convoluted Teflon® hose with vacuum wire and PVDF braid – medium wall





Construction:
A helically convoluted PTFE (polytetrafluorethylene) suction/ pressure hose, medium wall, with external vacuum wire and PVDF yarn braid.

Fittings:
Hose fittings with PTFE tail
Hose fittings with Hydraulic tail
Industrial fittings
Industrial fittings with PTFE liningt

Typical Aspplications:
TCMW1B9 should be specified where vibrations or frequent handling are applied in combination with vacuum.

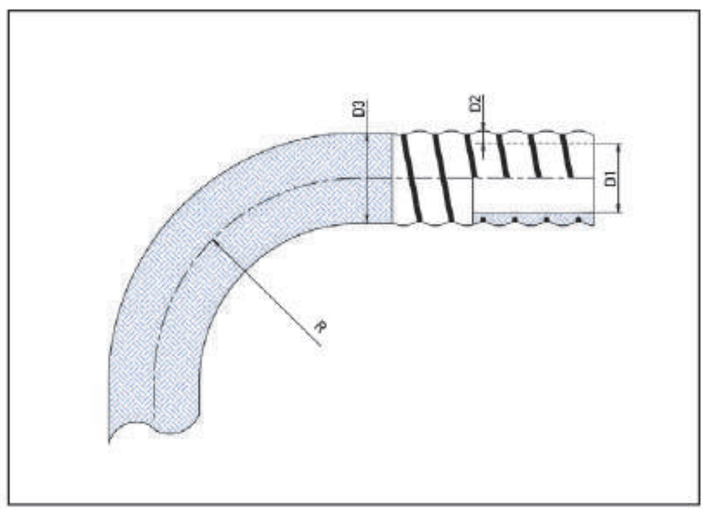
TEMP. –70°C +150°C

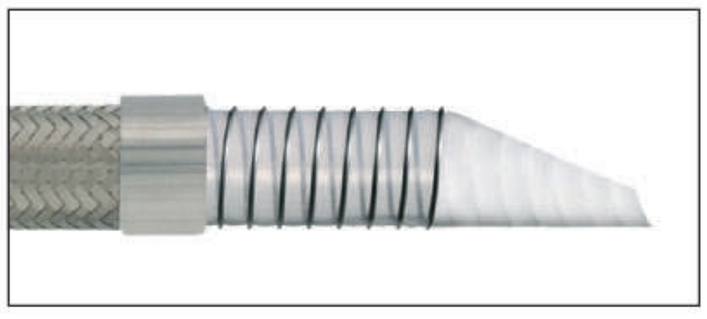
Size	D1 min.	D1 max.	D2 mm	D3 min.	D3 max.	R mm	WP Bar20°C	BP Bar20°C	Vacuum mbar20°C	Lmax m	Wt gr/m	Ref. virgin	Ref. Antistatic
½"	11.6	13.6	0.82	21.4	23.4	50	10	40	887	10	210	TCMW1B9012	TCAMW1B9012
5/8"	15.1	16.4	0.88	26.3	28.2	65	10	40	887	10	400	TCMW1B9016	TCAMW1B9016
¾"	19.5	20.5	1.00	31.1	33.9	55	10	40	887	10	490	TCMW1B9020	TCAMW1B9020
1"	24.5	25.5	1.10	36.7	40.7	85	10	40	887	10	810	TCMW1B9025	TCAMW1B9025
1¼"	31.5	32.5	1.15	44.4	48.6	100	10	40	887	10	1070	TCMW1B9032	TCAMW1B9032
1½"	36.5	37.5	1.45	49.7	52.4	120	10	40	887	10	1310	TCMW1B9040	TCAMW1B9040
1¾"	44.5	45.5	1.45	58.3	63.9	135	10	40	887	10	1850	TCMW1B9045	TCAMW1B9045
2"	49.5	50.5	1.50	62.5	69.2	165	10	40	887	10	2050	TCMW1B9050	TCAMW1B9050
2½"	62.5	63.5	1.60	83.4	91.6	230	7	28	887	10	3440	TCMW1B9065	TCAMW1B9065
3"	73.5	74.5	1.60	92.9	102.2	260	6	24	887	10	5710	TCMW1B9080	TCAMW1B9080

Teflon® is a registred trademark of Dupont.

ALMARC
PTFE/PFA LINED SYSTEMS

Xtraflex



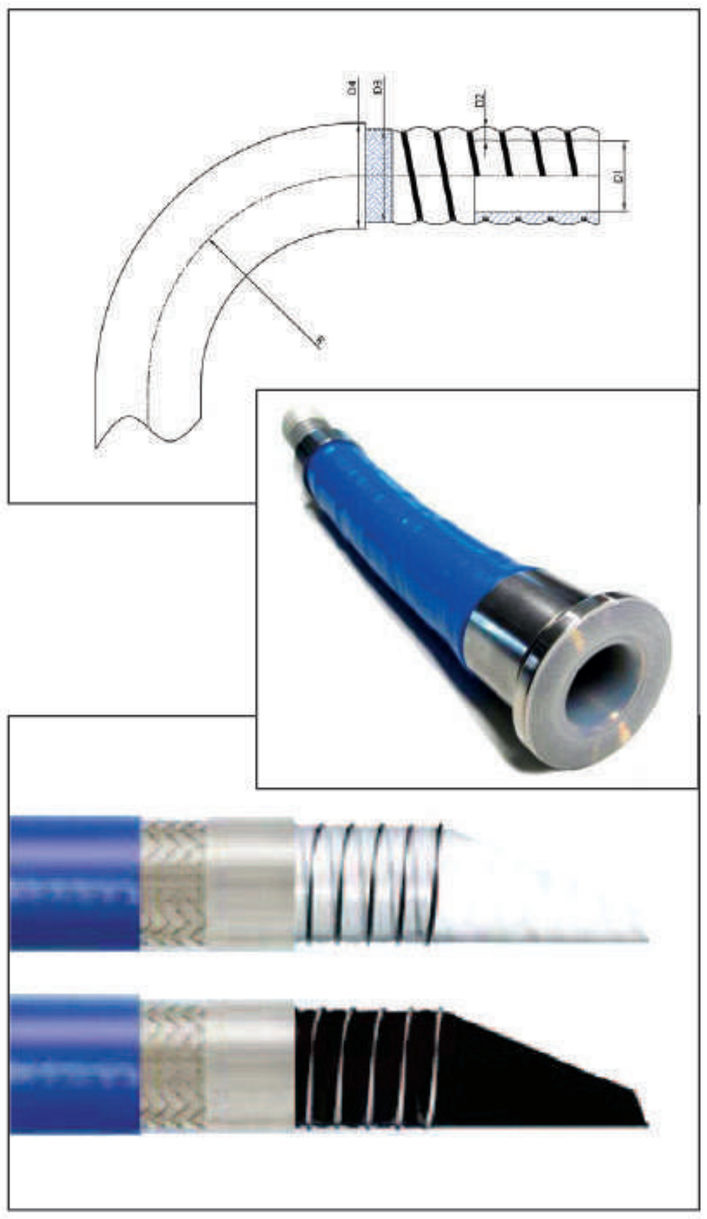


Type TWFB1 Smooth bore flexible Teflon® hose with stainless steel helix and high tensile stainless steel braid.

Construction:
Ultra hygienic non-convoluted PTFE (polytetrafluorethylene) liner with stainless steel helix and a AISI 304 high tensile, stainless steel braid. The hose has exceptionally good vacuum- and kink resistance properties for extreme performance. Smoothflex should be specified for applications where Ultra hygienic nonconvoluted hose and high flexibility are imperative, e.g. Food, Bio, Pharmaceutical and Cosmetic industry.
Only available in complete hose assembly form.

TEMP. –70°C +260°C

Size	D1 min.	D2 min.	D3 min.	R mm	WP Bar20°C	BP Bar20°C	vacuum mbar20°C	Wt gr/m	Ref. virgin	Ref. Antistatic
½"	11.50	1.25	17.80	38	50	250	887	290	TWFB1012	TAWFB1012
5/8"	15.50	1.25	21.80	42	50	250	887	361	TWFB1016	TAWFB1016
¾"	20.00	1.5	26.70	50	60	290	887	430	TWFB1020	TAWFB1020
1"	22.80	1.5	29.80	70	40	210	887	653	TWFB1025	TAWFB1025
1¼"	30.50	1.5	37.50	85	45	210	887	750	TWFB1032	TAWFB1032
1½"	36.50	2	46.50	100	40	175	887	800	TWFB1040	TAWFB1040
2"	48.50	2	58.30	140	25	135	887	950	TWFB1050	TAWFB1050



Type TWF SB1EP.
Smooth bore flexible PTFE hose with stainless steel helix and EPDM vulcanized high tensile stainless steel braid.

Construction:
Ultra hygienic non-convoluted PTFE (polytetrafluorethylene) liner with stainless steel helix and a AISI 304 high tensile, stainless steel braid.
The hose has exceptionally good vacuum - and kink resistance properties for extreme performance.

Smooth Flow® should be specified for applications where Ultra hygienic non-convoluted hose and high flexibility are imperative, e.g. Food, Bio, Pharmaceutical and Cosmetic industry.
Only available in complete hose assembly form.

TEMP. –70°C +150°C

Size	D1 average	D2 min.	D3 min.	D3 max.	R mm	WP Bar20°C	BP Bar20°C	Vacuum mbar20°C	Lmax m	Ref. virgin	Ref. Antistatic
½"	11.5	1.25	20.8	22.8	60	50	250	887	0	TWFSB1EP012	TAWFSB1EP012
5/8"	15.5	1.25	25.5	27.5	65	50	250	887	0	tTWFSB1EP016	TAWFSB1EP016
¾"	18.5	1	28.6	30.6	80	60	290	887	0	TWFSB1EP020	TAWFSB1EP020
1"	22.8	1	32.7	34.7	120	40	210	887	0	TWFSB1EP025	TAWFSB1EP025
1¼"	30.5	1.5	41.8	43.8	155	45	210	887	0	TWFSB1EP032	TAWFSB1EP032
1½"	36.5	1.5	48.1	50.1	200	40	175	887	0	TWFSB1EP040	TAWFSB1EP040
2"	48.5	1.65	60.2	62.2	250	25	135	887	0	TWFSB1EP050	TAWFSB1EP050

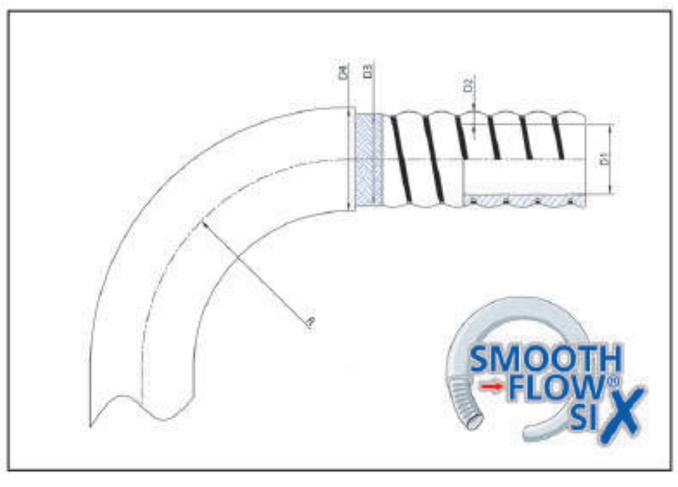
Teflon® is a registred trademark of Dupont.

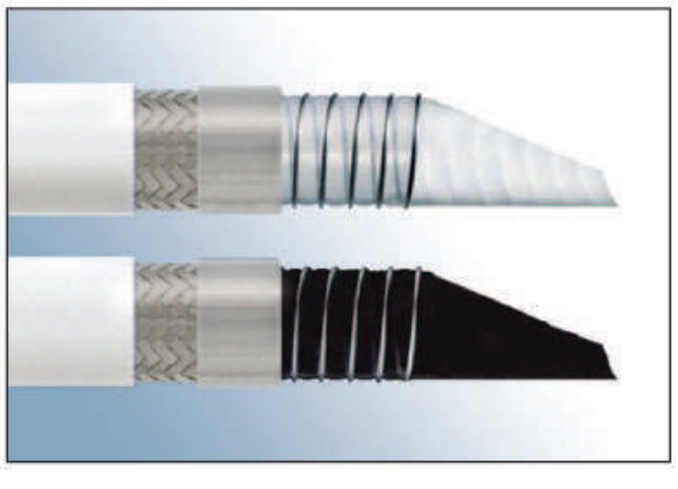
ALMARC
PTFE/PFA LINED SYSTEMS

Xtraflex

Smooth bore flexible PTFE hose with stainless steel helix with Silicone vulcanized high tensile stainless steel braid. Standard wall.

TEMP. From –70°C +150°C





Construction:
Ultra hygienic non-convoluted PTFE (polytetrafluorethylene) liner with stainless steel helix with an outer cover of vulcanized Silicone high tensile stainless steel braid, which ensures a high flexibility and easy cleanability. The hose has exceptionally good vacuum- and kink resistance properties for extreme performance.

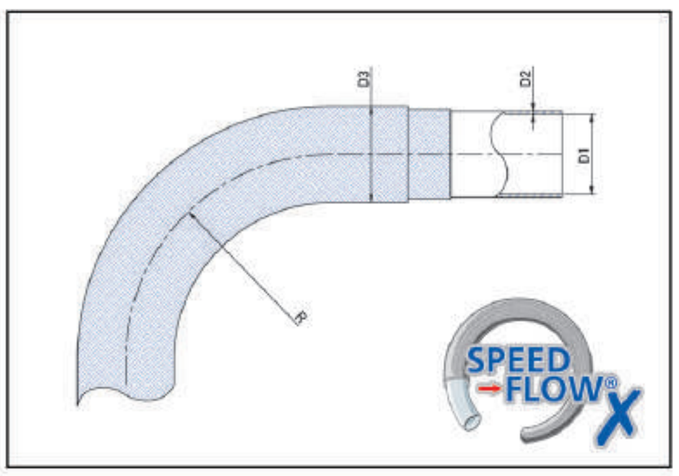
Smooth → Flow® should be specified for applications where Ultra hygienic non-convoluted hose and high flexibility are imperative. The Silicone vulcanized stainless steel braid ensures a high flexibility and easy cleanability. Making it ideal for Food, Bio, Pharmaceutical and Cosmetic industry.

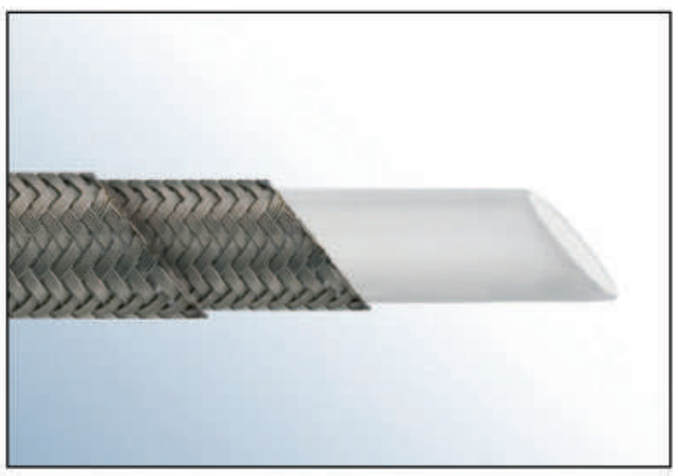
Only available in complete hose assembly form.

Size	D1 average	D2 mm	D3 min.	D3 max.	R mm	WP Bar20°C	BP Bar20°C	Lmax m	Weight Gr/m	Ref. Virgin	Ref. Antistatic
½"	11,5	1,25	20,8	22,8	60	50	250	0	400	TWFSB1SI012	TAWFSB1SI012
⅝"	15,5	1,25	25,5	27,5	65	50	250	0	640	TWFSB1SI016	TAWFSB1SI016
¾"	18,5	1	28,6	30,6	80	60	290	0	900	TWFSB1SI020	TAWFSB1SI020
1"	22,8	1	32,7	34,7	120	40	210	0	1000	TWFSB1SI025	TAWFSB1SI025
1¼"	30,5	1,5	41,8	43,8	155	45	210	0	1500	TWFSB1SI032	TAWFSB1SI032
1½"	36,5	1,5	48,1	50,1	200	40	175	0	1750	TWFSB1SI040	TAWFSB1SI040
2"	48,5	1,65	60,2	62,2	250	25	135	0	2650	TWFSB1SI050	TAWFSB1SI050

Type Speed → Flow® – G/D/1/S Smooth bore PTFE hose, double stainless steel braid – Gas quality

TEMP. –70°C +260°C





Construction:
Speed → Flow®-G/D/1/S is manufactured from virgin PTFE (polytetrafluorethylene) resin with a double AISI 304 stainless steel, high tensile braid. The stabilised PTFE inner core guarantees minimum making it ideal for gas applications.

Typical Applications:
Gas cylinder charging, breathing apparatus, discharging lines aerosol charging lines etc

Fittings:
Fittings with PTFE tail Industrial couplings

Size	D1 min.	D1 max.	D2 mm	D3 min.	D3 max.	R mm	WP Bar 20°C	BP Bar 20°C	Weight gr/m	REF VIRGIN
¼"	5,97	6,48	1,02	10,29	11,43	76	320	1280	250	TGD1S006
⅜"	10,03	10,15	1,02	14,99	15,50	133	206	827	300	TGD1S010

Other materials on request.
We reserve the right to alter the specifications without notice.

Type Lacto → Flow® S/SD.
Latest evolution of hose for milk collecting trucks specifically designed to meet the operator's demand for utmost flexibility and food safety.

Temperature from –30°C to +85°C (depending on conveyed media)
Sterilisation up to +120°C for a maximum of 30'

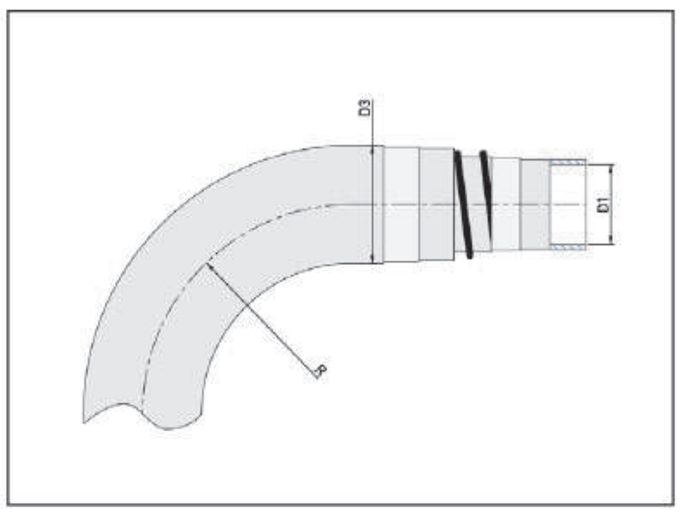
Construction:
Tube
NR/NBR rubber (code 198SL), light colour, odourless, tasteless, mirror-smooth.
Compliance: FDA Standards, BfR Recommendations (cat. 2) and D.M. 21/03/73 and following amendments.
RAL registration for food quality.

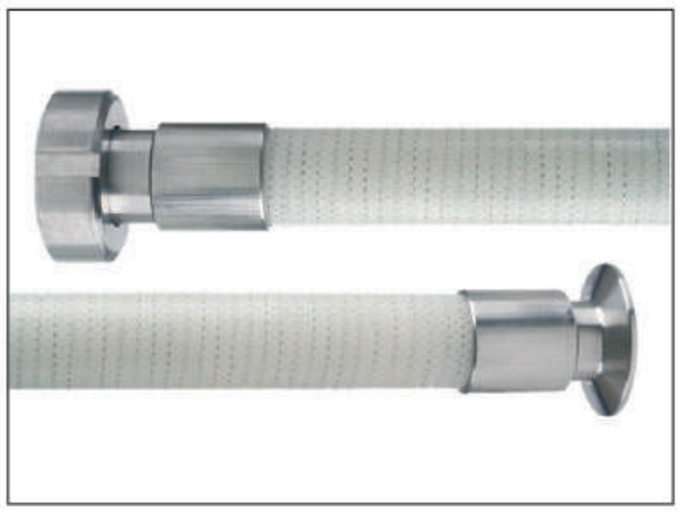
Reinforcement
Plies of synthetic cord and embedded galvanized
steel helix wire.

Cover
Synthetic polymer, blue colour, abrasion, ozone and weather resistant. Smooth, cloth finish.

Internal Diameter (mm)	Wall Thickness (mm)	Working Pressure (bar)	Vacuum (mm)	Bending Radius (kg/m)	Theoretical Weight (m)	Maximum Length
25	5.5	6	-0.9	75	0.75	40
32	5.5	6	-0.9	100	0.95	40
38	5.5	6	-0.9	115	1.13	40
40	5.5	6	-0.9	120	1.18	40
45	5.5	6	-0.9	135	1.31	40
50	5.5	6	-0.9	150	1.44	40
52	6.0	6	-0.9	160	1.60	40
53	6.0	6	-0.9	160	1.63	40
60	6.0	6	-0.9	180	1.85	40
63.5	6.0	6	-0.9	190	1.94	40
70	6.5	6	-0.9	210	2.30	40
76	7.0	6	-0.9	230	2.59	40
80	7.0	6	-0.9	240	2.70	40
100	7.0	6	-0.9	300	4.00	40

Type SIW1 Smooth bore Silicon hose with stainless steel helix





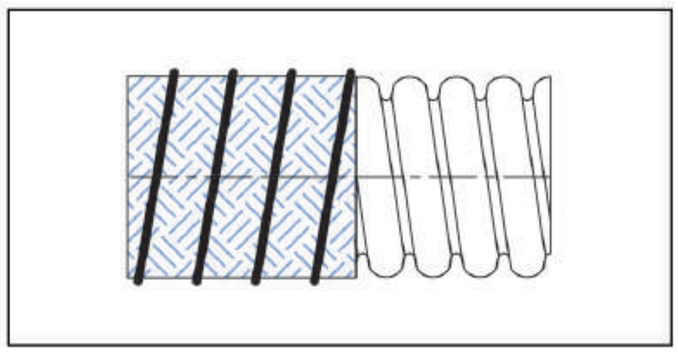
Construction:
SIW1 is manufactured from High purity platinum cured Silicone with AISI 304 stainless steel helix and 4 layers of polyester reinforcement
Compliance with FDA CFR 177.2600 and BGA Class XV standards.

Fittings:
Fittings with special designed tail.

TEMP. –60°C +200°C

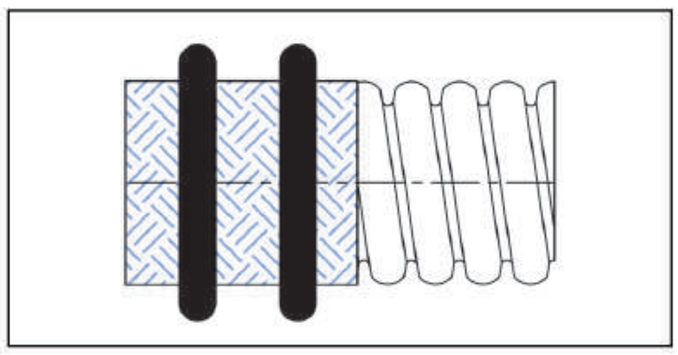
Size	D1 min.	D1 max.	D2 mm	D3 min.	D3 max.	R mm	WP Bar20°C	BP Bar20°C	Vacuum mbar20°C	Lmax m	Ref. Antistatic
1/4"	6.5	7	4.2	14.4	17.4	37	22.6	68	684	4	TCAMB1006
3/8"	10.5	11	4.2	18.4	21.4	42	18	54	684	4	TCAMB1010
1/2"	13.5	14	4.2	21.4	24.4	46	16.1	48	684	4	TCAMB1012
5/8"	16.5	17	4.2	24.4	27.4	49	14.7	44	684	4	TCAMB1016
3/4"	20.5	21	4.2	28.4	31.4	55	13.3	40	684	4	TCAMB1020
1"	25.5	26	5.3	35.6	38.6	64	12.1	36	684	4	TCAMB1025
1 1/4"	32.5	33	5.3	42.6	45.6	77	10.8	32	684	4	TCAMB1032
1 1/2"	38.5	39	5.3	48.6	51.6	91	10	30	684	4	TCAMB1040
2"	51.1	51.6	5.3	61.2	64.2	128	8.9	27	684	4	TCAMB1050
2 1/2"	64.3	64.8	5.3	74.4	77.4	183	7.5	23	684	4	TCAMB1065
3"	77.3	77.8	5.3	87.4	90.4	263	6.2	19	684	4	TCAMB1080
4"	101.3	101.8	5.3	111.4	114.4	514	3.7	11	684	4	TCAMB1100

Teflon® is a registred trademark of Dupont.



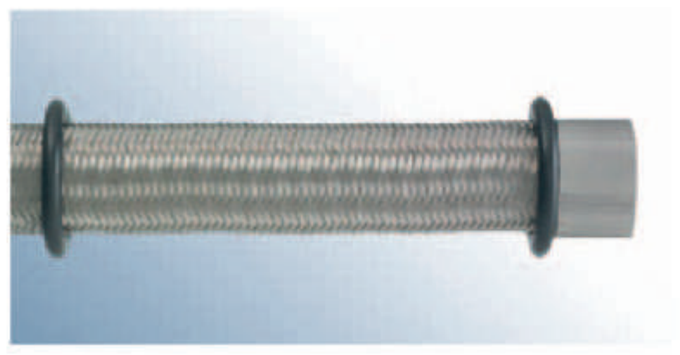
Protection helix

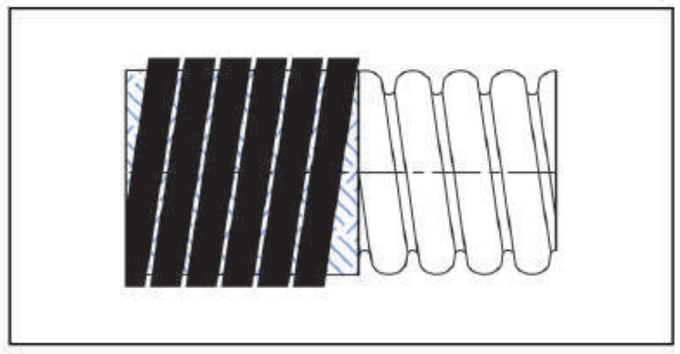
Protection helix in AISI 304 to avoid abrasion of the braid. As alternative to rubber cover in case of elevated temperatures.



Scuff rings

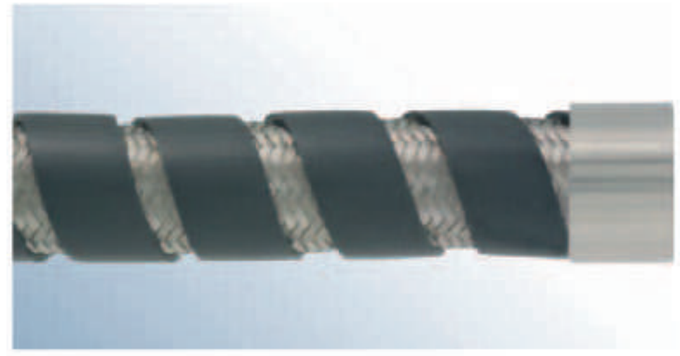
Lightweight abrasion protection. Solves problems in installations where abrasion of the braid might be caused by pump vibrations. Temperature range up to 120°C.

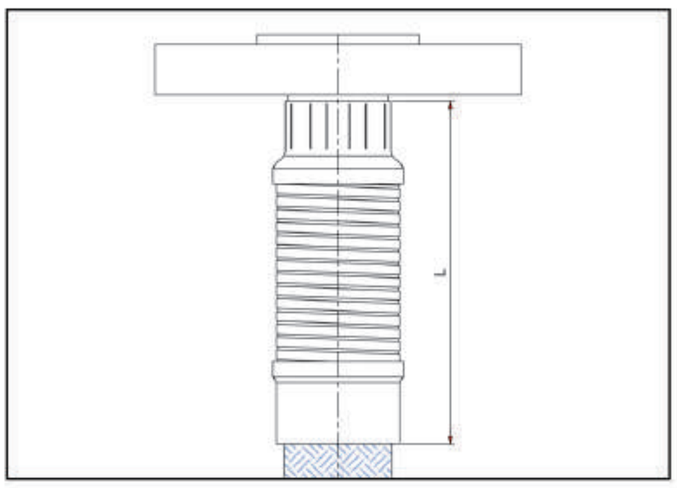




PVC coil

Lightweight PVC flat spiral. Insures protection where the hose is in contact with machinery or on manifolds where hoses are installed close to each other.





Stripwound metal hose guard

Stripwound metal hose guard.
Avoids kinking of the hose at the fitting, a very ridgid solution.

Other materials on request.
We reserve the right to alter the specifications without notice.

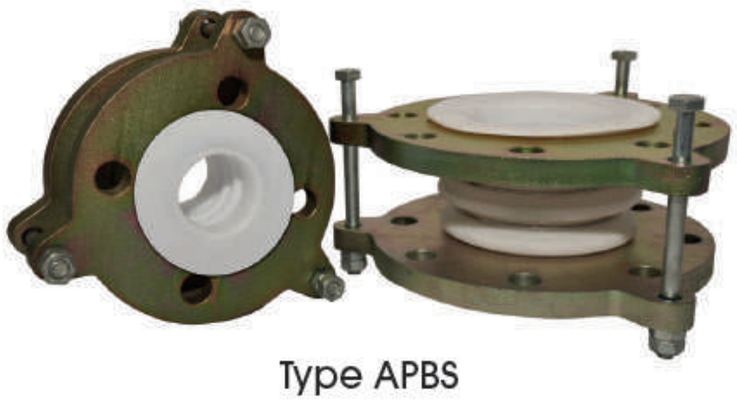
Fittings–SS Tri Clamp, Cam Lock (Autolock), Flanges, etc.

Flange to Camlock Male Adaptor

Other materials on request.
We reserve the right to alter the specifications without notice.

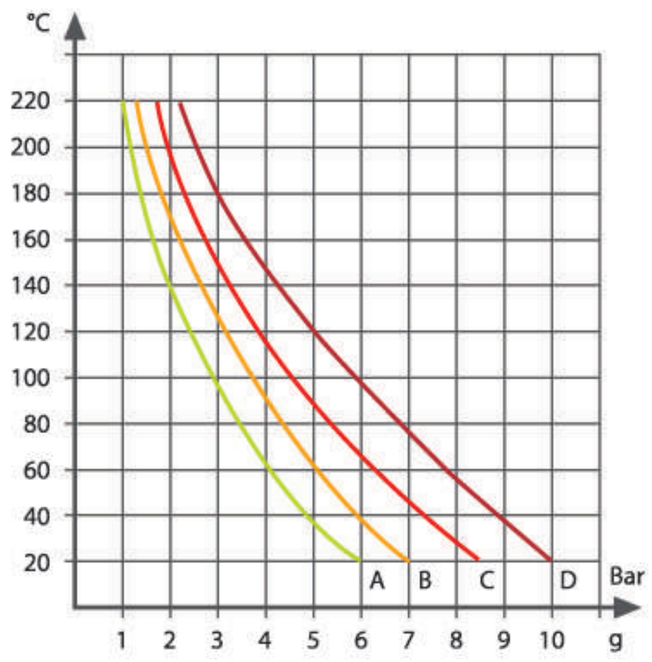
ALMARC
PTFE/PFA LINED SYSTEMS

PTFE BELLOW

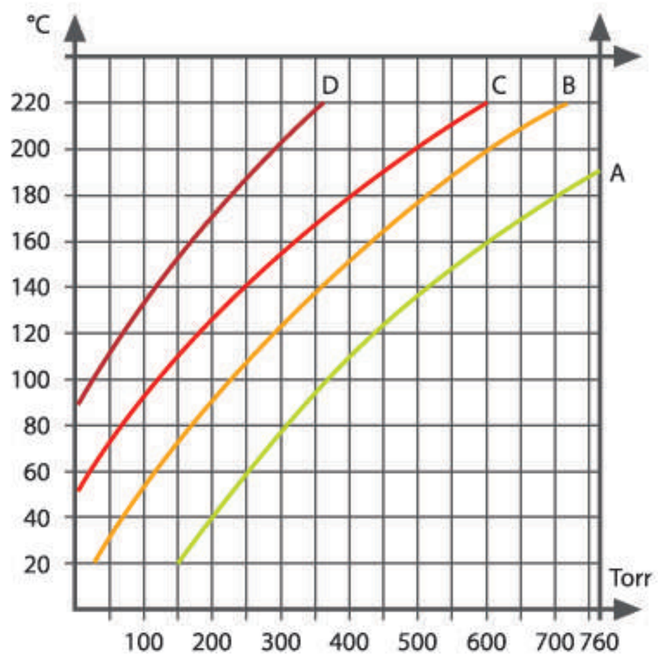


Type APBS

Item	Size	Number of Convolution	Neutral Length (mm)	+/–	Wt Kg
1	1" #150	3	50	12	2.5
2	1" #150	5	75	20	2.8
3	1-¼" #150	3	50	12	3
4	1-¼" #150	5	75	20	3.5
5	1-½" #150	3	50	12	4
6	1-½" #150	5	75	20	4.5
7	2 #150	3	75	15	6
8	2 #150	5	100	25	6.5
9	2-½" #150	3	75	22	7
10	2-½" #150	5	100	35	7.5
11	3" #150	3	100	25	8
12	3" #150	5	125	40	9
13	4" #150	3	100	25	10
14	4" #150	5	150	40	11
15	5" #150	3	125	28	12
16	5" #150	5	175	45	13
17	6" #150	3	150	28	15
18	6" #150	5	225	45	17
19	8" #150	3	150	28	20
20	8" #150	5	225	45	22
21	10" #150	3	150	28	35
22	10" #150	5	225	45	37
23	12" #150	3	150	30	48
24	12" #150	5	225	50	50



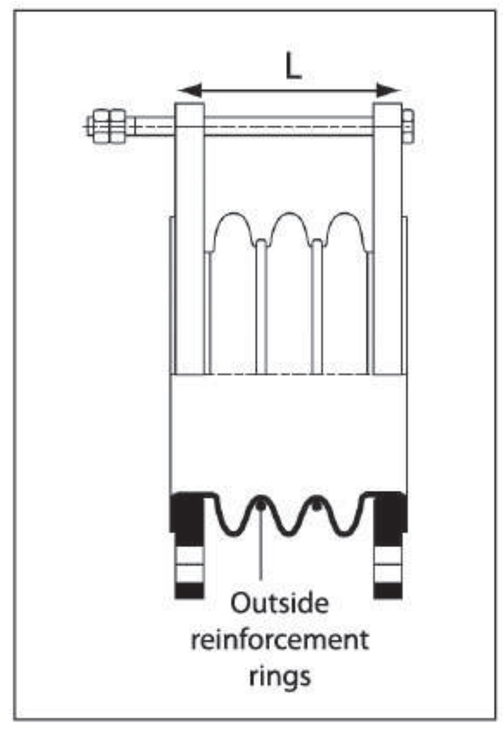
Pressure Resistance *(3 Convolutions)*
Type APBS



Vacuum Resistance
Type APBS

Curves	DN (mm)
A	300 & 350
B	200 & 250
C	100 & 150
D	25 & 80

The Performance Curves



PTFE Materials from European Origin using Paste Extruded production method and fine PTFE powder in accordance with standard ASTM 4895. They are then moulded under pressure and temperature, ensuring no damage to the material fibres. This technique offers excellent resistance to alternate bending (over 300,000 cycles) associated with very high resistance to permeation.

The PTFE used to produce the membranes complies with ASTM F1545 the characteristics of which are indicated in the table below.

FLANGES

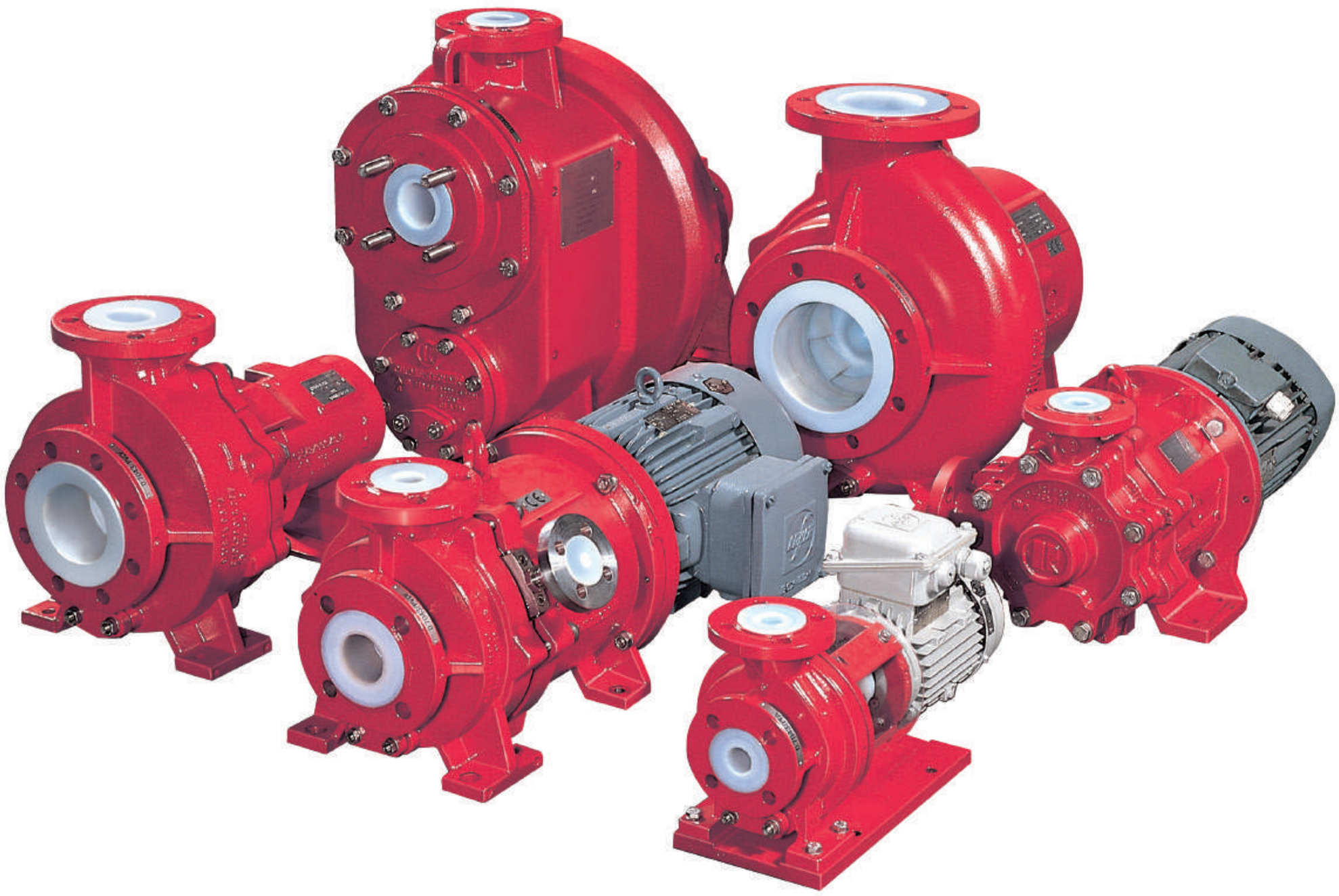
Standard Production of Carbon Steel Material and connection to ANSI #150 as Standard with other material like Stainless Steel and DIN and JIS connection on request.

	Units	
SPECIFIC DENSITY		2.14-2.19 ASTM D792
TENSILE STRENGTH	Mpa	210 mini
ELONGATION AT BREAK	%	250 mini

Reinforcement Rings

Standard Production Made from Stainless Steel 304L 1.4307 with other materials on request.

- For Almarc Type APBS 5 convolutions standard bellow, the values of vacuum and pressure resistance must be multiplied by 0.5.
- The vacuum resistance of Type APBS bellows from DN20 to DN50 bellows is 2 Torr up to 180°C.



Plastic Lined Process Pumps

- Magnetic drive and mechanically sealed
- ISO/DIN and ASME/ANSI
- Lining PFA/PTFE fluoroplastics, PE-UHMW
- Optional vortex, peripheral, self-priming
- Flows from 0,1 – 600 m^3/h (0,4 – 2.400 USgpm)
- Heads up to 145 m (480 ft) LC
- Temperatures up to 200 °C (400 °F)

Safety down to the last detail
Chemical process pumps, shut-off, control and safety valves forcorrosive, hazardous, contaminated, pure and high-purity fluids.

Richter Chemical Resistant
PFA Lined Sealless Magnetic Drive Pump

RMI

Richter Magnetic Drive Process Pumps
Medium Duty RMA (ASME/ANSI) and RMI (ISO/DIN)

General Specifications	
Flow rate	0.1 - 150 m³/h
Delivery heads	up to 110 m
Operating Pressure	up to 20 bar (290 psi)
Operating Temperature	-30°C to 150 °C
Non metallic double can system	Free of eddy current and energy loss
Optional SAFEGLIDE® PLUS	Extended dry running capabilities
Material	Ductile cast iron armouring to withstand system pressure and pipe forces

MNK

Richter Sealless Chemical Magnetic Drive Pumps
Heavy Duty MNKA (ASME/ANSI) and MNK (ISO/DIN)

General Specifications	
Flow rate	0.1 - 600 m³/h
Delivery heads	up to 140 m
Operating Pressure	up to 16 bar (235 psi)
Operating Temperature	-60 °C to 180 °C
Non metallic double can system	Free of eddy current and energy loss
Optional SAFEGLIDE® PLUS	Extended dry running capabilities
Optional SAFESEAL™	Greater protection and reduces leaking
Material	Ductile cast iron armouring to withstand system pressure and pipe forces

(**MNKA** magnetic drive pump with dimensions and performance data to ASME B73.3 and ANSI CI.150)

SAFERUN attachment

Richter SAFERUN
Pump condition monitoring to ATEX for MNK pumps

General Specifications	
Flow rate	0.1 - 600 m³/h
Delivery heads	up to 140 m
Operating Pressure	up to 16 bar (235 psi)
Operating Temperature	-60 °C to 180 °C
Non metallic double can system	Free of eddy current and energy loss
Optional SAFEGLIDE® PLUS	Extended dry running capabilities
Optional SAFESEAL™	Greater protection and reduces leaking
Material	Ductile cast iron armouring to withstand system pressure and pipe forces

SCK/F

Richter Heavy Duty Chemical Process Pump
PFA Lined Mechanical Seal Pump SCK/F

General Specifications	
Flow rate	0.1 - 300 m³/h
Delivery heads	Up to 100m
Operating Pressure	up to 16 bar (235 psi)
Operating Temperature	-60 °C to 180 °C
Type: Double Mechanical seal with quench/liquid seal	Useful for high solid laden, gas containing and crystallising media
Type: Single Mechanical Seal	For media that do not crystallise and are not environmentally hazardous
Material (Pressure bearing parts)	Ductile cast iron EN-JS 1049. Mechanical seal housing made of stainless steel

MNK-X / SCK-X

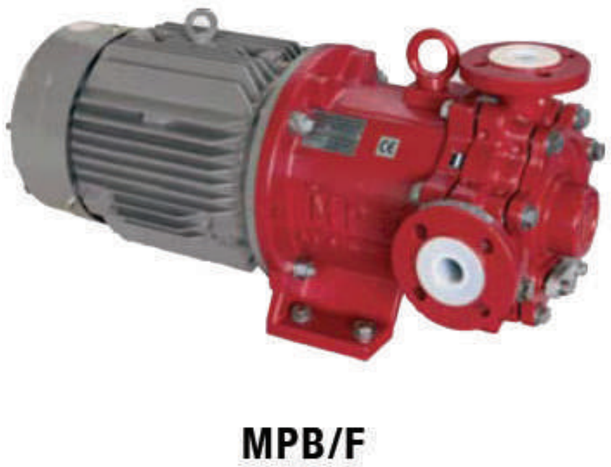
Richter Vortex Type Chemical Process Pump
PFA Lined Vortex Pumps MNK-X and SCK-X

General Specifications	
Flow rate	0.1 - 300 m³/h
Delivery heads	Up to 40m
Operating Pressure	up to 16 bar (235 psi)
Operating Temperature	-60 °C to 180 °C
Optional SAFEGLIDE® PLUS	Extended dry running capabilities
Perfect for:	Media with high solid intent (up to 50% by volume), particle size of about 10 to 20mm and gas contents up to 5% by volume.

MNK-S / SCK-S

Richter Self Priming Chemical Centrifugal Pumps
MNK-S and SCK-S

General Specifications	
Flow rate	0.1 - 300 m³/h
Delivery heads	Up to 40m
Operating Pressure	up to 10 bar (145 psi)
Operating Temperature	-60 °C to 180 °C
Optional SAFEGLIDE® PLUS	Extended dry running capabilities
Non metallic double can system	Free of eddy current and energy loss



MPB/F

Richter Chemical Peripheral Pumps with Magnetic Drive
MPB/F

General Specifications	
Flow rate	0.1 - 6 m³/h
Delivery heads	Up to 100m
Operating Pressure	Standstill vacuum up to 16 bar (235 psi)
Operating Temperature	-60 °C to 150 °C
Non metallic double can system	Free of eddy current and energy loss
Perfect for:	Low flow rate with high delivery head

Shut-Off, Control And Safety Valves

NEW Highly Permeation Resistant PFA-P Lining

- Lining PFA, PTEE and antistatic
- For corrosive, hazardous, contaminated, pure and high purity fluids
- DN 15 - 400 (½ – 16")
- ISO/DIN + ASME/ANSI standards
- Temperatures up to 200 °C (400 °F)
- Manual and remote-controlled
- Clean air act and FDA options

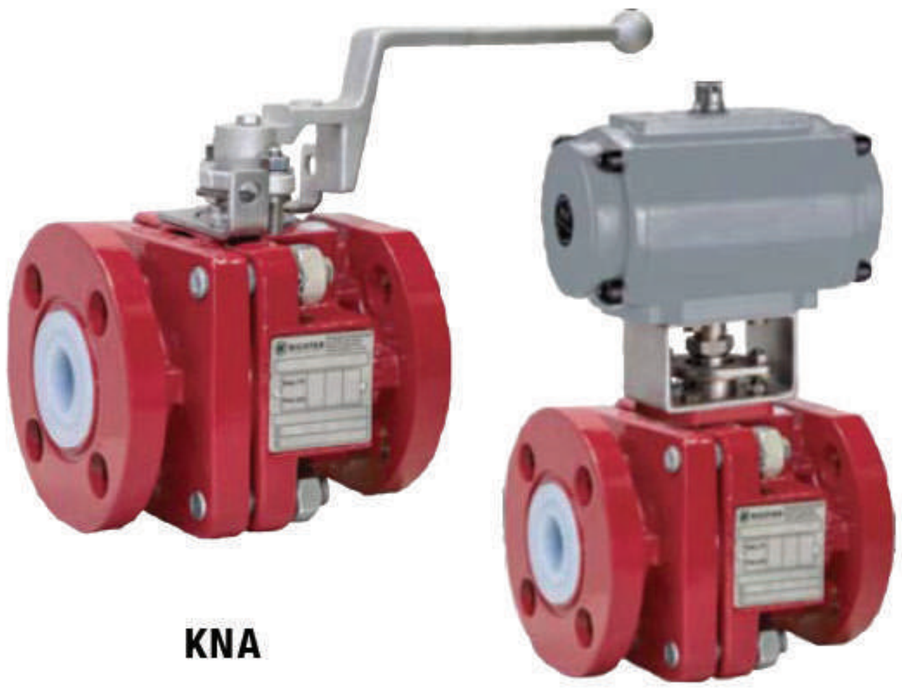
Safety down to the last detail
Chemical process pumps, shut-off, control and safety valves forcorrosive, hazardous, contaminated, pure and high-purity fluids.

ALMARC
PTFE/PFA LINED SYSTEMS

RICHTER PROCESS VALVES

KNA (Manual) & KNAP (Automated) Full Bore Ball Valves

COMPONENTS, MATERIALS



KNA

KNAP

Ball versions

Optionally zirconium, stainless steel etc.

Designation	Material
Main Body	Ductile Iron ASTM A395, PFA Lined
Body End Piece	Ductile Iron ASTM A395, PFA Lined
Ball/Stem Unit	Stainless Steel, PFA Lined
Stem	Stainless Steel, PFA Lined
Lever	Stainless Steel
Seat Rings	PTFE
Packing Bellows	PTFE
Thrust Ring	Stainless Steel
Spring Gland Follower	Stainless Steel
Packing Gland Follower	Stainless Steel
Bracket	Stainless Steel
Lever Stop	Stainless Steel
Coupling	Stainless Steel
Screws and Nuts	Stainless Steel

Size / #150	½"	¾"	1"	1½"	2"	3"	4"	6"	8"
L (mm)	130	150	127	165	178	203	229	267	457
Weight (kg)	5.6	6.0	5.6	12	14.5	33.5	50	91	125

MV, MVM Diaphragm Shut-Off and Control Valves

COMPONENTS, MATERIALS

MVM

**Also available with actuator*

Designation	Material
Body	Ductile Cast Iron EN JS1049 / ASTM A395
Lining Teflon	PFA (Perfluoroalkoxy)
Bonnet	Stainless Steel 1.4408 / CF8M
Hand Wheel	Stainless Steel 1.4408 / CF8M
Compressor	Stainless Steel
Diaphragm	TFM-PTFE (Modified PTFE)
Diaphragm Support	EPDM
Guide Ring	PTFE / Carbon
O-Ring	FKM
Packing Ring	PTFE
Packing Nut	Stainless Steel
Thrust Ring	Stainless Steel
Travel Stop	Stainless Steel
Scrapper Ring	FKM
Bearing	PTFE / Graphite
Tube Nut	Stainless Steel
Stem	Stainless Steel
Screws, Nuts	Stainless Steel

Size / #150	½"	¾"	1"	1½"	2"	3"	4"	6"
L (mm)	130	150	147.5	175	200	260	327	416
Weight (kg)	2.8	4	4.4	8.3	11.3	23	32	62

BC

CV, BC, SR, GR, RV, PRS Ball Check Valves

Horizontal or Vertical Installation
ASME (ANSI) - Face to Face Length Peabody-Dore 1" Onwards
COMPONENTS, MATERIALS

Designation	Material
Body Shell	Ductile Cast Iron EN-JS1049 (ASTM A395)
Body Lining	PFA (Perfluoroalkoxy)
Ball	PTFE, Optionally Stainless Steel, Hastelloy etc. Choice of hollow and solid

Size / #150	½"	¾"	1"	1½"	2"	3"	4"	6"
L (mm)	130	150	152	178	178	203	267	394
Weight (kg)	2.8	3	3.7	6.3	8.4	22	35	47

PFA/PTFE Shut-Off and Control Butterfly Valves

NKS (Wafer), NKL (Lug)
COMPONENTS, MATERIALS

NKS (Wafer) NKS (Lug)

Designation	Material
Shell	Ductile Cast Iron EN-JS1049 (ASTM A395)
Disc/Stem Unit, One Piece	Disc Stem Core Duplex Stainless Steel ASTM A351 CD-4 Mcu (1.4517), Lining PFA
Guide Pin	Stainless Steel
Hand Lever	Stainless Steel CF8 (1.4308)
O-Ring	FKM, Top and Bottom
Thrust Rings	Stainless Steel (Top and Bottom)
Body Lining	PTFE
Pressure Gasket	Aramide
Cup Spring Assembly	Stainless Steel (Top and Bottom)
Throttling Plate with 15°	Stainless Steel
Flexible Insert	Silicone
Grounding Cable	Stainless Steel
Screws, Nuts, Washers	Stainless Steel

Size / #150	2"	3"	4"	6"	8"	10"	12"	14"	16"
L (mm)	43	46	52	56	60	68	78	78	102
Weight (kg) - NKS	3.5	4.5	6	11	15	25	33	47	69
Weight (kg) - NKL	4.5	7.5	9.5	16	23	35	54	68	97

2 (PSG & SGS) & 3 (TSG) Way Bulls Eye Sight Glasses
COMPONENTS, MATERIALS

PSG

Designation	Material
Body Armouring	Ductile Cast Iron EN-JS1049 (0.7043)
Body Lining	PFA (Perfluoroalkoxy)
Cover Flange	Ductile Cast iron EN-JS1049 (0.7043)
Sight Glass Pane	Borosilicate Glass, e.g. Maxos
Flat Gasket	Aramide
Nuts, Bolts	Stainless Steel

Size / #150	1"	1½"	2"	2½"	3"	4"	6"
L (mm)	160	200	230	290	310	350	480
Weight (kg)	6	9	14	16	22	36	73

OTHER RICHTER PROCESS VALVES

GS/GSO Strainer

Bottom Drain Valve

Bellows-sealed control & shut-off valve

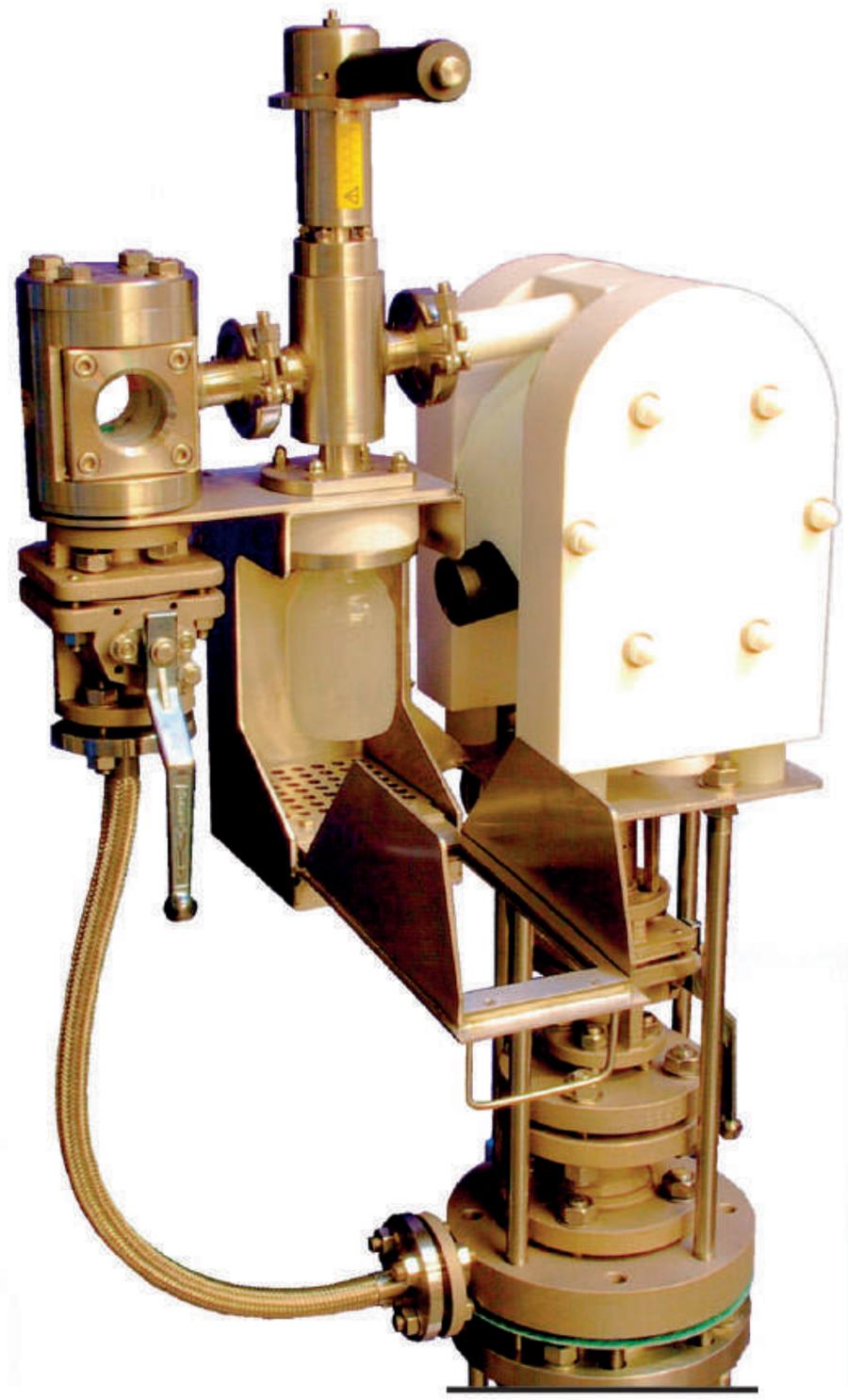
Tank Bottom Valve System

KSE/KSEA Safety Relief Valve

HV Globe Valve

Notes:

Pumps shown in this catalogue are customised based on specifications.
Valves shown in this catalogue are in-stock items (only common sizes).
For complete range of RICHTER products, please visit our website at ***www.almarc.com.sg***
For more in-depth specifications, please contact our sales team at ***sales@almarc.com.sg***



The first sample is the right sample

Safe, representative sampling systems for the chemical, pharmaceutical, biotechnology and petrochemical industries.

Introduction to Sampling

Within many process industries, including pharmaceutical, fine chemical and petrochemical taking samples of product has become an increasingly important activity. Reasons for this requirement are many and varied but can include confirming that a chemical reaction has been completed, checking that a product has the correct physical or chemical composition, taking a sample to retain for legal reasons, checking that a delivery of a chemical is within tolerance, etc. In tandem with the requirement to collect samples has been the requirement to ensure the health safety and welfare of all personnel, and the public more widely.

To address these twin requirements CRP has developed a comprehensive range of sampling equipment to allow representative samples of liquids, gases and powders to be taken safely from a wide variety of process equipment. While the standard range of equipment will allow samples to be taken in the majority of circumstances, CRP has a skilled team of engineers with many years of experience that can tailor equipment, or manufacture entirely bespoke equipment, to allow samples to be taken from equipment at the extremes of pressure and temperature that are encountered in the process industries. To back up this design expertise, CRP has in house PFA moulding expertise to allow bespoke designed equipment to be quickly turned into moulded products. Typical examples of this capability are special reactor sampler manifolds or custom pH probe connectors.

CRP Sampling Systems

In-line Sampling Systems

In-line sampling systems offer a simple solution to taking a representative sample from a process line.

Sample From the Main Process Line

The process samples can be taken directly from the main process line from bore sizes ½" through to 6" NB in either ASME 150/300 or DIN PN10/16 styles.

Various Material Options

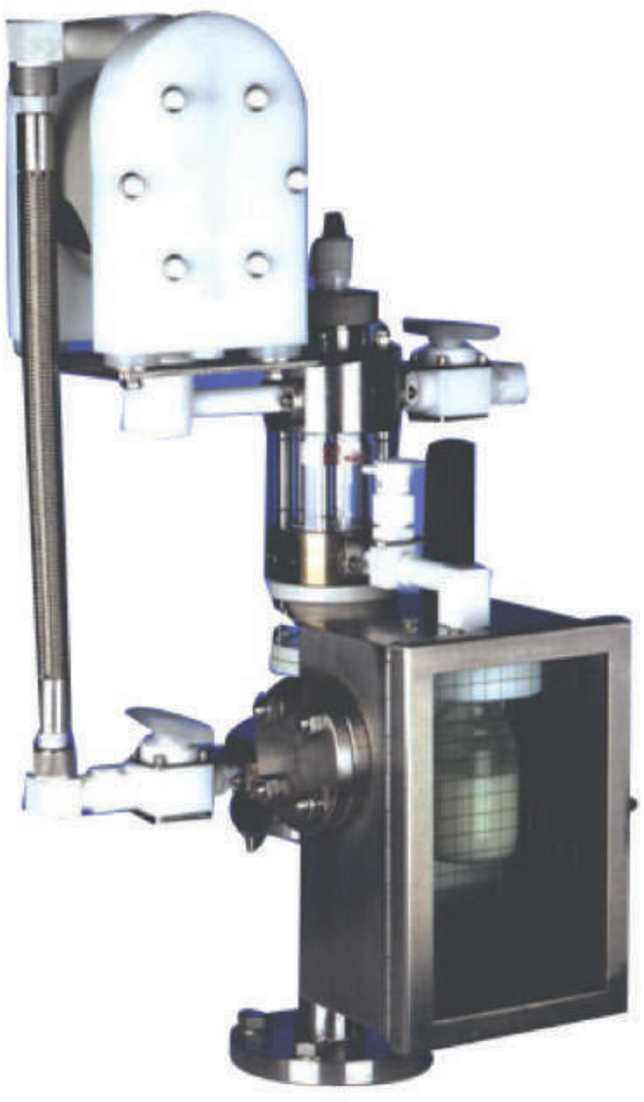
In-line sampling valves are available with stainless steel wetted parts (SD IL 300 series) or PFA wetted parts (SD IL 400 series) for corrosive process medias and processes requiring very high purity of product.

Pipe work Orientation

The sampling system can be supplied to suit in either horizontal or vertical pipeworks.

Modular Sample Dispensing

All our in-line samplers have a modular dispensing mount, whether the sample is dispensed through a PTFE dip tube into a hand held bottle, a screwed in bottle or into a self sealing septum capped bottle.



Recirculating Vessel Mounted Sampling Systems

With recirculating sampling, the sample is drawn from the vessel and pumped through the sampling system before being discharged back into the vessel often down the same dip pipe. The sample is dispensed from the sightglass section using a small bore valve into the chosen sample receiver.

Pump Options

The diaphragm pump can be of Virgin PTFE or antistatic PTFE to comply with ATEX directives. The discharge from the diaphragm pump can be connected by a PTFE flexible hose assembly or hard piped backed into the vessel.

Using a In-line Sampling Valve

The recirculating sampling system can be supplied with a in-line sampling valve mounted either in a horizontal or vertical line to take the sample from the flowing recirculation loop. A separate tubular sightglass shows visual indication of the flowing media.

For further details of the product, please visit our website at ***www.almarc.com.sg*** and click on the CRP Logo.

CTSG – SIGHT GLASS

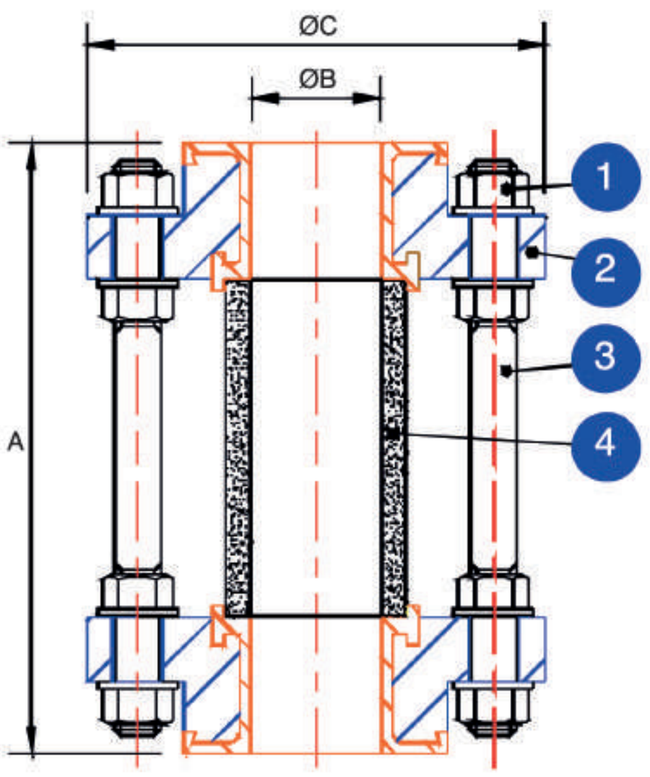
The CTSG Sight Glasses unique construction provides full 360° process viewing. Manufactured from heavy wall borosilicate glass tube and PFA / PTFE lined flanges for use in the most demanding corrosive and toxic applications.

Product Features

- Heat treated heavy wall borosilicate glass for managing high line pressures
- Parallel full port flow path prevents liquid retention or bug traps
- Stainless steel tie rods provide protection against side loads and mechanical damage
- Proven design offering safety and security

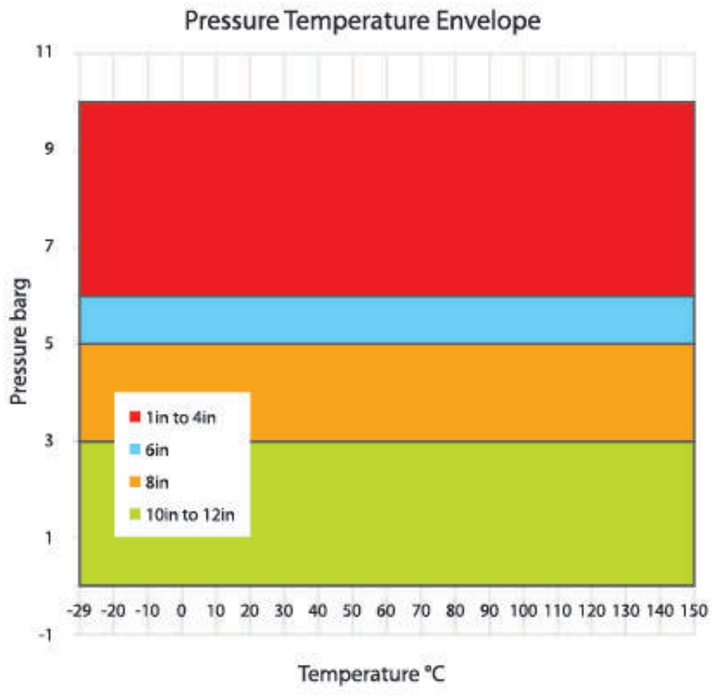
Materials Specification

Item	Qty	Description	Materials	Specification
1	16/32/48	Nuts / Washers	Stainless Steel	ASTM F594 Gr. 304
2	2	Flange [1 to 6] [DN25 to DN150]	Carbon Steel PFA	BS 1501-161-430A ASTM D3307
		Flange [8 to 12] [DN200 to DN300]	Carbon Steel	BS 1501-161-430A ASTM D1457 Type II
3	4/8/12	Tie Rods	Stainless Steel	BS970 Pt.1 Gr.303S42
4	1	Glass Tube Paint Finish	Glass 3.3 125μ Blue Semi-Gloss	ISO 3585 Epoxy



Dimensions

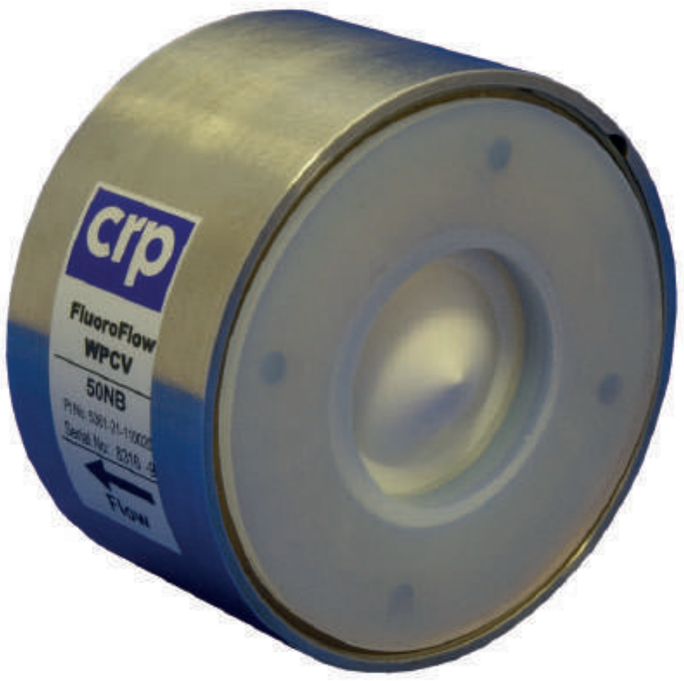
To Suit Pipework	Face to Face	Bore	Flange Diameter	Weight	Glass	
ASME 150 Piping Systems						
Inches	mm	Dim A mm	Dim B mm	Dim C mm	Kg	od mm	Wall mm
1	25	152	20	108	3.5	30	4.5
1½	40	178	36	127	4.9	50	7.0
2	50	203	42	152	7.0	60	9.0
3	80	241	72	190	11.5	90	9.0
4	100	292	103	229	17.2	120	9.0
6	150	356	152	279	25.7	170	9.0
8	200	300	197	343		215	9.0
10	250	300	282	406		300	9.0
12	300	300	307	483		325	9.0
DIN PN 10 / 16 Piping Systems							
Inches	mm	Dim A mm	Dim B mm	Dim C mm	Kg	od mm	Wall mm
1	25	160	20	115	3.8	30	4.5
1½	40	200	36	150	5.5	50	7.0
2	50	230	42	165	8.3	60	9.0
3	80	310	72	200	12.0	90	9.0
4	100	350	103	220	18.5	120	9.0
6	150	480	152	285	29.3	170	9.0
8	200	300	197	340		215	9.0
10	250	300	282	395		300	9.0
12	300	300	307	445		325	9.0



Options

Component	Description
Flanges	PFA lined and unlined stainless steel, or carbon steel, hygienic end
	connec ons - tri-clamp, RJT, SMS, DIN etc.
Shield	Perspex safety shield
Glass	Internally lined with FEP for caustic processes
Body	Flow disturbers and indicators, back lighting

WPCV – WAFER POPPET CHECK VALVE



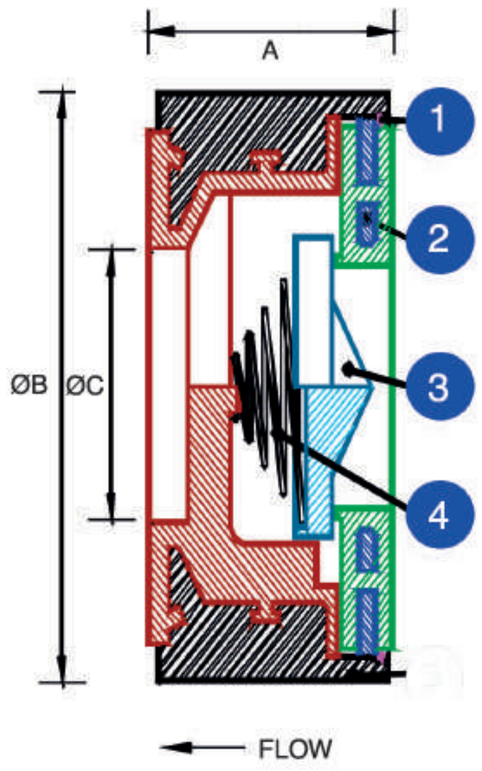
The WPCV check valve has a spring assisted poppet and a robust design suitable for a wide range of process applications. PFA, PTFE & Hastel loy to all wetted parts ensures long, high cycle performance.

Product Features

- Positively located spring and poppet – secure from misalignment
- Crush resistant design guards against installation abuse
- Ideal design for low pressure duties
- Full bore design provides maximum flow with minimum pressure drop
- Hastelloy C276 spring as standard – poppet lift pressure 14mBar - but customized ratings available
- Designed for easy disassembly

Materials Specification

Item	Qty	Description	Materials	Specification
1	1	Circlip	Stainless Steel	BS2056 Gr. 316S42
2	1	Seat Plate	Stainless Steel PFA	ASTM A240 Gr. 304 ASTM D3307
3	1	Poppet	PTFE	BS6564 UA1/1
4	1	Spring	Hastelloy C276	ASTM B574 Gr. UNS N10276
5	1	Valve Body	Stainless Steel PFA	ASTM A240 Gr. 304 ASTM D3307

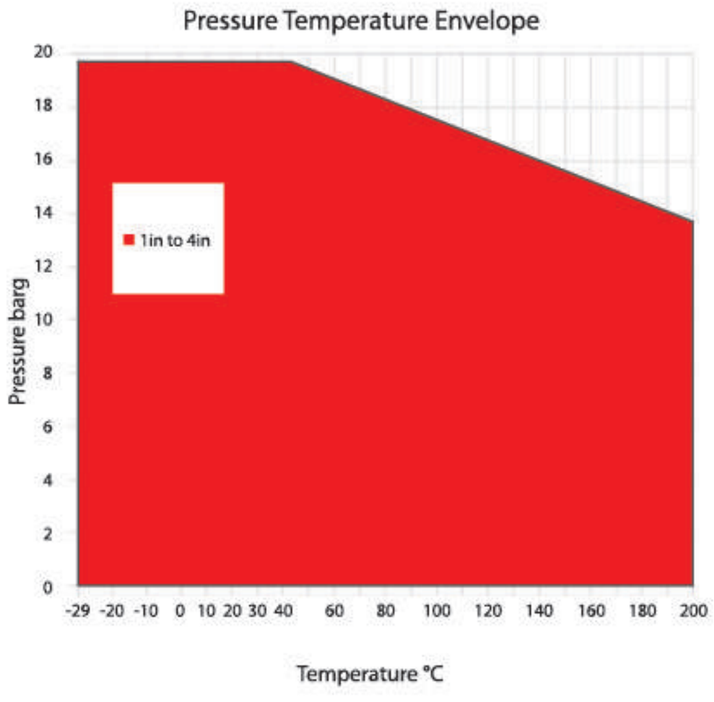


Dimensions

To Suit Pipework		Face to Face	Valve Diameter ASME 150	Valve Diameter DIN PN 10/16	Valve Bore	Weight
Inches	mm	Dim A mm	Dim B mm	Dim B mm	Dim C mm	Kg
½	15	30	45	51	16	0.2
1	25	35	63	73	25	0.5
1½	40	45	82	92	36	1.1
2	50	56	101	107	50	1.7
3	80	71	133	142	66	3.5
4	100	80	171	162	88	5.3

Options

Component	Description
Body	316 Stainless steel
Spring	Alternative pressure ratings
	PTFE encapsulated
	Alternative spring materials
	Spring removed (floating poppet)



FPCV – FLANGED POPPET CHECK VALVE

The FPCV check valve embodies all the features of the WPCV valve, with bolted flanged ends which provide standard valve face to face dimensions to suit either ASME or DIN process lines.

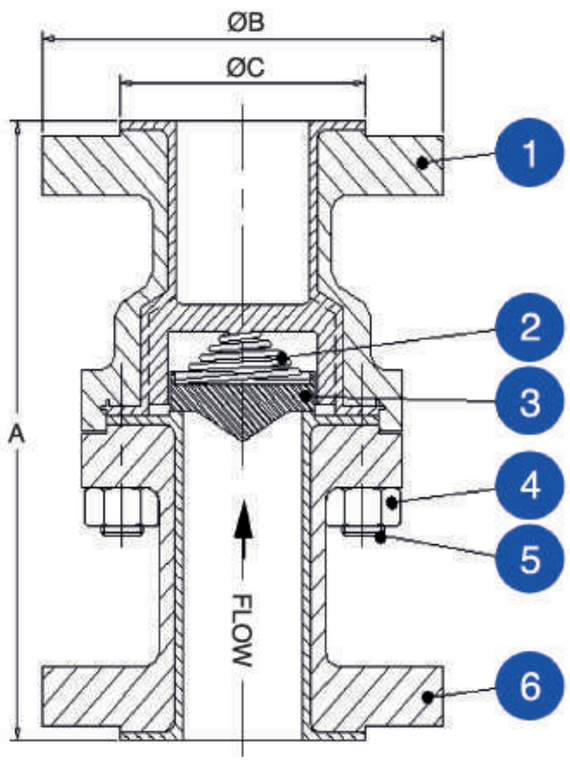
Product Features

- Flanged connection for installations not compatible with the wafer design
- All the features of the WPCV
- Standard face to face dimensions
- Design suitable for both horizontal and vertical installation
- Poppet lift pressure (cracking) 14mBar - but customized ratings available

Materials Specification

Item	Qty	Description	Materials	Specification
1	1	Valve Body	Carbon Steel PFA	ASTM A216 Gr. WCB ASTM D3307
2	1	Spring	Hastelloy C276	ASTM B574 Grade UNS N10276
3	1	Poppet	PTFE	BS6564 UA 1/1
4	4*	Nut	Stainless Steel	ASTM F594 Gr. 304
5	4*	Stud	Stainless Steel	BS970 Pt 1 Gr. 303S42
6	1	Valve Inlet	Carbon Steel PFA	ASTM A216 Gr. WCB ASTM D3307
		Paint Finish	125μ Blue Semi-Gloss	Epoxy

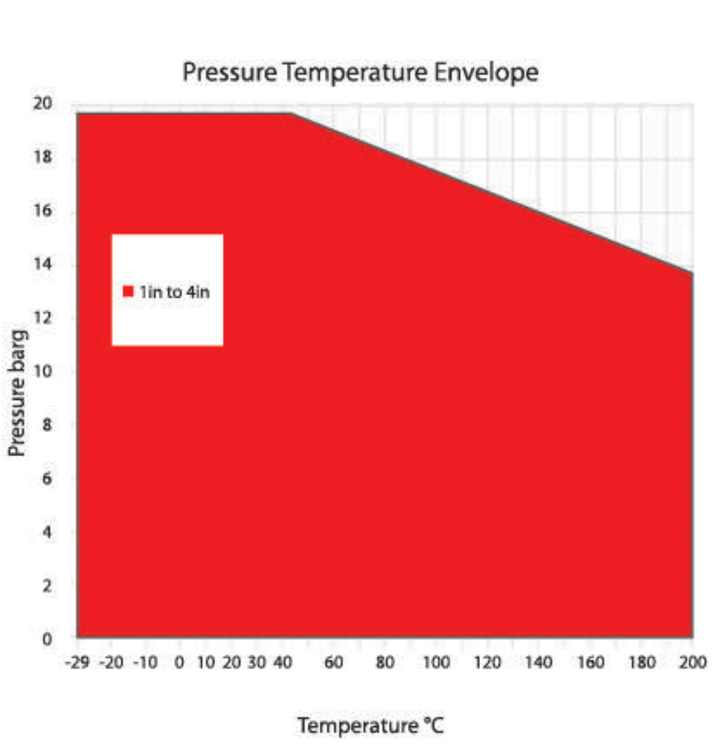
*On the 3" and 4" NB valve there are 6 off studs and nuts.



Dimensions

Nominal Bore		Face to Face	Flange Diameter	Rised Face	Weight
ASME 150 Piping Systems					
Inches	mm	Dim A mm	Dim B mm	Dim C mm	Kg
1	25	152	108	51	3
1½	40	178	127	73	7
2	50	203	152	92	10
3	80	241	190	127	18
4	100	292	229	152	28
DIN PN 10 / 16 Piping Systems*					
Inches	mm	Dim A mm	Dim B mm	Dim C mm	Kg
1	25	160	115	51	4
1½	40	200	150	73	7
2	50	230	165	92	10
3	80	310	200	127	20
4	100	350	220	152	30

*The DIN version of the valve is a fabricated construction.



Options

Component	Description
Body	Stainless steel
Length	Special face to face dimensions
Spring	Alternative pressure ratings
	PTFE encapsulated, alternative spring materials, spring removed (floating poppet)

STCV – SWING CHECK VALVE

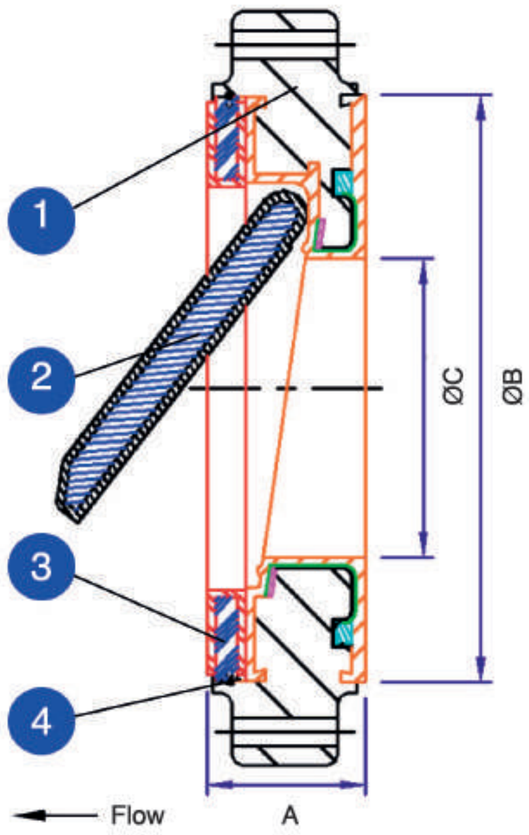
A high integrity PFA moulded wafer swing check valve, with fully encapsulated one piece disc/hinge assembly ensuring prolonged maintenance free service. Suitable for PTFE lined or unlined pipework in all severe process conditions.

Product Features

- Retained hinge design to aid installation and prevent disc removal in service
- Machined body T-slots and liner locking system securely holding liner in position
- Angled seat design ensures positive location in horizontal lines
- Virgin PFA with no pigmentation to hide defects
- Strong robust design

Materials Specification

Item	Qty	Description	Materials	Specification
1	1	Body	Cast Steel PFA	ASTM A216 Gr WCB ASTM D3307
2	1	Disc	Cast Steel PFA	ASTM A216 Gr WCB ASTM D3307
3	1	Retaining Plate	Carbon Steel PFA	BS4360 Gr 43A ASTM D3307
4	Circlip	Stainless Steel Paint Finish	BS2056 Gr 304S15 125μ Blue Semi-Gloss	ASTM F594 Gr. 304 Epoxy



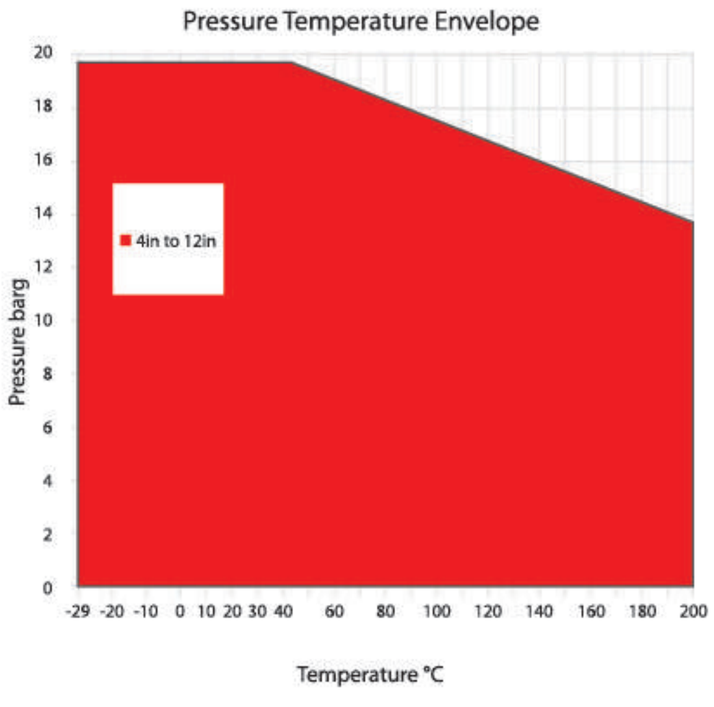
Dimensions

To Suit Pipework		Face to Face	Valve Diameter ASME 150	Valve Diameter DIN PN 10/16	Valve Bore	Weight
Inches	mm	Dim A mm	Dim B mm	Dim B mm	Dim C mm	Kg
4	100	52	171	152	71.5	6.0
6	150	56	219	218	110	12.0
8	200	60	275	273	150	21.5
10	250	68	336	329	184	27.5
12	300	78	406	378/384	230	40.5

*Face to Face dimensions in accordance wi th DIN3202/T3/K1 and API 609 standards

Options

Component	Description
Body	Stainless steel
	Antistatic liner
Spring	Soft seats, Kalrez & Viton for gas applications

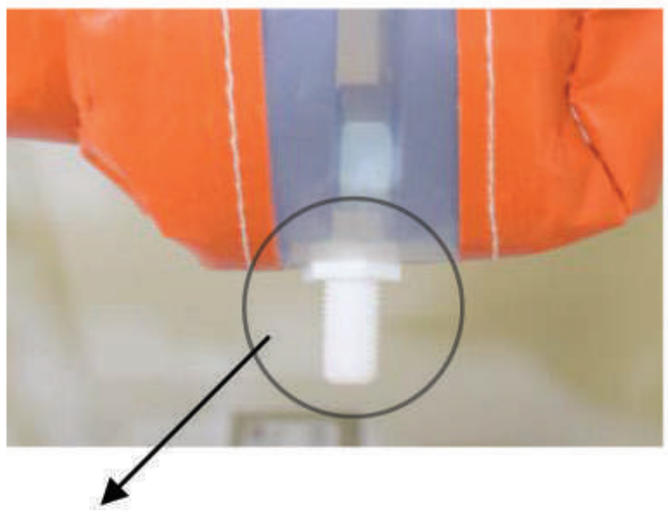


"Why use Ramco Safety Shields?"

Where hazardous and corrosive chemical is involved in pipelines, even a small drop of chemical spillage can cause serious or fatal injuries to personnel. Ramco Safety Shield Products has a wide range of flange and valve shields to prevent hazardous spray outs of dangerous chemicals so as to

- Prevent injuries
- Protect equipments
- Resist acids, alkalis and most chemicals

Installation of the shields can be done with ease ("No tools required")
All shields come with a replaceable indicating litmus patch.
VUE GUARDS ARE NOT STANDARD WITH PH PATCH



Certification

Ramco Manufacturing is a registered ISO 1991 Company.
Products hold ABS Type II Approval and Factory Mutual (FM) Approval.

Ramco TFE SPRA-GARD® Shield (Flanges)

Ramco TFE SPRA-GARD® Tee Safety Shield

Ramco TFE VUE-GARD® Safety Shield

Ramco PVC ECONO-GARD® Safety Shield

Ramco TFE SPRA-GARD® Bonnet Shield

Ramco PPL SPRA-GARD® Shield (Flanges)

Ramco PPL VUE-GARD® Safety Shield

Ramco Metal Flange Safety Shield

Ramco TFE SPRA-GARD® Tee Safety Shield

Ramco TFE SPRA-GARD® Shield (Valves)

Ramco PPL VUE-GARD® Safety Shield

Ramco Navy Shield

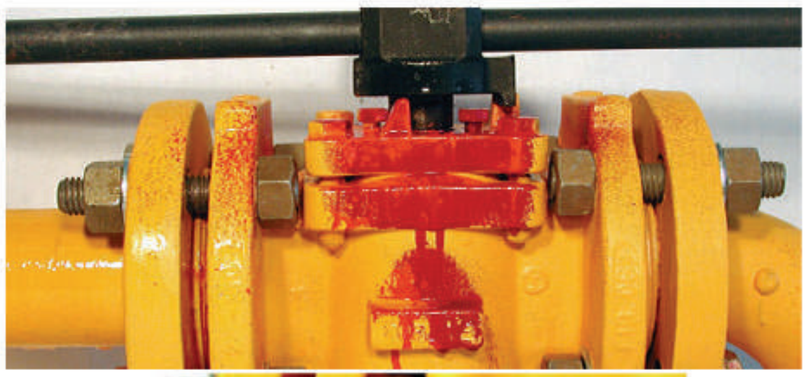
*This list is non-exhaustive. For more safety shields, visit our website at **www.almarc.com.sg** or contact us at **sales@almarc.com.sg***

RAMCO SAFETY SHIELDS FOR PIPE CONNECTIONS

PHYSICAL CHARACTERISTICS

	SPRA-GARD SHIELD				ECONO-GARD SHIELD		METAL SHIELDS		
Conditions	TFE	VUE	PPL	PPL(VUE)	PE	PVC (Red, White, Clear)	Galvanized	304	316
Temperature °F (Max) [°C]	450 [232]	300 [150]	225 [107]	225 [107]	140 [60]	140 [60]	800 [427]	2650 [1454]	2650 [1454]
Pressure PSI [Bar]	1650 [114]	1000 [69]	1100 [76]	1000 [69]	350 [24]	435 [30]	3000 [207]	3000 [207]	3000 [207]

RAMCO ACID & BASE ALERT SYSTEM



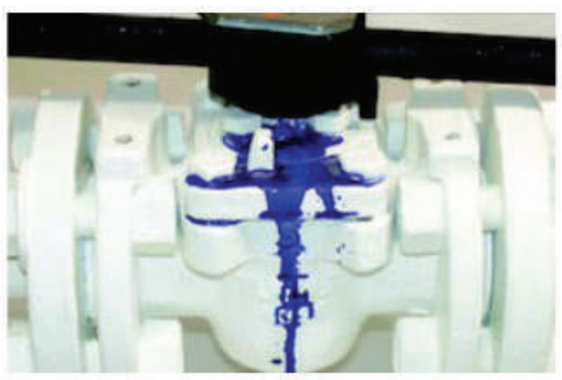
ACID ALERT SYSTEM

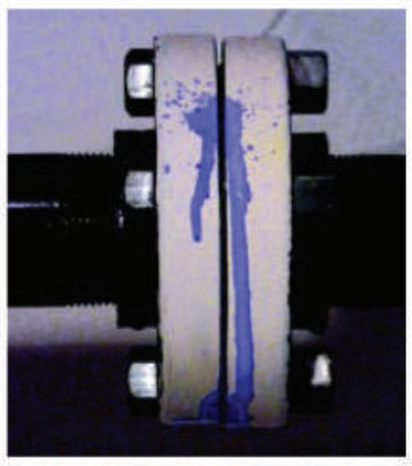
GOLDEN YELLOW **Paint turns *RED* at pH 3 and below**

Immediate visual detection

For leaking acids & acid vapours

- Protects employees, expensive equipment, and the environment
- Visually detects leaks before the situation becomes catastrophic
- Enhances on-site Safety and Hazmat programs
- Helps isolate the origin of the leak
- Reverses from red to yellow when leak is repaired and acid is rinsed with tap water or an alkaline solution





BASE ALERT SYSTEM

BRIGHT WHITE **Paint turns *BRILLIANT BLUE* at pH 10 and**

Immediate visual detection

For leaking bases / caustics

- Protects employees, expensive equipment, and the environment
- Visually detects leaks before the situation becomes catastrophic
- Enhances on-site Safety and Hazmat programs
- Helps isolate the origin of the leak
- Reverses from blue to white when leak is repaired and base is rinsed with tap water

NEUTRALISER

For acid alert system colour reversal

- pH 11.5 and able to neutralize acid spill or leak
- Expedite color transition of acid detecting paint after an acid exposure
- Once the indicating red colour changed back to golden yellow, rinse the site with water

For more details on RAMCO products, please visit our website at ***www.almarc.com.sg*** or contact us at ***sales@almarc.com.sg***

All pictures used on this page are with permission from RAMCO Manufacturing Company Inc.

PIPING ISOMETRIC DRAWING

PIPING ISOMETRIC DRAWING

PIPING ISOMETRIC DRAWING

Regional HQ (Singapore)

ALMARC ENGINEERING PTE LTD

23 Kian Teck Way

Singapore 628742

Tel: (65) 6758 0010 Fax: (65) 6758 0014

www.almarc.com.sg

Malaysia Sales Office

ALMARC ENGINEERING SDN BHD

Cheras Centre Point Lot G-07

Podium Medan Connaught

No. 1 Jalan 3/144a Cheras

56000 Kuala Lumpur, Malaysia

Tel: (603) 8958 7511

Malaysia Factory

ALMARC ENGINEERING SDN BHD

11 Jalan Empayar 2

Taman Perindustrian Empayar

Gelang Patah

81550 Johor, Malaysia

Tel : (607) 510 4392

Thailand Sales/Rep Office

ALMARC ENGINEERING PTE LTD

The Ninth Tower, 35th Floor, Tower A

33/4 Rama 9 Road, Huaykwang

Bangkok 10310, Thailand

Tel : (66) 89 699 3268

Indonesia Office/Factory

PT ALMARC ENGINEERING INDONESIA

Unit A1 Gudang Gracia

Jl. Proklamasi No.12, Tanjong Mekar,

Tunggakjati, Karawang Barat, Karawang

Tel : (65) 9786 9485

Distributed by