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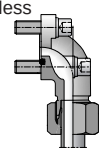
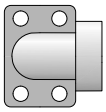
BFW
DIN Flange / Metric
Flareless

K36

90° Elbows

G5EQ
Code 61, 62 / SAE-ORB

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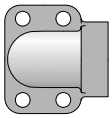
GEQ
Code 61, 62 / NPT

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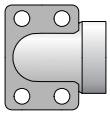
W6EQ
Code 61, 62 / Weld
Socket – Tube

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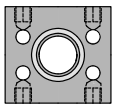
Tee

QPQPJQ
Code 61, 62 Junction Tee

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Stainless Steel Flanges

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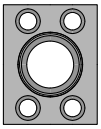
Code 61, 62 / SAE-ORB

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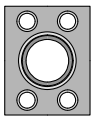
GQ
Code 61, 62 / NPT

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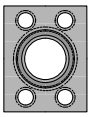
W5Q
Code 61, 62 / Weld
Socket – Pipe

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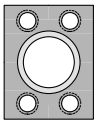
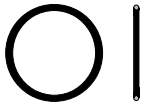
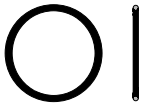
PQ
Code 61, 62 / Blank

K42

O-rings and Seals (Shown in Section M)

O-rings and Seals

ORFS O-ring

M4

SAE 4-Bolt Flange O-ring

M10

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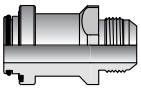
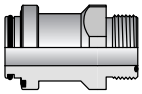
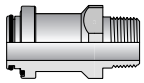
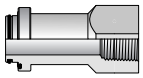
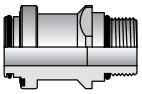
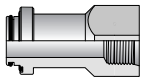
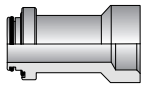
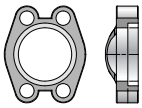
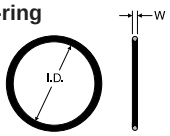
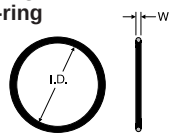
Dual Seal Flanges

37° Flare	**XHQ4O** 37° Flare  K43	**ORFS**	**LOHQ4O** ORFS  K43	**NPTF**	**FHQ4O** Male NPTF  K43
GHQ4O Female NPTF  K44	**SAE-ORB**	**F5OHQ4O** Male SAE-ORB  K44	**G5HQ4O** Female SAE-ORB  K44	**Socket Weld Pipe**	**W7HQ4O** Socket Weld Pipe  K45
Dual Seal Plug	**PQ4O** Dual Seal Plug  K45	**Q4 Insert**	**Q4 Insert** Flange Insert  K45		
Flange Clamps	**FCS** Flange Clamps – Split  K9	**FCC** Flange Clamp – Captive  K9			

O-rings and Seals (Shown in Section M)

O-rings and Seals	**Radial Seal O-ring**  M10	**Flange Seal O-ring**  M10

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Hydraulic Flanges and Components

The 4-bolt flange connections conforming to SAE J518 and ISO 6162-1 and -2 are proven, leak-free connections, especially suited for larger sizes, higher pressures and assembly in tight quarters. Threaded port connections such as SAE straight thread and ISO 6149 are reasonably easy to assemble and provide 6000 psi and higher pressure capability up to size 12 (M27). Beyond this size, the pressure rating starts to decrease and assembly torques increase rapidly.

The 4-bolt flange port connections provide the ability to connect larger sizes and achieve higher-pressures at reasonable assembly torque. Because of the lower assembly torque required compared to equivalent size threaded port, these connections are well suited for tight quarters where wrench clearance is limited.

Design and Construction

Parker's 4-bolt flange products are designed to provide different methods of connecting a tube, hose, pipe or another fitting to the SAE standard 4-bolt flange port.

Flange Fittings — All Parker flange fittings, except for those with square mounting hole patterns (nomenclature code QS), are designed to conform to O-ring groove, bolt holes and bolt pattern dimensions of either Code 61 or Code 62 of SAE J518 and ISO 6162-1 (Code 61) or -2 (Code 62).

The flange adapters (Code Q1 and Q2), and flange block fittings (Codes Q1B, Q2B and QSB) have O-ring grooves conforming to SAE J518 dimensions. The flange block fittings (Codes Q1B and Q2B) have through holes for the mounting bolts, again conforming to SAE J518. There is no industry standard for the bolt pattern of the square pattern block flanges with codes QSP and QSB.

The flange pad fittings (Codes Q1P, Q2P, and QSP) have a flat face (no O-ring groove) and the mounting holes are tapped. Where these fittings are used, the seal is in the mating part (flange adapter, flange hose fitting, flange block fitting, etc.) as shown in Fig. K1.

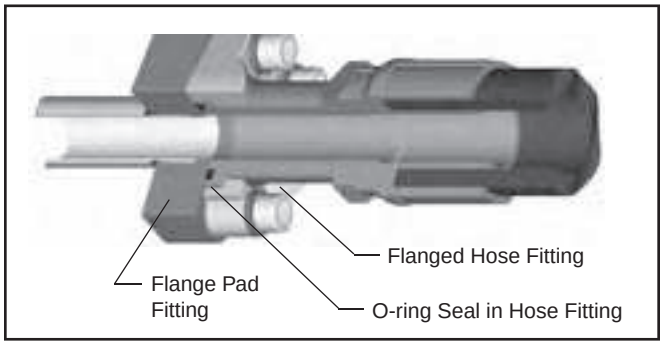

Fig. K1 – Flange Pad Fitting

Dimensions other than the O-ring groove, bolt holes, bolt pattern, and the flange foot print (for codes Q1B and Q2B only) are not governed by any industry standard. However, Parker's product design follows common industry practice and sound engineering.

Flange Clamps — Clamps are used for providing the holding power to the 4-bolt flange connection. They are offered in split and captive (one-piece) versions. The captive version is also offered with either drilled or tapped bolt holes which is used for connecting a tube to another tube or hose.

Parker flange clamps are forged for higher strength and durability and meet all requirements of SAE J518. The split clamps make it easy to assemble the connection in close quarters. They also make removal of the flange head component, such as a hose assembly, easy by loosening all four bolts and removing one clamp half, as shown in Fig. K2.

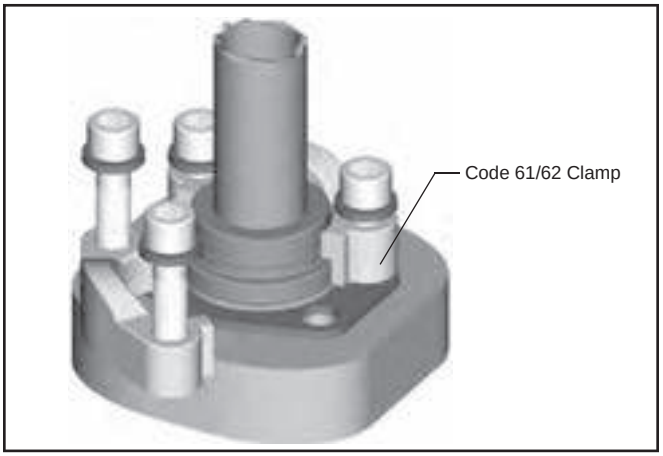

Fig. K2 – Assembly / Removal SAE J518 Connection

How Flange Connections Work

The connection's success is in its simplicity. It is a static face seal using a high durometer O-ring for the seal and clamps and bolts for holding power as shown in Fig. K3.

The (O-ring) seal is compressed between the bottom of the groove in the flange head and the flat surface of the port or flange pad, providing a reliable soft seal. The alternate seal plate has a high durometer bonded rubber seal on the inside edge, which compresses between the two flat surfaces, providing a soft seal with the same reliability. A metal-to-metal contact at the outer face of the flange with the port face keeps the seal from extruding under pressure. This metal-to-metal contact is maintained by the clamping force provided by tightening the bolts via the clamps.

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This simple design provides several advantages over threaded port connections, such as NPTF, SAE, BSPP, ISO 6149, etc., in larger sizes:

- Ability to connect up to 5 inch O.D tube (Code 61 only)
- Much lower tightening torque required for the four bolts compared to that required for equivalent size threaded port
- Less tightening torque means smaller wrenches and wrench swing clearances — providing ease of assembly in tight quarters
- Up to 6000 psi capability through 2” size (Code 62 only)
- Single seal point between tube/pipe/hose assembly and the port
- Ease of disassembly through the use of split clamps

This connection requires a larger area (foot print) on the component than an equivalent threaded port.

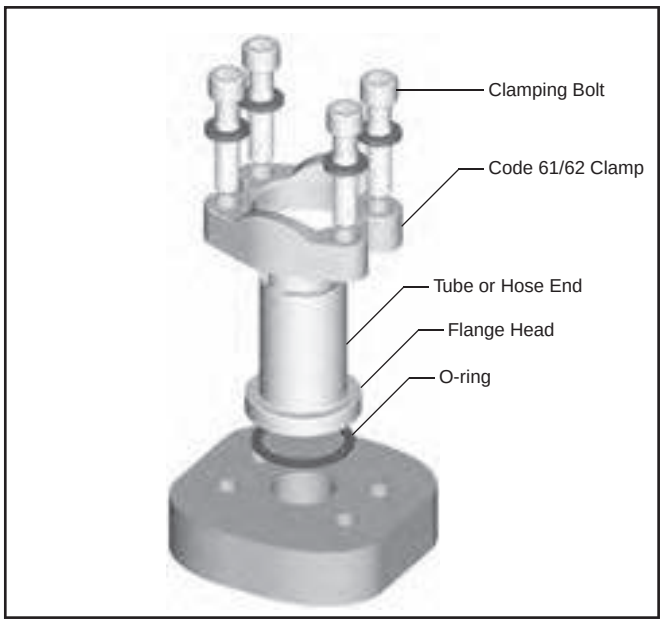

Fig. K3 – Four-Bolt Flange Connection (SAE J518)

Reference Locations:

Standard Material Specifications: Please refer to Table S34 located in the General Technical section.

Assembly and Installation: Please refer to Hydraulic Flanges Assembly located within the Assembly/Installation section of this catalog

Dynamic Pressure Ratings: Please refer to the last column of the part number tables located on the following pages of this section for the appropriate dynamic pressure ratings.

Feature	Advantage	Benefit
Conforms to SAE J518 and ISO 6162	Controls dimensions and tolerances of code 61 and 62 port connections	Insures interchangeability and consistency
Forged Construction	Reliable, long life performance	No downtime, reduced costs
	Compact envelope size, no sharp edges	Reduced weight
Over 60 Configurations	Flexibility in plumbing, match system needs	Best solution and best value
Parflange Technology	Designed to be used with Code 61/62 fittings	Eliminates messy and time consuming brazing process
Mounting Hardware	Grade 8 bolts standard	Performs in rigorous applications for the life of the flange
Flange Kits	Flange with hardware for mounting (O-ring, bolts and lockwashers)	Reduces order and assembly error

Dimensions and pressures for reference only, subject to change.

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Dual Seal Flange Adapters

Parker's Dual Seal Flange Adapter product line provides a solution for high vibration, high shock hydraulic four bolt connection styles used in various applications. This Parker innovation is offered as an alternative to traditional ISO 6162-2 (SAE J518) Code 62 Flange connections providing improved port retention, increased sealing capability and elimination of costly field replacement due to failure. Dual Seal Flange Adapters incorporate both radial and face seal technologies, reducing the potential for system leakage and ingression of air or water caused by side loading of traditional flange face seal connections.

Dual Seal Flange Adapters have a system working pressure rating of 7500 PSI with a 4:1 design factor. The face seal system incorporates Parker's Captive O-ring Groove technology to prevent O-ring fall out during installation, minimizing connection failures seen with traditional flange connections.

Design and Construction

The Dual Seal Flange adapter consists of three components: a body, a face sealing O-ring and a radial sealing O-ring. The body is manufactured from Heat Code Traceable 316 stainless steel and the O-rings are manufactured from 90 durometer Nitrile. Additional components used for assembly of the Dual Seal Flange adapters include four bolts, flange clamps and lock washers. Flange clamps are available from Parker Tube Fittings Division, with standard sizes listed on Page K9 of this catalog section.

The Dual Seal Flange Adapter Body

Dual Seal Flange Adapters bodies are manufactured in ½", 1" and 1 ½" sizes with ten different cold drawn tube, pipe or hose end configurations available as standard. Straight bodies are machined from 316/316L bar stock.

Dual Seal Flange Clamps

Flange clamps are offered in both split and captive (one-piece) versions depending on the adapter configuration being used. Flange clamps are machined from 316/316L materials. For all straight Dual Seal Flange Adapter bodies split flange clamp are required. The 90° and 45° cast shaped versions can be installed with either split or captive flange clamps.

Industry Acceptance

Dual Seal Flange Adapters are designed to conform to bolt thread and bolt pattern dimensions of ISO 6162-2 or SAE J518 Code 62.

Materials used to manufacture Parker Dual Seal Flange Adapters are compliant to NACE MR0175. All products are Heat Code Traceable and have been tested to SAE requirements.

How Dual Seal Flange Adapters Work

As shown below, Dual Seal Flange connections use both a radial seal and face seal to achieve a superior leak free port connection. The primary radial seal (A) improves the pressure capabilities of this adapter to 7500 PSI while offering additional system integrity. The face seal (B) provides resistance of external pressures introduced by the application environment. The flange clamps (C) and bolts (D) are used to compress the O-rings into the port and provide the clamping force necessary. Reference Fig. K4 below.

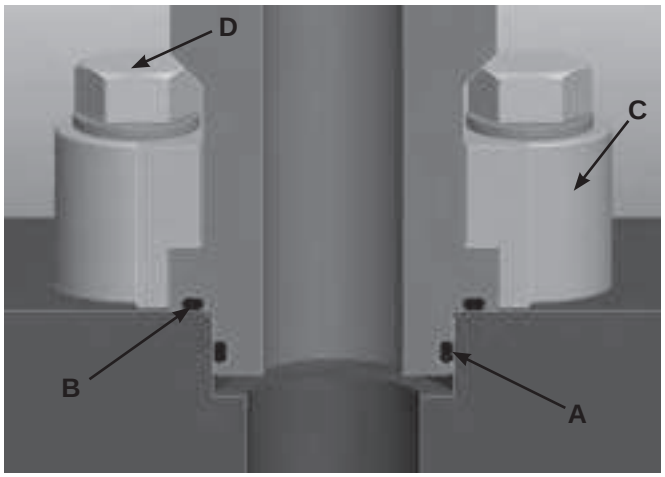

Fig. K4

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The Parker Advantage

Improved Pressure Rating: Parker's new Dual Seal design is rated for up to 7500 PSI to meet current and future hydraulic design needs. This design has also been tested to meet standard SAE J1644 parameters.

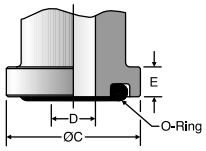
Captive O-ring Groove: The design of Parker's Dual Seal Flange Adapters incorporates a captive O-ring groove (CORG) which prevents O-ring fall out during installation further preventing the possibility of leaks.

Radial Seal: The primary radial seal (A) improves the pressure capabilities of the Dual Seal system to 7500 PSI while offering additional system integrity.

Ingression Seal: Reduces the potential for side loading and ultimately connection failure in high impulse and high vibration applications.

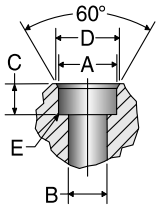
Multiple Standard Configurations: Parker's Dual Seal Flange Adapter product line includes a variety of tube, pipe, and hose connection styles to meet hydraulic system design needs. Included are Parker's Seal-Lok (SAE J1453), Triple-Lok (SAE J514), SAE ORB (SAE J1926) and NPTF for traditional hydraulic connections. In addition, to offer a solution for schedule pipe assemblies, Parker offers socket weld configurations.

Code 61 and Code 62 Port Ends



SIZE	Flange O.D. C (inch)	Drill D Max (inch)	Flange Height E (inch)
CODE 61			
8	1.19	0.50	0.265
12	1.50	0.75	0.265
16	1.75	1.00	0.315
20	2.00	1.25	0.315
24	2.38	1.50	0.315
32	2.81	2.00	0.375
CODE 62			
8	1.25	0.50	0.305
12	1.63	0.75	0.345
16	1.88	1.00	0.375
20	2.13	1.25	0.405
24	2.50	1.50	0.495
32	3.13	2.00	0.495

Port Ends for Dual Seal Flange Port



SIZE	A (in.)	B (in.)	C (in.)	D (CSK)	E (R)
8	0.750 - 0.752	0.500	0.400	.82 X 60°	0.02
16	1.375 - 1.377	0.938	0.400	1.445 X 60°	0.02
24	1.750 - 1.752	1.312	0.530	1.82 X 60°	0.02

Dimensions and pressures for reference only, subject to change.

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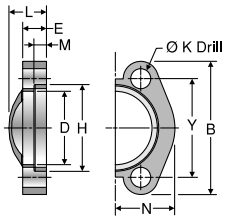
Code 61/62 Flange Clamps, Split

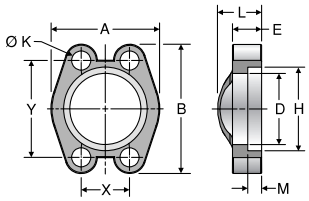


TUBE FITTING PART # FLANGE HALF	HOSE PRODUCTS PART # FLANGE HALF	HOSE PRODUCTS PART # KIT	FLANGE SIZE (in.)	B (in.)	D (in.)	E (in.)	H (in.)	K DRILL DIA. (in.)	L (in.)	M (in.)	N (in.)	Y (in.)	MOUNTING HARDWARE HHCS	Dynamic Pressure (x 1,000 PSI) -S	-SS
CODE 61 FLANGE CLAMPS, SPLIT															
8FCS1	**51H-8**	**5151HK-8**	0.50	2.12	0.955	0.50	1.22	0.344	0.75	0.245	0.86	1.50	5/16-18 x 1.25	5.0	5.0
12FCS1	**51H-12**	**5151HK-12**	0.75	2.56	1.265	0.56	1.53	0.406	0.88	0.245	0.98	1.88	3/8-16 x 1.25	5.0	5.0
16FCS1	**51H-16**	**5151HK-16**	1.00	2.75	1.515	0.62	1.78	0.406	0.94	0.295	1.11	2.06	3/8-16 x 1.25	5.0	5.0
20FCS1	**51H-20**	**5151HK-20**	1.25	3.12	1.720	0.56	2.03	0.469	0.88	0.295	1.39	2.31	7/16-14 x 1.50	4.0	4.0
24FCS1	**51H-24**	**5151HK-24**	1.50	3.69	2.000	0.62	2.41	0.531	1.00	0.295	1.58	2.75	1/2-13 x 1.50	3.0	3.0
32FCS1	**51H-32**	**5151HK-32**	2.00	4.00	2.470	0.62	2.84	0.531	1.03	0.355	1.86	3.06	1/2-13 x 1.50	3.0	3.0
40FCS1	**51H-40**	**5151HK-40**	2.50	4.50	2.950	0.75	3.34	0.531	1.50	0.355	2.09	3.50	1/2-13 x 1.75	2.5	2.5
48FCS1	**51H-48**	**5151HK-48**	3.00	5.31	3.580	0.88	4.03	0.656	1.62	0.355	2.53	4.19	5/8-11 x 1.75	2.0	2.0
56FCS1	**51H-56**	**5151HK-56**	3.50	6.00	4.030	0.88	4.53	0.656	1.12	0.422	2.70	4.75	5/8-11 x 1.75	0.5	0.5
64FCS1	**51H-64**	**5151HK-64**	4.00	6.38	4.530	1.00	5.03	0.656	1.38	0.422	2.95	5.13	5/8-11 x 2.00	0.5	0.5
CODE 62 FLANGE CLAMPS, SPLIT															
12FCS2	**HFH-12**	**HFHFHK-12**	0.75	2.81	1.280	0.75	1.66	0.406	1.12	0.325	1.14	2.00	3/8-16 x 1.50	6.0	6.0
16FCS2	**HFH-16**	**HFHFHK-16**	1.00	3.19	1.530	0.94	1.91	0.469	1.31	0.355	1.33	2.25	7/16-14 x 1.75	6.0	6.0
20FCS2	**HFH-20**	**HFHFHK-20**	1.25	3.75	1.750	1.06	2.16	0.531	1.50	0.385	1.48	2.63	1/2-13 x 1.75	6.0	6.0
24FCS2	**HFH-24**	**HFHFHK-24**	1.50	4.44	2.030	1.19	2.53	0.656	1.69	0.475	1.83	3.13	5/8-11 x 2.25	6.0	6.0
32FCS2	**HFH-32**	**HFHFHK-32**	2.00	5.25	2.660	1.44	3.16	0.781	2.06	0.475	2.20	3.81	3/4-10 x 2.75	6.0	6.0

To order a flange clamp split kit, insert a “K” after the material designator in the Tube Fitting part number. The Kit includes two flange clamp halves, 4 HHCS bolts, 4 lock washers and an O-ring.

FCC

Code 61/62 Flange Clamp, Captive



TUBE FITTING PART # DRILLED HOLES	TUBE FITTING PART # TAPPED HOLES	FLANGE SIZE (in.)	A (in.)	B (in.)	D (in.)	E (in.)	H (in.)	K DRILL DIA. (in.)	L (in.)	M (in.)	T TAP UN-2B	X (in.)	Y (in.)	MOUNTING HARDWARE HHCS	Dynamic Pressure (x 1,000 PSI) -SX	-SS
CODE 61 FLANGE CLAMP, CAPTIVE																
8FCC1	**8FCCT1**	0.50	1.81	2.125	0.955	0.50	1.219	0.344	0.75	0.245	5/16-18	0.688	1.500	5/16-18 x 1.25	5.0	
12FCC1	**12FCCT1**	0.75	2.06	2.560	1.265	0.56	1.531	0.406	0.88	0.245	3/8-16	0.875	1.875	3/8-16 x 1.25	5.0	
16FCC1	**16FCCT1**	1.00	2.31	2.750	1.515	0.62	1.781	0.406	0.94	0.295	3/8-16	1.031	2.062	3/8-16 x 1.25	5.0	
20FCC1	**20FCCT1**	1.25	2.88	3.125	1.720	0.56	2.031	0.469	0.88	0.295	7/16-14	1.188	2.312	7/16-14 x 1.50	4.0	
24FCC1	**24FCCT1**	1.50	3.25	3.690	2.000	0.62	2.406	0.531	1.00	0.295	1/2-13	1.406	2.750	1/2-13 x 1.50	3.0	
32FCC1	**32FCCT1**	2.00	3.81	4.000	2.470	0.62	2.844	0.531	1.03	0.355	1/2-13	1.688	3.062	1/2-13 x 1.50	3.0	
40FCC1	**40FCCT1**	2.50	4.28	4.500	2.950	0.75	3.344	0.531	1.50	0.355	1/2-13	2.000	3.500	1/2-13 x 1.75	2.5	
48FCC1	**48FCCT1**	3.00	5.16	5.315	3.580	0.88	4.031	0.656	1.62	0.355	5/8-11	2.438	4.188	5/8-11 x 1.75	2.0	
56FCC1	**56FCCT1**	3.50	5.50	6.000	4.030	0.88	4.531	0.656	1.12	0.422	5/8-11	2.750	4.750	5/8-11 x 1.75	0.5	
64FCC1	**64FCCT1**	4.00	6.00	6.375	4.530	1.00	5.031	0.656	1.38	0.422	5/8-11	3.062	5.125	5/8-11 x 2.00	0.5	
CODE 62 FLANGE CLAMP, CAPTIVE																
12FCC2	**12FCCT2**	0.75	2.38	2.810	1.280	0.75	1.656	0.406	1.12	0.325	3/8-16	0.938	2.000	3/8-16 x 1.50	6.0	
16FCC2	**16FCCT2**	1.00	2.75	3.190	1.530	0.94	1.906	0.469	1.31	0.355	7/16-14	1.093	2.250	7/16-14 x 1.75	6.0	
20FCC2	**20FCCT2**	1.25	3.06	3.750	1.750	1.06	2.156	0.531	1.50	0.385	1/2-13	1.250	2.625	1/2-13 x 1.75	6.0	
24FCC2	**24FCCT2**	1.50	3.75	4.440	2.030	1.19	2.531	0.656	1.69	0.475	5/8-11	1.437	3.125	5/8-11 x 2.25	6.0	
32FCC2	**32FCCT2**	2.00	4.50	5.250	2.660	1.44	3.156	0.781	2.06	0.475	3/4-10	1.750	3.812	3/4-10 x 2.75	6.0	

Dimensions and pressures for reference only, subject to change.

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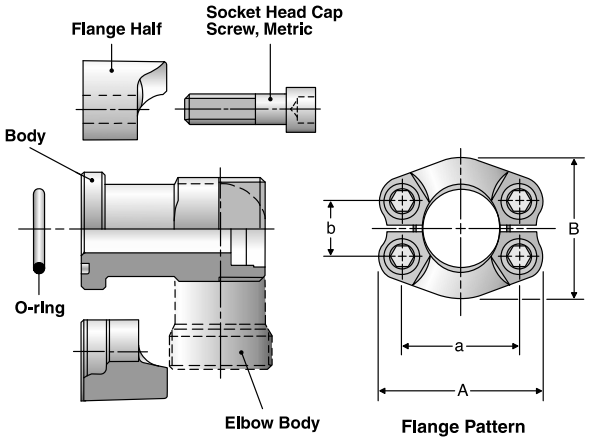
FHS3

Flange Components



Code 61

For Straights and Elbows
(ISO 6162-1, Type 1)

Size	For Tube O.D. Series	Working Pressure (bar)	SAE Flange Halves	4 Socket Head Cap Screws DIN 912-8.8	O-ring
1/2	15L	315	**FHS 32CFX**	M8X30	OR18.64 x 3.53X
1/2	16S	350			
3/4	18L	315	**FHS 33CFX**	M10X35	OR25.00 x 3.53X
3/4	22L	160			
3/4	20S	350			
3/4	25S	350			
1	28L	160	**FHS 34CFX**	M10X35	OR32.92 x 3.53X
1	30S	350			
1 1/4	35L	160	**FHS 35CFX**	M12X40*	OR37.70 x 3.53X
1 1/4	25S	280			
1 1/4	30S	280			
1 1/4	38S	280			
1 1/2	42L	160	**FHS 36CFX**	M12X40	OR47.22 x 3.53X
1 1/2	38S	210			

Size	For Tube O.D. Series	A ≈	B ≈	a	b
1/2	15L	54	46	38.1	17.5
1/2	16S	54	46	38.1	17.5
3/4	18L	65	52	47.6	22.2
3/4	22L	65	52	47.6	22.2
3/4	20S	65	52	47.6	22.2
3/4	25S	65	52	47.6	22.2
1	28L	70	59	52.4	26.2
1	30S	70	59	52.4	26.2
1 1/4	35L	79	73	58.7	30.2
1 1/4	25S	79	73	58.7	30.2
1 1/4	30S	79	73	58.7	30.2
1 1/4	38S	79	73	58.7	30.2
1 1/2	42L	94	83	69.9	35.7
1 1/2	38S	94	83	69.9	35.7

Tightening torques for socket head cap screws see Table R6.

* Does not meet ISO 6162 specification.

Note: Clamp halves are sold separately, not as a set.

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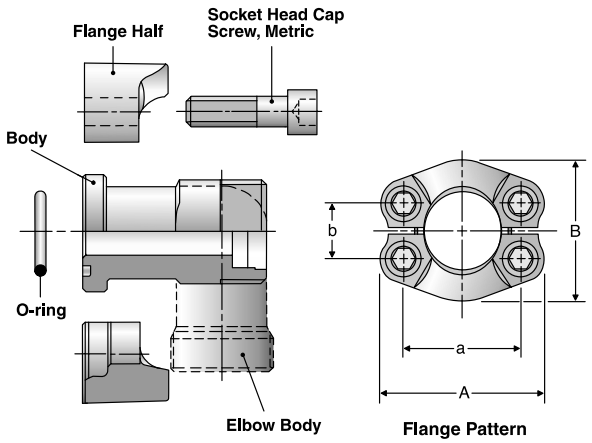
FHS6

Flange Components



Code 62

For Straights and Elbows
(ISO 6162-2, Type 1)

Size	For Tube O.D. Series	Working Pressure (bar)	SAE Flange Halves	4 Socket Head Cap Screws DIN 912-8.8	O-ring
1/2	16S	400	**FHS 62CFX**	M8X35	OR18.64 x 3.53X
3/4	16S	400	**FHS 63CFX**	M10X35	OR25.00 x 3.53X
3/4	20S	400	**FHS 63CFX**	M10X35	OR25.00 x 3.53X
3/4	25S	400	**FHS 63CFX**	M10X35	OR25.00 x 3.53X
1	25S	400	**FHS 64CFX**	M12X45	OR32.92 x 3.53X
1	30S	400	**FHS 64CFX**	M12X45	OR32.92 x 3.53X
1 1/4	30S	400	**FHS 65CFX**	M14X50*	OR37.70 x 3.53X
1 1/4	38S	315	**FHS 65CFX**	M14X50*	OR37.70 x 3.53X
1 1/2	38S	315	**FHS 66CFX**	M16X55	OR47.22 x 3.53X

Size	For Tube O.D. Series	A ≈	a	B ≈	b
1/2	16S	56	40.5	47	18.2
3/4	16S	71	50.8	60	23.8
3/4	20S	71	50.8	60	23.8
3/4	25S	71	50.8	60	23.8
1	25S	81	57.2	70	27.8
1	30S	81	57.2	70	27.8
1 1/4	30S	95	66.7	77	31.8
1 1/4	38S	95	66.7	77	31.8
1 1/2	38S	113	79.4	95	36.5

Tightening torques for socket head cap screws see Table R7.

* Does not meet ISO 6162 specification.

Note: Clamp halves are sold separately, not as a set.

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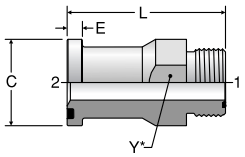
LOHQ1

Code 61 Flange Connector
Code 61 / ORFS



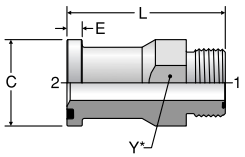
* Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 Code 61	C (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 LOHQ1	3/4	3/4	1.500	0.265	2.79	1 3/8	5.0
16 LOHQ1	1	1	1.750	0.315	2.81	1 5/8	5.0
20 LOHQ1	1 1/4	1 1/4	2.000	0.315	3.21	1 7/8	4.0
24 LOHQ1	1 1/2	1 1/2	2.375	0.315	3.29	2 1/8	3.0

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

LOHQ2

Code 62 Flange Connector
Code 62 / ORFS



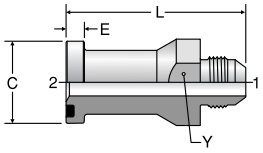
* Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 Code 62	C (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 LOHQ2	3/4	3/4	1.625	0.345	3.02	1 3/8	6.0
12-16 LOHQ2	3/4	1	1.875	0.375	3.34	1 5/8	6.0
16 LOHQ2	1	1	1.875	0.375	3.36	1 5/8	6.0
20 LOHQ2	1 1/4	1 1/4	2.125	0.405	3.48	1 7/8	6.0
24 LOHQ2	1 1/2	1 1/2	2.500	0.495	4.14	2 1/8	5.0

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

XHQ1

Code 61 Flange Connector
Code 61 / 37° Flare



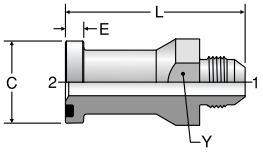
* Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 Code 61	C (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 XHQ1	3/4	3/4	1.500	0.265	2.77	1 3/8	5.0
16 XHQ1	1	1	1.750	0.315	2.91	1 5/8	5.0
20 XHQ1	1 1/4	1 1/4	2.000	0.315	3.36	1 7/8	4.0
24 XHQ1	1 1/2	1 1/2	2.375	0.315	3.57	2 1/8	3.0
32 XHQ1	2	2	2.812	0.375	4.04	2 5/8	2.0

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

XHQ2

Code 62 Flange Connector
Code 62 / 37° Flare



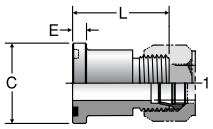
* Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 Code 62	C (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 XHQ2	3/4	3/4	1.625	0.345	3.08	1 3/8	5.0
16 XHQ2	1	1	1.875	0.375	3.43	1 5/8	5.0
20 XHQ2	1 1/4	1 1/4	2.125	0.405	3.60	1 7/8	4.0
24 XHQ2	1 1/2	1 1/2	2.500	0.495	4.34	2 1/8	3.0

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

BUHQ1

Code 61 Connector
Code 61 / Flareless



TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 Code 61	C (in.)	E (in.)	L (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 BUHQ1	3/4	3/4	1.500	0.265	1.82	
16 BUHQ1	1	1	1.750	0.315	1.88	
20 BUHQ1	1 1/4	1 1/4	2.000	0.315	1.82	
24 BUHQ1	1 1/2	1 1/2	2.375	0.315	1.94	
32 BUHQ1	2	2	2.812	0.375	1.97	

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

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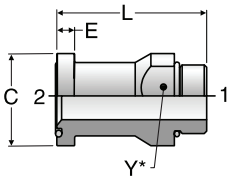
F5OHQ1

Code 61 Connector
Code 61 / SAE-ORB



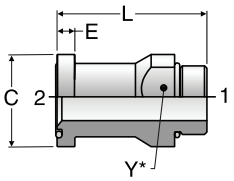
Y* - Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 Code 61	C (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 F5OHQ1	3/4	3/4	1.500	0.265	2.63	1 3/8	5.0
16 F5OHQ1	1	1	1.750	0.315	2.73	1 5/8	4.5
20 F5OHQ1	1 1/4	1 1/4	2.000	0.315	3.13	1 7/8	4.0
24 F5OHQ1	1 1/2	1 1/2	2.375	0.315	3.22	2 1/8	3.0
32 F5OHQ1	2	2	2.812	0.375	3.49	2 3/4	3.0

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

F5OHQ2

Code 62 Connector
Code 62 / SAE-ORB



Y* - Across Wrench Flats

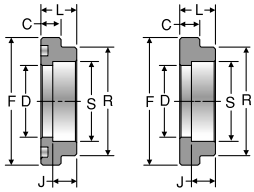
TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 Code 62	C (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 F5OHQ2	3/4	3/4	1.625	0.345	3.08	1 3/8	6.0
16 F5OHQ2	1	1	1.875	0.375	3.25	1 5/8	6.0
20 F5OHQ2	1 1/4	1 1/4	2.125	0.405	3.37	1 7/8	6.0
24 F5OHQ2	1 1/2	1 1/2	2.500	0.495	3.99	2 1/8	5.0
32 F5OHQ2	2	2	3.125	0.495	4.86	2 3/4	3.0

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

B3HQ

Braze Flange Head Connector, Tube
Tube Braze Socket* / Code 61/62 Flange Head

*** For clearance brazing**



O-ring Face Flat Face

TUBE FITTING PART # O-ring FACE	TUBE FITTING PART # FLAT FACE	FLANGE SIZE (in.)	TUBE O.D. (in.)	C (in.)	D (in.)	F (in.)	J (in.)	L (in.)	R (in.)	S (in.)	Dynamic Pressure (x 1,000 PSI) -SX	-SS
TUBE BRAZE SOCKET / CODE 61 FLANGE HEAD												
8B3HQ1	8B3HQ1N	0.50	1/2	0.265	0.406	1.188	0.312	0.50	0.940	0.502	5.0	
10-8B3HQ1	10-8B3HQ1N	0.50	5/8	0.265	0.500	1.188	0.312	0.50	0.940	0.625	5.0	
12B3HQ1	12B3HQ1N	0.75	3/4	0.265	0.656	1.500	0.375	0.56	1.250	0.752	4.5	
16-12B3HQ1	16-12B3HQ1N	0.75	1	0.315	0.750	1.500	0.375	0.56	1.250	1.002	4.5	
16B3HQ1	16B3HQ1N	1.00	1	0.315	0.906	1.750	0.375	0.56	1.500	1.002	4.5	
20-16B3HQ1	20-16B3HQ1N	1.00	1 1/4	0.315	1.000	1.750	0.375	0.56	1.500	1.252	4.0	
20B3HQ1	20B3HQ1N	1.25	1 1/4	0.315	1.125	2.000	0.375	0.56	1.700	1.252	3.5	
24-20B3HQ1	24-20B3HQ1N	1.25	1 1/2	0.315	1.250	2.000	0.375	0.56	1.700	1.502	3.5	
24B3HQ1	24B3HQ1N	1.50	1 1/2	0.315	1.375	2.380	0.438	0.62	1.980	1.502	3.0	
28-24B3HQ1	28-24B3HQ1N	1.50	1 3/4	0.315	1.500	2.380	0.438	0.62	1.980	1.752	2.7	
32B3HQ1	32B3HQ1N	2.00	2	0.375	1.875	2.810	0.500	0.62	2.450	2.002	3.0	
36-32B3HQ1	36-32B3HQ1N	2.00	2 1/4	0.375	2.000	2.810	0.500	0.62	2.450	2.252	3.0	
40B3HQ1	40B3HQ1N	2.50	2 1/2	0.375	2.375	3.312	0.562	0.68	2.921	2.502	2.2	
44-40B3HQ1	44-40B3HQ1N	2.50	2 3/4	0.375	2.500	3.312	0.500	0.68	2.921	2.752	2.2	
48B3HQ1	48B3HQ1N	3.00	3	0.375	2.875	4.000	0.562	0.75	3.546	3.002	1.7	
TUBE BRAZE SOCKET / CODE 62 FLANGE HEAD												
12B3HQ2	12B3HQ2N	0.75	3/4	0.345	0.656	1.625	0.500	0.69	1.250	0.752	6.0	
16-12B3HQ2	16-12B3HQ2N	0.75	1	0.345	0.750	1.625	0.500	0.69	1.250	1.002	6.0	
16B3HQ2	16B3HQ2N	1.00	1	0.375	0.810	1.875	0.625	0.81	1.500	1.002	6.0	
20-16B3HQ2	20-16B3HQ2N	1.00	1 1/4	0.375	1.000	1.875	0.625	0.81	1.500	1.252	6.0	
20B3HQ2	20B3HQ2N	1.25	1 1/4	0.405	1.010	2.125	0.812	1.00	1.718	1.252	6.0	
24-20B3HQ2	24-20B3HQ2N	1.25	1 1/2	0.405	1.250	2.125	0.812	1.00	1.718	1.502	5.5	
24B3HQ2	24B3HQ2N	1.50	1 1/2	0.495	1.250	2.500	1.000	1.19	2.000	1.502	6.0	
28-24B3HQ2	28-24B3HQ2N	1.50	1 3/4	0.495	1.500	2.500	1.000	1.19	2.000	1.752	4.5	
32B3HQ2	32B3HQ2N	2.00	2	0.495	1.750	3.125	1.375	1.50	2.620	2.002	5.5	
36-32B3HQ2	36-32B3HQ2N	2.00	2 1/4	0.495	2.000	3.125	1.312	1.50	2.620	2.252	4.0	

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

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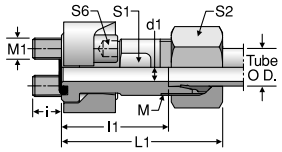
GFS

SAE Flange Connector – Standard Series
Code 61 & 62 / Metric Flareless



TUBE FITTING PART #	SIZE (in.)	TUBE O.D. (mm)	WORKING PRESSURE (bar)	M THREAD	d1 (mm)	i (mm)	l 1 (mm)	L1 ≈ (mm)	S1 (mm)	S2 (mm)	S6 (mm)	MATERIAL FROM STOCK CF	MATERIAL FROM STOCK 71	EO-2 FROM STOCK CF	EO-2 FROM STOCK 71
SAE FLANGE CONNECTIONS – CODE 61 – STANDARD SERIES															
GFS32/15LCF	1/2	15L	200	M22 x 1.5	12	11.5	41	56	24	27	6	•		•	
GFS32/16SCF	1/2	16S	220	M24 x 1.5	12	11.5	41.5	60	24	30	6	•		•	
GFS33/18LCF	3/4	18L	200	M26 x 1.5	15	15.5	45.5	62	30	32	8	•		•	
GFS33/22LCF	3/4	22L	100	M30 x 2	19	15.5	45.5	62	30	36	8	•		•	
GFS33/20SCF	3/4	20S	220	M30 x 2	16	15.5	46.5	68	30	36	8	•		•	
GFS33/25SCF	3/4	25S	220	M36 x 2	17	15.5	45	69	30	46	8	•		•	
GFS34/28LCF	1	28L	100	M36 x 2	24	13.5	46.5	63	36	41	8	•		•	
GFS34/30SCF	1	30S	220	M42 x 2	24	13.5	49.5	76	36	50	8	•		•	
GFS35/35LCF	1 1/4	35L	100	M45 x 2	30	18.5	47.5	69	41	50	8	•		•	
GFS35/25SCF	1 1/4	25S	175	M36 x 2	20	18.5	48	72	41	46	8	•		•	
GFS35/30SCF	1 1/4	30S	175	M42 x 2	25	18.5	48.5	75	41	50	8	•		•	
GFS35/38SCF	1 1/4	38S	175	M52 x 2	28	18.5	50	81	46	60	8	•		•	
GFS36/42LCF	1 1/2	42L	100	M52 x 2	36	18.5	53	76	46	60	10	•		•	
GFS36/38SCF	1 1/2	38S	130	M52 x 2	32	18.5	54	85	46	60	10	•		•	
SAE FLANGE CONNECTIONS – CODE 62 – HIGH PRESSURE SERIES															
GFS62/16SCF	1/2	16S	250	M24 x 1.5	12	13.5	44.5	63	24	30	6	•		•	
GFS63/16SCF	3/4	16S	250	M24 x 1.5	12	15.5	50.5	69	30	30	8	•		•	
GFS63/20SCF	3/4	20S	250	M30 x 2	16	15.5	50.5	72	30	36	8	•		•	
GFS63/25SCF	3/4	25S	250	M36 x 2	17	15.5	51	75	30	46	8	•		•	
GFS64/25SCF	1	25S	250	M36 x 2	20	20.5	60	84	36	46	10	•		•	
GFS64/30SCF	1	30S	250	M42 x 2	24	20.5	60.5	87	36	50	10	•		•	
GFS65/30SCF	1 1/4	30S	250	M42 x 2	25	22.5	65.5	92	41	50	10	•		•	
GFS65/38SCF	1 1/4	38S	200	M52 x 2	30	22.5	67	98	46	60	10	•		•	
GFS66/38SCF	1 1/2	38S	200	M52 x 2	30	24.5	73	104	46	60	14	•		•	

EO-2 Part Number example: GFS33/18ZLCF

Tightening torques for socket head cap screws see Tables R6 and R7.

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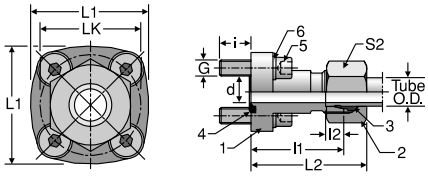
BFG

DIN Flange / Metric Flareless

Tube connection according to DIN 2353



TUBE FITTING PART #	WORKING PRESSURE (bar)	TUBE O.D. (mm)	d (mm)	G	i (mm)	l 1 (mm)	l 2 (mm)	L1 (mm)	L2 (mm)	LK (mm)	S2 (mm)	MATERIAL FROM STOCK		EO-2 FROM STOCK	
												CF	71	CF	71
BFG15L/LK40CF	65	15	12	M 6	12.5	35	7	42	43	40	27	•		•	
BFG18L/LK40CF	65	18	15	M 6	12.5	35	7.5	42	44	40	32	•		•	
BFG22L/LK40CF	65	22	19	M 6	12.5	35	7.5	42	44.5	40	36	•		•	
BFG15L/LK35CF	155	15	12	M 6	12.5	30	7	39	38	35	27	•		•	
BFG10L/LK35CF	200	10	8	M 6	12.5	30	7	39	39	35	19	•		•	
BFG12L/LK35CF	200	12	10	M 6	12.5	30	7	39	39	35	22	•		•	

Unassembled BFG Fitting Components

1 Straight Body	2 Nut	3 Progressive Ring	4 O-ring	5 Cap Screws DIN 912-8.8 (4 pcs.)	6 Spring Washer DIN 127 (4 pcs.)
BFG15L/LK40CFX	M15LCFX	DPR15LCFX	OR26X2.5X	M6X22	A6
BFG15L/LK40CFX	M18LCFX	DPR18LCFX	OR26X2.5X	M6X22	A6
BFG22L/LK40CFX	M22LCFX	DPR22LCFX	OR26X2.5X	M6X22	A6
BFG15L/LK35CFX	M15LCFX	DPR15LCFX	OR20X2.5X	M6X22	A6
BFG10L/LK35CFX	M10LCFX	DPR10LCFX	OR20X2.5X	M6X22	A6
BFG12L/LK35CFX	M12LCFX	DPR12LCFX	OR20X2.5X	M6X22	A6

EO-2 Part Number example: BFG15ZL/LK40CF

Tightening torques for socket head cap screws see Table R6.

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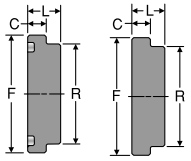
P

Flange Head Plug
Code 61/62 Flange Head Plug



O-ring Face Flat Face

TUBE FITTING PART #		FLANGE SIZE	C	F	L	R	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	-SX	-SS
CODE 61 FLANGE HEAD PLUG								
8PQ1	**8PQ1N**	0.50	0.265	1.188	0.500	0.940	5.0	
12PQ1	**12PQ1N**	0.75	0.265	1.500	0.560	1.250	5.0	
16PQ1	**16PQ1N**	1.00	0.315	1.750	0.560	1.500	5.0	
20PQ1	**20PQ1N**	1.25	0.315	2.000	0.560	1.700	4.0	
24PQ1	**24PQ1N**	1.50	0.315	2.380	0.620	1.980	3.0	
32PQ1	**32PQ1N**	2.00	0.375	2.810	0.620	2.450	3.0	
40PQ1	**40PQ1N**	2.50	0.375	3.312	0.680	2.921	2.5	
48PQ1	**48PQ1N**	3.00	0.375	4.000	0.750	3.546	2.0	
CODE 62 FLANGE HEAD PLUG								
12PQ2	**12PQ2N**	0.75	0.345	1.625	0.687	1.250	6.0	
16PQ2	**16PQ2N**	1.00	0.375	1.875	0.812	1.500	6.0	
20PQ2	**20PQ2N**	1.25	0.405	2.125	1.000	1.718	6.0	
24PQ2	**24PQ2N**	1.50	0.495	2.500	1.187	2.000	6.0	
32PQ2	**32PQ2N**	2.00	0.495	3.125	1.500	2.625	6.0	

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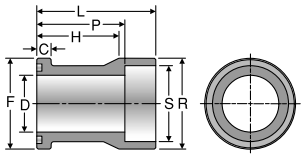
W7HQ

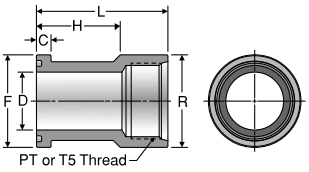
Weld Socket Flange Connector, Pipe
Extended Weld Socket, Pipe / Code 61 or 62 Flange Head



TUBE FITTING PART #	PIPE SIZE (in.)	FLANGE SIZE (in.)	C (in.)	D (in.)	F (in.)	H (in.)	L (in.)	P (in.)	R (in.)	S (in.)	Dynamic Pressure (x 1,000 PSI) SX	SS
EXTENDED WELD SOCKET, PIPE / CODE 61 FLANGE HEAD												
12W7HQ1	3/4	0.75	0.265	0.750	1.500	1.62	2.34	1.78	1.500	1.062	3.5	
16W7HQ1	1	1.00	0.315	1.000	1.750	1.62	2.38	1.75	1.750	1.328	3.5	
20W7HQ1	1 1/4	1.25	0.315	1.250	2.000	1.81	2.62	1.94	2.000	1.672	3.5	
24W7HQ1	1 1/2	1.50	0.315	1.500	2.375	2.00	2.88	2.12	2.375	1.922	2.7	
32W7HQ1	2	2.00	0.375	2.000	2.812	2.00	3.00	2.12	2.812	2.406	2.5	
EXTENDED WELD SOCKET, PIPE / CODE 62 FLANGE HEAD												
16W7HQ2	1	1.00	0.375	1.000	1.875	2.34	3.06	2.43	2.000	1.328	5.5	
20W7HQ2	1 1/4	1.25	0.405	1.125	2.125	2.50	3.31	2.62	2.312	1.672	5.5	
24W7HQ2	1 1/2	1.50	0.495	1.375	2.500	3.06	3.93	3.18	2.750	1.922	5.5	
32W7HQ2	2	2.00	0.495	1.875	3.125	3.18	4.06	3.18	3.250	2.406	5.0	

GHQ / G5HQ

Threaded Port Flange Adapter
NPTF or SAE Port / Code 61 Flange Head



GHQ

TUBE FITTING PART #	PT PORT THREAD NPTF	FLANGE SIZE (in.)	C (in.)	D (in.)	F (in.)	H (in.)	L (in.)	R (in.)	Dynamic Pressure (x 1,000 PSI) -SX	-SS
NPTF PORT / CODE 61 FLANGE HEAD										
12GHQ1	3/4-14	0.75	0.265	0.75	1.500	1.62	2.47	1.50	4.0	
16GHQ1	1-11 1/2	1.00	0.315	1.00	1.750	1.62	2.66	1.75	4.0	
20GHQ1	1 1/4-11 1/2	1.25	0.315	1.25	2.000	1.81	2.84	2.00	3.0	
24GHQ1	1 1/2-11 1/2	1.50	0.315	1.50	2.375	2.00	3.00	2.38	2.0	
32GHQ1	2-11 1/2	2.00	0.375	2.00	2.812	2.00	3.00	2.81	2.0	

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

G5HQ

TUBE FITTING PART #	T5 PORT THREAD UN-2B	SAE PORT DASH SIZE	FLANGE SIZE (in.)	C (in.)	D (in.)	F (in.)	H (in.)	L (in.)	R (in.)	Dynamic Pressure (x 1,000 PSI) -SX	-SS
SAE PORT / CODE 61 FLANGE HEAD											
12G5HQ1	1 1/6-12	12	0.75	0.265	0.75	1.500	1.62	2.47	1.50	4.0	
16G5HQ1	1 5/16-12	15	1.00	0.315	1.00	1.750	1.62	2.66	1.75	3.0	
20G5HQ1	1 5/8-12	20	1.25	0.315	1.25	2.000	1.81	2.84	2.00	2.2	
24G5HQ1	1 7/8-12	24	1.50	0.315	1.50	2.375	2.00	3.00	2.38	2.5	
32G5HQ1	2 1/2-12	32	2.00	0.375	2.00	2.812	2.00	3.00	2.81	1.2	

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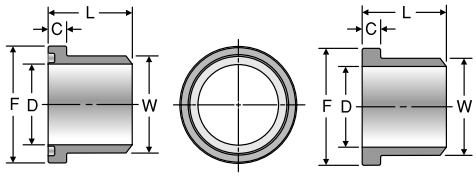
WB1HQ1 / WB3HQ1 / WB5HQ1

Code 61 Weld Butt Flange
Connector, Pipe
Schedule 40, 80 or 160 Weld Butt /
Code 61 Flange Head



O-ring Face Flat Face

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WELD BUTT FLANGE CONNECTION TYPE	TUBE FITTING PART #		PIPE SIZE	FLANGE SIZE	C	D	F	L	W	Dynamic Pressure (x 1,000 PSI)	
	O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	-SX	-SS
SCHEDULE 40 WELD BUTT / CODE 61 FLANGE HEAD											
WB1HQ1 For Schedule 40 pipe	8WB1HQ1	8WB1HQ1N	1/2	0.50	0.265	0.622	1.188	1.06	0.840	5.3	
	12WB1HQ1	12WB1HQ1N	3/4	0.75	0.265	0.824	1.500	1.06	1.050	4.6	
	16WB1HQ1	16WB1HQ1N	1	1.00	0.315	1.049	1.750	1.25	1.315	4.0	
	20WB1HQ1	20WB1HQ1N	1 1/4	1.25	0.315	1.380	2.000	1.44	1.660	3.6	
	24WB1HQ1	24WB1HQ1N	1 1/2	1.50	0.315	1.610	2.375	1.75	1.900	3.0	
	32WB1HQ1	32WB1HQ1N	2	2.00	0.375	2.067	2.812	2.00	2.375	2.6	
	40WB1HQ1	40WB1HQ1N	2 1/2	2.50	0.375	2.469	3.312	2.31	2.875	2.6	
	48WB1HQ1	48WB1HQ1N	3	3.00	0.375	3.068	4.000	2.32	3.500	2.3	
SCHEDULE 80 WELD BUTT / CODE 61 FLANGE HEAD											
WB3HQ1 For Schedule 80 pipe	8WB3HQ1	8WB3HQ1N	1/2	0.50	0.265	0.548	1.188	1.06	0.840	5.0	
	12WB3HQ1	12WB3HQ1N	3/4	0.75	0.265	0.744	1.500	1.06	1.050	3.5	
	16WB3HQ1	16WB3HQ1N	1	1.00	0.315	0.959	1.750	1.25	1.315	4.0	
	20WB3HQ1	20WB3HQ1N	1 1/4	1.25	0.315	1.280	2.000	1.44	1.660	3.5	
	24WB3HQ1	24WB3HQ1N	1 1/2	1.50	0.315	1.502	2.375	1.75	1.900	3.0	
	32WB3HQ1	32WB3HQ1N	2	2.00	0.375	1.941	2.812	2.00	2.375	3.0	
	40WB3HQ1	40WB3HQ1N	2 1/2	2.50	0.375	2.325	3.312	2.31	2.875	2.7	
	48WB3HQ1	48WB3HQ1N	3	3.00	0.375	2.902	4.000	2.32	3.500	2.2	
SCHEDULE 160 WELD BUTT / CODE 61 FLANGE HEAD											
WB5HQ1 For Schedule 160 pipe	8WB5HQ1	8WB5HQ1N	1/2	0.50	0.265	0.464	1.188	1.06	0.840	5.0	
	12WB5HQ1	12WB5HQ1N	3/4	0.75	0.265	0.612	1.500	1.06	1.050	4.0	
	16WB5HQ1	16WB5HQ1N	1	1.00	0.315	0.815	1.750	1.25	1.315	4.5	
	20WB5HQ1	20WB5HQ1N	1 1/4	1.25	0.315	1.160	2.000	1.44	1.660	4.0	
	24WB5HQ1	24WB5HQ1N	1 1/2	1.50	0.315	1.338	2.375	1.75	1.900	3.0	
	32WB5HQ1	32WB5HQ1N	2	2.00	0.375	1.687	2.812	2.00	2.375	3.0	
	40WB5HQ1	40WB5HQ1N	2 1/2	2.50	0.375	2.125	3.312	2.31	2.875	2.5	
	48WB5HQ1	48WB5HQ1N	3	3.00	0.375	2.624	4.000	2.32	3.500	2.0	

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WB3HQ2 / WB5HQ2 / WB7HQ2

Code 62 Weld Butt Flange
Connector, Pipe
Schedule 80, 160 or
XXS Weld Butt / Code 62
Flange Head

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WELD BUTT FLANGE CONNECTION TYPE	TUBE FITTING PART #		PIPE SIZE	FLANGE SIZE	C	D	F	L	W	Dynamic Pressure (x 1,000 PSI)	
	O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	-SX	-SS
SCHEDULE 80 WELD BUTT / CODE 62 FLANGE HEAD											
WB3HQ2 For Schedule 80 pipe	**12WB3HQ2**	**12WB3HQ2N**	**3/4**	0.75	0.345	0.742	1.625	1.42	1.050	5.0	
	16WB3HQ2	**16WB3HQ2N**	**1**	1.00	0.375	0.957	1.875	1.61	1.315	4.5	
	20WB3HQ2	**20WB3HQ2N**	**1 1/4**	1.25	0.405	1.278	2.125	1.73	1.660	3.5	
	24WB3HQ2	**24WB3HQ2N**	**1 1/2**	1.50	0.495	1.500	2.500	2.17	1.900	3.0	
	32WB3HQ2	**32WB3HQ2N**	**2**	2.00	0.495	1.939	3.125	2.48	2.375	3.0	
SCHEDULE 160 WELD BUTT / CODE 62 FLANGE HEAD											
WB5HQ2 For Schedule 160 pipe	**12WB5HQ2**	**12WB5HQ2N**	**3/4**	0.75	0.345	0.614	1.625	1.42	1.050	6.0	
	16WB5HQ2	**16WB5HQ2N**	**1**	1.00	0.375	0.815	1.875	1.61	1.315	5.5	
	20WB5HQ2	**20WB5HQ2N**	**1 1/4**	1.25	0.405	1.160	2.125	1.73	1.660	5.0	
	24WB5HQ2	**24WB5HQ2N**	**1 1/2**	1.50	0.495	1.337	2.500	2.17	1.900	5.0	
	32WB5HQ2	**32WB5HQ2N**	**2**	2.00	0.495	1.689	3.125	2.48	2.375	4.5	
SCHEDULE XXS WELD BUTT / CODE 62 FLANGE HEAD											
WB7HQ2 For Schedule XXS pipe	**12WB7HQ2**	**12WB7HQ2N**	**3/4**	0.75	0.345	0.434	1.625	1.42	1.050	6.0	
	16WB7HQ2	**16WB7HQ2N**	**1**	1.00	0.375	0.599	1.875	1.61	1.315	6.0	
	20WB7HQ2	**20WB7HQ2N**	**1 1/4**	1.25	0.405	0.896	2.125	1.73	1.660	6.0	
	24WB7HQ2	**24WB7HQ2N**	**1 1/2**	1.50	0.495	1.100	2.500	2.17	1.900	6.0	
	32WB7HQ2	**32WB7HQ2N**	**2**	2.00	0.495	1.503	3.125	2.48	2.375	6.0	

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

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Columbus, Ohio
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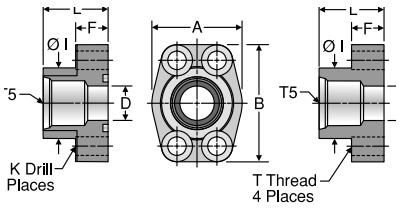
G5Q

SAE Port Block Adapter
SAE Port / Code 61 or 62 Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		SAE PORT DASH SIZE	T5 STRAIGHT THREAD UN-2B	FLANGE SIZE (in.)	A (in.)	B (in.)	D (in.)	F (in.)	I (in.)	K DRILL DIA. (in.)	L (in.)	T THREAD UNC-2B	MOUNTING HARDWARE -SHCS	Dynamic Pressure (x 1,000 PSI) -SX	-SS[1]
O-ring FACE	FLAT FACE														
SAE PORT / CODE 61 BLOCK FLANGE OR PAD															
8G5Q1B	**8G5Q1P**	8	3/4-16	0.50	1.81	2.13	0.50	0.63	1.25	0.344	1.42	5/16-18	5/16-18 x 1.25	5.0	
12G5Q1B	**12G5Q1P**	12	1 1/16-12	0.75	1.97	2.56	0.75	0.71	1.54	0.406	1.42	3/8-16	3/8-16 x 1.50	4.0	
16G5Q1B	**16G5Q1P**	16	1 5/16-12	1.00	2.17	2.75	1.00	0.71	1.81	0.406	1.50	3/8-16	3/8-16 x 1.50	3.5	
20G5Q1B	**20G5Q1P**	20	1 5/8-12	1.25	2.68	3.12	1.25	0.83	2.22	0.469	1.61	7/16-14	7/16-14 x 1.75	3.0	
24G5Q1B	**24G5Q1P**	24	1 7/8-12	1.50	3.07	3.66	1.50	0.98	2.50	0.531	1.77	1/2-13	1/2-13 x 1.75	2.5	
SAE PORT / CODE 62 BLOCK FLANGE OR PAD															
8G5Q2B	**8G5Q2P**	8	3/4-16	0.50	1.81	2.21	0.50	0.63	1.33	0.344	1.42	5/16-18	5/16-18 x 1.25	6.0	
12G5Q2B	**12G5Q2P**	12	1 1/16-12	0.75	2.17	2.80	0.75	0.83	1.65	0.406	1.38	3/8-16	3/8-16 x 1.50	5.5	
16G5Q2B	**16G5Q2P**	16	1 5/16-12	1.00	2.56	3.19	1.00	0.98	1.98	0.409	1.65	7/16-14	7/16-14 x 1.75	4.5	
20G5Q2B	**20G5Q2P**	20	1 5/8-12	1.25	3.07	3.75	1.25	1.06	2.36	0.531	1.77	1/2-13	1/2-13 x 1.75	3.0	
24G5Q2B	**24G5Q2P**	24	1 7/8-12	1.50	3.70	4.41	1.50	1.18	2.68	0.656	1.97	5/8-11	5/8-11 x 2.25	2.7	
32G5Q2B	**32G5Q2P**	32	2 1/2-12	2.00	4.50	5.28	2.00	1.46	3.38	0.781	2.56	3/4-10	3/4-10 x 2.75	2.0	

1) See page K40 for standard stainless steel sizes and dimensions.

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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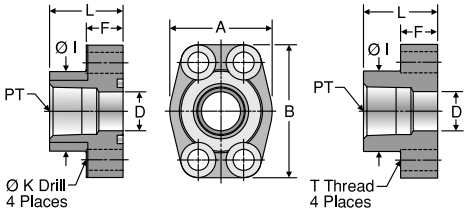
GQ

NPTF Port Block Adapter
NPTF Port / Code 61 or 62 Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		PT PORT THREAD	FLANGE SIZE	A	B	D	F	I	K DRILL DIA.	L	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	NPTF	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS[1]
NPTF PORT / CODE 61 BLOCK FLANGE OR PAD														
8GQ1B	**8GQ1P**	1/2 - 14	0.50	1.81	2.13	0.50	0.63	1.25	0.344	1.42	5/16-18	5/16-18 x 1.25	5.0	
12GQ1B	**12GQ1P**	3/4 -14	0.75	1.97	2.56	0.75	0.71	1.54	0.406	1.42	3/8-16	3/8-16 x 1.50	4.5	
16GQ1B	**16GQ1P**	1 - 11 1/2	1.00	2.17	2.75	1.00	0.71	1.81	0.406	1.50	3/8-16	3/8-16 x 1.50	4.0	
20GQ1B	**20GQ1P**	1 1/4 - 11 1/2	1.25	2.68	3.12	1.25	0.83	2.22	0.469	1.61	7/16-14	7/16-14 x 1.75	3.5	
24GQ1B	**24GQ1P**	1 1/2 - 11 1/2	1.50	3.07	3.66	1.50	0.98	2.50	0.531	1.77	1/2-13	1/2-13 x 1.75	2.7	
32GQ1B	**32GQ1P**	2 - 11 1/2	2.00	3.54	4.00	2.00	0.98	3.12	0.531	1.77	1/2-13	1/2-13 x 1.75	2.2	
40GQ1B	**40GQ1P**	2 1/2 - 8	2.50	4.09	4.49	2.50	0.98	3.62	0.531	1.97	1/2-13	1/2-13 x 1.75	2.0	
48GQ1B	**48GQ1P**	3 1/2 - 8	3.00	4.88	5.28	3.00	1.06	4.47	0.656	1.97	5/8-11	5/8-11 x 2.00	1.1	
NPTF PORT / CODE 62 BLOCK FLANGE OR PAD														
8GQ2B	**8GQ2P**	1/2 - 14	0.50	1.81	2.21	0.50	0.63	1.33	0.344	1.42	5/16-18	5/16-18 x 1.25	6.0	
12GQ2B	**12GQ2P**	3/4 - 14	0.75	2.17	2.80	0.75	0.83	1.65	0.406	1.38	3/8-16	3/8-16 x 1.50	5.0	
16GQ2B	**16GQ2P**	1 - 11 1/2	1.00	2.56	3.19	1.00	0.98	1.98	0.469	1.65	7/16-14	7/16-14 x 1.75	4.0	
20GQ2B	**20Q2P**	1 1/4 - 11 1/2	1.25	3.07	3.75	1.25	1.06	2.36	0.531	1.77	1/2-13	1/2-13 x 1.75	3.5	
24GQ2B	**24GQ2P**	1 1/2 - 11 1/2	1.50	3.70	4.41	1.50	1.18	2.68	0.656	1.97	5/8-11	5/8-11 x 2.25	3.0	
32GQ2B	**32GQ2P**	2 - 11 1/2	2.00	4.50	5.28	2.00	1.46	3.38	0.781	2.56	3/4-10	3/4-10 x 2.75	2.5	

1) See page K40 for standard stainless steel sizes and dimensions.

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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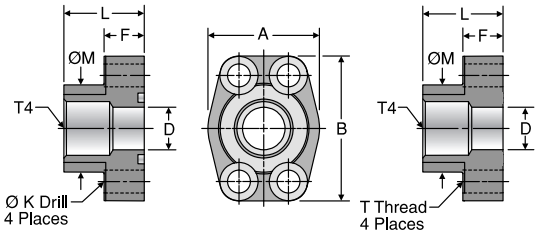
G4Q

BSPP Port Block Adapter
BSPP Port / Code 61 or 62
Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		T4 THREAD	FLANGE SIZE	A	B	D	F	K DRILL DIA.	L	M	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	BSPP	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	SX	SS
BSPP PORT / CODE 61 BLOCK FLANGE OR PAD														
8G4Q1B	**8G4Q1P**	1/2-14	0.50	1.81	2.13	0.502	0.63	0.344	1.42	1.25	5/16-18	5/16-18 x 1.25	5.0	
12G4Q1B	**12G4Q1P**	3/4-14	0.75	1.97	2.56	0.752	0.71	0.406	1.42	1.54	3/8-16	3/8-16 x 1.50	4.0	
16G4Q1B	**16G4Q1P**	1-11	1.00	2.17	2.75	1.002	0.71	0.406	1.50	1.81	3/8-16	3/8-16 x 1.50	3.0	
20G4Q1B	**20G4Q1P**	1 1/4-11	1.25	2.68	3.12	1.252	0.83	0.469	1.61	2.22	7/16-14	7/16-14 x 1.75	2.5	
24G4Q1B	**24G4Q1P**	1 1/2-11	1.50	3.07	3.66	1.502	0.98	0.531	1.77	2.50	1/2-13	1/2-13 x 1.75	2.2	
32G4Q1B	**32G4Q1P**	2-11	2.00	3.54	4.00	2.002	0.98	0.531	1.77	3.12	1/2-13	1/2-13 x 1.75	1.7	
BSPP PORT / CODE 62 BLOCK FLANGE OR PAD														
8G4Q2B	**8G4Q2P**	1/2-14	0.50	1.81	2.21	0.502	0.63	0.344	1.42	1.33	5/16-18	5/16-18 x 1.25	6.0	
12G4Q2B	**12G4Q2P**	3/4-14	0.75	2.17	2.80	0.752	0.83	0.406	1.38	1.65	3/8-16	3/8-16 x 1.50	5.0	
16G4Q2B	**16G4Q2P**	1-11	1.00	2.56	3.19	1.002	0.98	0.492	1.65	1.98	7/16-14	7/16-14 x 1.75	4.0	
20G4Q2B	**20G4Q2P**	1 1/4-11	1.25	3.07	3.75	1.252	1.06	0.531	1.77	2.36	1/2-13	1/2-13 x 1.75	3.0	
24G4Q2B	**24G4Q2P**	1 1/2-11	1.50	3.70	4.41	1.502	1.18	0.656	1.97	2.68	5/8-11	5/8-11 x 2.25	2.5	
32G4Q2B	**32G4Q2P**	2-11	2.00	4.50	5.28	2.002	1.46	0.781	2.56	3.35	3/4-10	3/4-10 x 2.75	2.0	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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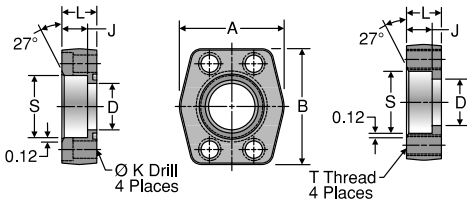
W5Q

Flat Weld Socket Block Connector, Pipe
Flat Weld Socket, Pipe / Code 61 or 62
Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		PIPE SIZE	FLANGE SIZE	A	B	D	J	K DRILL DIA.	L	S	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS[1]
FLAT WELD SOCKET, PIPE / CODE 61 BLOCK FLANGE OR PAD														
8W5Q1B	**8W5Q1P**	1/2	0.50	1.813	2.125	0.502	0.560	0.344	0.750	0.855	5/16-18	5/16-18 x 1.50	5.0	
12W5Q1B	**12W5Q1P**	3/4	0.75	2.063	2.563	0.752	0.560	0.406	0.750	1.062	3/8-16	3/8-16 x 1.50	5.0	
16W5Q1B	**16W5Q1P**	1	1.00	2.313	2.750	1.002	0.630	0.406	0.880	1.328	3/8-16	3/8-16 x 1.75	5.0	
20W5Q1B	**20W5Q1P**	1 1/4	1.25	2.875	3.125	1.252	0.690	0.469	0.940	1.672	7/16-14	7/16-14 x 1.75	4.0	
24W5Q1B	**24W5Q1P**	1 1/2	1.50	3.250	3.688	1.502	0.750	0.531	1.190	1.922	1/2-13	1/2-13 x 2.25	3.0	
32W5Q1B	**32W5Q1P**	2	2.00	3.813	4.000	2.002	0.875	0.531	1.380	2.406	1/2-13	1/2-13 x 2.50	3.0	
40W5Q1B	**40W5Q1P**	2 1/2	2.50	4.281	4.500	2.502	1.000	0.531	1.750	2.906	1/2-13	1/2-13 x 2.75	2.5	
48W5Q1B	**48W5Q1P**	3	3.00	5.156	5.313	3.000	1.250	0.656	2.120	3.547	5/8-11	5/8-11 x 3.50	2.0	
56W5Q1B	**56W5Q1P**	3 1/2	3.50	5.500	6.000	3.500	1.190	0.656	1.440	4.047	5/8-11	5/8-11 x 2.75	0.5	
64W5Q1B	**64W5Q1P**	4	4.00	6.000	6.380	4.000	1.250	0.656	1.500	4.578	5/8-11	5/8-11 x 2.75	0.5	
80W5Q1B	**80W5Q1P**	5	5.00	7.120	7.250	4.500	1.380	0.656	1.750	5.641	5/8-11	5/8-11 x 3.00	0.5	
FLAT WELD SOCKET, PIPE / CODE 62 BLOCK FLANGE OR PAD														
8W5Q2B	**8W5Q2P**	1/2	0.50	1.940	2.300	0.502	0.560	0.344	1.250	0.855	5/16-18	5/16-18 x 2.00	6.0	
12W5Q2B	**12W5Q2P**	3/4	0.75	2.500	2.950	0.752	0.560	0.406	1.250	1.062	3/8-16	3/8-16 x 2.00	6.0	
16W5Q2B	**16W5Q2P**	1	1.00	2.750	3.190	1.002	0.630	0.469	1.500	1.328	7/16-14	7/16-14 x 2.50	6.0	
20W5Q2B	**20W5Q2P**	1 1/4	1.25	3.060	3.750	1.252	0.690	0.531	1.500	1.672	1/2-13	1/2-13 x 2.50	6.0	
24W5Q2B	**24W5Q2P**	1 1/2	1.50	3.750	4.440	1.502	0.750	0.656	1.750	1.922	5/8-11	5/8-11 x 3.00	6.0	
32W5Q2B	**32W5Q2P**	2	2.00	4.500	5.250	2.002	0.875	0.781	1.750	2.406	3/4-10	3/4-10 x 3.00	6.0	
40W5Q2B[2]	**40W5Q2P[2]**	2 1/2	2.50	5.870	6.870	2.502	1.000	0.906	2.060	2.906	7/8-9	7/8-9 x 3.50	3.0	
48W5Q2B[2]	**48W5Q2P[2]**	3	3.00	7.000	8.500	3.002	1.250	1.156	2.620	3.547	1 1/8-7	1 1/8-7 x 4.50	3.0	

1) See page K41 for standard stainless steel sizes and dimensions.
2) Not covered in SAE J518. Bolt hole centerline dimensions are: 2.312” x 4.875” for 40W5Q2 and 2.812” x 6.000” for 48W5Q2.

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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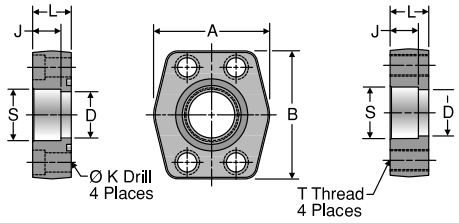
Flat Weld Socket Block Connector, Tube
Flat Weld Socket, Tube / Code 61 or 62
Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		TUBE O.D.	FLANGE SIZE	A	B	D	J	K DRILL DIA.	L	S	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS
FLAT WELD SOCKET, TUBE / CODE 61 BLOCK FLANGE OR PAD														
12W4Q1B	**12W4Q1P**	3/4	0.75	2.06	2.56	0.625	0.560	0.406	0.750	0.752	3/8-16	3/8-16 x 1.50	5.0	
16-12W4Q1B	**16-12W4Q1P**	1	0.75	2.06	2.56	0.750	0.560	0.406	0.750	1.002	3/8-16	3/8-16 x 1.50	5.0	
16W4Q1B	**16W4Q1P**	1	1.00	2.31	2.75	0.875	0.630	0.406	0.880	1.002	3/8-16	3/8-16 x 1.75	5.0	
20-16W4Q1B	**20-16W4Q1P**	1 1/4	1.00	2.31	2.75	1.000	0.630	0.406	0.880	1.252	3/8-16	3/8-16 x 1.75	5.0	
20W4Q1B	**20W4Q1P**	1 1/4	1.25	2.88	3.12	1.125	0.690	0.469	0.940	1.252	7/16-14	7/16-14 x 1.75	4.0	
24-20W4Q1B	**24-20W4Q1P**	1 1/2	1.25	2.88	3.12	1.250	0.690	0.469	0.940	1.502	7/16-14	7/16-14 x 1.75	4.0	
24W4Q1B	**24W4Q1P**	1 1/2	1.50	3.25	3.69	1.375	0.750	0.531	1.190	1.502	1/2-13	1/2-13 x 2.25	3.0	
28-24W4Q1B	**28-24W4Q1P**	1 3/4	1.50	3.25	3.69	1.500	0.750	0.531	1.190	1.752	1/2-13	1/2-13 x 2.25	3.0	
32W4Q1B	**32W4Q1P**	2	2.00	3.81	4.00	1.875	0.875	0.531	1.375	2.002	1/2-13	1/2-13 x 2.50	3.0	
36-32W4Q1B	**36-32W4Q1P**	2 1/4	2.00	3.81	4.00	2.000	0.875	0.531	1.375	2.252	1/2-13	1/2-13 x 2.50	3.0	
FLAT WELD SOCKET, TUBE / CODE 62 BLOCK FLANGE OR PAD														
12W4Q2B	**12W4Q2P**	3/4	0.75	2.38	2.81	0.625	0.560	0.406	1.250	0.752	3/8-16	3/8-16 x 2.00	6.0	
16-12W4Q2B	**16-12W4Q2P**	1	0.75	2.38	2.81	0.750	0.560	0.406	1.250	1.002	3/8-16	3/8-16 x 2.00	6.0	
16W4Q2B	**16W4Q2P**	1	1.00	2.75	3.19	0.875	0.630	0.469	1.500	1.002	7/16-14	7/16-14 x 2.25	6.0	
20-16W4Q2B	**20-16W4Q2P**	1 1/4	1.00	2.75	3.19	1.000	0.630	0.469	1.500	1.252	7/16-14	7/16-14 x 2.25	6.0	
20W4Q2B	**20W4Q2P**	1 1/4	1.25	3.06	3.75	1.125	0.690	0.531	1.500	1.252	1/2-13	1/2-13 x 2.50	6.0	
24-20W4Q2B	**24-20W4Q2P**	1 1/5	1.25	3.06	3.75	1.250	0.690	0.531	1.500	1.502	1/2-13	1/2-13 x 2.50	6.0	
24W4Q2B	**24W4Q2P**	1 1/2	1.50	3.75	4.44	1.375	0.750	0.656	1.750	1.502	5/8-11	5/8-11 x 2.75	6.0	
28-24W4Q2B	**28-24W4Q2P**	1 3/4	1.50	3.75	4.44	1.500	0.750	0.656	1.750	1.752	5/8-11	5/8-11 x 2.75	6.0	
32W4Q2B1[1]	**32W4Q2P1**[1]	2	2.00	4.50	5.25	1.875	0.875	0.781	1.750	2.002	3/4-10	3/4-10 x 3.00	6.0	
36-32W4Q2B1[1]	**36-32W4Q2P1**[1]	2 1/4	2.00	4.50	5.25	2.000	0.875	0.781	1.750	2.252	3/4-10	3/4-10 x 3.00	6.0	

1) Not covered in SAE J518.

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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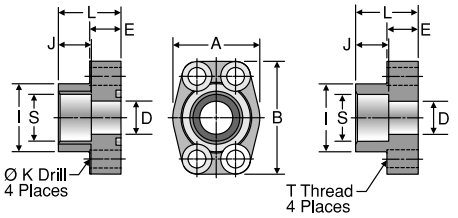
W7Q

Extended Weld Socket Block Connector, Pipe
Deep Weld Socket, Pipe / Code 61 or 62
Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		PIPE SIZE	FLANGE SIZE	A	B	D	E	I	J	K DRILL DIA.	L	S	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS
EXTENDED WELD SOCKET, PIPE / CODE 61 BLOCK FLANGE OR PAD																
12W7Q1B	**12W7Q1P**	3/4	0.75	1.97	2.56	0.75	0.710	1.54	0.750	0.406	1.420	1.062	3/8-16	3/8-16 x 1.50	5.0	
16W7Q1B	**16W7Q1P**	1	1.00	2.17	2.75	1.00	0.710	1.81	0.750	0.406	1.500	1.328	3/8-16	3/8-16 x 1.50	4.5	
20W7Q1B	**20W7Q1P**	1 1/4	1.25	2.68	3.12	1.25	0.830	2.22	0.870	0.469	1.610	1.672	7/16-14	7/16-14 x 1.75	2.7	
24W7Q1B	**24W7Q1P**	1 1/2	1.50	3.07	3.66	1.50	0.980	2.50	0.940	0.531	1.770	1.922	1/2-13	1/2-13 x 1.75	3.0	
32W7Q1B	**32W7Q1P**	2	2.00	3.54	4.00	2.00	0.980	3.12	1.020	0.531	1.770	2.406	1/2-13	1/2-13 x 1.75	2.5	
40W7Q1B	**40W7Q1P**	2 1/2	2.50	4.09	4.49	2.50	0.980	3.62	1.180	0.531	1.970	2.908	1/2-13	1/2-13 x 1.75	2.2	
EXTENDED WELD SOCKET, PIPE / C ODE 62 BLOCK FLANGE OR PAD																
12W7Q2B	**12W7Q2P**	3/4	0.75	2.17	2.80	0.75	0.830	1.65	0.870	0.406	1.380	1.062	3/8-16	3/8-16 x 1.50	6.0	
16W7Q2B	**16W7Q2P**	1	1.00	2.56	3.19	1.00	0.980	1.98	0.870	0.469	1.650	1.328	7/16-14	7/16-14 x 1.75	6.0	
20W7Q2B	**20W7Q2P**	1 1/4	1.25	3.07	3.75	1.25	1.060	2.36	0.980	0.531	1.770	1.672	1/2-13	1/2-13 x 1.75	5.5	
24W7Q2B	**24W7Q2P**	1 1/2	1.50	3.7	4.41	1.50	1.180	2.68	1.100	0.656	1.970	1.922	5/8-11	5/8-11 x 2.25	5.5	
32W7Q2B	**32W7Q2P**	2	2.00	4.5	5.28	2.00	1.460	3.35	0.940	0.781	2.560	2.406	3/4-10	3/4-10 x 2.75	5.0	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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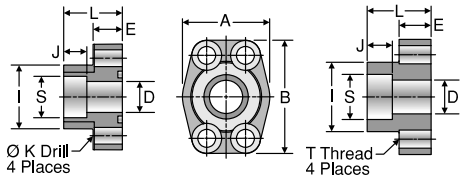
W6Q

Extended Weld Socket Block Connector, Tube
Deep Weld Socket, Tube / Code 61 or 62
Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		TUBE O.D.	FLANGE SIZE	A	B	D	E	I	J	K DRILL DIA.	L	S	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS
EXTENDED WELD SOCKET, TUBE / CODE 61 BLOCK FLANGE OR PAD																
12W6Q1B	12W6Q1P	3/4	0.75	1.97	2.56	0.625	0.71	1.54	0.560	0.406	1.420	0.752	3/8-16	3/8-16 x 1.50	5.0	
16-12W6Q1B	16-12W6Q1P	1	0.75	1.97	2.56	0.750	0.71	1.54	0.560	0.406	1.420	1.002	3/8-16	3/8-16 x 1.50	5.0	
16W6Q1B	16W6Q1P	1	1.00	2.17	2.75	0.875	0.71	1.81	0.630	0.406	1.500	1.002	3/8-16	3/8-16 x 1.50	5.0	
20-16W6Q1B	20-16W6Q1P	1 1/4	1.00	2.17	2.75	1.000	0.71	1.81	0.630	0.406	1.500	1.252	3/8-16	3/8-16 x 1.50	5.0	
20W6Q1B	20W6Q1P	1 1/4	1.25	2.68	3.12	1.125	0.83	2.22	0.690	0.469	1.610	1.252	7/16-14	7/16-14 x 1.75	4.0	
24-20W6Q1B	24-20W6Q1P	1 1/2	1.25	2.68	3.12	1.250	0.83	2.22	0.690	0.469	1.610	1.502	7/16-14	7/16-14 x 1.75	4.0	
24W6Q1B	24W6Q1P	1 1/2	1.50	3.07	3.66	1.375	0.98	2.50	0.750	0.531	1.770	1.502	1/2-13	1/2-13 x 1.75	3.0	
28-24W6Q1B	28-24W6Q1P	1 3/4	1.50	3.07	3.66	1.500	0.98	2.50	0.750	0.531	1.770	1.752	1/2-13	1/2-13 x 1.75	3.0	
32W6Q1B	32W6Q1P	2	2.00	3.54	4.00	1.875	0.98	3.12	0.870	0.531	1.770	2.002	1/2-13	1/2-13 x 1.75	3.0	
36-32W6Q1B	36-32W6Q1P	2 1/4	2.00	3.54	4.00	2.000	0.98	3.12	0.870	0.531	1.770	2.252	1/2-13	1/2-13 x 1.75	3.0	
40W6Q1B	40W6Q1P	2 1/2	2.50	4.09	4.49	2.375	0.98	3.62	1.000	0.531	1.970	2.502	1/2-13	1/2-13 x 1.75	2.5	
44-40W6Q1B	44-40W6Q1P	2 3/4	2.50	4.09	4.49	2.500	0.98	3.62	1.000	0.531	1.970	2.752	1/2-13	1/2-13 x 1.75	2.2	
EXTENDED WELD SOCKET, TUBE / CODE 62 BLOCK FLANGE OR PAD																
12W6Q2B	12W6Q2P	3/4	0.75	2.17	2.80	0.625	0.83	1.65	0.560	0.406	1.380	0.752	3/8-16	3/8-16 x 1.50	6.0	
16-12W6Q2B	16-12W6Q2P	1	0.75	2.17	2.80	0.750	0.83	1.65	0.560	0.406	1.380	1.002	3/8-16	3/8-16 x 1.50	6.0	
16W6Q2B	16W6Q2P	1	1.00	2.56	3.19	0.875	0.98	1.98	0.630	0.469	1.650	1.002	7/16-14	7/16-14 x 1.75	6.0	
20-16W6Q2B	20-16W6Q2P	1 1/4	1.00	2.56	3.19	1.000	0.98	1.98	0.630	0.469	1.650	1.252	7/16-14	7/16-14 x 1.75	6.0	
20W6Q2B	20W6Q2P	1 1/4	1.25	3.07	3.75	1.125	1.06	2.36	0.690	0.531	1.770	1.252	1/2-13	1/2-13 x 1.75	6.0	
24-20W6Q2B	24-20W6Q2P	1 1/2	1.25	3.07	3.75	1.250	1.06	2.36	0.690	0.531	1.770	1.502	1/2-13	1/2-13 x 1.75	6.0	
24W6Q2B	24W6Q2P	1 1/2	1.50	3.70	4.41	1.375	1.18	2.68	0.750	0.656	1.970	1.502	5/8-11	5/8-11 x 2.25	6.0	
28-24W6Q2B	28-24W6Q2P	1 3/4	1.50	3.70	4.41	1.500	1.18	2.68	0.750	0.656	1.970	1.752	5/8-11	5/8-11 x 2.25	6.0	
32W6Q2B	32W6Q2P	2	2.00	4.50	5.28	1.875	1.46	3.35	0.870	0.781	2.560	2.002	3/4-10	3/4-10 x 2.75	6.0	
36-32W6Q2B	36-32W6Q2P	2 1/4	2.00	4.50	5.28	2.000	1.46	3.35	0.870	0.781	2.560	2.252	3/4-10	3/4-10 x 2.75	5.5	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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Tube Fittings Division
Columbus, Ohio
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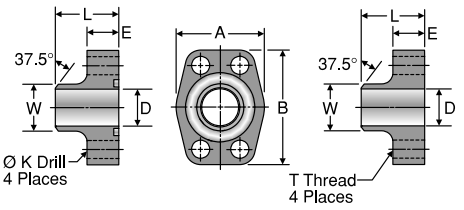
WB1Q1 / WB3Q1 / WB5Q1

Code 61 Weld Butt Block Connector, Pipe
Schedule 40, 80 or 160 Weld Butt /
Code 61 Block Flange or Pad



O-ring Face Flat Face

WELD BUTT BLOCK CONNECTION TYPE	TUBE FITTING PART #		PIPE SIZE	FLANGE SIZE	A	B	D PIPE I.D.	E	K DRILL DIA.	L	T THREAD	W PIPE O.D.	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
	O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	(in.)	SHCS	-SX	-SS
SCHEDULE 40 WELD BUTT / CODE 61 BLOCK FLANGE OR PAD															
WB1Q1 For Schedule 40 pipe	**12WB1Q1B**	**12WB1Q1P**	3/4	0.75	1.97	2.56	0.846	0.710	0.406	1.420	3/8-16	1.050	3/8-16 x 1.50	3.5	
	16WB1Q1B	**16WB1Q1P**	1	1.00	2.17	2.75	1.051	0.710	0.406	1.500	3/8-16	1.315	3/8-16 x 1.50	3.0	
	20WB1Q1B	**20WB1Q1P**	1 1/4	1.25	2.68	3.12	1.382	0.830	0.469	1.610	7/16-14	1.660	7/16-14 x 1.75	2.7	
	24WB1Q1B	**24WB1Q1P**	1 1/2	1.50	3.07	3.66	1.612	0.980	0.531	1.730	1/2-13	1.900	1/2-13 x 1.75	2.2	
	32WB1Q1B	**32WB1Q1P**	2	2.00	3.54	4.00	2.069	0.980	0.531	1.770	1/2-13	2.375	1/2-13 x 1.75	2.0	
	40WB1Q1B	**40WB1Q1P**	2 1/2	2.50	4.09	4.49	2.471	0.980	0.531	1.970	1/2-13	2.875	1/2-13 x 1.75	2.0	
	48WB1Q1B	**48WB1Q1P**	3	3.00	4.88	5.28	3.070	1.060	0.656	1.970	5/8-11	3.500	5/8-11 x 2.00	1.7	
SCHEDULE 80 WELD BUTT / CODE 61 BLOCK FLANGE OR PAD															
WB3Q1 For Schedule 80 pipe	**12WB3Q1B**	**12WB3Q1P**	3/4	0.75	1.97	2.56	0.744	0.710	0.406	1.420	3/8-16	1.050	3/8-16 x 1.50	5.0	
	16WB3Q1B	**16WB3Q1P**	1	1.00	2.17	2.75	0.959	0.710	0.406	1.500	3/8-16	1.315	3/8-16 x 1.50	4.5	
	20WB3Q1B	**20WB3Q1P**	1 1/4	1.25	2.68	3.12	1.280	0.830	0.469	1.610	7/16-14	1.660	7/16-14 x 1.75	4.0	
	24WB3Q1B	**24WB3Q1P**	1 1/2	1.50	3.07	3.66	1.502	0.980	0.531	1.730	1/2-13	1.900	1/2-13 x 1.75	3.0	
	32WB3Q1B	**32WB3Q1P**	2	2.00	3.54	4.00	1.941	0.980	0.531	1.770	1/2-13	2.375	1/2-13 x 1.75	3.0	
	40WB3Q1B	**40WB3Q1P**	2 1/2	2.50	4.09	4.49	2.325	0.980	0.531	1.970	1/2-13	2.875	1/2-13 x 1.75	2.5	
	48WB3Q1B	**48WB3Q1P**	3	3.00	4.88	5.28	2.902	1.060	0.656	1.970	5/8-11	3.500	5/8-11 x 2.00	2.0	
SCHEDULE 160 WELD BUTT / CODE 61 BLOCK FLANGE OR PAD															
WB5Q1 For Schedule 160 pipe	**12WB5Q1B**	**12WB5Q1P**	3/4	0.75	1.97	2.56	0.614	0.710	0.406	1.420	3/8-16	1.050	3/8-16 x 1.50	5.0	
	16WB5Q1B	**16WB5Q1P**	1	1.00	2.17	2.75	0.817	0.710	0.406	1.500	3/8-16	1.315	3/8-16 x 1.50	5.0	
	20WB5Q1B	**20WB5Q1P**	1 1/4	1.25	2.68	3.12	1.162	0.830	0.469	1.610	7/16-14	1.660	7/16-14 x 1.75	4.0	
	24WB5Q1B	**24WB5Q1P**	1 1/2	1.50	3.07	3.66	1.340	0.980	0.531	1.730	1/2-13	1.900	1/2-13 x 1.75	3.0	
	32WB5Q1B	**32WB5Q1P**	2	2.00	3.54	4.00	1.689	0.980	0.531	1.770	1/2-13	2.375	1/2-13 x 1.75	3.0	
	40WB5Q1B	**40WB5Q1P**	2 1/2	2.50	4.09	4.49	2.127	0.980	0.531	1.970	1/2-13	2.875	1/2-13 x 1.75	2.5	
	48WB5Q1B	**48WB5Q1P**	3	3.00	4.88	5.28	2.626	1.060	0.656	1.970	5/8-11	3.500	5/8-11 x 2.00	2.0	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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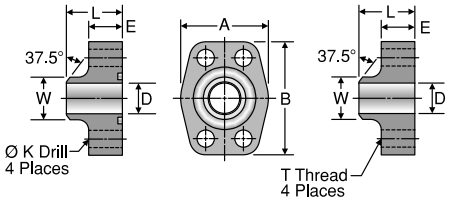
WB3Q2 / WB5Q2 / WB7Q2

Code 62 Weld Butt Block Connector, Pipe Schedule 80, 160 or XXS Weld Butt / Code 62 Block Flange or Pad



O-ring Face Flat Face

WELD BUTT BLOCK CONNECTION TYPE	TUBE FITTING PART #		PIPE SIZE	FLANGE SIZE	A	B	D PIPE I.D.	E	K DRILL DIA.	L	T THREAD	W PIPE O.D.	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
	O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	(in.)	SHCS	-SX	-SS
SCHEDULE 80 WELD BUTT / CODE 62 BLOCK FLANGE OR PAD															
WB3Q2 For Schedule 80 pipe	**12WB3Q2B**	**12WB3Q2P**	3/4	0.75	2.17	2.80	0.744	0.83	0.406	1.38	3/8-16	1.050	3/8-16 x 1.50	5.0	
	16WB3Q2B	**16WB3Q2P**	1	1.00	2.56	3.19	0.959	0.83	0.469	1.61	7/16-14	1.315	7/16-14 x 1.75	4.5	
	20WB3Q2B	**20WB3Q2P**	1 1/4	1.25	3.07	3.75	1.280	0.98	0.531	1.73	1/2-13	1.660	1/2-13 x 1.75	3.5	
	24WB3Q2B	**24WB3Q2P**	1 1/2	1.50	3.70	4.41	1.502	1.18	0.656	2.17	5/8-11	1.900	5/8-11 x 2.25	3.0	
	32WB3Q2B	**32WB3Q2P**	2	2.00	4.50	5.28	1.941	1.46	0.781	2.56	3/4-10	2.375	3/4-10 x 2.75	3.0	
SCHEDULE 160 WELD BUTT / CODE 62 BLOCK FLANGE OR PAD															
WB5Q2 For Schedule 160 pipe	**12WB5Q2B**	**12WB5Q2P**	3/4	0.75	2.17	2.80	0.614	0.83	0.406	1.38	3/8-16	1.050	3/8-16 x 1.50	6.0	
	16WB5Q2B	**16WB5Q2P**	1	1.00	2.56	3.19	0.817	0.83	0.469	1.61	7/16-14	1.315	7/16-14 x 1.75	6.0	
	20WB5Q2B	**20WB5Q2P**	1 1/4	1.25	3.07	3.75	1.162	0.98	0.531	1.73	1/2-13	1.660	1/2-13 x 1.75	5.0	
	24WB5Q2B	**24WB5Q2P**	1 1/2	1.50	3.70	4.41	1.340	1.18	0.656	2.17	5/8-11	1.900	5/8-11 x 2.25	5.0	
	32WB5Q2B	**32WB5Q2P**	2	2.00	4.50	5.28	1.689	1.46	0.781	2.56	3/4-10	2.375	3/4-10 x 2.75	6.0	
SCHEDULE XXS WELD BUTT / CODE 62 BLOCK FLANGE OR PAD															
WB7Q2 For Schedule XXS pipe	**12WB7Q2B**	**12WB7Q2P**	3/4	0.75	2.17	2.80	0.436	0.83	0.406	1.38	3/8-16	1.050	3/8-16 x 1.50	6.0	
	16WB7Q2B	**16WB7Q2P**	1	1.00	2.56	3.19	0.601	0.83	0.469	1.61	7/16-14	1.315	7/16-14 x 1.75	6.0	
	20WB7Q2B	**20WB7Q2P**	1 1/4	1.25	3.07	3.75	0.898	0.98	0.531	1.73	1/2-13	1.660	1/2-13 x 1.75	6.0	
	24WB7Q2B	**24WB7Q2P**	1 1/2	1.50	3.70	4.41	1.102	1.18	0.656	2.17	5/8-11	1.900	5/8-11 x 2.25	6.0	
	32WB7Q2B	**32WB7Q2P**	2	2.00	4.50	5.28	1.505	1.46	0.781	2.56	3/4-10	2.375	3/4-10 x 2.75	6.0	

1) SAE J518 does not cover these sizes in Code 62.

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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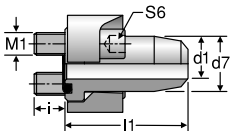
SAE-Flange / Weld Butt



For metric tube welded connection

TUBE FITTING PART #	SIZE (in.)	TUBE O.D. x WALL THICKNESS (mm)	WORKING PRESSURE (bar)	d1 (mm)	d7 (mm)	l (mm)	l 1 (mm)	S6 (mm)	WELD NIPPLE BODY	FROM STOCK CF	71
SAE FLANGE CONNECTION – CODE 61 – STANDARD SERIES											
AS32/15X2	1/2	15 x 2	200	11	23.9	11.5	38	6	AS32/15X2X		
AS32/16X3	1/2	16 x 3	220	10	23.9	11.5	38	6	AS32/16X3X		
AS33/18X1.5	3/4	18 x 1.5	130	15	31.8	15.5	50	8	AS33/18X1.5X		
AS33/22X2	3/4	22 x 2	140	18	31.8	15.5	50	8	AS33/22X2X		
AS33/20X3	3/4	20 x 3	220	14	31.8	15.5	50	8	AS33/20X3X		
AS33/25X4	3/4	25 x 4	220	17	31.8	15.5	50	8	AS33/25X4X		
AS34/28X2	1	28 x 2	115	24	38	13.5	50	8	AS34/28X2X		
AS34/30X4.5	1	30 x 4.5	220	21	38	13.5	50	8	AS34/30X4.5X		
AS35/35X2	1 1/4	35 x 2	90	31	43	18.5	55	8	AS35/35X2X		
AS35/25X3	1 1/4	25 x 3	175	19	43	18.5	55	8	AS35/25X3X		
AS35/30X4	1 1/4	30 x 4	175	22	43	18.5	55	8	AS35/30X4X		
AS35/38X5	1 1/4	38 x 5	175	28	43	18.5	55	8	AS35/38X5X		
AS36/42X3	1 1/2	42 x 3	115	36	50	18.5	57	10	AS36/42X3X		
AS36/38X4	1 1/2	38 x 4	130	30	50	18.5	57	10	AS36/38X4X		
AS38/50X6	2	50 x 6	130	38	62	24	62	12	AS38/50X6X		
AS38/65X8	2	65 x 8	130	49	65	24	62	12	AS38/65X8X		
SAE FLANGE CONNECTION – CODE 62 – HIGH PRESSURE SERIES											
AS62/16X3	1/2	16 x 3	260	10	23.9	13.5	41	6	AS62/16X3X		
AS63/25X5	3/4	25 x 5	260	15	31.8	15.5	55	8	AS63/25X5X		
AS64/25X5	1	25 x 5	260	15	38	20.5	67	10	AS64/25X5X		
AS64/30X4	1	30 x 4	200	22	38	20.5	67	10	AS64/30X4X		
AS65/30X4*	1 1/4	30 x 4	200	22	43.7	17.5	78	10	AS65/30X4X		
AS65/38X5	1 1/4	38 x 5	200	28	43.7	17.5	78	10	AS65/38X5X		
AS65/38X8*	1 1/4	38 x 8	260	22	43.7	17.5	78	10	AS65/38X8X		
AS66/38X5	1 1/2	38 x 5	200	28	50.8	24.5	85	14	AS66/38X5X		
AS66/38X8	1 1/2	38 x 8	260	22	50.8	24.5	85	14	AS66/38X8X		
AS68/50X9	2	50 x 9	260	32	66.6	32.5	116	17	AS68/50X9X		
AS68/65X9	2	65 x 8	190	49	66.6	32.5	116	17	AS68/65X8X		

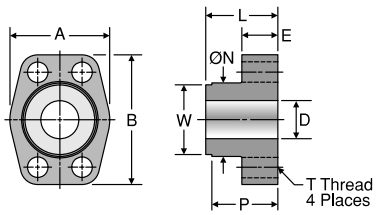
* Identical types.

Tightening torques for socket head cap screws see Tables R6 and R7.

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

WBT

Code 61 Weld Butt Tank Adapter
Weld Butt with Pilot / Code 61 Block Flange Pad



TUBE FITTING PART #	FLANGE SIZE (in.)	A (in.)	B (in.)	D (in.)	E (in.)	L (in.)	P (in.)	ØN (in.)	T THREAD UNC-2B	W (in.)	Dynamic Pressure (x 1,000 PSI) -S	-SS
12WBTQ1P	0.75	1.97	2.56	0.75	0.71	1.42	1.30	1.45	3/8-16	1.375	0.5	
16WBTQ1P	1.00	2.17	2.75	1.00	0.71	1.50	1.37	1.81	3/8-16	1.500	0.5	
20WBTQ1P	1.25	2.68	3.12	1.25	0.83	1.61	1.49	2.22	7/16-14	1.750	0.5	
24WBTQ1P	1.50	3.07	3.66	1.50	0.98	1.77	1.64	2.50	1/2-13	2.125	0.5	
32WBTQ1P	2.00	3.54	4.00	2.00	0.98	1.77	1.65	3.12	1/2-13	2.500	0.5	
40WBTQ1P	2.50	4.09	4.50	2.50	0.98	1.97	1.85	3.62	1/2-13	3.250	0.5	

Dimensions and pressures for reference only, subject to change.

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Tube Fittings Division
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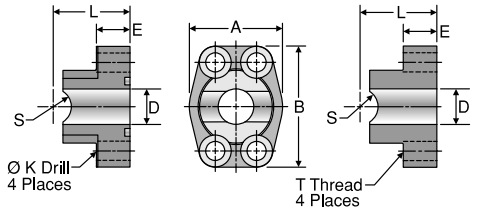
WSD

Code 61 Weld Saddle Block Connector
Pipe or Tube Weld Saddle /
Code 61 Block Flange or Pad



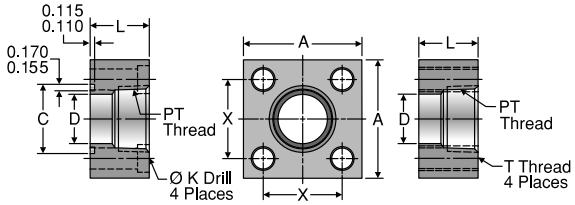
O-ring Face Flat Face

TUBE FITTING PART #		PIPE OR TUBE SIZE	FLANGE SIZE	A	B	D	E	K DRILL DIA.	L	S	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS
PIPE WELD SADDLE / CODE 61 BLOCK FLANGE OR PAD														
12WSD1Q1B	**12WSD1Q1P**	3/4	0.75	1.97	2.56	0.75	0.710	0.406	1.775	0.532	3/8-16	3/8-16 x 1.50	5.0	
16WSD1Q1B	**16WSD1Q1P**	1	1.00	2.17	2.75	1.00	0.710	0.406	1.912	0.665	3/8-16	3/8-16 x 1.50	5.0	
20WSD1Q1B	**20WSD1Q1P**	1 1/4	1.25	2.68	3.12	1.25	0.830	0.469	2.146	0.837	7/16-14	7/16-14 x 1.75	4.0	
24WSD1Q1B	**24WSD1Q1P**	1 1/2	1.50	3.07	3.66	1.50	0.980	0.531	2.290	0.957	1/2-13	1/2-13 x 1.75	3.0	
32WSD1Q1B	**32WSD1Q1P**	2	2.00	3.54	4.00	2.00	0.980	0.531	2.340	1.200	1/2-13	1/2-13 x 1.75	3.0	
TUBE WELD SADDLE / CODE 61 BLOCK FLANGE OR PAD														
12WSD2Q1B	**12WSD2Q1P**	3/4	0.75	1.97	2.56	0.75	0.710	0.406	1.420	0.382	3/8-16	3/8-16 x 1.50	5.0	
16-12WSD2Q1B	**16-12WSD2Q1P**	1	0.75	1.97	2.56	0.75	0.710	0.406	1.420	0.507	3/8-16	3/8-16 x 1.50	5.0	
16WSD2Q1B	**16WSD2Q1P**	1	1.00	2.17	2.75	1.00	0.710	0.406	1.737	0.507	3/8-16	3/8-16 x 1.50	5.0	
20-16WSD2Q1B	**20-16WSD2Q1P**	1 1/4	1.00	2.17	2.75	1.00	0.710	0.406	1.500	0.632	3/8-16	3/8-16 x 1.50	5.0	
20WSD2Q1B	**20WSD2Q1P**	1 1/4	1.25	2.68	3.12	1.25	0.830	0.469	1.858	0.632	7/16-14	7/16-14 x 1.75	4.0	
24-20WSD2Q1B	**24-20WSD2Q1P**	1 1/2	1.25	2.68	3.12	1.25	0.830	0.469	1.665	0.757	7/16-14	7/16-14 x 1.75	4.0	
24WSD2Q1B	**24WSD2Q1P**	1 1/2	1.50	3.07	3.66	1.50	0.980	0.531	2.022	0.757	1/2-13	1/2-13 x 1.75	3.0	
28-24WSD2Q1B	**28-24WSD2Q1P**	1 3/4	1.50	3.07	3.66	1.50	0.980	0.531	2.198	0.882	1/2-13	1/2-13 x 1.75	3.0	
32WSD2Q1B	**32WSD2Q1P**	2	2.00	3.54	4.00	2.00	0.980	0.531	2.262	1.007	1/2-13	1/2-13 x 1.75	3.0	
36-32WSD2Q1B	**36-32WSD2Q1P**	2 1/4	2.00	3.54	4.00	2.00	0.980	0.531	2.247	1.132	1/2-13	1/2-13 x 1.75	3.0	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

GQS

NPTF Port Square Block Flange Adapter
NPTF Port / Square Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		PT THREAD	FLANGE SIZE	A	B	C MIN.	D	K DRILL DIA.	L	T THREAD	X		MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	NPTF	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	(in.)	O-ring	SHCS	SX	SS
12GQSB	**12GQSP**	3/4-14	0.75	2.25	1.12	1.250	0.75	0.406	1.25	3/8-16	1.438	2-214	3/8-16 x 2.00	5.0	
16GQSB	**16GQSP**	1-11 1/2	1.00	3.00	1.50	1.560	1.00	0.531	1.50	1/2-13	2.000	2-219	1/2-13 x 2.25	5.0	
20GQSB	**20GQSP**	1 1/4-11 1/2	1.25	3.00	1.50	1.750	1.25	0.531	1.50	1/2-13	2.000	2-222	1/2-13 x 2.25	4.0	
24GQSB	**24GQSP**	1 1/2-11 1/2	1.50	4.00	2.00	2.115	1.50	0.656	1.75	5/8-11	2.750	2-225	5/8-11 x 2.75	3.0	
32GQSB	**32GQSP**	2-11 1/2	2.00	4.00	2.00	2.490	2.00	0.656	1.75	5/8-11	2.750	2-228	5/8-11 x 2.75	2.7	
40GQSB	**40GQSP**	2 1/2-8	2.50	5.50	2.75	2.995	2.50	0.906	2.25	7/8-9	3.750	2-232	7/8-9 x 3.50	2.5	
48GQSB	**48GQSP**	3-8	3.00	5.50	2.75	3.615	3.00	0.906	2.25	7/8-9	3.750	2-237	7/8-9 x 3.50	1.2	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

Dimensions and pressures for reference only, subject to change.

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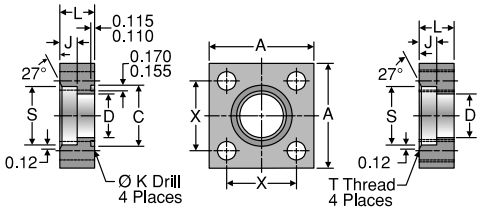
W5SQS

Weld Socket Square Block Connector, Pipe
Pipe Weld Socket / Square Block Flange or Pad



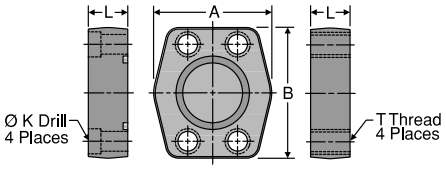
O-ring Face Flat Face

TUBE FITTING PART #		PIPE SIZE	FLANGE SIZE	A	B	C MIN.	D	J	K DRILL DIA.	L	S	T THREAD	X		MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	(in.)	O-ring	SHCS	-SX	-SS
12W5SQSB	12W5SQSP	3/4	0.75	2.25	1.12	1.250	0.75	0.50	0.406	1.00	1.062	3/8-16	1.438	2-214	3/8-16 x 1.75	5.0	
16W5SQSB	16W5SQSP	1	1.00	3.00	1.50	1.560	1.00	0.50	0.531	1.00	1.328	1/2-13	2.000	2-219	1/2-13 x 1.75	5.0	
20W5SQSB	20W5SQSP	1 1/4	1.25	3.00	1.50	1.750	1.25	0.50	0.531	1.00	1.672	1/2-13	2.000	2-222	1/2-13 x 1.75	4.0	
24W5SQSB	24W5SQSP	1 1/2	1.50	4.00	2.00	2.115	1.50	0.62	0.656	1.25	1.922	5/8-11	2.750	2-225	5/8-11 x 2.25	3.0	
32W5SQSB	32W5SQSP	2	2.00	4.00	2.00	2.490	2.00	0.62	0.656	1.25	2.406	5/8-11	2.750	2-228	5/8-11 x 2.25	3.0	
40W5SQSB	40W5SQSP	2 1/2	2.50	5.50	2.75	2.995	2.50	0.75	0.906	1.50	2.906	7/8-9	3.750	2-232	7/8-9 x 2.75	2.5	
48W5SQSB	48W5SQSP	3	3.00	5.50	2.75	3.615	3.00	0.75	0.906	1.50	3.547	7/8-9	3.750	2-237	7/8-9 x 2.75	2.0	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

PQ

Block Plug
Code 61/62 Block Flange or Pad Plug



O-ring Face Flat Face

TUBE FITTING PART #		FLANGE SIZE	A	B	K DRILL DIA.	L	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS[1]
CODE 61 BLOCK FLANGE OR PAD PLUG										
8PQ1B	8PQ1P	0.50	1.813	2.125	0.344	0.750	5/16-18	5/16-18 x 1.50	5.0	
12PQ1B	12PQ1P	0.75	2.063	2.563	0.406	0.750	3/8-16	3/8-16 x 1.50	5.0	
16PQ1B	16PQ1P	1.00	2.313	2.750	0.406	0.880	3/8-16	3/8-16 x 1.75	5.0	
20PQ1B	20PQ1P	1.25	2.875	3.125	0.469	0.940	7/15-14	7/16-14 x 1.75	4.0	
24PQ1B	24PQ1P	1.50	3.250	3.688	0.531	1.190	1/2-13	1/2-13 x 2.25	3.0	
32PQ1B	32PQ1P	2.00	3.813	4.000	0.531	1.440	1/2-13	1/2-13 x 2.50	3.0	
40PQ1B	40PQ1P	2.50	4.281	4.500	0.531	1.815	1/2-13	1/2-13 x 2.75	2.5	
48PQ1B	48PQ1P	3.00	5.156	5.313	0.656	2.190	5/8-11	5/8-11 x 3.50	2.0	
56PQIB	56PQ1P	3.50	5.500	6.000	0.656	1.440	5/8-11	5/8-11 x 2.75	0.5	
64PQIB	64PQIP	4.00	6.000	6.380	0.656	1.440	5/8-11	5/8-11 x 2.75	0.5	
CODE 62 BLOCK FLANGE OR PAD PLUG										
8PQ2B	8PQ2P	0.50	1.940	2.300	0.344	1.250	5/16-18	5/16-18 x 2.00	6.0	
12PQ2B	12PQ2P	0.75	2.500	2.950	0.406	1.250	3/8-16	3/8-16 x 2.00	6.0	
16PQ2B	16PQ2P	1.00	2.750	3.190	0.469	1.500	7/16-14	7/16-14 x 2.50	6.0	
20PQ2B	20PQ2P	1.25	3.060	3.750	0.531	1.430	1/2-13	1/2-13 x 2.50	6.0	
24PQ2B	24PQ2P	1.50	3.750	4.440	0.656	1.815	5/8-11	5/8-11 x 3.00	6.0	
32PQ2B	32PQ2P	2.00	4.500	5.250	0.781	1.815	3/4-10	3/4-10 x 3.00	6.0	
40PQ2B[2]	40PQ2P[2]	2.50	5.870	6.870	0.940	1.930	7/8-9	7/8-9 x 3.50	6.0	
48PQ2B[2]	48PQ2P[2]	3.00	7.000	8.500	1.190	2.690	1 1/8-7	1 1/8-7 x 4.50	6.0	

1) See page K42 for standard stainless steel sizes and dimensions.

2) SAE J518 does not cover these sizes in Code 62. Bolt hole centerline dimensions are: 2.312” x 4.875” for 4OPQ2 and 2.812” x 6.000” for 48PQ2.

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

Dimensions and pressures for reference only, subject to change.

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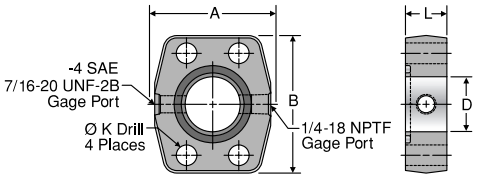
SPGG5

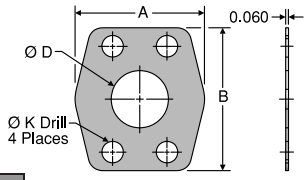
Flange Spacer with Gage Ports
Code 61/62 Spacer with Side Gage Ports



TUBE FITTING PART #	FLANGE SIZE (in.)	A (in.)	B (in.)	D (in.)	K DRILL DIA. (in.)	L (in.)	Dynamic Pressure (x 1,000 PSI) -SX	-SS
CODE 61 O-ring SPACER								
8SPGG5Q1B	0.50	1.813	2.125	0.500	0.344	1.25	5.0	
12SPGG5Q1B	0.75	2.063	2.563	0.750	0.406	1.25	5.0	
16SPGG5Q1B	1.00	2.313	2.750	1.000	0.406	0.88	5.0	
20SPGG5Q1B	1.25	2.875	3.125	1.250	0.469	0.94	4.0	
24SPGG5Q1B	1.50	3.250	3.688	1.500	0.531	1.19	3.0	
32SPGG5Q1B	2.00	3.813	4.000	2.000	0.531	1.38	3.0	
40SPGG5Q1B	2.50	4.281	4.500	2.500	0.531	1.75	2.5	
48SPGG5Q1B	3.00	5.156	5.313	3.000	0.656	2.12	2.0	
CODE 62 O-ring SPACER								
8SPGG5Q2B	0.50	1.940	2.300	0.500	0.344	1.25	6.0	
12SPGG5Q2B	0.75	2.500	2.950	0.750	0.406	1.25	6.0	
16SPGG5Q2B	1.00	2.750	3.190	1.000	0.469	1.50	6.0	
20SPGG5Q2B	1.25	3.060	3.750	1.250	0.531	1.50	6.0	
24SPGG5Q2B	1.50	3.750	4.440	1.500	0.656	1.75	6.0	
32SPGG5Q2B	2.00	4.500	5.250	2.000	0.781	1.75	6.0	

CP

Flange Connector Plate
Code 61/62 Flange Connector Plate



TUBE FITTING PART #	FLANGE SIZE (in.)	A (in.)	B (in.)	D (in.)	K DRILL DIA. (in.)	Dynamic Pressure (x 1,000 PSI) -SX	-SS
CODE 61 FLANGE CONNECTOR PLATE							
8CP1	0.50	1.81	2.12	0.50	0.344	5.0	
12CP1	0.75	2.06	2.56	0.75	0.406	5.0	
16CP1	1.00	2.31	2.75	1.00	0.406	5.0	
20CP1	1.25	2.88	3.12	1.25	0.469	4.0	
24CP1	1.50	3.25	3.69	1.50	0.531	3.0	
32CP1	2.00	3.81	4.00	2.00	0.531	3.0	
40CP1	2.50	4.12	4.44	2.50	0.531	2.5	
48CP1	3.00	5.16	5.31	3.00	0.656	2.5	
CODE 62 FLANGE CONNECTOR PLATE							
12CP2	0.75	2.38	2.81	0.75	0.406	6.0	
16CP2	1.00	2.75	3.19	1.00	0.469	6.0	
20CP2	1.25	3.06	3.75	1.25	0.531	6.0	
24CP2	1.50	3.75	4.44	1.50	0.656	6.0	
32CP2	2.00	4.50	5.25	2.00	0.781	6.0	

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Tube Fittings Division
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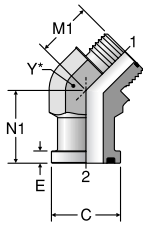
LOVQ1

Code 61 Flange 45° Elbow
Code 61 / ORFS



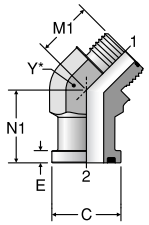
* Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M1 (in.)	N1 (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 LOVQ1	3/4	3/4	1.500	0.265	1.28	1.58	1 7/16	5.0
16 LOVQ1	1	1	1.750	0.315	1.47	1.85	1 5/8	5.0
20 LOVQ1	1 1/4	1 1/4	2.000	0.315	1.59	2.04	1 7/8	4.0
24 LOVQ1	1 1/2	1 1/2	2.375	0.315	1.78	2.38	2 1/2	3.0

WARNING: This product can expose you to chemicals including Diisononyl Phthalate which is known to the State of California to cause cancer. For more information go to www.p65warnings.ca.gov.

LOVQ2

Code 62 Flange 45° Elbow
Code 62 / ORFS

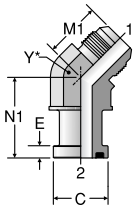


* Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M1 (in.)	N1 (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 LOVQ2	3/4	3/4	1.625	0.345	1.28	1.58	1 7/16	6.0
16 LOVQ2	1	1	1.875	0.375	1.47	1.85	1 5/8	6.0
20 LOVQ2	1 1/4	1 1/4	2.125	0.405	1.59	2.04	1 7/8	5.0
24 LOVQ2	1 1/2	1 1/2	2.500	0.495	1.78	2.38	2 1/2	4.5

XVQ1

Code 61 Flange 45° Elbow
Code 61 / 37° Flare



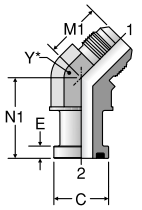
* Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M1 (in.)	N1 (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 XVQ1	3/4	3/4	1.500	0.265	1.28	1.58	1 7/16	5.0
16 XVQ1	1	1	1.750	0.315	1.47	1.85	1 5/8	5.0
20 XVQ1	1 1/4	1 1/4	2.000	0.315	1.59	2.04	1 7/8	4.0
24 XVQ1	1 1/2	1 1/2	2.375	0.315	1.78	2.38	2 1/2	3.0
32 XVQ1	2	2	2.812	0.375	2.22	3.00	2 1/2	2.0

WARNING: This product can expose you to chemicals including Diisononyl Phthalate which is known to the State of California to cause cancer. For more information go to www.p65warnings.ca.gov.

XVQ2

Code 62 Flange 45° Elbow
Code 62 / 37° Flare

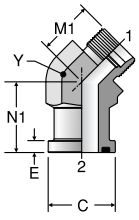


* Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M1 (in.)	N1 (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 XVQ2	3/4	3/4	1.625	0.345	1.28	1.58	1 7/16	5.0
16 XVQ2	1	1	1.875	0.375	1.47	1.85	1 5/8	5.0
20 XVQ2	1 1/4	1 1/4	2.125	0.405	1.59	2.04	1 7/8	4.0
24 XVQ2	1 1/2	1 1/2	2.500	0.495	1.78	2.38	2 1/2	3.0

BUVQ1

Code 61 45° Elbow
Code 61 / Flareless



* Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M1 (in.)	N1 (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 BUVQ1	3/4	3/4	1.500	0.265	1.27	1.58	1 7/16	
16 BUVQ1	1	1	1.750	0.315	1.36	1.85	1 5/8	
20 BUVQ1	1 1/4	1 1/4	2.000	0.315	1.45	2.40	1 7/8	
24 BUVQ1	1 1/2	1 1/2	2.375	0.315	1.52	2.90	2 1/2	
32 BUVQ1	2	2	2.812	0.375	1.83	3.00	2 1/2	

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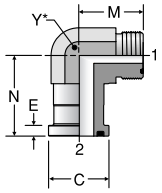
LOEQ1

Code 61 Flange 90° Elbow
Code 61 / ORFS

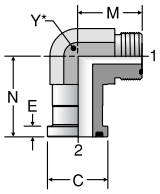


*Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M (in.)	N (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 LOEQ1	3/4	3/4	1.500	0.265	1.66	2.13	1 3/16	5.0
16 LOEQ1	1	1	1.750	0.315	1.81	2.37	1 7/16	5.0
20 LOEQ1	1 1/4	1 1/4	2.000	0.315	2.06	2.62	1 5/8	4.0
24 LOEQ1	1 1/2	1 1/2	2.375	0.315	2.54	2.64	2	3.0

LOEQ2

Code 62 Flange 90° Elbow
Code 62 / ORFS

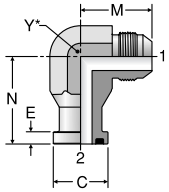


*Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M (in.)	N (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S
12 LOEQ2	3/4	3/4	1.625	0.345	1.66	2.13	1 3/16	6.0
16 LOEQ2	1	1	1.875	0.375	1.81	2.37	1 7/16	6.0
20 LOEQ2	1 1/4	1 1/4	2.125	0.405	2.06	2.76	1 5/8	5.0
24 LOEQ2	1 1/2	1 1/2	2.500	0.495	2.33	3.15	2	4.5

XEQ1

Code 61 Flange 90° Elbow
Code 61 / 37° Flare

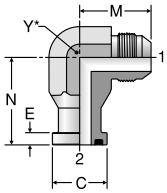


*Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M (in.)	N (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S	-SS	-B
12 XEQ1	3/4	3/4	1.500	0.265	1.66	2.13	1 3/16	5.0		
16 XEQ1	1	1	1.750	0.315	1.81	2.37	1 7/16	5.0		
20 XEQ1	1 1/4	1 1/4	2.000	0.315	2.06	2.62	1 5/8	4.0		
24 XEQ1	1 1/2	1 1/2	2.375	0.315	2.33	3.15	2	3.0		
32 XEQ1	2	2	2.812	0.375	3.06	4.25	2 1/2	2.0		

XEQ2

Code 62 Flange 90° Elbow
Code 62 / 37° Flare

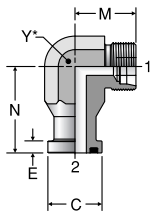


*Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M (in.)	N (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S	-SS	-B
12 XEQ2	3/4	3/4	1.625	0.345	1.66	2.13	1 3/16	5.0		
16 XEQ2	1	1	1.875	0.375	1.81	2.57	1 7/16	5.0		
20 XEQ2	1 1/4	1 1/4	2.125	0.405	2.06	2.76	1 5/8	4.0		
24 XEQ2	1 1/2	1 1/2	2.500	0.495	2.33	3.15	2	3.0		

BUEQ1

Code 61 90° Elbow
Code 61 / Flareless



*Y – Across Wrench Flats

TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 (in.)	C (in.)	E (in.)	M (in.)	N (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -S	-SS	-B
12 BUEQ1	3/4	3/4	1.500	0.265	1.73	1.81	1 3/16			
16 BUEQ1	1	1	1.750	0.315	1.99	2.13	1 7/16			
20 BUEQ1	1 1/4	1 1/4	2.000	0.315	1.99	2.26	1 5/8			
24 BUEQ1	1 1/2	1 1/2	2.375	0.315	2.33	2.64	2			
32 BUEQ1	2	2	2.812	0.375	2.45	4.25	2 1/2			

WARNING: This product can expose you to chemicals including Diisononyl Phthalate which is known to the State of California to cause cancer. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

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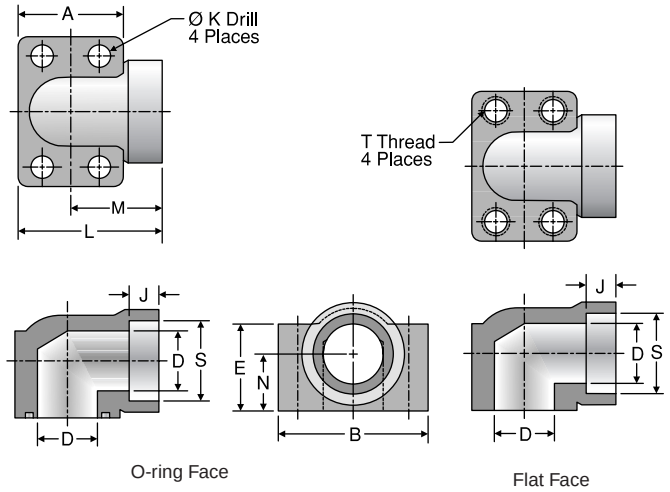
W7EQ

Weld Socket Block Elbow Connector, Pipe
Weld Socket, Pipe / Code 61 or 62
Block Flange or Pad



O-ring Face

Flat Face

TUBE FITTING PART #		PIPE SIZE	FLANGE SIZE	A	B	D	E	J	K DRILL DIA.	L	M	N	S	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS
WELD SOCKET, PIPE / CODE 61 BLOCK FLANGE OR PAD																	
12W7EQ1B	**12W7EQ1P**	3/4	0.75	1.69	2.56	0.75	1.25	0.56	0.406	2.28	1.44	0.875	1.062	3/8-16	3/8-16 x 2.00	5.0	
16W7EQ1B	**16W7EQ1P**	1	1.00	1.94	2.75	1.00	1.50	0.56	0.406	2.62	1.66	1.062	1.328	3/8-16	3/8-16 x 2.25	4.5	
20W7EQ1B	**20W7EQ1P**	1 1/4	1.25	2.19	3.12	1.25	1.81	0.62	0.469	3.00	1.91	1.188	1.672	7/16-14	7/16-14 x 2.75	3.5	
24W7EQ1B	**24W7EQ1P**	1 1/2	1.50	2.56	3.69	1.50	2.00	0.69	0.531	3.33	2.05	1.312	1.922	1/2-13	1/2-13 x 3.00	3.0	
32W7EQ1B	**32W7EQ1P**	2	2.00	3.06	4.33	2.00	2.50	0.75	0.531	3.81	2.28	1.656	2.406	1/2-13	1/2-13 x 3.50	3.0	
WELD SOCKET, PIPE / CODE 62 BLOCK FLANGE OR PAD																	
12W7EQ2B	**12W7EQ2P**	3/4	0.75	1.94	2.75	0.75	1.50	0.56	0.406	2.62	1.66	1.062	1.062	3/8-16	3/8-16 x 2.25	6.0	
16W7EQ2B	**16W7EQ2P**	1	1.00	2.19	3.12	1.00	1.81	0.62	0.469	3.00	1.91	1.188	1.328	7/16-14	7/16-14 x 2.50	6.0	
20W7EQ2B	**20W7EQ2P**	1 1/4	1.25	2.56	3.69	1.25	2.00	0.69	0.531	3.32	2.05	1.312	1.672	1/2-13	1/2-13 x 3.00	5.0	
24W7EQ2B	**24W7EQ2P**	1 1/2	1.50	3.06	4.33	1.50	2.50	0.75	0.656	3.81	2.28	1.656	1.922	5/8-11	5/8-11 x 3.50	5.0	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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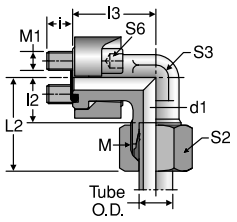
WFS

SAE Flange Connection
Code 61 & 62 / Metric Flareless



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TUBE FITTING PART #	SIZE (in.)	END SIZE (mm)	WORKING PRESSURE (bar)	M THREAD	d1 (mm)	l (mm)	l 1 (mm)	l 2 (mm)	l 3 (mm)	L1 ≈ (mm)	L2 ≈ (mm)	S1 (mm)	S2 (mm)	S3 (mm)	S6 (mm)	FROM STOCK CF	FROM STOCK 71	FROM STOCK CF	FROM STOCK 71
SAE FLANGE CONNECTIONS – CODE 61 – STANDARD SERIES																			
WFS32/15LCF	1/2	15L	200	M22 x 1.5	12	11.5	41	29	36	56	44	24	27	24	6	•		•	
WFS32/16SCF	1/2	16S	220	M24 x 1.5	12	11.5	41.5	29.5	36	60	48	24	30	24	6	•		•	
WFS33/18LCF	3/4	18L	200	M26 x 1.5	15	15.5	45.5	31.5	42	62	48	30	32	30	8	•		•	
WFS33/22LCF	3/4	22L	100	M30 x 2	19	15.5	45.5	33.5	42	62	50	30	36	30	8	•		•	
WFS33/20SCF	3/4	20S	220	M30 x 2	16	15.5	46.5	32.5	42	68	54	30	36	30	8	•		•	
WFS33/25SCF	3/4	25S	220	M36 x 2	17	15.5	45	33	42	69	57	30	46	30	8	•		•	
WFS34/28LCF	1	28L	100	M36 x 2	24	13.5	46.5	36.5	45	63	53	36	41	36	8	•		•	
WFS34/30SCF	1	30S	220	M42 x 2	24	13.5	49.5	36.5	45	76	63	36	50	36	8	•		•	
WFS35/35LCF	1 1/4	35L	100	M45 x 2	30	18.5	47.5	46.5	50	69	68	41	50	41	8	•		•	
WFS35/25SCF	1 1/4	25S	175	M36 x 2	20	18.5	48	43	50	72	67	41	46	41	8	•		•	
WFS35/30SCF	1 1/4	30S	175	M42 x 2	25	18.5	48.5	43.5	50	75	70	41	50	41	8	•		•	
WFS35/38SCF	1 1/4	38S	175	M52 x 2	28	18.5	50	43	50	81	74	46	60	41	8	•		•	
WFS36/42LCF	1 1/2	42L	100	M52 x 2	36	18.5	53	47	55	76	70	46	60	50	10	•		•	
WFS36/38SCF	1 1/2	38S	130	M52 x 2	32	18.5	54	48	55	85	79	46	60	50	10	•		•	
SAE FLANGE CONNECTIONS – CODE 62 – HIGH PRESSURE SERIES																			
WFS62/16SCF	1/2	16S	250	M24 x 1.5	12	13.5	44.5	29.5	39	63	48	24	30	24	6	•		•	
WFS63/16SCF	3/4	16S	250	M24 x 1.5	12	15.5	50.5	36.5	48	69	55	30	30	32	8	•		•	
WFS63/20SCF	3/4	20S	250	M30 x 2	16	15.5	50.5	35.5	48	72	57	30	36	32	8	•		•	
WFS63/25SCF	3/4	25S	250	M36 x 2	17	15.5	51	36	48	75	60	30	46	32	8	•		•	
WFS64/25SCF	1	25S	250	M36 x 2	20	20.5	60	44	60	84	65	36	46	41	10	•		•	
WFS64/30SCF	1	30S	250	M42 x 2	24	20.5	60.5	41.5	60	87	68	36	50	41	10	•		•	
WFS65/30SCF	1 1/4	30S	250	M42 x 2	25	22.5	65.5	44.5	68	92	71	41	50	46	10	•		•	
WFS65/38SCF	1 1/4	38S	200	M52 x 2	30	22.5	67	45	68	98	76	46	60	46	10	•		•	
WFS66/38SCF	1 1/2	38S	200	M52 x 2	30	24.5	73	56	76	104	87	46	60	50	14	•		•	

EO-2 Part Number example: WFS33/18ZLCF

Tightening torques for socket head cap screws see Tables R6 and R7.

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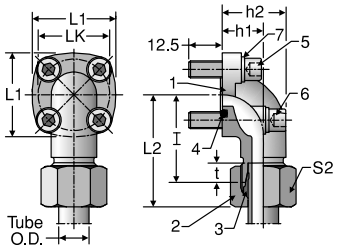
BFW

Hydraulic Flange Elbow
DIN Flange / Metric Flareless



TUBE FITTING PART #	WORKING PRESSURE (bar)	END SIZE (mm)	h1 (mm)	h1 (mm)	I (mm)	L1 (mm)	L2 (mm)	LK (mm)	S2 (mm)	t (mm)	MATERIAL FROM STOCK CF	MATERIAL FROM STOCK 71	EO-2 FROM STOCK CF	EO-2 FROM STOCK 71
BFW15L/LK40CF	65	15	22.5	36.5	38	42	46	40	27	7	•		•	
BFW18L/LK40CF	65	18	22.5	36.5	38	42	47	40	32	7.5	•		•	
BFW22L/LK40CF	65	22	22.5	36.5	38	42	47.5	40	36	7.5	•		•	
BFW28L/LK40CF	65	28	28	43	40	42	49	40	41	7.5	•		•	
BFW35L/LK40CF	65	35	32	55	41	42	52	40	50	10.5	•		•	
BFW35L/LK55CF	65	35	32	51.5	49	58	62	55	50	10.5	•		•	
BFW42L/LK55CF	65	42	40	64.5	49	58	61	55	60	11	•		•	
BFW15L/LK35CF	155	15	16.5	26.5	38	39	46	35	27	7	•		•	
BFW20S/LK55CF	155	20	24	38	45	58	56	55	36	10.5	•		•	
BFW20S/LK40CF	155	20	22.5	35.5	40	42	50	40	36	10.5	•		•	
BFW25S/LK55CF	155	25	30	46	49	58	61	55	46	12	•		•	
BFW30S/LK55CF	155	30	32	50	49	58	62	55	50	13.5	•		•	
BFW10L/LK35CF	200	10	16.5	26.5	38	39	47	35	19	7	•		•	
BFW12L/LK35CF	200	12	16.5	26.5	38	39	47	35	22	7	•		•	
BFW16S/LK35CF	200	16	20	31	38	39	48	35	30	8.5	•		•	

Unassembled BFW Fitting Components

1 Elbow Body	2 Nut	3 Progressive Ring	4 O-ring	5 2 Cap Screws DIN 912-8.8	6 2 Cap Screws DIN 912-8.8	7 4 Spr. Washers DIN 127
BFW15L/LK40CFX	M15LCFX	DPR15LCFX	OR26X2.5X	M6X22	M6X22	A6
BFW18L/LK40CFX	M18LCFX	DPR18LCFX	OR26X2.5X	M6X22	M6X22	A6
BFW22L/LK40CFX	M22LCFX	DPR22LCFX	OR26X2.5X	M6X22	M6X22	A6
BFW28L/LK40CFX	M28LCFX	DPR28LCFX	OR26X2.5X	M6X20	M6X50	A6
BFW35L/LK40CFX	M35LCFX	DPR35LCFX	OR26X2.5X	M6X22	M6X60	A6
BFW35L/LK55CFX	M35LCFX	DPR35LCFX	OR33X2.5X	M8X25	M8X60	A8
BFW42L/LK55CFX	M42LCFX	DPR42LCFX	OR33X2.5X	M8X25	M8X70	A8
BFW15L/LK35CFX	M15LCFX	DPR15LCFX	OR20X2.5X	M6X22	M6X35	A6
BFW20S/LK55CFX	M20SCFX	DPR20SCFX	OR33X2.5X	M8X25	M8X50	A8
BFW20S/LK40CFX	M20SCFX	DPR20SCFX	OR26X2.5X	M6X22	M6X45	A6
BFW25S/LK55CFX	M25SCFX	DPR25SCFX	OR33X2.5X	M8X25	M8X55	A8
BFW30S/LK55CFX	M30SCFX	DPR20SCFX	OR33X2.5X	M8X25	M8X55	A8
BFW10L/LK35CFX	M10LCFX	DRP10LCFX	OR20X2.5X	M6X22	M6X35	A6
BFW12L/LK35CFX	M12LCFX	DPR12LCFX	OR20X2.5X	M6X22	M6X35	A6
BFW16S/LK35CFX	M16SCFX	DPR16SCFX	OR20X2.5X	M6X22	M6X40	A6
BFW20S/LK35CFX	M20SCFX	DPR20SCFX	OR20X2.5X	M6X22	M6X45	A6

EO-2 Part Number example: BFW15ZL/LK40CF

Tightening torques for socket head cap screws see Table R6.

Dimensions and pressures for reference only, subject to change.

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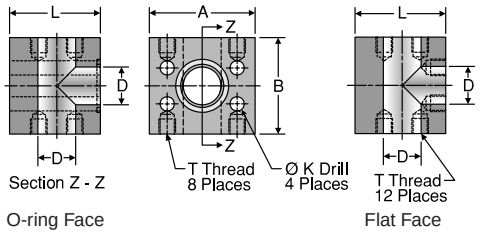
Block Junction Tee
Code 61 or 62 Block Pads / Block Flange or Pad

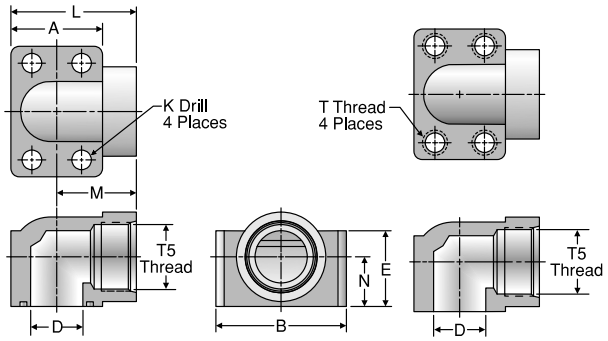


O-ring Face Flat Face

TUBE FITTING PART #		FLANGE SIZE	A	B	D	K DRILL DIA.	L	T THREAD	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	-SX	-SS
CODE 61 BLOCK PADS / BLOCK FLANGE OR PAD										
12Q1PQ1PJQ1B	12Q1PQ1PJQ1P	0.75	2.62	2.75	0.75	0.406	2.25	3/8-16	5.0	
16Q1PQ1PJQ1B	16Q1PQ1PJQ1P	1.00	2.82	2.97	1.00	0.406	2.50	3/8-16	5.0	
20Q1PQ1PJQ1B	20Q1PQ1PJQ1P	1.25	3.19	3.47	1.25	0.469	3.00	7/16-14	4.0	
24Q1PQ1PJQ1B	24Q1PQ1PJQ1P	1.50	3.75	3.97	1.50	0.531	3.50	1/2-13	3.0	
32Q1PQ1PJQ1B	32Q1PQ1PJQ1P	2.00	4.00	4.25	2.00	0.531	3.97	1/2-13	3.0	
CODE 62 BLOCK PADS / BLOCK FLANGE OR PAD										
12Q2PQ2PJQ2B	12Q2PQ2PJQ2P	0.75	2.81	2.97	0.75	0.406	2.50	3/8-16	6.0	
16Q2PQ2PJQ2B	16Q2PQ2PJQ2P	1.00	3.19	3.47	1.00	0.469	3.00	7/16-14	6.0	
20Q2PQ2PJQ2B	20Q2PQ2PJQ2P	1.25	3.75	3.97	1.25	0.531	3.50	1/2-13	6.0	
24Q2PQ2PJQ2B	24Q2PQ2PJQ2P	1.50	4.50	4.47	1.50	0.656	4.00	5/8-11	6.0	
32Q2PQ2PJQ2B	32Q2PQ2PJQ2P	2.00	5.25	4.97	1.94	0.781	5.00	3/4-10	6.0	

G5EQ

SAE Port Block Elbow
SAE Port / Code 61 or 62 Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		T5 STRAIGHT THREAD	SAE PORT DASH	FLANGE SIZE	A	B	D	E	K DRILL DIA.	L	M	N	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	UN-2B	SIZE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS
SAE PORT / CODE 61 BLOCK FLANGE OR PAD																
12G5EQ1B	12G5EQ1P	1-1/16-12	12	0.75	1.69	2.56	0.75	1.25	0.406	2.28	1.440	0.875	3/8-16	3/8-16 x 2.00	4.0	
16G5EQ1B	16G5EQ1P	1-5/16-12	16	1.00	1.94	2.75	1.00	1.50	0.406	2.62	1.660	1.062	3/8-16	3/8-16 x 2.25	3.0	
20G5EQ1B	20G5EQ1P	1-5/8-12	20	1.25	2.19	3.12	1.25	1.81	0.469	3.00	1.910	1.188	7/16-14	7/16-14 x 2.75	2.5	
24G5EQ1B	24G5EQ1P	1-7/8-12	24	1.50	2.56	3.69	1.50	2.00	0.531	3.33	2.050	1.312	1/2-13	1/2-13 x 3.00	2.0	
32G5EQ1B	32G5EQ1P	2-1/2-12	32	2.00	3.06	4.33	2.00	2.50	0.531	3.81	2.280	1.656	1/2-13	1/2-13 x 3.50	1.5	
SAE PORT / CODE 62 BLOCK FLANGE OR PAD																
12G5EQ2B	12G5EQ2P	1-1/16-12	12	0.75	1.94	2.75	0.75	1.50	0.406	2.62	1.660	1.062	3/8-16	3/8-16 x 2.25	5.0	
16G5EQ2B	16G5EQ2P	1-5/16-12	16	1.00	2.19	3.12	1.00	1.81	0.469	3.00	1.910	1.188	7/16-14	7/16-14 x 2.50	4.0	
20G5EQ2B	20G5EQ2P	1-5/8-12	20	1.25	2.56	3.69	1.25	2.00	0.531	3.32	2.050	1.312	1/2-13	1/2-13 x 3.00	3.5	
24G5EQ2B	24G5EQ2P	1-7/8-12	24	1.50	3.06	4.33	1.50	2.50	0.656	3.81	2.280	1.656	5/8-11	5/8-11 x 3.50	3.5	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

Dimensions and pressures for reference only, subject to change.

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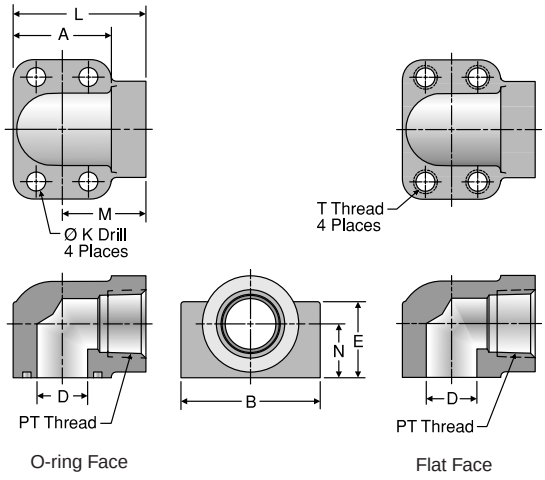
NPTF Port Block Elbow Adapter
NPTF / Code 61 or 62 Block Flange or Pad



TUBE FITTING PART #		PT THREAD	FLANGE SIZE	A	B	D	E	K DRILL DIA.	L	M	N	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	NPTF	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS
NPTF PORT / CODE 61 BLOCK FLANGE OR PAD															
12GEQ1B	**12GEQ1P**	3/4 - 14	0.75	1.69	2.56	0.75	1.25	0.406	2.28	1.440	0.875	3/8-16	3/8-16 x 2.00	4.0	
16GEQ1B	**16GEQ1P**	1 - 11 1/2	1.00	1.94	2.75	1.00	1.50	0.406	2.62	1.660	1.062	3/8-16	3/8-16 x 2.25	4.0	
20GEQ1B	**20GEQ1P**	1 1/4 - 11 1/2	1.25	2.19	3.12	1.25	1.81	0.469	3.00	1.910	1.188	7/16-14	7/16-14 x 2.75	2.7	
24GEQ1B	**24GEQ1P**	1 1/2 - 11 1/2	1.50	2.56	3.69	1.50	2.00	0.531	3.33	2.050	1.312	1/2-13	1/2-13 x 3.00	2.5	
32GEQ1B	**32GEQ1P**	2 - 11 1/2	2.00	3.06	4.33	2.00	2.50	0.531	3.81	2.280	1.656	1/2-13	1/2-13 x 3.50	1.7	
NPTF PORT / CODE 62 BLOCK FLANGE OR PAD															
12GEQ2B	**12GEQ2P**	3/4 - 14	0.75	1.94	2.75	0.75	1.50	0.406	2.62	1.660	1.062	3/8-16	3/8-16 x 2.25	5.5	
16GEQ2B	**16GEQ2P**	1 - 11 1/2	1.00	2.19	3.12	1.00	1.81	0.469	3.00	1.910	1.188	7/16-14	7/16-14 x 2.50	5.0	
20GEQ2B	**20GEQ2P**	1 1/4 - 11 1/2	1.25	2.56	3.69	1.25	2.00	0.531	3.32	2.050	1.312	1/2-13	1/2-13 x 3.00	3.5	
24GEQ2B	**24GEQ2P**	1 1/2 - 11 1/2	1.50	3.06	4.33	1.50	2.50	0.656	3.81	2.280	1.656	5/8-11	5/8-11 x 3.50	3.0	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

Dimensions and pressures for reference only, subject to change.

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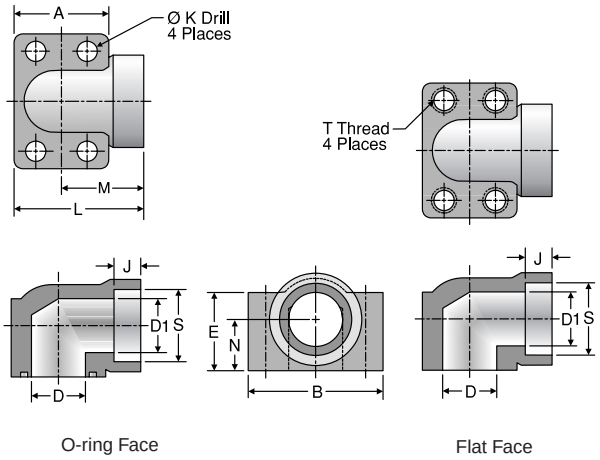
W6EQ

Weld Socket Block Elbow Connector, Tube
Weld Socket, Tube / Code 61 or 62 Block Flange or Pad



O-ring Face

Flat Face

TUBE FITTING PART #		TUBE O.D.	FLANGE SIZE	A	B	D	D1	E	J	K DRILL DIA.	L	M	N	S	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)	
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SX	-SS
WELD SOCKET, TUBE / CODE 61 BLOCK FLANGE OR PAD																		
12W6EQ1B	**12W6EQ1P**	3/4	0.75	1.69	2.56	0.75	0.63	1.25	0.312	0.406	2.280	1.44	0.875	0.752	3/8-16	3/8-16 x 2.00	5.0	
16-12W6EQ1B	**16-12W6EQ1P**	1	0.75	1.69	2.56	0.75	0.75	1.25	0.438	0.406	2.280	1.44	0.875	1.002	3/8-16	3/8-16 x 2.00	5.0	
16W6EQ1B	**16W6EQ1P**	1	1.00	1.94	2.75	1.00	0.88	1.50	0.438	0.406	2.620	1.66	1.062	1.002	3/8-16	3/8-16 x 2.25	5.0	
20-16W6EQ1B	**20-16W6EQ1P**	1 1/4	1.00	1.94	2.75	1.00	1.00	1.50	0.500	0.406	2.620	1.66	1.062	1.252	3/8-16	3/8-16 x 2.25	5.0	
20W6EQ1B	**20W6EQ1P**	1 1/4	1.25	2.19	3.12	1.25	1.13	1.81	0.500	0.469	3.000	1.91	1.188	1.252	7/16-14	7/16-14 x 2.75	4.0	
24-20W6EQ1B	**24-20W6EQ1P**	1 1/2	1.25	2.19	3.12	1.25	1.25	1.81	0.562	0.469	3.000	1.91	1.188	1.502	7/16-14	7/16-14 x 2.75	4.0	
24W6EQ1B	**24W6EQ1P**	1 1/2	1.50	2.56	3.69	1.50	1.38	2.00	0.562	0.531	3.328	2.05	1.312	1.502	1/2-13	1/2-13 x 3.00	3.0	
28-24W6EQ1B	**28-24W6EQ1P**	1 3/4	1.50	2.56	3.69	1.50	1.50	2.00	0.562	0.531	3.328	2.05	1.312	1.752	1/2-13	1/2-13 x 3.00	3.0	
32W6EQ1B	**32W6EQ1P**	2	2.00	3.06	4.33	2.00	1.88	2.50	0.625	0.531	3.812	2.28	1.656	2.002	1/2-13	1/2-13 x 3.50	3.0	
36-32W6EQ1B	**36-32W6EQ1P**	2 1/4	2.00	3.06	4.33	2.00	2.00	2.50	0.625	0.531	3.812	2.28	1.656	2.252	1/2-13	1/2-13 x 3.50	3.0	
WELD SOCKET, TUBE / CODE 62 BLOCK FLANGE OR PAD																		
12W6EQ2B	**12W6EQ2P**	3/4	0.75	1.94	2.75	0.75	0.63	1.50	0.560	0.406	2.620	1.66	1.062	0.752	3/8-16	3/8-16 x 2.25	6.0	
16-12W6EQ2B	**16-12W6EQ2P**	1	0.75	1.94	2.75	0.75	0.75	1.50	0.620	0.406	2.620	1.66	1.062	1.002	3/8-16	3/8-16 x 2.25	6.0	
16W6EQ2B	**16W6EQ2P**	1	1.00	2.19	3.12	1.00	0.88	1.81	0.620	0.469	3.000	1.91	1.188	1.002	7/16-14	7/16-14 x 2.50	6.0	
20-16W6EQ2B	**20-16W6EQ2P**	1 1/4	1.00	2.19	3.12	1.00	1.00	1.81	0.690	0.469	3.000	1.91	1.188	1.252	7/16-14	7/16-14 x 2.50	6.0	
20W6EQ2B	**20W6EQ2P**	1 1/4	1.25	2.56	3.69	1.25	1.13	2.00	0.690	0.531	3.320	2.05	1.312	1.252	1/2-13	1/2-13 x 3.00	6.0	
24-20W6EQ2B	**24-20W6EQ2P**	1 1/2	1.25	2.56	3.69	1.25	1.25	2.00	0.750	0.531	3.320	2.05	1.312	1.502	1/2-13	1/2-13 x 3.00	6.0	
24W6EQ2B	**24W6EQ2P**	1 1/2	1.50	3.06	4.33	1.50	1.38	2.50	0.750	0.656	3.810	2.28	1.656	1.502	5/8-11	5/8-11 x 3.50	6.0	
28-24W6EQ2B	**28-24W6EQ2P**	1 3/4	1.50	3.06	4.33	1.50	1.50	2.50	0.750	0.656	3.810	2.28	1.656	1.752	5/8-11	5/8-11 x 3.50	6.0	

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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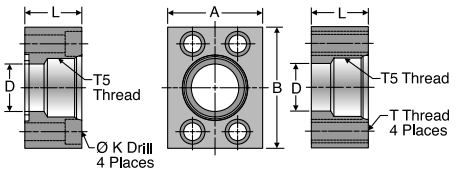
SAE Port / Code 61 or 62 Block Flange



O-ring Face Flat Face

TUBE FITTING PART #		SAE PORT DASH SIZE	FLANGE SIZE (in.)	A (in.)	B (in.)	D (in.)	K DRILL DIA. (in.)	L (in.)	T5 STRAIGHT THREAD UN-2B	MOUNTING HARDWARE SHCS	Dynamic Pressure (x 1,000 PSI) -SS
O-ring FACE	FLAT FACE										
SAE PORT / CODE 61 FLANGE BLOCK											
8G5Q1B	*	8	0.50	1.50	2.12	0.50	0.344	1.20	3/4-16	5/16-18 x 1.25	5.0
12G5Q1B	*	12	0.75	1.75	2.62	0.75	0.406	1.20	1 1/16-12	3/8-16 x 1.50	5.0
16G5Q1B	*	16	1.00	2.00	2.82	1.00	0.406	1.45	1 5/16-12	3/8-16 x 1.50	5.0
20G5Q1B	*	20	1.25	2.50	3.19	1.25	0.469	1.45	1 5/8-12	7/16-14 x 1.75	4.0
24G5Q1B	*	24	1.50	2.75	3.75	1.50	0.531	1.70	1 7/8-12	1/2-13 x 2.00	3.0
32G5Q1B	*	32	2.00	3.25	4.00	2.00	0.531	1.70	2 1/2-12	1/2-13 x 2.00	
SAE PORT / CODE 62 FLANGE BLOCK											
8G5Q2B	*	8	0.50	1.75	2.22	0.50	0.344	0.95	3/4-16	5/16-18 x 1.25	6.0
12G5Q2B	*	12	0.75	2.00	2.81	0.75	0.406	1.20	1 1/16-12	3/8-16 x 1.50	6.0
16G5Q2B	*	16	1.00	2.25	3.19	1.00	0.469	1.45	1 5/16-12	7/16-14 x 1.75	6.0
20G5Q2B	*	20	1.25	2.75	3.75	1.25	0.531	1.45	1 5/8-12	1/2-13 x 1.75	6.0
24G5Q2B	*	24	1.50	3.25	4.50	1.50	0.656	1.70	1 7/8-12	5/8-11 x 2.00	5.0
32G5Q2B	*	32	2.00	4.00	5.25	2.00	0.781	1.70	2 1/2-12	3/4-10 x 2.25	3.0

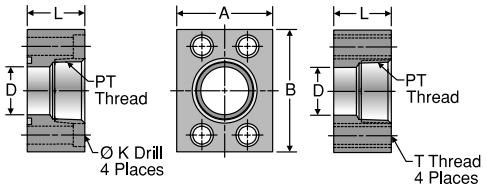
* Consult factory.

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

GQ – Stainless Steel

NPTF Port Block Flange Adapter
NPTF Port / Code 61 or 62 Block Flange



O-ring Face Flat Face

TUBE FITTING PART #		PT THREAD NPTF	FLANGE SIZE (in.)	A (in.)	B (in.)	D (in.)	K DRILL DIA. (in.)	L (in.)	MOUNTING HARDWARE SHCS	Dynamic Pressure (x 1,000 PSI) -SS
O-ring FACE	FLAT FACE									
NPTF PORT / CODE 61 BLOCK FLANGE										
8GQ1B	*	1/2-14	0.50	1.50	2.12	0.50	0.344	1.20	5/16-18 x 1.75	5.0
12GQ1B	*	3/4-14	0.75	1.75	2.62	0.75	0.406	1.20	3/8-16 x 2.00	5.0
16GQ1B	*	1-11 1/2	1.00	2.00	2.82	1.00	0.406	1.45	3/8-16 x 2.25	5.0
20GQ1B	*	1 1/4-11 1/2	1.25	2.50	3.19	1.25	0.469	1.45	7/16-14 x 2.25	4.0
24GQ1B	*	1 1/2-11 1/2	1.50	2.75	3.75	1.50	0.531	1.70	1/2-13 x 2.50	3.0
32GQ1B	*	2-11 1/2	2.00	3.25	4.00	2.00	0.531	1.70	1/2-13 x 2.50	2.7
40GQ1B	*	2 1/2-8	2.50	4.00	4.50	2.50	0.531	1.95	1/2-13 x 2.75	2.5
48GQ1B	*	3-8	3.00	4.50	5.31	3.00	0.656	2.20	5/8-11 x 3.00	1.2
NPTF PORT / CODE 62 BLOCK FLANGE										
12GQ2B	*	3/4-14	0.75	2.00	2.81	0.75	0.406	1.20	3/8-16 x 2.00	6.0
16GQ2B	*	1-11 1/2	1.00	2.25	3.19	1.00	0.469	1.45	7/16-14 x 2.50	5.0
20GQ2B	*	1 1/4-11 1/2	1.25	2.75	3.75	1.25	0.531	1.45	1/2-13 x 2.50	4.0
24GQ2B	*	1 1/2-11 1/2	1.50	3.25	4.50	1.50	0.656	1.70	5/8-11 x 2.75	3.5
32GQ2B	*	2-11 1/2	2.00	4.00	5.25	2.00	0.781	1.70	3/4-10 x 3.00	3.0

* Consult factory.

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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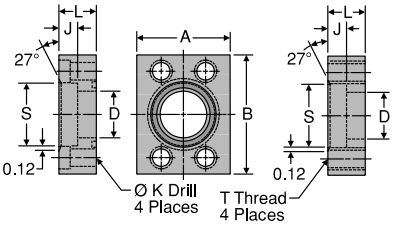
W5Q – Stainless Steel

Flat Weld Socket Block Flange Connector, Pipe
Flat Weld Socket, Pipe / Code 61 or 62
Block Flange or Pad



O-ring Face Flat Face

TUBE FITTING PART #		PIPE SIZE	FLANGE SIZE	A	B	D	J	K DRILL DIA.	L	S	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SS
FLAT WELD SOCKET, PIPE / CODE 61 BLOCK FLANGE OR PAD													
8W5Q1B	**8W5Q1P**	1/2	0.50	1.50	2.12	0.500	0.380	0.344	0.69	0.860	5/16-18	5/16-18 x 1.25	5.0
12W5Q1B	**12W5Q1P**	3/4	0.75	1.75	2.62	0.750	0.500	0.406	0.94	1.070	3/8-16	3/8-16 x 1.75	5.0
16W5Q1B	**16W5Q1P**	1	1.00	2.00	2.82	1.000	0.500	0.406	0.94	1.335	3/8-16	3/8-16 x 1.75	5.0
20W5Q1B	**20W5Q1P**	1 1/4	1.25	2.50	3.19	1.250	0.500	0.469	0.94	1.680	7/16-14	7/16-14 x 1.75	4.0
24W5Q1B	**24W5Q1P**	1 1/2	1.50	2.75	3.75	1.500	0.500	0.531	1.19	1.920	1/2-13	1/2-13 x 2.25	3.0
32W5Q1B	**32W5Q1P**	2	2.00	3.25	4.00	2.000	0.620	0.531	1.44	2.411	1/2-13	1/2-13 x 2.50	3.0
40W5Q1B	**40W5Q1P**	2 1/2	2.50	4.00	4.50	2.500	0.750	0.531	1.69	2.911	1/2-13	1/2-13 x 2.75	2.5
48W5Q1B	**48W5Q1P**	3	3.00	4.50	5.31	3.000	1.240	0.656	2.12	3.540	5/8-11	5/8-11 x 3.50	2.0
FLAT WELD SOCKET, PIPE / CODE 62 BLOCK FLANGE OR PAD													
8W5Q2B	**8W5Q2P**	1/2	0.50	1.75	2.22	0.500	0.500	0.344	0.94	0.860	5/16-18	5/16-18 x 1.50	6.0
12W5Q2B	**12W5Q2P**	3/4	0.75	2.00	2.81	0.750	0.500	0.406	0.94	1.070	3/8-16	3/8-16 x 1.75	6.0
16W5Q2B	**16W5Q2P**	1	1.00	2.25	3.19	1.000	0.500	0.469	0.94	1.335	7/16-14	7/16-14 x 1.75	6.0
20W5Q2B	**20W5Q2P**	1 1/4	1.25	2.75	3.75	1.250	0.500	0.531	1.19	1.672	1/2-13	1/2-13 x 2.25	6.0
24W5Q2B	**24W5Q2P**	1 1/2	1.50	3.25	4.50	1.500	0.500	0.656	1.44	1.920	5/8-11	5/8-11 x 2.75	6.0
32W5Q2B	**32W5Q2P**	2	2.00	4.00	5.25	2.000	0.620	0.781	1.69	2.411	3/4-10	3/4-10 x 3.00	6.0
40W5Q2B	**40W5Q2P**	2 1/2	2.50	5.00	6.88	2.500	0.620	0.906	1.94	2.911	7/8-9	7/8-9 x 3.50	6.0
48W5Q2B	**48W5Q2P**	3	3.00	6.00	8.50	3.000	0.620	1.156	2.44	3.540	1 1/8-7	1 1/8-7 x 4.50	6.0

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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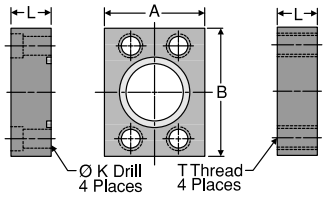
PQ – Stainless Steel

Block Plug
Code 61/62 Block Flange or Pad Plug



O-ring Face Flat Face

TUBE FITTING PART #		FLANGE SIZE	A	B	K DRILL DIA.	L	T THREAD	MOUNTING HARDWARE	Dynamic Pressure (x 1,000 PSI)
O-ring FACE	FLAT FACE	(in.)	(in.)	(in.)	(in.)	(in.)	UNC-2B	SHCS	-SS
CODE 61 BLOCK FLANGE OR PAD PLUG									
8PQ1B	**8PQ1P**	0.50	1.500	2.120	0.344	1.20	5/16-18	5/16-18 x 2.00	5.0
12PQ1B	**12PQ1P**	0.75	1.750	2.620	0.406	1.20	3/8-16	3/8-16 x 2.00	5.0
16PQ1B	**16PQ1P**	1.00	2.000	2.820	0.406	1.45	3/8-16	3/8-16 x 2.25	5.0
20PQ1B	**20PQ1P**	1.25	2.500	3.190	0.469	1.45	7/16-14	7/16-14 x 2.25	4.0
24PQ1B	**24PQ1P**	1.50	2.750	3.750	0.531	1.70	1/2-13	1/2-13 x 2.50	3.0
32PQ1B	**32PQ1P**	2.00	3.250	4.000	0.531	1.70	1/2-13	1/2-13 x 2.50	3.0
40PQ1B	**40PQ1P**	2.50	4.000	4.500	0.531	1.95	1/2-13	1/2-13 x 2.75	2.5
48PQ1B	**48PQ1P**	3.00	4.500	5.310	0.656	2.20	5/8-11	5/8-11 x 3.00	2.0
CODE 62 BLOCK FLANGE OR PAD PLUG									
8PQ2B	**8PQ2P**	0.50	1.750	2.220	0.344	0.94	5/16-18	5/16-18 x 1.50	6.0
12PQ2B	**12PQ2P**	0.75	2.000	2.810	0.406	1.19	3/8-16	3/8-16 x 2.00	6.0
16PQ2B	**16PQ2P**	1.00	2.250	3.190	0.492	1.44	7/16-14	7/16-14 x 2.25	6.0
20PQ2B	**20PQ2P**	1.25	2.750	3.750	0.531	1.44	1/2-13	1/2-13 x 2.50	6.0
24PQ2B	**24PQ2P**	1.50	3.250	4.500	0.656	1.69	5/8-11	5/8-11 x 2.75	6.0
32PQ2B	**32PQ2P**	2.00	4.000	5.250	0.781	1.69	3/4-10	3/4-10 x 3.00	6.0
40PQ2B	**40PQ2P**	2.50	5.000	6.880	0.906	1.94	7/8-9	7/8-9 x 3.50	6.0
48PQ2B	**48PQ2P**	3.00	6.000	8.500	1.190	2.44	1 1/8-7	1 1/8-7 x 3.75	6.0

To receive mounting hardware with flange, insert a “K” after the material designator. Mounting hardware kits are available for O-ring Face part numbers and include 4 bolts, 4 lock washers and an O-ring.

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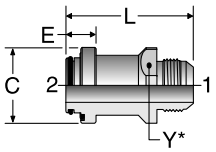
XHQ4O

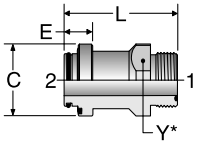
Dual Seal Flange Connector
Dual Seal / 37° Flare



TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 DUAL SEAL	C (in.)	D1 DRILL (in.)	D2 DRILL (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -SS
8 XHQ4O	1/2	1/2	1.25	0.391	0.391	0.69	2.98	1.00	7.2
16 XHQ4O	1	1	1.88	0.844	0.844	0.75	3.18	1.63	4.8
24 XHQ4O	1 1/2	1 1/2	2.50	1.310	1.310	1.00	4.00	2.13	3.6

LOHQ4O

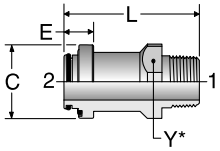
Dual Seal Flange Connector
Dual Seal / ORFS



TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 DUAL SEAL	C (in.)	D1 DRILL (in.)	D2 DRILL (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -SS
8 LOHQ4O	1/2	1/2	1.25	0.374	0.374	0.69	2.83	1.00	7.5
16 LOHQ4O	1	1	1.88	0.807	0.807	0.75	2.96	1.63	6.0
24 LOXHQ4O	1 1/2	1 1/2	2.50	1.260	1.260	1.00	3.61	2.13	5.0

FHQ4O

Dual Seal Flange Connector
Dual Seal / Male NPTF



TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 DUAL SEAL	C (in.)	D1 DRILL (in.)	D2 DRILL (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -SS
8 FHQ4O	1/2	1/2	1.25	0.500	0.500	0.69	3.18	1.00	7.2
16 FHQ4O	1	1	1.88	0.938	0.938	0.75	3.45	1.63	5.4
24 FHQ4O	1 1/2	1 1/2	2.50	1.312	1.312	1.00	4.10	2.13	3.6

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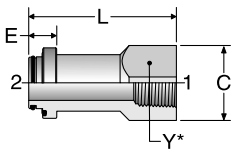
GHQ4O

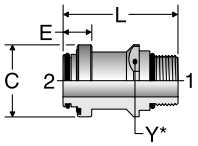
Dual Seal Flange Connector
Dual Seal / Female NPTF



TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 DUAL SEAL	C (in.)	D1 DRILL (in.)	D2 DRILL (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -SS
8 GHQ4O	1/2	1/2	1.25	0.500	0.500	0.69	2.96	1.00	6.0
16 GHQ4O	1	1	1.88	0.938	0.938	0.75	3.94	1.63	3.6
24 GHQ4O	1 1/2	1 1/2	2.50	1.312	1.312	1.00	4.81	2.25	3.0

F5OHQ4O

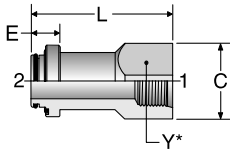
Dual Seal Flange Connector
Dual Seal / Male SAE-ORB



TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 DUAL SEAL	C (in.)	D1 DRILL (in.)	D2 DRILL (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -SS
8 F5OHQ4O	1/2	1/2	1.25	0.394	0.394	0.69	2.87	1.00	6.0
16 F5OHQ4O	1	1	1.88	0.844	0.844	0.75	3.00	1.63	6.0
24 F5OHQ4O	1 1/2	1 1/2	2.50	1.312	1.312	1.00	3.65	2.17	5.0

G5HQ4O

Dual Seal Flange Connector
Dual Seal / Female SAE-ORB



TUBE FITTING PART #	END SIZE 1 (in.)	END SIZE 2 DUAL SEAL	C (in.)	D1 DRILL (in.)	D2 DRILL (in.)	E (in.)	L (in.)	Y (in.)	Dynamic Pressure (x 1,000 PSI) -SS
8 G5HQ4O	1/2	1/2	1.25	0.406	0.406	0.69	2.77	1.00	5.0
16 G5HQ4O	1	1	1.88	0.938	0.938	0.75	3.72	1.63	3.5
24 G5HQ4O	1 1/2	1 1/2	2.50	1.312	1.312	1.00	4.59	2.25	2.5

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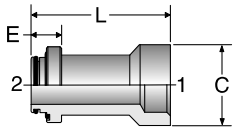
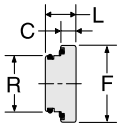


TUBE FITTING PART #	END SIZE 1 PIPE	END SIZE 2 DUAL SEAL	C (in.)	D1 DRILL (in.)	D2 DRILL (in.)	E (in.)	L (in.)	Dynamic Pressure (x 1,000 PSI) -SS
8 W7HQ4O	1/2	1/2	1.25	0.406	0.406	0.69	2.64	7.5
16 W7HQ4O	1	1	1.88	0.938	0.938	0.75	3.44	7.5
24 W7HQ4O	1 1/2	1 1/2	2.50	1.312	1.312	1.00	4.43	7.5

PQ4O

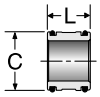
Dual Seal Flange Connector
Dual Seal Plug



TUBE FITTING PART #	END SIZE 2 DUAL SEAL	F (in.)	C (in.)	L (in.)	R (in.)	Dynamic Pressure (x 1,000 PSI) -SS
8 PQ4O	1/2	1.25	0.31	0.69	0.75	7.5
16 PQ4O	1	1.88	0.38	0.75	1.37	7.5
24 PQ4O	1 1/2	2.50	0.50	1.00	1.75	7.5

Q4 Insert

Dual Seal Flange Insert



TUBE FITTING PART #	END SIZE 2 DUAL SEAL	L (in.)	C (in.)	Dynamic Pressure (x 1,000 PSI) -SS
8 Q4 INSERT	1/2	1.00	0.75	7.5
16 Q4 INSERT	1	1.00	1.37	7.5
24 Q4 INSERT	1 1/2	1.00	1.74	7.5

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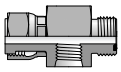
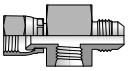

L5

XHX6G5TP
37° Swivel / 37° Flare / SAE-ORB

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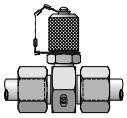
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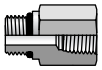
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E28

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G65L
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GLO
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L7

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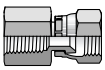
L7

GTX
NPT Gauge / 37° Flare

L7

G6X
NPT Gauge / 37° Swivel

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BSP Pressure Gauge Adapters

MAVE
BSPP Gauge / EO Swivel

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MAV
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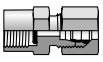

L6

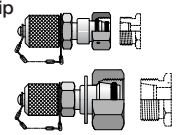
G4MXSMO
BSPP Gauge / 37° Flare

L6

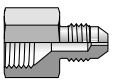
G4MLOSMO
BSPP Gauge / ORFS

L6

Swivel Tube Adapters

VKA3
EO Swivel / Diagnostic Tip

L8

Orifice Fittings

XHX7
37° Seat / 37° Flare with Orifice

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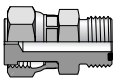
LOHL6
ORFS Swivel with Orifice / ORFS

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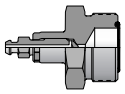
ORFS / Port Bleed Adapters

PNLOBA
Bleed Screw / ORFS

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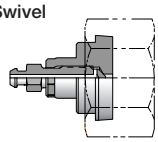
FNLBA
Bleed Screw / ORFS Swivel

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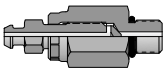
P5ONBA
Bleed Screw / SAE-ORB

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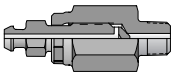
HPBA
Bleed Screw / NPT

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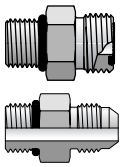
Screen Fittings

Screen Fittings

L11

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

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Introduction

Parker offers a line of specialty-type adapters specifically designed for diagnostic, fixed flow control and bleeding applications.

Diagnostic products consist of a line of in-line diagnostic tees, pressure gauge connectors and diagnostic tips. These products have been developed to work in conjunction with electronic diagnostic products available from Parker's Quick Coupling Division and other mechanical pressure and temperature sensing equipment. Some products can be used for fluid sampling and bleeding purposes as well.

Parker offers a standard and custom line of fixed flow control orifice fittings. These products are available as standard in two Parker product series — ORFS and 37° flare, and as a custom option in virtually any orifice size, fitting series, size, material and configuration.

Parker's bleed adapters provide a quick, clean, and simple method of bleeding entrapped air from hydraulic systems. A common problem in hydraulic systems is trapped air and the subsequent spillage of hydraulic oil while removing components to bleed air from lines under pressure.

Parker offers a limited line of PTT (Parker Triple Thread) 30° flare adapters for transportation markets. Lastly, Parker offers a line of screen fittings as a final measure of protection.

Fig. L1 — Parker offers a full line of diagnostic, orifice, bleed adapters and specialty fittings

Diagnostic Fittings and Adapters

In-Line Diagnostic Tees

Features

- Designed around the two most common hydraulic tube/hose interfaces: O-ring face seal (Parker Seal-Lok) and 37° flare (JIC / Parker Triple-Lok) (see A)
- ORFS and 37° flare swivel feature offers unlimited positioning without displacing port adapter (see B)
- Uses elastomeric sealing: SAE –4 (7/16-20 UNF) port as universal diagnostic port per SAE J1926-1 / ISO 11926 (see C)
- Enlarged and lengthened body hex ensures that diagnostic port offers full thread engagement and pressure capability (see D)
- Adaptable to Parker's line of diagnostic and fluid sampling tips including: EMA3, PD and PDFS, as well as various direct connecting electronic/mechanical pressure gauges*
- Designed to complement Parker's line of Senso-Control® and Senso-Node diagnostic equipment

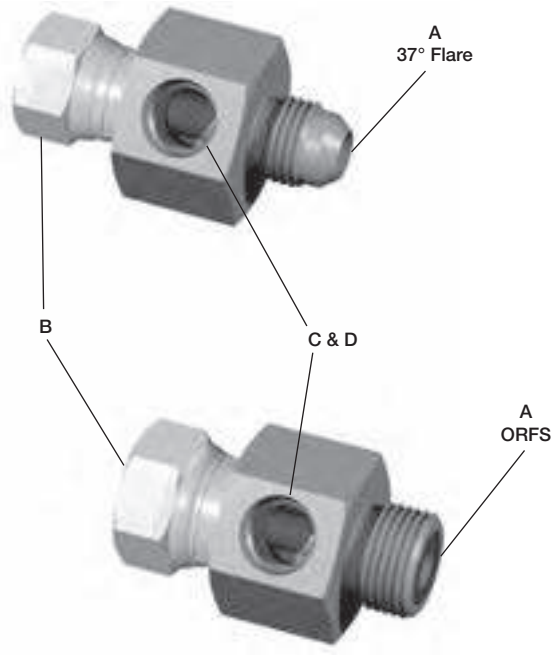

Fig. L2 — Parker's XHX6G5TP (top) and LOHL6G5TP (bottom) in-line diagnostic tees

***Diagnostic and sampling tips EMA3, PD and PDFS series are available from Parker's Quick Coupling Division (tel. 763-544-7781 and/or www.parker.com/quickcouplings)**

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Applications

- In-line pressure and temperature measurements
- In-line oil sampling to evaluate hydraulic contamination, caused by problems with filtration or internal components
- In-field diagnostics without removal of port adapters. Simply remove hose swivel and insert in-line tee.
- Permanent or temporary OEM and MRO diagnostic applications:
  - Where traditional in-port diagnostic tips cannot be located or easily accessed
  - Where OEM diagnostic tips have not been installed
  - Non-traditional diagnostic locations (portable)
  - Where port threads are not compatible with standard diagnostic tips
- To eliminate reducer bushings and couplings typically required to neck down from larger size connections to smaller connections; e.g. reductions required for a gauge, diagnostic tip, bleed adapter, or tube/hose connection.

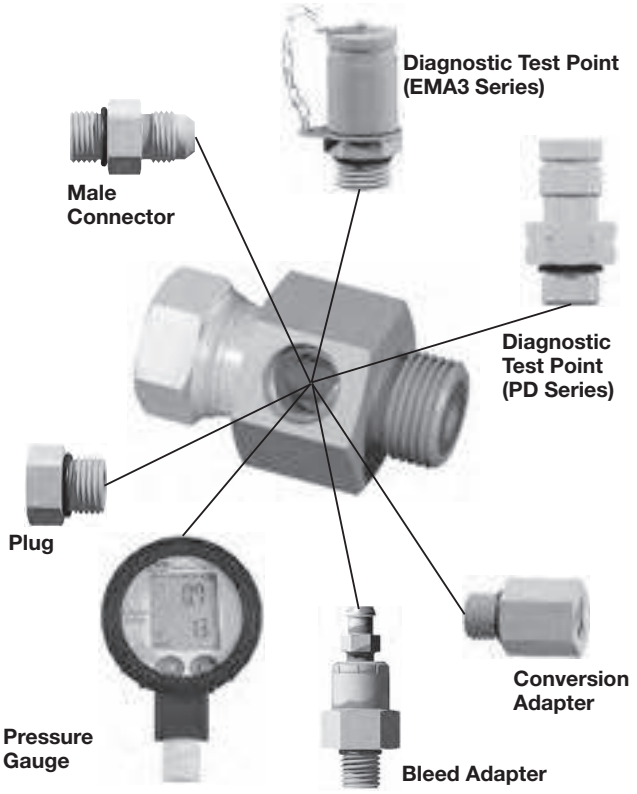

Fig. L3 — Illustration showing the versatility of Parker's diagnostic tee product line

Assembly Instructions

The body of the diagnostic tee can be used repeatedly for 10-20 remakes at full rated pressure and assembly torque. See Tables L1 and L2 for recommended swivel nut assembly torques.

Part Number	Assembly Torque (+10%-0)	
	in.-lb.	ft.-lb.
4-4 XHX6G5TP	130	11
6-4 XHX6G5TP	235	20
8-4 XHX6G5TP	525	43
10-4 XHX6G5TP	—	55
12-4 XHX6G5TP	—	80
16-4 XHX6G5TP	—	115
20-4 XHX6G5TP	—	160
24-4 XHX6G5TP	—	185

Note: Assembly values are for dry, unlubricated swivel nut connections

Table L1 — Assembly Torques (Swivel nut) for Diagnostic Tees

Part Number	Assembly Torque (+10%-0)	
	in.-lb.	ft.-lb.
4-4 LHL6G5TP	220	18
6-4 LHL6G5TP	360	30
8-4 LHL6G5TP	480	40
10-4 LHL6G5TP	—	60
12-4 LHL6G5TP	—	85
14-4 LHL6G5TP	—	100
16-4 LHL6G5TP	—	110
20-4 LHL6G5TP	—	150
24-4 LHL6G5TP	—	230
32-4 LHL6G5TP	—	360

Table L2 — Assembly Torques (Swivel nut) for Diagnostic Tees

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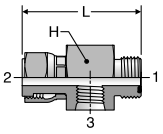
LOHL6G5TP

Gauge Port Tee
ORFS / ORFS Swivel /
SAE-ORB

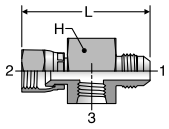


TUBE FITTING PART #	END SIZE 1 (in.)	2 (in.)	3 UN/UNF	H (in.)	L (in.)	Pressure (x 1,000 PSI) Dynamic -S
4-4 LOHL6G5TP	1/4	1/4	7/16-20	1-1/16	1.83	6.0
6-4 LOHL6G5TP	3/8	3/8	7/16-20	1-1/16	1.95	6.0
8-4 LOHL6G5TP	1/2	1/2	7/16-20	1-1/16	2.18	6.0
10-4 LOHL6G5TP	5/8	5/8	7/16-20	1-1/8	2.40	6.0
12-4 LOHL6G5TP	3/4	3/4	7/16-20	1-1/4	2.59	6.0
16-4 LOHL6G5TP	1	1	7/16-20	1-1/2	2.85	6.0
20-4 LOHL6G5TP	1 1/4	1 1/4	7/16-20	1-3/4	3.07	5.0
24-4 LOHL6G5TP	1 1/2	1 1/2	7/16-20	2-1/8	3.22	4.0

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

XHX6G5TP

Gauge Port Tee
37° Flare / 37° Swivel /
SAE-ORB

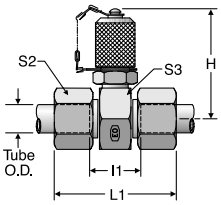


TUBE FITTING PART #	END SIZE 1 (in.)	2 (in.)	3 UN/UNF	H (in.)	L (in.)	Pressure (x 1,000 PSI) Dynamic -S
4-4 XHX6G5TP	1/4	1/4	7/16-20	1-1/16	1.99	6.0
6-4 XHX6G5TP	3/8	3/8	7/16-20	1-1/16	2.08	5.0
8-4 XHX6G5TP	1/2	1/2	7/16-20	1-1/16	2.30	5.0
10-4 XHX6G5TP	5/8	5/8	7/16-20	1-1/8	2.49	5.0
12-4 XHX6G5TP	3/4	3/4	7/16-20	1-1/4	2.66	5.0
16-4 XHX6G5TP	1	1	7/16-20	1-1/2	2.99	4.0
20-4 XHX6G5TP	1 1/4	1 1/4	7/16-20	1-3/4	3.33	4.0
24-4 XHX6G5TP	1 1/2	1 1/2	7/16-20	2	3.71	2.5

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

GMA3

Diagnostic Tip
EO Tube / EO Tube /
M16 x 2.0 Integrated Tip



TUBE FITTING PART #	END SIZE (mm)	H (mm)	l 1 (mm)	L1 (mm)	S2 (mm)	S3 (mm)	Pressure (x 1,000 PSI) Dynamic CF
GMA3/06L	6	49	21	51	14	24	4.5
GMA3/08L	8	49	21	51	17	24	4.5
GMA3/10L	10	49	23	53	19	24	4.5
GMA3/12L	12	50	23	53	22	27	4.5
GMA3/15L	15	52	25	55	27	30	4.5
GMA3/18L	18	53	24	57	32	32	4.5
GMA3/22L	22	55	28	61	36	36	2.3
GMA3/28L	28	57	28	61	41	41	2.3
GMA3/35L	35	60	26	69	50	46	2.3
GMA3/42L	42	64	25	71	60	55	2.3
GMA3/06S	6	49	25	55	17	24	9.1
GMA3/08S	8	49	25	55	19	24	9.1
GMA3/10S	10	49	24	57	22	24	9.1
GMA3/12S	12	49	24	57	24	24	9.1
GMA3/14S	14	50	27	63	27	27	9.1
GMA3/16S	16	52	26	63	30	30	5.8
GMA3/20S	20	55	26	69	36	36	5.8
GMA3/25S	25	57	27	75	46	41	5.8
GMA3/30S	30	60	28	81	50	46	5.8
GMA3/38S	38	64	29	91	60	55	4.5

To specify EO-2, add "Z" between tube size and series.
Example: GMA3/28ZLA3C

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

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BSPP Diagnostic Pressure Gauge Adapters

Parker's BSPP direct-connect pressure gauge adapters are available in the most common tube/hose connections — O-ring face seal, 37° Flare (JIC) and 24° Metric Flareless (DIN 2353). European pressure gauges often utilize BSPP threads on the pressure gauges (manometers). Sealing is achieved at the bottom of the port with a sealing washer as shown in Fig. L4.

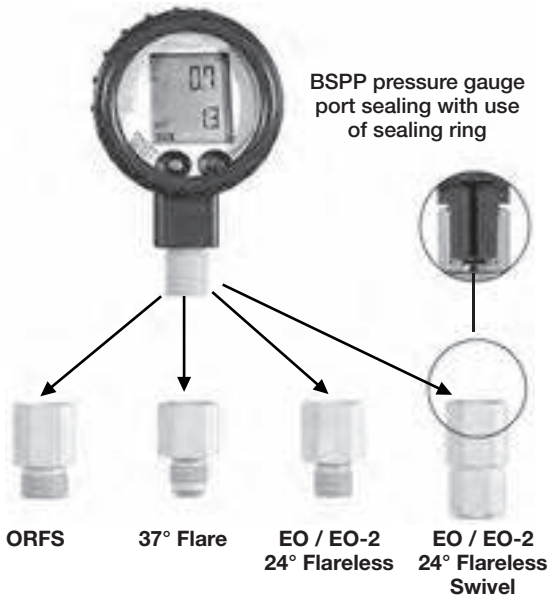
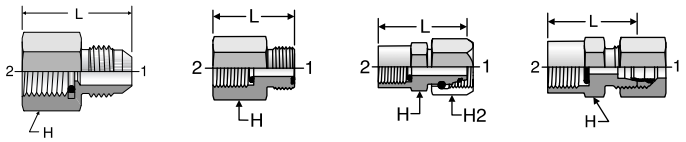


Fig. L4 — BSPP pressure gauge connections

BSPP Pressure Gauge Adapters



G4MXSMO (Type A) | **G4MLOSMO** (Type B) | **MAVE** (Type C) | **MAV** (Type D)

TUBE FITTING PART #	TYPE	END SIZE 1 (in.)	END SIZE 2 BSPP	L (mm)	H BODY HEX (mm)	H2 NUT HEX (mm)	Pressure (x 1,000 PSI) Dynamic S
4-4G4MXSMO	A	1/4	1/4-19	31.0	17	—	5.0
6G4MXSMO	A	3/8	1/4-19	28.0	17	—	5.0
8-4G4MXSMO	A	1/2	1/4-19	31.0	19	—	5.0
4-4G4MLOSMO	B	1/4	1/4-19	26.8	17	—	5.0
6G4MLOSMO	B	3/8	1/4-19	28.2	19	—	5.0
8-4G4MLOSMO	B	1/2	1/4-19	29.8	22	—	5.0
		1 (mm)	2 BSPP				Dynamic CF
MAVE06LR	C	6	1/4-19	35.5	19	14	4.6
MAVE08LR	C	8	1/4-19	35.5	19	17	4.6
MAVE10LR	C	10	1/4-19	36.0	19	19	4.6
MAVE06SR	C	6	1/2-14	42.5	27	17	9.1
MAVE08SR	C	8	1/2-14	43.0	27	19	9.1
MAVE10SR	C	10	1/2-14	43.5	27	22	9.1
MAVE12SR	C	12	1/2-14	45.0	27	24	9.1
MAVE06SR1/4	C	6	1/4-19	35.5	19	17	9.1
MAVE08SR1/4	C	8	1/4-19	35.5	19	19	9.1
MAVE10SR1/4	C	10	1/4-19	39.0	19	22	9.1
MAVE12SR1/4	C	12	1/4-19	39.0	19	24	9.1
MAV04LLR	D	4	1/4-19	33.0	19	10	1.4
MAV06LR	D	6	1/4-19	37.0	19	14	4.5
MAV08LR	D	8	1/4-19	37.0	19	17	4.5
MAV10LR	D	10	1/4-19	38.0	19	19	4.5
MAV12LR	D	12	1/4-19	38.0	19	22	4.5
MAV06SR	D	6	1/2-14	46.0	27	17	9.1
MAV08SR	D	8	1/2-14	46.0	27	19	9.1
MAV10SR	D	10	1/2-14	47.0	27	22	9.1
MAV12SR	D	12	1/2-14	47.0	27	24	9.1

Note: MAV supplied as standard with PSR +M nut (EO assembled)

* BSPP Pressure Gauge Connection requires seal. 1/4" replacement seal P/N: M25180.

** BSPP Pressure Gauge Connection requires seal. 1/4" replacement seal P/N: DKI1/4CFX, 1/2" replacement seal P/N: DKI1/2CFX.

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
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NPT and SAE-ORB Diagnostic Pressure Gauge Adapters

Parker's NPT and SAE-ORB direct-connect pressure gauge adapters are available in the most common North American tube/hose connections — O-ring face seal and 37° Flare (JIC). North American pressure gauge manufacturers offer gauges primarily with NPT and some with SAE-ORB port stud options. These 37° flare and ORFS connectors are designed to attach pressure gauges to hose swivel ends or directly to run / branch tees for in-line diagnostic applications as shown on the right.

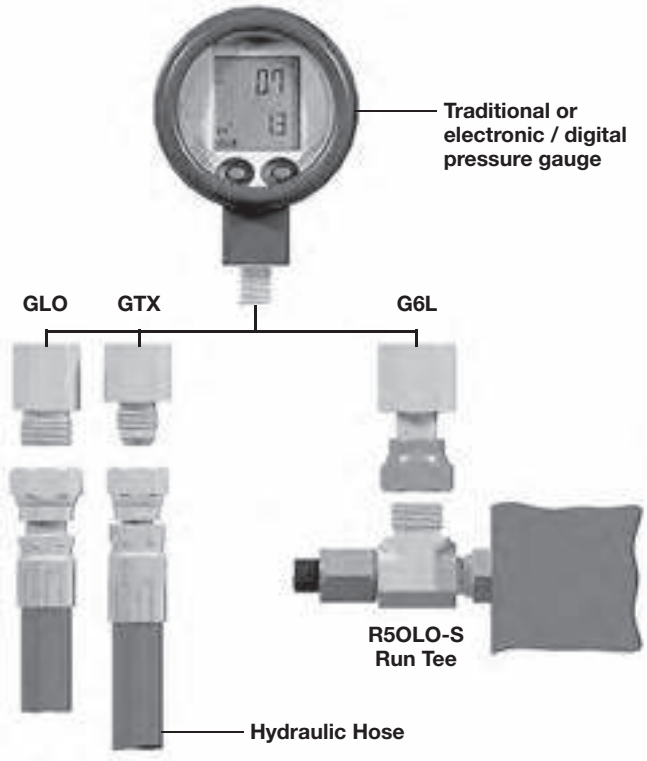
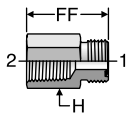
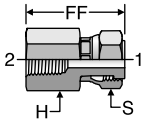


Fig. L5 — Typical applications for NPT pressure gauge adapters. Illustrations show direct hose connections and Run Tee connection.

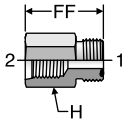
NPT / SAE Pressure Gauge Adapters



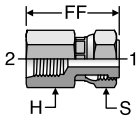
GLO
(Type A)



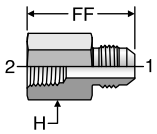
G6L
(Type B)



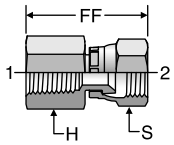
G5L
(Type C)



G65L
(Type D)



GTX
(Type E)



G6X
(Type F)

TUBE FITTING PART #	TYPE	END SIZE 1 (in.)	END SIZE 2 NPT	FF (in.)	H BODY HEX (in.)	S SWIVEL NUT HEX (in.)	Pressure (x 1,000 PSI) Dynamic -S
4-4 GLO	A	1/4	1/4-18	1.25	3/4	—	6.0
6 GLO	A	3/8	1/4-18	1.30	3/4	—	6.0
8-4 GLO	A	1/2	1/4-18	1.20	7/8	—	6.0
4-4 G6L	B	1/4	1/4-18	1.48	3/4	11/16	6.0
6 G6L	B	3/8	1/4-18	1.60	7/8	13/16	6.0
8-4 G6L	B	1/2	1/4-18	1.75	7/8	15/16	6.0
			UN/UNF				
4 G5LO	C	1/4	7/16-20	1.10	3/4	—	6.0
6-4 G5LO	C	3/8	7/16-20	1.08	3/4	—	6.0
8-4 G5LO	C	1/2	7/16-20	0.78	7/8	—	6.0
4 G65L	D	1/4	7/16-20	1.38	11/16	11/16	6.0
6-4 G65L	D	3/8	7/16-20	1.51	3/4	13/16	6.0
8-4 G65L	D	1/2	7/16-20	1.57	7/8	15/16	6.0
			NPT				
2 GTX	E	1/8	1/8-27	1.13	9/16	—	6.0
3 GTX	E	3/16	1/8-27	1.13	9/16	—	6.0
4-4 GTX	E	1/4	1/4-18	1.39	3/4	—	6.0
4 GTX	E	1/4	1/8-27	1.19	9/16	—	6.0
6-2 GTX	E	3/8	1/8-27	1.13	5/8	—	6.0
6 GTX	E	3/8	1/4-18	1.41	3/4	—	6.0
8-4 GTX	E	1/2	1/4-18	1.41	13/16	—	6.0
4-4 G6X	F	1/4	1/4-18	9/16	3/4	9/16	6.0
4 G6X	F	1/4	1/8-27	9/16	9/16	9/16	6.0
6 G6X	F	3/8	1/4-18	11/16	3/4	11/16	5.0

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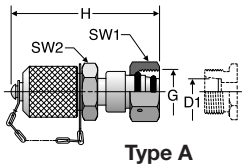
EO Diagnostic Swivels

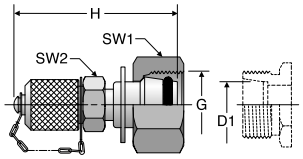
EO Diagnostic Swivels are commonly used on EO tees (24° flareless - DIN 2353) where periodic pressure and temperature checks are required. The M16 x 2 diagnostic tip mates with the SMA3 diagnostic nose offered by Parker's Quick Coupling Division.

VKA3

M16 x 2.0 Diagnostic Tip / EO Swivel



Type A



Type B

TUBE FITTING PART # STEEL	TYPE	D1 TUBE O.D. (mm)	G Metric	H REF. (mm)	SW1 (mm)	SW2 (mm)	Pressure (x 1,000 PSI) Dynamic CF
VKA3/06L	A	6	M12 x 1.5	55	17	17	4.5
VKA3/08L	A	8	M14 x 1.5	51	17	17	4.5
VKA3/10L	A	10	M16 x 1.5	53	17	19	4.5
VKA3/12L	A	12	M18 x 1.5	53	17	22	4.5
VKA3/15L	B	15	M22 x 1.5	59	17	27	4.5
VKA3/18L	B	18	M26 x 1.5	59	17	32	4.5
VKA3/22L	B	22	M30 x 2	60	17	39	2.3
VKA3/28L	B	28	M36 x 2	64	17	41	2.3
VKA3/35L	B	35	M45 x 2	71	17	50	2.3
VKA3/42L	B	42	M52 x 2	72	17	60	2.3
VKA3/06S	A	6	M14 x 1.5	50	17	17	9.1
VKA3/08S	A	8	M16 x 1.5	52	17	19	9.1
VKA3/10S	A	10	M18 x 1.5	53	17	22	9.1
VKA3/12S	A	12	M20 x 1.5	54	19	24	9.1
VKA3/14S	B	14	M22 x 1.5	59	17	27	9.1
VKA3/16S	B	16	M24 x 1.5	58	17	30	5.8
VKA3/20S	B	20	M30 x 2	65	17	36	5.8
VKA3/25S	B	25	M36 x 2	68	17	46	5.8
VKA3/30S	B	30	M42 x 2	74	17	50	5.8
VKA3/38S	B	38	M52 x 2	81	17	60	4.5

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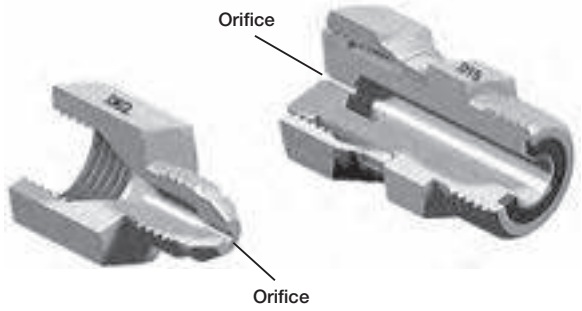
Orifice Fittings

These compact and cost effective orifice adapters allow OEMs to pre-set, at the factory, a specified orifice in specific hydraulic tube or hose lines. Costly flow control valves can be eliminated or minimized in a system by selecting the proper orifice sizes at the factory. OEMs can also be assured that end users are not adjusting the factory established flow and speed characteristics of the hydraulic system.



The Parker Advantage

- 37° flare and O-ring face seal configurations as standard
- Three standard body sizes available: 1/4" 3/8", and 1/2"
- Available in commonly accepted pre-set orifice sizes as shown on accompanying tables
- Designed for permanent or temporary installation
- Can be installed in-line into hydraulic system by simply connecting between hose swivel and adapter
- Orifice size is permanently stamped on body
- Can eliminate costly flow control valves

Applications:

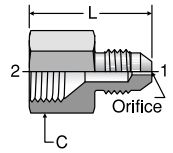
- Fixed rotation speed for hydraulic motors
- Fixed speed on cylinder extend or retract

Direct Port Orifice Fittings:

Available as a custom product, Parker also offers a line of orifice adapters that will replace a traditional port adapter.

XHX7 Orifice

In-Line Orifice Connector
37° Flare / Female 37° Seat



TUBE FITTING PART #	END SIZE 1 & 2 (in.)	C HEX (in.)	ORIFICE (in.)	L (in.)	Pressure (x 1,000 PSI) Dynamic -S
4 XHX7-S .015 Orifice	1/4	9/16	.015	1.10	5.0
4 XHX7-S .031 Orifice	1/4	9/16	.031	1.10	5.0
4 XHX7-S .047 Orifice	1/4	9/16	.047	1.10	5.0
4 XHX7-S .062 Orifice	1/4	9/16	.062	1.10	5.0
4 XHX7-S .078 Orifice	1/4	9/16	.078	1.10	5.0
4 XHX7-S .094 Orifice	1/4	9/16	.094	1.10	5.0
6 XHX7-S .015 Orifice	3/8	11/16	.015	1.18	5.0
6 XHX7-S .031 Orifice	3/8	11/16	.031	1.18	5.0
6 XHX7-S .047 Orifice	3/8	11/16	.047	1.18	5.0
6 XHX7-S .062 Orifice	3/8	11/16	.062	1.18	5.0
6 XHX7-S .078 Orifice	3/8	11/16	.078	1.18	5.0
6 XHX7-S .094 Orifice	3/8	11/16	.094	1.18	5.0
8 XHX7-S .015 Orifice	1/2	7/8	.015	1.32	5.0
8 XHX7-S .031 Orifice	1/2	7/8	.031	1.32	5.0
8 XHX7-S .047 Orifice	1/2	7/8	.047	1.32	5.0
8 XHX7-S .062 Orifice	1/2	7/8	.062	1.32	5.0
8 XHX7-S .078 Orifice	1/2	7/8	.078	1.32	5.0
8 XHX7-S .094 Orifice	1/2	7/8	.094	1.32	5.0

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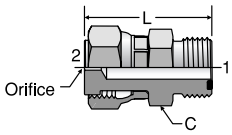
LOHL6 Orifice

In-Line Orifice Connector
ORFS Swivel / ORFS



TUBE FITTING PART #	END SIZE 1 & 2 (in.)	C HEX (in.)	ORIFICE (in.)	L (in.)	Pressure (x 1,000 PSI) Dynamic -S
4 LOHL6-S .015 Orifice	1/4	5/8	.015	1.33	9.2
4 LOHL6-S .031 Orifice	1/4	5/8	.031	1.33	9.2
4 LOHL6-S .047 Orifice	1/4	5/8	.047	1.33	9.2
4 LOHL6-S .062 Orifice	1/4	5/8	.062	1.33	9.2
4 LOHL6-S .078 Orifice	1/4	5/8	.078	1.33	9.2
4 LOHL6-S .094 Orifice	1/4	5/8	.094	1.33	9.2
6 LOHL6-S .015 Orifice	3/8	3/4	.015	1.44	9.2
6 LOHL6-S .031 Orifice	3/8	3/4	.031	1.44	9.2
6 LOHL6-S .047 Orifice	3/8	3/4	.047	1.44	9.2
6 LOHL6-S .062 Orifice	3/8	3/4	.062	1.44	9.2
6 LOHL6-S .078 Orifice	3/8	3/4	.078	1.44	9.2
6 LOHL6-S .094 Orifice	3/8	3/4	.094	1.44	9.2
8 LOHL6-S .015 Orifice	1/2	7/8	.015	1.67	9.2
8 LOHL6-S .031 Orifice	1/2	7/8	.031	1.67	9.2
8 LOHL6-S .047 Orifice	1/2	7/8	.047	1.67	9.2
8 LOHL6-S .062 Orifice	1/2	7/8	.062	1.67	9.2
8 LOHL6-S .078 Orifice	1/2	7/8	.078	1.67	9.2
8 LOHL6-S .094 Orifice	1/2	7/8	.094	1.67	9.2

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Bleed Adapters

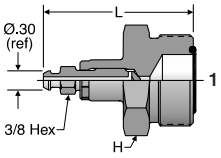
Entrapped air is a major contributor to inefficient operation. Typically, bleeding hydraulic systems is done by cracking a connection to "bleed off" the entrapped air. This practice is not recommended, especially in larger size fittings where high forces can exist. Parker's bleed adapters are especially beneficial in applications where elastomeric seals (O-rings) can be extruded and/or damaged during bleeding such as with O-ring face seal fittings.

Parker's bleed adapters are designed specifically for installation directly to ORFS (O-ring Face Seal) type fittings or into SAE/NPT manifolds and valves where bleeding is often required.

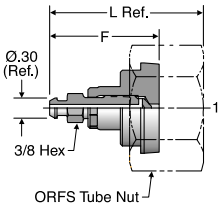
Product Characteristics

- Bleed hydraulic systems without "cracking" hydraulic connections
- Uses standard automotive bleed screw design
- Bleed screw is permanently crimped into body housing for blowout prevention
- In-port options with SAE and NPT male studs
- Tube/hose connection options to male and female ORFS

ORFS Bleed Adapters



PNLOBA



FNLBA
ORFS Tube Nut sold separately

TUBE FITTING PART #	END SIZE 1 (in.)	F (in.)	H (in.)	L (in.)	Pressure (x 1,000 PSI) Dynamic -S
4 PNLOBA	1/4	-	11/16	1.90	9.2
6 PNLOBA	3/8	-	3/4	1.97	9.2
8 PNLOBA	1/2	-	7/8	2.07	9.2
10 PNLOBA	5/8	-	1 1/16	2.19	6.0
12 PNLOBA	3/4	-	1 1/4	2.27	6.0
16 PNLOBA	1	-	1 1/2	2.35	6.0
20 PNLOBA	1 1/4	-	1 3/4	2.41	6.0
24 PNLOBA	1 1/2	-	2 1/8	2.48	5.0
8 FNLBA	1/2	1.63	15/16	2.07	9.2
10 FNLBA	5/8	1.63	1 1/8	2.17	6.0
12 FNLBA	3/4	1.63	1 3/8	2.21	6.0
16 FNLBA	1	1.63	1 5/8	2.21	6.0
20 FNLBA	1 1/4	1.63	1 7/8	2.21	6.0
24 FNLBA	1 1/2	1.63	2 1/4	2.21	5.0

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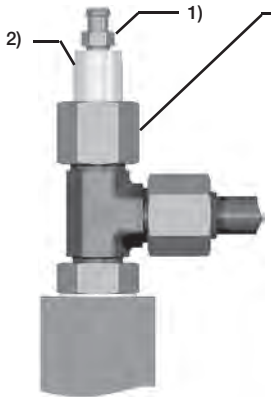
Bleeding Hydraulic Systems with Parker Bleed Adapters

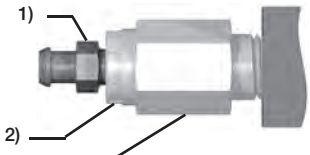
Whenever possible, the bleed adapter should be mounted at the highest point within the hydraulic system. The trapped air can be relieved while the system is running at low pressure. To bleed, loosen the bleed screw 1/2 turn counterclockwise. After the hydraulic fluid begins to run freely from the bleed screw, the bleed screw should be re-tightened.

Bleed Screw Tightening Torque: 35-40 in.-lbs.

Warning: When bleeding hydraulic fluid, operate the system below 500 psi. To avoid injury, ensure that all persons are clear of the path of discharge. Another recommended practice is to attach a section of hose over the bleed screw/adapter to direct oil away from the area and to reduce oil spillage.

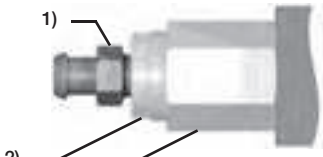


Seal-Lok Bleed Adapter
(Sizes -8 thru -24)
For use with
Seal-Lok Fittings



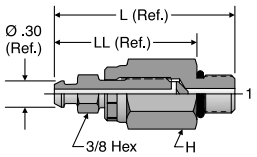
Pipe Thread Bleed Adapter
1/4 NPT
For use with Pipe Thread
Ports

Notes:
1) Standard automotive bleedscrew.
2) Locking crimp prevents screw from being completely unthreaded.

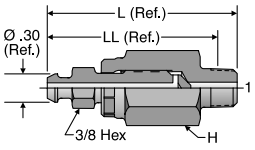


Straight Thread Bleed Adapter
Size 4 (7/16-20 UNF)
For use with SAE Straight
Thread Ports

Port Bleed Adapters



4 P5ONBA



1/4 HPBA

TUBE FITTING PART #	END SIZE 1	BODY HEX (in.)	H (in.)	L REF. (in.)	LL REF. (in.)	Pressure (x 1,000 PSI) Static -S	Pressure (x 1,000 PSI) Dynamic -S
4 P5ONBA	7/16-20 UN/UNF-2A	11/16	11/16	2.05	1.62	10.0	6.0
1/4 HPBA	1/4-18 NPTF	11/16	11/16	2.20	1.86	10.0	6.0

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Screen Fittings

Introduction

Parker screen fittings ensure the final measure of protection against particles that find their way into a system (even a properly filtrated one) during installation, maintenance, failure of components, or by other means. Screen fittings provide a vital safeguard for critical components against damage due to contamination. They are intended to work in conjunction with a good filtration system and are available with screens that retain particle sizes from 480 to 65 micron.

Parker screen fittings are ideal for protecting:

- Gauges and instrumentation
- Critical hydraulic components such as pump compensator load sensing controls, proportional valves, relief valves, etc.
- Precision orifices from clogging
- Expensive components in test bench circuits (against particle contamination created by failed components)

Fig. L6 — Screen Fittings.

Design and Construction

Fitting Body. Parker screen fittings utilize standard Seal-Lok O-ring face seal and Triple-Lok 37° flare fitting bodies located in Section A and B respectively in this catalog. All screen fittings are manufactured with the micron rating stamped on the fitting body.

Screen. Screen fittings are constructed with stainless-steel screen elements. Sizes -6 through -12 fittings are manufactured with a dome-style screen, while size -4 fittings are made with a basket-style screen (see Fig. L7 and L8). Table L3 displays the various micron ratings for available screens. Additionally, Parker screen fittings have bi-directional flow capacity and can be installed in either the tube or port end of the fitting. Screens are not sold separately.

Screen fittings are for last measurement of protection, not for filtration. A filter is recommended for hydraulic systems. To prevent build up of debris, screens must be replaced or cleaned when filters are replaced or during flushing of hydraulic system.

Fig. L7 — Six dome-style screens and one basket-style screen.

Square Mesh Number	Nominal Micron Rating
40	480*
60	320*
80	230
100	165*
150	125
200	100
325	65

These micron ratings are not available as standard from stock

Table L3 — Micron Ratings for available screens

Pressure Ratings

Parker screen fittings have the same dynamic pressure ratings as the equivalent fitting body (without the screen). Refer to sections A and B for the pressure ratings for Seal-Lok O-ring face seal and Triple-Lok 37° flare fittings.

How to Order:

Please call the Tube Fittings Division for part number and ordering - 614-279-7070

Fig. L8 — Fitting cutaway with dome-style screen.

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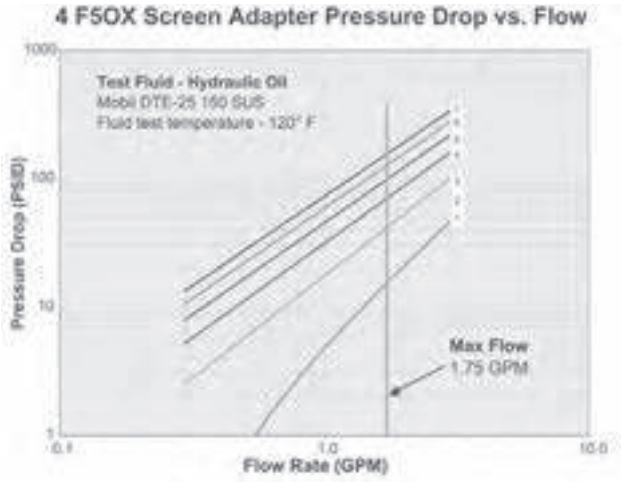
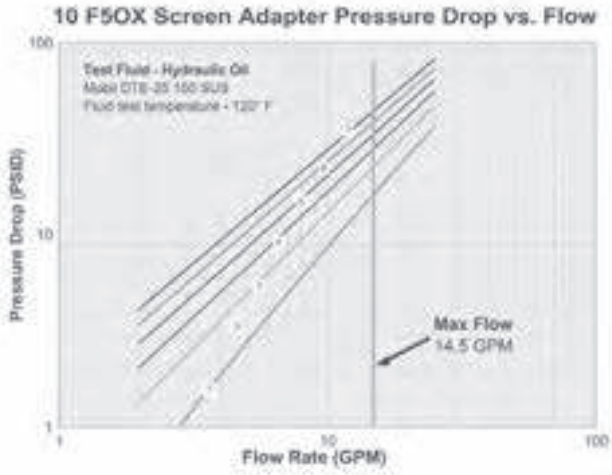
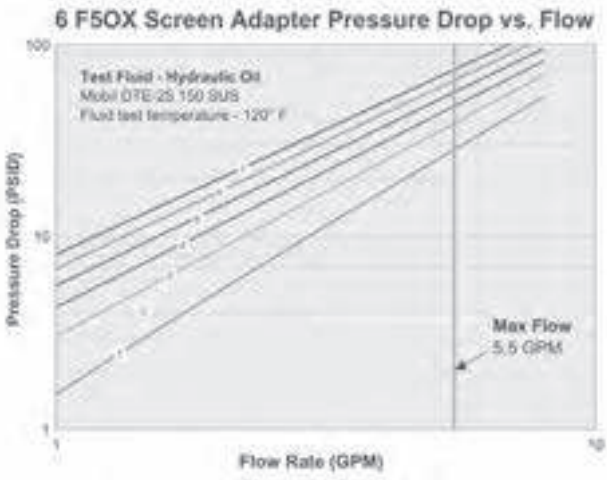
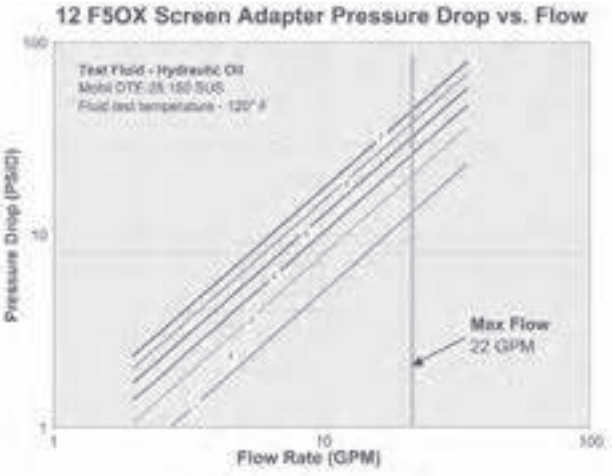
Pressure Drop

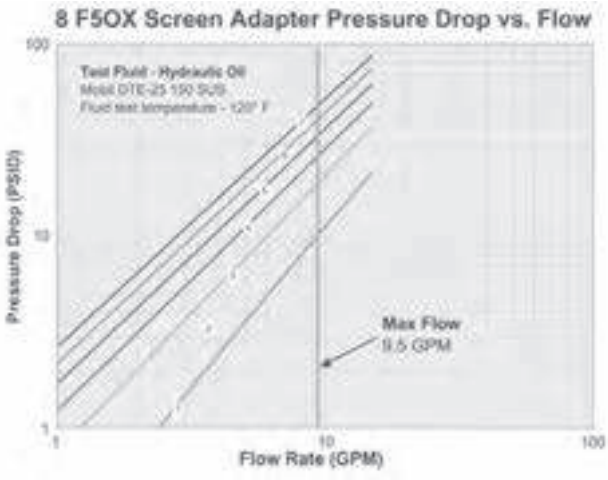
All screen fittings have been tested to determine the maximum pressure drop and screen retention. The following "Pressure Drop vs. Flow" charts were derived from actual test data and may be used as a guide in determining pressure drop at various flow rates through screen fittings for the fluid indicated.

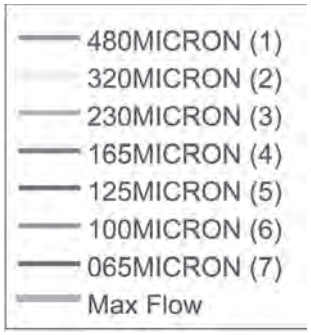












Refer to the General Technical Section for pressure drop data through standard fitting without screen.

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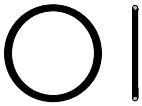
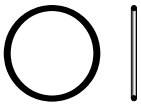
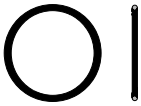
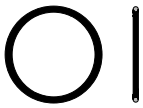
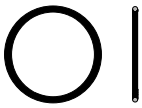
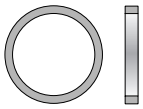
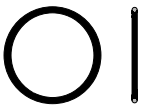
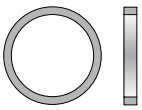
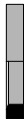
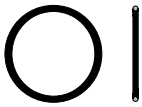
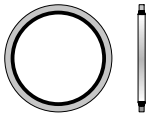
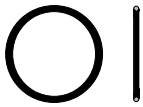
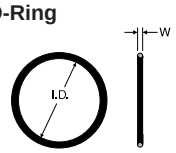
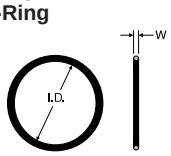
O-Ring Face Seal	**ORFS O-Ring**  M4	**XO O-Ring**  M4	**Port Ends – SAE, Metric, BSPP, JIS, K4**	**SAE O-Ring**  M4	**ISO 6149 O-Ring**  M5
Metric O-Ring  M5	**Metric Retaining Ring**  M5	**BSPP O-Ring**  M6	**BSPP Retaining Ring**  M6	**EOlastic Seal Ring**  M6	**JIS B2351 O-Ring**  M7
BSPP Bonded Seal  M7	**EO/EO-2**	**EO-2 Sealing Ring**  M7	**Pressure Gauge Sealing Ring**  M8	**EO Swivel O-Ring**  M8	**EO O-Ring**  M9
4-Bolt Flanges	**SAE 4-Bolt Flange O-Ring**  M9	**Dual Seal Flanges**	**Radial Seal O-Ring**  M9	**Flange Seal O-Ring**  M9	

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O-Ring Material Selection

Standard O-rings supplied with Parker tube fittings and adapters are 90 durometer hard nitrile (Buna-N). These O-rings are well suited for most industrial hydraulic and pneumatic systems. They have high extrusion resistance making them suitable for very high pressure static applications. Optional high temperature fluorocarbon, Parker compound #V0894, is also available for higher temperature specifications.

O-rings for other media or higher temperature applications can be selected from the following chart. The chart should be used only as a general guide. Before making final selection for a given application, it is recommended that appropriate tests be conducted to assure compatibility with the fluid, temperature, pressure and other environmental conditions.

For fluids not shown in the chart, please contact the Tube Fittings Division.

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Polymer (Abbreviation)	Recommended for	Not Recommended for	Parker Compound No.	Color	SAE J515 Type	Hardness Shore "A"	Temperature Range (°F)	Comments
Nitrile-Butadiene (NBR)	Petroleum base oils and fluids, mineral oils, ethylene glycol base fluids, silicone and di-ester base lubricants, air, water under 150°F, and natural gas.	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons, and methanol.	NBR	Black	CH[2]	90	-30° to 250° F	Standard from stock
			N0674	Black	–	70	-30° to 250° F	
			N0103	Black	–	70	-65° to 225° F	
			N1059	Black	CH[2]	90	-30° to 275° F	Low compression set
			N0507	Black	–	90	-65° to 180° F	Orange identification dot
			N0304	Black	–	75	-65° to 225° F	
			N0508	Black	–	75	-35° to 250° F	Meets FDA requirements for food products
HNBR			KA183	Black	–	85	-58° to 300° F	CNG applications. Standard from stock
Fluorocarbon (FKM[5] or FPM)	Petroleum base oils and fluids, some phosphate ester base fluids, silicone and silicate ester base lubricants, di-ester base lubricants, acids and halogenated hydrocarbons.	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, and hot hydrofluoric or chlorosulfonic acids.	V0747	Black	–	75	-15° to 400° F	
			V0884	Brown[1]	–	75	-15° to 400° F	
			V0894	Brown[1]	HK[4]	90	-15° to 400° F	
			FKM	Brown	–	90	-15° to 400° F	Standard from stock
Ethylene-Propylene (EPDM)	Phosphate ester base hydraulic fluids, hot water, steam to 400°F, silicone oils and greases, dilute acids and alkalis, ketones, alcohols and automotive brake fluids.	Petroleum base oils and di-ester base lubricants.	E0540	Black	CA[3]	80	-65° to 275° F	
			E0893	Purple[1]	CA[3]	80	-65° to 275° F	
			E0962	Black	–	90	-65° to 275° F	CO2 climate control systems. H2 fuel cells.
Neoprene (CR)	Refrigerants (freons, ammonia), high aniline point petroleum oils, mild acids, and silicate ester lubricants.	Phosphate ester fluids and ketones.	C0873	Black	–	70	-45° to 250° F	
			C0944	Red[1]	–	70	-45° to 250° F	
Silicone (Si)	Dry heat (air to 400°F) and high aniline point oils.	Most petroleum fluids, ketones, water and steam.	S0604	Rust[1]	–	70	-65° to 450° F	

Table M1 — O-Ring Selection

1) These Parker "Chromassure" color assurance O-rings are available from the Parker Hannifin O-Ring Division. They help eliminate assembly errors, reduce warranty costs and liability risks, and assure safety in aftermarket business.
2) Formerly SAE Type I.
3) Formerly SAE Type II.
4) Formerly SAE Type III.
5) "FKM" is the ASTM designation for fluorocarbon. Its ISO designation is "FPM".

Note: Use 90 durometer hard O-rings for applications with 1500 psi or higher pressures.

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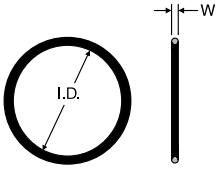
ORFS O-Ring

ORFS Tube End O-Ring

Specify size and compound
Example: 2-018 NBR (standard NBR)



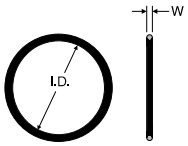
TUBE FITTING PART #	FITTING DASH SIZE	END SIZE (in.)	END SIZE (mm)	I.D. (in.)	I.D. (mm)	W (in.)	W (mm)	Material NBR*	Material FKM**	Material CNG***
2-011	4	1/4	6	0.30	7.7	0.07	1.78	•	•	•
2-012	6	3/8	8, 10	0.36	9.3	0.07	1.78	•	•	•
2-014	8	1/2	12	0.49	12.4	0.07	1.78	•	•	•
2-016	10	5/8	14, 15, 16	0.61	15.6	0.07	1.78	•	•	
2-018	12	3/4	18, 20	0.74	18.8	0.07	1.78	•	•	
2-020	14	7/8	22	0.86	21.8	0.07	1.78	•		
2-021	16	1	25	0.93	23.5	0.07	1.78	•	•	
2-025	20	1 1/4	28, 30, 32	1.18	29.9	0.07	1.78	•	•	
2-029	24	1 1/2	35, 38	1.49	37.8	0.07	1.78	•	•	
2-135	32	2	50	1.93	49.0	0.10	2.54	•	•	

* NBR is the standard compound — 90-durometer Nitrile.
** FKM is an optional 90-durometer fluorocarbon compound.
*** CNG is an optional 85 durometer HNBR compound for CNG applications
See page M3 for O-ring Material Selection and data.

XO O-Ring

Triple-Lok 2 O-Ring

Specify size and compound
Example: 2-019 NBR (standard NBR)

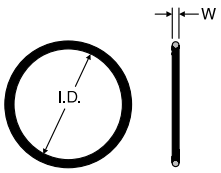


TUBE FITTING PART #	TUBE O.D. (in.)	I.D. (in.)	W (in.)	Material NBR
5-193	1/4	0.18	0.04	•
5-179	5/16	0.24	0.04	•
5-056	3/8	0.30	0.04	•
5-058	1/2	0.43	0.05	•
2-013	5/8	0.43	0.07	•
2-016	3/4	0.61	0.07	•
2-017	7/8	0.68	0.07	•
2-019	1	0.80	0.07	•
2-023	1 1/4	1.05	0.07	•
2-026	1 1/2	1.24	0.07	•
2-133	2	1.80	0.10	•

SAE O-Ring

SAE Straight Thread Port O-Ring

Specify size and compound
Example: 3-906 NBR (standard NBR)



TUBE FITTING PART #	FITTING DASH SIZE	I.D. (in.)	W (in.)	Material NBR*	Material FKM**	Material CNG***
3-902	2	0.24	0.06	•	•	
3-903	3	0.30	0.06	•	•	
3-904	4	0.35	0.07	•	•	•
3-905	5	0.41	0.07	•	•	
3-906	6	0.47	0.08	•	•	•
3-908	8	0.64	0.09	•	•	•
3-910	10	0.76	0.10	•	•	
3-912	12	0.92	0.12	•	•	
3-914	14	1.05	0.12	•	•	
3-916	16	1.17	0.12	•	•	
3-920	20	1.48	0.12	•	•	
3-924	24	1.72	0.12	•	•	
3-932	32	2.34	0.12	•	•	

* NBR is the standard compound — 90-durometer Nitrile.
** FKM is an optional 90-durometer fluorocarbon compound.
*** CNG is an optional 85 durometer HNBR compound for CNG applications
See page M3 for O-ring Material Selection and data.

Dimensions for reference only, subject to change.

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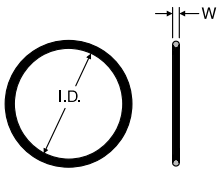
ISO 6149 O-Ring

Metric Straight Thread
Port O-Ring



Specify size and compound (for option compound only)
Example: M-12 ISO O-RING (standard NBR)
M-12 ISO VITON O-RING (optional FKM)

TUBE FITTING PART #	PORT THREAD	I.D. (mm)	W (mm)	Material NBR**	Material FKM***
M-8 ISO O-Ring	M8 x 1	6.1	1.6	•	
M-10 ISO O-Ring	M10 x 1	8.1	1.6	•	
M-12 ISO O-Ring	M12 x 1.5	9.3	2.2	•	•
M-14 ISO O-Ring	M14 x 1.5	11.3	2.2	•	•
M-16 ISO O-Ring	M16 x 1.5	13.3	2.2	•	•
M-18 ISO O-Ring	M18 x 1.5	15.3	2.2	•	•
M-22 ISO O-Ring	M22 x 1.5	19.3	2.2	•	•
M-27 ISO O-Ring	M27 x 2	23.6	2.9	•	•
***M-30 ISO O-Ring**	M30 x 2	26.6	2.9	•	
M-33 ISO O-Ring	M33 x 2	29.6	2.9	•	•
M-38 ISO O-Ring	M38 x 2	34.6	2.9	•	
M-42 ISO O-Ring	M42 x 2	38.6	2.9	•	•
M-48 ISO O-Ring	M48 x 2	44.6	2.9	•	•
M-60 ISO O-Ring	M60 x 2	56.6	2.9	•	

* M30X2 is not a standard ISO 6149 size.

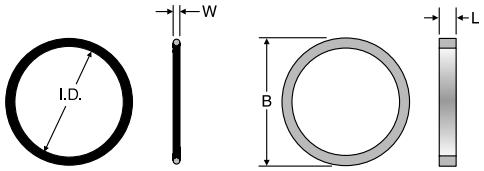
** NBR is the standard compound — 90-durometer peroxide-cured Nitrile.

*** FKM is an optional 90-durometer fluorocarbon compound (for part number, VITON is used eg. M-8 ISO VITON O-RING).

See page M3 for O-ring Material Selection and data.

Metric O-Ring & Retaining Ring

For ISO 9974-1 / DIN 3852-1Port



Specify size, compound and material
Example: 2-012 NBR (standard NBR O-ring)
M12RRCF (standard steel retaining ring)

TUBE FITTING PART #	METRIC THREAD SIZE	I.D. (mm)	W (mm)	From Stock NBR*	From Stock FKM**	TUBE FITTING PART #	B (mm)	L (mm)	Material CF (S)	Material 71 (SS)
3-902	M8 x 1	6.07	1.63	•	•	**M8RR**	13.15	1.00	•	
6-074	M10 x 1	8.00	1.50	•	•	**M10RR**	14.75	1.00	•	
2-012	M12 x 1.5	9.25	1.78	•	•	**M12RR**	17.75	1.30	•	
2-013	M14 x 1.5	10.82	1.78	•	•	**M14RR**	19.75	1.30	•	
3-907	M16 x 1.5	13.46	2.08	•	•	**M16RR**	21.75	1.50	•	
2-114	M18 x 1.5	15.54	2.62	•	•	**M18RR**	23.75	2.00	•	
2-017	M20 x 1.5	17.17	1.78	•		**M20RR**	25.75	1.30	•	
2-018	M22 x 1.5	18.77	1.78	•	•	**M22RR**	27.75	1.30	•	
2-019	M24 x 1.5	20.35	1.78	•		**M24RR**	29.75	1.30	•	
2-118	M26 x 1.5	21.89	2.62	•		**M26RR**	31.75	2.00	•	
2-119	M27 x 2	23.47	2.62	•	•	**M27RR**	32.75	2.00	•	
2-121	M30 x 2	26.64	2.62	•		**M30RR**	36.32	2.00	•	
2-122	M33 x 2	28.24	2.62	•		**M33RR**	39.75	2.00	•	
2-124	M36 x 2	31.42	2.62	•		**M36RR**	42.75	2.00	•	
2-128	M42 x 2	37.77	2.62	•		**M42RR**	49.75	2.00	•	
2-130	M45 x 2	40.94	2.62	•		**M45RR**	52.75	2.00	•	
2-132	M48 x 2	44.12	2.62	•		**M48RR**	54.95	2.00	•	
2-133	M50 x 2	45.69	2.62	•		**M50RR**	56.31	2.00	•	

* NBR is the standard compound — 90-durometer Nitrile.

** FKM is an optional 90-durometer fluorocarbon compound.

See page M3 for O-ring Material Selection and data.

Dimensions for reference only, subject to change.

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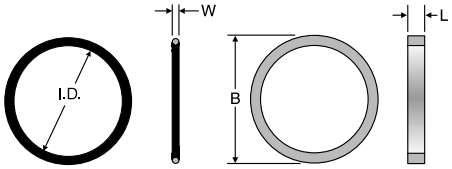
BSPP O-Ring & Retaining Ring

For ISO 1179-1 / DIN 3852-2 Port



Specify size and compound (for O-ring only)
Example: 2-113 NBR (standard NBR O-ring)
3/8 RETAINING RING (standard steel retaining ring)

TUBE FITTING PART #	BSPP THREAD SIZE	I.D. (mm)	W (mm)	Material NBR*	Material FKM**	TUBE FITTING PART #	B (mm)	L (mm)	Material S	Material SS
OR8X2X	1/8-28	8	2	•	•	**1/8 Retaining Ring**	15.0	1.4	•	
2-111	1/4-19	10.77	2.62	•	•	**1/4 Retaining Ring**	19.5	1.9	•	
2-113	3/8-19	13.94	2.62	•	•	**3/8 Retaining Ring**	23.5	1.9	•	
5-256	1/2-14	17.96	2.62	•	•	**1/2 Retaining Ring**	28.5	1.9	•	
2-119	3/4-14	23.47	2.62	•	•	**3/4 Retaining Ring**	34.5	2.6	•	
2-217	1-11	29.74	3.53	•	•	**1 Retaining Ring**	43.5	2.6	•	
2-222	1 1/4-11	37.69	3.53	•		**1 1/4 Retaining Ring**	52.5	2.6	•	
2-224	1 1/2-11	44.04	3.53	•		**1 1/2 Retaining Ring**	60.0	2.6	•	
2-227	2-11	53.57	3.53			**2 Retaining Ring**	75.0	2.6		

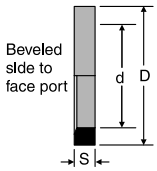
* NBR is the standard compound — 90-durometer Nitrile.

** FKM is an optional 90-durometer fluorocarbon compound.

See page M3 for O-ring Material Selection and data.

EOlastic Seal Ring

EOlastic Soft Seal for
BSPP & Metric Threads ("ED Seal")
DIN 3869



Specify size and compound
(for optional compound only)
Example: ED8X1X (standard NBR)
ED8X1VITX (optional FKM)

TUBE FITTING PART #	For Male Metric Thread	For Male Thread BSPP	D (mm)	d (mm)	S (mm)	Material NBR*	Material FKM**
ED8X1X	M8 x 1		9.9	6.5	1.0	•	•
ED10X1X	M10 x 1	G 1/8 A	11.9	8.4	1.0	•	•
ED12X1.5X	M12 x 1.5		14.4	9.8	1.5	•	•
ED14X1.5X	M14 x 1.5	G 1/4 A	16.5	11.6	1.5	•	•
ED16X1.5X	M16 x 1.5		18.9	13.8	1.5	•	•
ED3/8X		G 3/8 A	18.9	14.7	1.5	•	•
ED18X1.5X	M18 x 1.5		20.9	15.7	1.5	•	•
ED20X1.5X	M20 x 1.5		22.9	17.8	1.5	•	•
ED1/2X		G 1/2 A	23.9	18.5	1.5	•	•
ED22X1.5X	M22 x 1.5		24.3	19.6	1.5	•	•
ED26X1.5X	M26 x 1.5	G 3/4 A	29.2	23.9	1.5	•	•
ED26X1.5X	M27 x 2	G 3/4 A	29.2	23.9	1.5	•	•
ED33X2X	M33 x 2	G 1 A	35.7	29.7	2.0	•	•
ED42X2X	M42 x 2	G 1 1/4 A	45.8	38.8	2.0	•	•
ED48X2X	M48 x 2	G 1 1/2 A	50.7	44.7	2.0	•	•

* NBR is the standard compound — 90-durometer Nitrile.

** FKM is an optional 85-durometer fluorocarbon compound (for part number VIT is used as suffix). Example: ED8X1VITX

Dimensions for reference only, subject to change.

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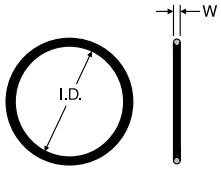
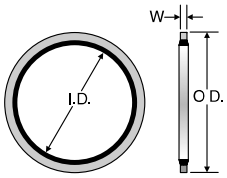
JIS B2351 O-Ring



TUBE FITTING PART #	JIS DASH SIZE	T4 THREAD BSPP	I.D. (mm)	W (mm)	JIS B 2401 Description
P8 O-RING	2	1/8-28	7.8	1.9	O-RING CLASS 1 B P 8
P11 O-RING	4	1/4-19	10.8	2.4	O-RING CLASS 1 B P 11
P14 O-RING	6	3/8-19	13.8	2.4	O-RING CLASS 1 B P 14
P18 O-RING	8	1/2-14	17.8	2.4	O-RING CLASS 1 B P 18
P24 O-RING	12	3/4-14	23.7	3.5	O-RING CLASS 1 B P 24
P29 O-RING	16	1-11	28.7	3.5	O-RING CLASS 1 B P 29

* NBR is the standard compound — 90-durometer Nitrile.

BSPP Bonded Seal

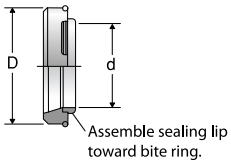


Used on K4 Style Straight Fittings
as a Port Seal
For use with ISO 1179 / DIN 3852-2 port

TUBE FITTING PART #	BSPP THREAD SIZE	O.D. (mm)	I.D. (mm)	W (mm)	Material S*	Material SS	Material B
D9DT-2	1/8-28	15.9	10.4	2.0	•		
D9DT-4	1/4-19	20.6	13.7	2.0	•		
D9DT-6	3/8-19	23.8	17.3	2.0	•		
D9DT-8	1/2-14	28.6	21.5	2.3	•		
D9DT-10	5/8-14	31.8	23.5	2.3	•		
D9DT-12	3/4-14	34.9	27.1	2.3	•		
D9DT-16	1-11	42.8	33.9	2.3	•		
D9DT-20	1 1/4-11	52.4	42.9	3.3	•		
D9DT-24	1 1/2-11	58.6	48.4	3.3	•		

* NBR is the standard elastomer compound — 90-durometer Nitrile
Zinc plated steel ring

EO-2 Sealing Ring



Specify size and material
Examples:
DOZ10S (standard steel with NBR)
DOZ10SVIT (standard steel with FKM)
DOZ10S71 (standard stainless steel with FKM)

TUBE FITTING PART #	SERIES	TUBE O.D. (mm)	D (mm)	d (mm)	Material S NBR*	Material S FKM**	Material SS FKM***
DOZ04LL	LL	4	6.8	4	•		
DOZ06LL	very light	6	8.8	6	•		
DOZ06L	L	6	10.3	6	•	•	•
DOZ08L	light	8	12.3	8	•	•	•
DOZ10L		10	14.3	10	•	•	•
DOZ12L		12	16.3	12	•	•	•
DOZ15L		15	20.3	15	•	•	•
DOZ18L		18	24.3	18	•	•	•
DOZ22L		22	27.7	22	•	•	•
DOZ28L		28	33.7	38	•	•	•
DOZ35L		35	42.7	35	•	•	•
DOZ42L		42	49.7	42	•	•	•
DOZ06S	S	6	12.3	6	•	•	•
DOZ08S	heavy	8	14.3	8	•	•	•
DOZ10S		10	16.3	10	•	•	•
DOZ12S		12	18.3	12	•	•	•
DOZ14S		14	20.3	14	•	•	•
DOZ16S		16	22.3	16	•	•	•
DOZ20S		20	27.7	20	•	•	•
DOZ25S		25	33.7	25	•	•	•
DOZ30S		30	39.7	30	•	•	•
DOZ38S		38	49.7	38	•	•	•

* Steel black zinc plated with NBR 90-durometer Nitrile compound.
** Steel black zinc plated with FKM 90-durometer fluorocarbon compound.
*** Stainless steel with FKM 90-durometer fluorocarbon compound.

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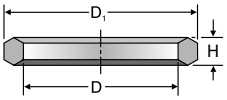
Pressure Gauge Sealing Ring

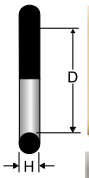


Specify size and material
Examples: DKI1/2CFX (steel)
DKI1/271X (stainless steel)

TUBE FITTING PART #	FOR INTERNAL BSPP THREAD	D (mm)	D1 (mm)	H (mm)	Material		
					CFX (S)	71 (SS)	COPPER
DKI1/4	G 1/4 - 19	6.0	11.3	4.5	•		
DKI1/2	G 1/2 - 19	12.0	18.5	5.0	•	•	
M25180	G 1/4	6.4	11.0	1.6			•

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

EO Swivel O-Ring



O-ring for EO Swivel Nuts, Weld Nipples, and Caps
Part Numbers: RED, DA, GZ, GZR, EGE, EGEO, SKA, EW, ET, EL, VKA, MAVE

EO SIZE/SERIES	O-RING NBR*	D	H	O-RING FKM[2]	D	H
6L	**OR4.5X1.5X**	4.5	1.5	**OR4.5X1.5VITX**	4.5	1.5
8L	**OR6.5X1.5X**	6.5	1.5	**OR6.5X1.5VITX**	6.5	1.5
10L	**OR8.5X1.5X**	8.5	1.5	**OR8X1.5VITX**	8.0	1.5
12L	**OR10.5X1.5X**	10.5	1.5	**OR10X1.5VITX**	10.0	1.5
15L	**OR12.5X2X**	12.5	2.0	**OR12X2VITX**	12.0	2.0
18L	**OR16X2X**	16.0	2.0	**OR15X2VITX**	15.0	2.0
22L	**OR20X2X**	20.0	2.0	**OR20X2VITX**	20.0	2.0
28L	**OR26X2X**	26.0	2.0	**OR26X2VITX**	26.0	2.0
35L	**OR32X2.5X**	32.0	2.5	**OR32X2.5VITX**	32.0	2.5
42L	**OR39X2.5X**	39.0	2.5	**OR38X2.5VITX**	38.0	2.5
6S	**OR4.5X1.5X**	4.5	1.5	**OR4.5X1.5VITX**	4.5	1.5
8S	**OR6.5X1.5X**	6.5	1.5	**OR6.5X1.5VITX**	6.5	1.5
10S	**OR8.5X1.5X**	8.5	1.5	**OR8X1.5VITX**	8.0	1.5
12S	**OR10.5X1.5X**	10.5	1.5	**OR10X1.5VITX**	10.0	1.5
14S	**OR12X2X**	12.0	2.0	**OR12X2VITX**	12.0	2.0
16S	**OR14X2X**	14.0	2.0	**OR13X2VITX**	13.0	2.0
20S	**OR17X2.5X**	17.0	2.5	**OR16.3X2.4VITX**	16.3	2.4
25S	**OR22X2.5X**	22.0	2.5	**OR20.3X2.4VITX**	20.3	2.4
30S	**OR27X2.5X**	27.0	2.5	**OR25.3X2.4VITX**	25.3	2.4
38S	**OR35X2.5X**	35.0	2.5	**OR33.3X2.4VITX**	33.3	2.4

[1]NBR is standard compound — 90-durometer Nitrile.
[2]FKM is optional 85-durometer Fluorocarbon compound.

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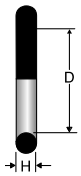
EO O-Ring

O-ring for EO Banjo Fitting Bolts
Part Numbers: WH/TH

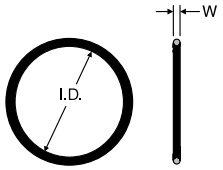


BANJO BOLT METRIC THREAD	BANJO BOLT BSPP THREAD	D	H	O-RING NBR*	O-RING FKM**
M10	G 1/8	9.3	1.5	**OR9.3X1.5X**	**OR9.3X1.5VITX**
M12, M14	G 1/4	12.5	1.5	**OR12.5X1.5X**	**OR12.5X1.5VITX**
M16	G 3/8	16.0	1.5	**OR16X1.5X**	**OR16X1.5VITX**
M18		18.0	1.5	**OR18X1.5X**	**OR18X1.5VITX**
M20, M22	G 1/2	20.0	1.5	**OR20X1.5X**	**OR20X1.5VITX**
M26, M27	G 3/4	25.0	2.0	**OR25X2X**	**OR25X2VITX**
M33	G 1	33.0	2.5	**OR33X2.5X**	**OR33X2.5VITX**
M42	G 1 1/4	41.0	2.5	**OR41X2.5X**	**OR41X2.5VITX**
M48	G 1 1/2	46.0	3.0	**OR46X3X**	**OR46X3VITX**

*NBR is standard compound — 90-durometer Nitrile.
**FKM is optional 85-durometer Fluorocarbon compound.

SAE 4-Bolt Flange O-Ring

Code 61 and Code 62 Flanges



Specify size and compound
Example: 2-210 NBR

TUBE FITTING PART #	HOSE PRODUCTS DIVISION PART #1)	FITTING DASH SIZE	W (in.)	I.D. (in.)	Material NBR*
2-210	711510-6	8	0.139	0.734	•
2-214	711510-5	12	0.139	0.984	•
2-219	711510-4	16	0.139	1.296	•
2-222	711510-3	20	0.139	1.484	•
2-225	711510-2	24	0.139	1.859	•
2-228	711510-1	32	0.139	2.234	•
2-232	711510-7	40	0.139	2.734	•
2-237	711510-8	48	0.139	3.359	•
2-241		56	0.139	3.859	•
2-245		64	0.139	4.359	•
2-253		80	0.139	5.359	•

* NBR is the standard compound — 90-durometer Nitrile.

O-ring for DIN 2353 EO Gear Pump Flange Adapters
Part Numbers: BFG/BFW

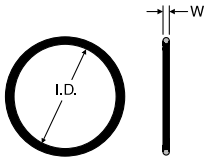
FLANGE SERIES "LK"	D	H	O-RING NBR*
LK35	20.0	2.5	**OR20X2.5X**
LK40	26.0	2.5	**OR26X2.5X**
LK55	33.0	2.5	**OR33X2.5X**

*NBR is standard compound — 90-durometer Nitrile.

M

Radial Seal O-Ring

Dual Seal Port O-Ring

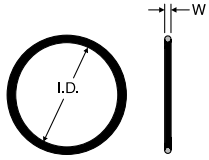


TUBE FITTING PART #	END SIZE 2 DUAL SEAL	W (in.)	I.D. (in.)
2-113	1/2	0.103	0.549
2-123	1	0.103	1.174
2-129	1 1/2	0.103	1.549

Standard O-ring compound - 90 durometer NBR. Ordering example with material: 2-113 NBR.

Flange Seal O-Ring

Dual Seal Flange Head O-Ring



TUBE FITTING PART #	END SIZE 2 DUAL SEAL	W (in.)	I.D. (in.)
2-022	1/2	0.070	0.989
2-129	1	0.103	1.549
2-136	1 1/2	0.103	1.987

Standard O-ring compound - 90 durometer NBR.

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PARKLAMP

Inch Tube Clamps

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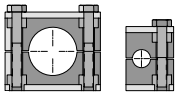
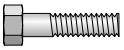
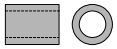
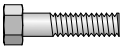
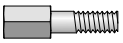
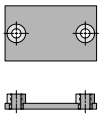
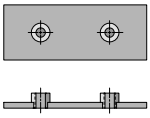
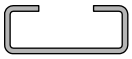
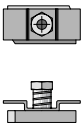
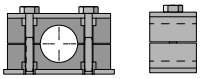
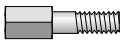
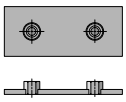
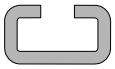
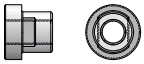
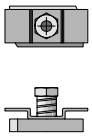
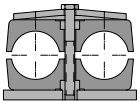
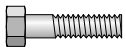
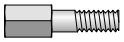
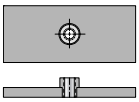
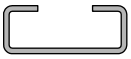
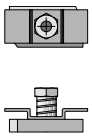
Standard Series	**Clamp Halves**  N7	**CP** Cover Plate  N8	**BCP** Hexagon Head Bolt for Cover Plate  N8	**IPS** Insert  N8	**BIP** Hexagon Head Bolt for Insert  N8
LP Locking Plate  N8	**SB** Stacking Bolt  N8	**WP** Weld Plate  N9	**WPE** Weld Plate Elongated  N9	**R** Mounting Rail  N9	**HRN** Hexagon Rail Nut  N9
CRA Channel Rail Adapter  N9	**Heavy Series**	**Clamp Halves** Heavy  N10	**CPH** Cover Plate Heavy  N11	**BCPH** Hexagon Head Bolt for Cover Plate  N11	**LPH** Locking Plate Heavy  N11
SBH Stacking Bolt Heavy  N11	**WPH** Weld Plate Heavy  N11	**RH** Mounting Rail Heavy  N12	**RNH** Mounting Rail Nut Heavy  N12	**CRA** Channel Rail Adatper  N12	
Twin Series	**Clamp Halves**  N13	**CPT** Cover Plate  N14	**BCPT** Hexagon Head Bolt for Cover Plate  N14	**LPT** Locking Plate  N14	**SBT** Stacking Bolt  N14
WPT Weld Plate Twin  N15	**R** Mounting Rail  N15	**RNT** Mounting Rail Nut Twin  N15	**CRA** Channel Rail Adapter  N15		

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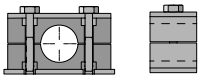
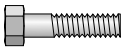
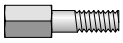
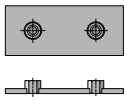
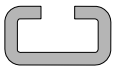
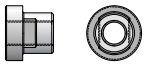
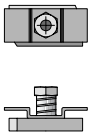
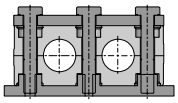
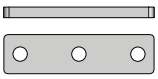
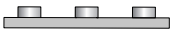
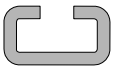
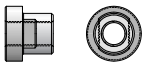
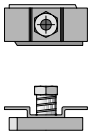
Compact Spiral Hose Heavy Series	**Clamp Halves** Heavy  N16	**CPH** Cover Plate Heavy  N17	**BCPH** Hexagon Head Bolt for Cover Plate  N17	**LPH** Locking Plate Heavy  N17	**SBH** Stacking Bolt Heavy  N17
WPH Weld Plate Heavy  N17	**RH** Mounting Rail Heavy  N18	**RNH** Mounting Rail Nut Heavy  N18	**CRA** Channel Rail Adatper  N18	**Compact Spiral Hose Heavy Twin**	**Clamp Halves** Heavy Twin  N19
CPHT Cover Plate  N20	**BCPH** Hexagon Head Bolt for Cover Plate  N20	**WPHT** Weld Plate  N20	**RH** Mounting Rail Heavy  N20	**RNH** Mounting Rail Nut Heavy  N20	**CRA** Channel Rail Adatper  N20

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Introduction

The ParKlamp system is designed for restraining tube, pipe and hose assemblies against unwanted and potentially harmful effects of mechanical shock and vibration forces that are common in fluid power systems.

The clamping system is the most commonly overlooked aspect of fluid power system design. Failure to properly restrain the fluid conductors can result in leakage, downtime and system malfunction, as well as significantly reduce the life of tube, pipe and hose assemblies. With the ParKlamp system, the risk of problems resulting from mechanical shock and vibration can be significantly reduced.

Design and Construction

Designed to meet the basic envelope dimensions of DIN 3015, Part 1, the ParKlamp plastic clamp halves are interchangeable with the Parker metric clamp system. The primary difference between these two clamping systems is the utilization of inch, as opposed to metric, thread hardware in the ParKlamp system. All plastic clamp halves in the ParKlamp system are manufactured from Polypropylene material. The hardware portion of the ParKlamp system is available in plated steel and stainless steel.

For convenience, the ParKlamp system is divided into three different series: Standard, Heavy and Twin. Each series has corresponding components, physical dimensions and mechanical properties. Within each series, there are a number of groups, each with specific envelope dimensions. Reference the "Group#" column in each table to match clamps with appropriate components. Components from different series and/or groups can not be intermixed. However, the standard and twin series can be mounted on the same mounting rail.

How It Works

The ParKlamp system has two primary methods for mounting: weld plates and mounting rails.

Clamps should be mounted to a rigid structure for optimum performance. Clamping tube, pipe or hose assemblies together without mounting them to a rigid structure, often called "floating clamps," does not provide adequate support.

Proper design of a clamping system requires that the clamps be positioned appropriately on the tube, pipe or hose assemblies. See the Assembly and Installation section of this catalog for more information on clamp location and spacing.

Weld Plate Mounting (Fig. N1)

The weld plate mounting system allows the user to attach a single clamp assembly to a structure of similar material (steel to steel, etc) by welding the components together. Once the weld plate is attached to a structure, one clamp halve can be placed onto the weld plate, followed by the tube, pipe or hose assembly. Next, the second plastic clamp halve can be placed on the tube, pipe or hose assembly, followed by the cover plate (or Insert). To complete the assembly, the Hex Head attachment bolts are inserted into the assembly and tightened to the torque shown in the Assembly section of this catalog.

Fig. N1 – Weld Plate Assembly

Fig. N2 – Mounting Rail Assembly

Assembly and Installation

Please refer to Section R for the assembly and installation instructions for ParKlamp Inch Tube Clamps.

Mounting Rail Mounting (Fig. N2)

Use of a mounting rail is another way to assemble the clamping system components onto a support structure. Using a mounting rail allows multiple clamps to be mounted side-by-side for restraining a group of tube, pipe, or hose assemblies. The mounting rail also provides the ability to move the location of the clamps in one direction for easier alignment. The rail can be attached to a support structure by welding or bolting. Once the mounting rail is in place, rail nuts can be slid into the rail. The first clamp half, followed by the tube, pipe or hose assembly, can then be installed over the corresponding rail nuts. After this, the second clamp half, the cover plate (or Insert) and the hex head attachment bolts can be installed to complete the assembly.

Stacking (Fig. N3)

A primary feature of the ParKlamp system is its ability to accommodate stacking of a series of clamps to various heights, thus requiring a smaller footprint for mounting. To do this, simply use the stacking bolts to mount the first clamp assembly, then install a stacking plate over the first clamp and stacking bolts. The second clamp assembly can then be placed over the first clamp assembly. Complete the mounting by assembling a cover plate and using the hex head bolts to tighten the upper clamp assembly. **Note: When stacking, the clamps must be from the same series and group.**

Fig. N3 – Stacked Assembly

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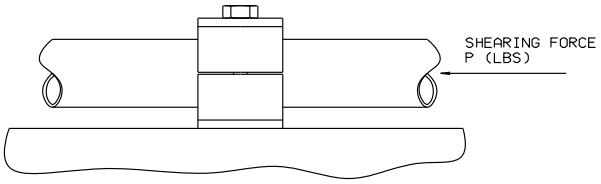
Shearing Force Diagram

The forces shown in these diagrams represent the resistance to sliding provided by the clamps in the axial direction.

The sliding starts when the shown values are reached.



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STANDARD SERIES					
		Polypropylene			
Clamp Group	Hexagon Head Bolt	Tightening torque [Nm] Ft/lb		Max. load in pipe direction F [kN] lbf	
1		8	6	0,6	135
1A		8	6	1,1	247
2	M6 / 1/4"-20	8	6	1,3	292
3	UNC	8	6	1,4	315
4		8	6	1,5	337
5		8	6	1,9	427
6		8	6	2,0	450

HEAVY SERIES					
		Polypropylene			
Clamp Group	Hexagon Head Bolt	Tightening torque [Nm] Ft/lb		Max. load in pipe direction F [kN] lbf	
3S	M10 / 3/8"-	12	9	1,6	360
4S	16 UNC	12	9	2,9	652
5S	M12 / 7/16" -	15	11	3,3	742
6S	14 UNC	30	12	8,2	1.843

Clamp Body Material Properties

	Polypropylene PP
MECHANICAL PROPERTIES	
Density	.901g/cc
Tensile Strength	25 MPa
	(4,000 psi)
Flexural Modulus	1073 MPa
Compressive	
Strength	90MPa
(Resistance)	(23,050 psi)
Notched	
IZOD Impact Strength	3.1 KJ/mm^2

	Polypropylene PP
THERMAL PROPERTIES	
Max. Temperature	-30° to +90° C
Resistance	-22° to +194°F
ELECTRICAL PROPERTIES	
Specific Volume	
Resistivity Ohm x Inch	3.9 x 10^{17}
CHEMICAL PROPERTIES	
Light Acids, Solvents	Stable
Fuels, Mineral Oils	Stable
Alcohol, Paints, Saltwater	Stable

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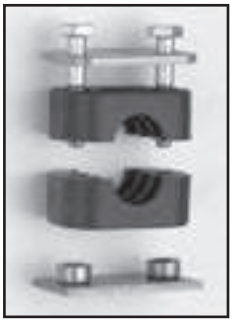
How to Order ParKlamp Kits

Select a symbol from Box 1 and pair it with a symbol from Box 2 to create a part number for the kit.

Example: Weld Plate Kit – Twin Series for 3/4" tube.

Box 1	Box 2
WPT	3190

Box 1 : Mounting – Assembly Type	
Symbol	**Description**
WP	Weld Plate Kit – Standard Series
WPH	Weld Plate Kit – Heavy Series
WPE	Elongated Weld Plate Kit – Standard Series
WPT	Weld Plate Kit – Twin Series
RN	Rail Nut Kit – Standard Series
RNH	Rail Nut Kit – Heavy Series
RNT	Rail Nut Kit – Twin Series
SA	Stacked Assembly Kit – Standard Series
SAH	Stacked Assembly Kit – Heavy Series
SAT	Stacked Assembly Kit – Twin Series



Weld Plate Kit

Rail Nut Kit

Stacked Assembly Kit

Box 2: Clamp Half – Size/Type Designation			
Symbol	**Size**	**Type**	**Series**
1064	1/4"	Tube	Standard – Twin
1064A	1/4"	Tube	Standard
3134H	1/4"	100R1 Hose	Standard
4150H	1/4"	100R2 Hose	Heavy
1095	3/8"	Tube	Standard – Twin
3095	3/8"	Tube	Heavy
1095A	3/8"	Tube	Standard
3174H	3/8"	100R1 Hose	Standard
4198H	3/8"	100R2 Hose	Heavy
2127	1/2"	Tube	Standard – Twin
3127	1/2"	Tube	Heavy
3205H	1/2"	100R1 Hose	Standard
4221H	1/2"	100R2 Hose	Heavy
3213	1/2"	Pipe	Standard
4213	1/2"	Pipe	Heavy
2160	5/8"	Tube	Standard – Twin
3160	5/8"	Tube	Heavy
3239H	5/8"	100R1 Hose	Standard
4251H	5/8"	100R2 Hose	Heavy
3190	3/4"	Tube	Standard – Twin
4190	3/4"	Tube	Heavy
5278H	3/4"	100R1 Hose	Standard
4292H	3/4"	100R2 Hose	Heavy
4266	3/4"	Pipe	Standard – Twin
4267	3/4"	Pipe	Heavy
3254	1"	Tube	Standard – Twin
4254	1"	Tube	Heavy
5357H	1"	100R1 Hose	Standard
6378H	1"	100R2 Hose	Heavy
5334	1"	Pipe	Standard – Heavy – Twin
5320	1 1/4"	Tube	Standard – Heavy – Twin
5438H	1 1/4"	100R1 Hose	Standard
6484H	1 1/4"	100R2 Hose	Heavy
5422	1 1/4"	Pipe	Heavy
5381	1 1/2"	Tube	Standard – Heavy – Twin
6498H	1 1/2"	100R1 Hose	Standard
6544H	1 1/2"	100R2 Hose	Heavy
6483	1 1/2"	Pipe	Standard – Heavy
6508	2"	Tube	Standard – Heavy
6603	2"	Pipe	Heavy
6635	2 1/2"	Tube	Heavy
7762	3"	Tube	Heavy

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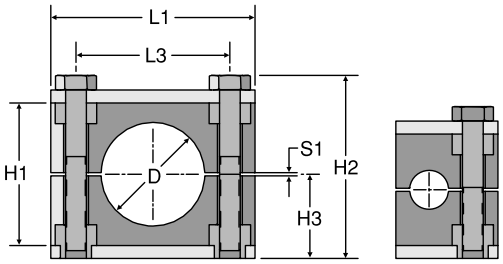
Clamp Halves

Standard Series



Groups 1A, 2, 3, 4, 5 and 6

Group 1

See note below

TUBE CLAMP HALVES

PART #	TUBE SIZE	GROUP #	D		H1	H2	H3	L1	L3	S1	STANDARD FROM STOCK
			in.	mm	in.	in.	in.	in.	in.	in.	
1064-PP	1/4	1	0.25	6.4	1.06	1.45	0.65	1.02	NA	0.01	•
1095-PP	3/8	1	0.38	9.5	1.06	1.45	0.65	1.02	NA	0.01	•
1064A-PP	1/4	1A	0.25	6.4	1.06	1.45	0.65	1.45	0.78	0.01	•
1095A-PP	3/8	1A	0.38	9.5	1.06	1.45	0.65	1.45	0.78	0.01	•
2127-PP	1/2	2	0.50	12.7	1.29	1.69	0.77	1.65	1.02	0.01	•
2160-PP	5/8	2	0.63	16.0	1.29	1.69	0.77	1.65	1.02	0.01	•
3190-PP	3/4	3	0.75	19.0	1.41	1.77	0.80	1.96	1.29	0.01	•
3254-PP	1	3	1.00	25.4	1.41	1.77	0.80	1.96	1.29	0.01	•
5320-PP	1 1/4	5	1.25	32.0	2.28	2.72	1.28	2.79	2.04	0.03	•
5381-PP	1 1/2	5	1.50	38.1	2.28	2.72	1.28	2.79	2.04	0.03	•
6508-PP	2	6	2.00	50.8	2.59	3.00	1.42	3.38	2.59	0.03	•

PIPE CLAMP HALVES

PART #	PIPE SIZE	GROUP #	D		H1	H2	H3	L1	L3	S1	STANDARD FROM STOCK
			in.	mm	in.	in.	in.	in.	in.	in.	
3213-PP	1/2	3	0.84	21.3	1.41	1.77	0.80	1.96	1.29	0.01	•
4266-PP	3/4	4	1.05	26.6	1.65	2.09	0.96	2.32	1.57	0.01	•
5334-PP	1	5	1.31	33.4	2.28	2.72	1.28	2.79	2.04	0.03	•
6483-PP	1 1/2	6	1.90	48.3	2.59	3.00	1.42	3.38	2.59	0.03	•

100R1 HOSE CLAMP HALVES

PART #	HOSE SIZE	GROUP #	D		H1	H2	H3	L1	L3	S1	STANDARD FROM STOCK
			in.	mm	in.	in.	in.	in.	in.	in.	
H3134PP	1/4	3	0.53	13.4	1.41	1.77	0.80	1.96	1.29	0.01	•
H3174PP	3/8	3	0.69	17.4	1.41	1.77	0.80	1.96	1.29	0.01	•
H3205PP	1/2	3	0.81	20.5	1.41	1.77	0.80	1.96	1.29	0.01	•
H3239PP	5/8	3	0.94	23.9	1.41	1.77	0.80	1.96	1.29	0.01	•
H5278PP	3/4	5	1.09	27.8	2.28	2.72	1.28	2.79	2.04	0.03	•
H5357PP	1	5	1.41	35.7	2.28	2.72	1.28	2.79	2.04	0.03	•
H5438PP	1 1/4	5	1.72	43.8	2.28	2.72	1.28	2.79	2.04	0.03	•
H6498PP	1 1/2	6	1.96	49.8	2.59	3.00	1.42	3.38	2.59	0.03	•

Note: One clamp set includes two identical halves of polypropylene. Tube and pipe clamp halves are black in color. Hose clamp halves are green in color. Hardware shown in the illustrations above is **not** included.

Other sizes available. Please contact TFD for a quote.

WARNING: This product can expose you to chemicals including 1,4-Dioxane which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

When selecting components, please reference and match the "Group#" column in each part table with the associated clamps.

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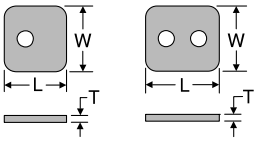
Cover Plate

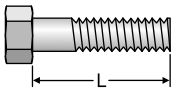


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	W WIDTH (in.)	T THICKNESS (in.)	STANDARD FROM STOCK -S	-SS
CP-1	1	1.10	1.18	0.11	•	•
CP-1A	1A	1.33	1.18	0.11	•	•
CP-2	2	1.59	1.18	0.11	•	•
CP-3	3	1.88	1.18	0.11	•	•
CP-4	4	2.24	1.18	0.11	•	•
CP-5	5	2.75	1.18	0.11	•	•
CP-6	6	3.38	1.18	0.11	•	•

Material: Steel: Zinc plated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

BCP
Hexagon Head Bolt for Cover Plate
(2 required for Groups 1A-6)

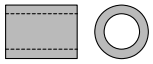


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	STANDARD FROM STOCK -S	-SS
BCP-1	1	1.25	•	•
BCP-1A	1A	1.25	•	•
BCP-2	2	1.38	•	•
BCP-3	3	1.50	•	•
BCP-4	4	1.88	•	•
BCP-5	5	2.38	•	•
BCP-6	6	2.75	•	•

Note: Bolt threads are 1/4 - 20 UNC, Grade 5, zinc clear chromate plated
Material: SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

IPS
Insert

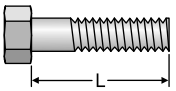


TUBE FITTING PART #	STANDARD FROM STOCK
IPS	•

Material: Plastic
One size fits all groups (2 required for Groups 1A - 6).
(Use when not using a cover plate.)

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

BIP
Hexagon Head Bolt for Insert

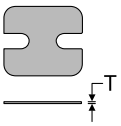


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	STANDARD FROM STOCK
BIP-1	1	1.13	•
BIP-1A	1A	1.13	•
BIP-2	2	1.38	•
BIP-3	3	1.38	•
BIP-4	4	1.63	•
BIP-5	5	2.38	•
BIP-6	6	2.75	•

Note: Bolt threads are 1/4 - 20 UNC, Grade 5, zinc clear chromate plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

LP
Locking Plate

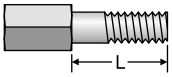


TUBE FITTING PART #	GROUP #	T THICKNESS (in.)	STANDARD FROM STOCK
LP-1	1	0.03	•
LP-1A	1A	0.03	•
LP-2	2	0.03	•
LP-3	3	0.03	•
LP-4	4	0.03	•
LP-5	5	0.03	•
LP-6	6	0.03	•

Material: Steel, zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

SB
Stacking Bolt
(2 required for Groups 1A-6)



TUBE FITTING PART #	GROUP #	L LENGTH (in.)	STANDARD FROM STOCK
SB-1	1	0.78	•
SB-1A	1A	0.78	•
SB-2	2	1.00	•
SB-3	3	1.18	•
SB-4	4	1.38	•
SB-5	5	1.96	•
SB-6	6	2.36	•

Note: Bolt threads are 1/4 - 20 UNC, 1010 steel, zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

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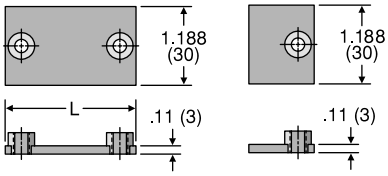
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

WP
Weld Plate

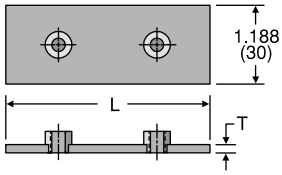


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	L LENGTH (mm)	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
WP-1	1	1.25	31.5	•	•
WP-1A	1A	1.41	36	•	•
WP-2	2	1.65	42	•	•
WP-3	3	1.96	50	•	•
WP-4	4	2.36	60	•	•
WP-5	5	2.79	71	•	•
WP-6	6	3.46	88	•	•

Material: Steel DD11 (1.0332): EN 10111
Steel C4C (1.0303): EN 10263-2

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

WPE
Weld Plate Elongated

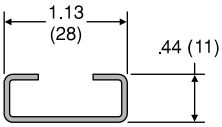


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	L LENGTH (mm)	T THICKNESS (in.)	STANDARD FROM STOCK
WPE-1	1	2.28	58	0.11	•
WPE-1A	1A	2.51	64	0.11	•
WPE-2	2	2.75	70	0.11	•
WPE-3	3	3.07	78	0.11	•
WPE-4	4	3.42	87	0.11	•
WPE-5	5	3.93	100	0.11	•
WPE-6	6	4.52	115	0.11	•

Material: 1020 steel, zinc-phosphate plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

R
Mounting Rail

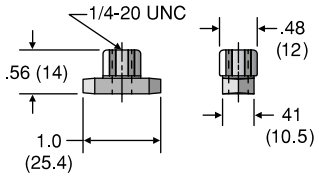


TUBE FITTING PART #	LENGTH	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
R-1	3.28 ft. (1 meter)	•	•
R-2	6.56 ft. (2 meters)	•	•

Material: Steel: Unplated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

HRN
Hexagon Rail Nut



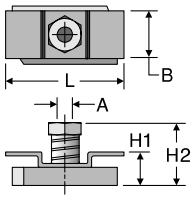
TUBE FITTING PART #	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
HRN	•	•

Material: Steel: Zinc plated
SS: 316 stainless steel

Note: To be used with mounting rail (R)

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

CRA
Channel Rail Adapter



TUBE FITTING PART #	THREAD "A" UNC	L in. (mm)	B in. (mm)	H1 in. (mm)	H2 in. (mm)	STANDARD FROM STOCK
CRA 1-8	1/4-20	1.37 (35)	0.74 (19)	0.51 (13)	0.77 (19.5)	•

Material: Steel, zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Click here for CADs, Support Resources or to Configure Parts Online

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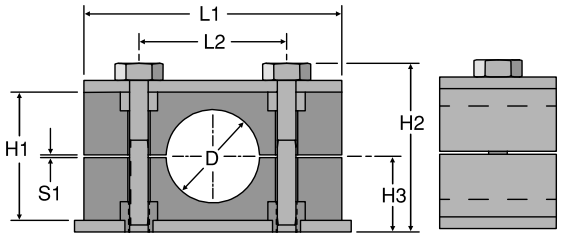
Clamp Halves

Heavy Series



See note below

TUBE CLAMP HALVES											
PART #	TUBE SIZE	GROUP #	D (in.)	D (mm)	H1 (in.)	H2 (in.)	H3 (in.)	L1 (in.)	L2 (in.)	S1 (in.)	STANDARD FROM STOCK
3095-HPP	3/8	H3	0.37	9.5	1.25	2.17	0.94	2.16	1.29	0.02	•
3127-HPP	1/2	H3	0.50	12.7	1.25	2.17	0.94	2.16	1.29	0.02	•
3160-HPP	5/8	H3	0.63	16.0	1.25	2.17	0.94	2.16	1.29	0.02	•
4190-HPP	3/4	H4	0.75	19.0	1.88	2.80	1.26	2.75	1.77	0.02	•
4254-HPP	1	H4	1.00	25.4	1.88	2.80	1.26	2.75	1.77	0.02	•
5320-HPP	1 1/4	H5	1.25	32.0	2.36	3.27	1.50	3.34	2.36	0.02	•
5381-HPP	1 1/2	H5	1.50	38.1	2.36	3.27	1.50	3.34	2.36	0.02	•
6508-HPP	2	H6	2.00	50.8	3.50	4.61	2.17	4.52	3.54	0.07	•
6635-HPP	2 1/2	H6	2.50	63.5	3.50	4.61	2.17	4.52	3.54	0.07	•
7762-HPP	3	H7	3.00	76.2	4.72	5.74	2.75	5.98	4.80	0.07	•

PIPE CLAMP HALVES											
PART #	PIPE SIZE	GROUP #	D (in.)	D (mm)	H1 (in.)	H2 (in.)	H3 (in.)	L1 (in.)	L2 (in.)	S1 (in.)	STANDARD FROM STOCK
4213-HPP	1/2	H4	0.84	21.3	1.88	2.80	1.26	2.75	1.77	0.02	•
4267-HPP	3/4	H4	1.05	26.7	1.88	2.80	1.26	2.75	1.77	0.02	•
5334-HPP	1	H5	1.31	33.4	2.36	3.27	1.50	3.34	2.36	0.02	•
5422-HPP	1 1/4	H5	1.66	42.2	2.36	3.27	1.50	3.34	2.36	0.02	•
6483-HPP	1 1/2	H6	1.90	48.3	3.50	4.61	2.17	4.52	3.54	0.07	•
6603-HPP	2	H6	2.37	60.3	3.50	4.61	2.17	4.52	3.54	0.07	•

100R2 HOSE CLAMP HALVES											
PART #	HOSE SIZE	GROUP #	D (in.)	D (mm)	H1 (in.)	H2 (in.)	H3 (in.)	L1 (in.)	L2 (in.)	S1 (in.)	STANDARD FROM STOCK
H4150HPP	1/4	H4	0.59	15.0	1.83	2.80	1.26	2.75	1.77	0.02	•
H4198HPP	3/8	H4	0.78	19.8	1.83	2.80	1.26	2.75	1.77	0.02	•
H4221HPP	1/2	H4	0.87	22.1	1.83	2.80	1.26	2.75	1.77	0.02	•
H4251HPP	5/8	H4	0.99	25.1	1.83	2.80	1.26	2.75	1.77	0.02	•
H4292HPP	3/4	H4	1.15	29.2	1.83	2.80	1.26	2.75	1.77	0.02	•
H6378HPP	1	H6	1.49	37.8	3.42	4.61	2.17	4.52	3.54	0.07	•
H6484HPP	1 1/4	H6	1.91	48.4	3.42	4.61	2.17	4.52	3.54	0.07	•
H6544HPP	1 1/2	H6	2.14	54.4	3.42	4.61	2.17	4.52	3.54	0.07	•

Note: One clamp set includes two identical halves of polypropylene. Tube and pipe clamps are black in color. Hose clamp halves are green in color. Hardware shown in the illustration above is **not** included.

WARNING: This product can expose you to chemicals including 1,4-Dioxane which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

When selecting components, please reference and match the "Group#" column in each part table with the associated clamps.

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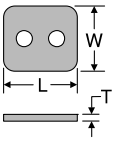
CPH
Cover Plate Heavy

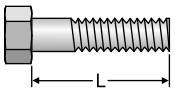


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	W WIDTH (in.)	T THICKNESS (in.)	T THICKNESS (mm)	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
CPH-3	H3	2.16	1.18	0.31	8	•	•
CPH-4	H4	2.75	1.18	0.31	8	•	•
CPH-5	H5	3.34	1.18	0.31	8	•	•
CPH-6	H6	4.52	1.77	0.39	10	•	•
CPH-7	H7	5.98	2.36	0.39	10	•	•

Material: Steel: Zinc phosphate plated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

BCPH
Hexagon Head Bolt for Cover Plate
(2 required per clamp set)

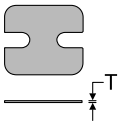


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	UNC THREAD	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
BCPH-3	H3	1.75	3/8 - 16	•	•
BCPH-4	H4	2.25	3/8 - 16	•	•
BCPH-5	H5	2.75	3/8 - 16	•	•
BCPH-6	H6	4.00	7/16 - 14	•	•
BCPH-7	H7	5.25	5/8 - 11	•	•

Material: Steel: Zinc clear chromate plated, Grade 5 bolt
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

LPH
Locking Plate Heavy

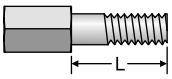


TUBE FITTING PART #	GROUP #	T THICKNESS (in.)	STANDARD FROM STOCK
LPH-3	H3	0.31	•
LPH-4	H4	0.31	•
LPH-5	H5	0.31	•
LPH-6	H6	0.39	•
LPH-7	H7	0.39	•

Material: Steel, zinc phosphate plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

SBH
Stacking Bolt Heavy
(2 required per clamp set)

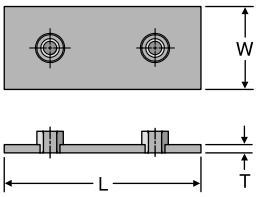


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	STANDARD FROM STOCK
SBH-3	H3	1.02	•
SBH-4	H4	1.61	•
SBH-5	H5	2.01	•
SBH-6	H6	3.27	•
SBH-7	H7	4.33	•

Material: 1010 steel, zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

WPH
Weld Plate Heavy



TUBE FITTING PART #	GROUP #	L LENGTH (in.)	L LENGTH (mm)	W WIDTH (in.)	W WIDTH (mm)	T THICKNESS (in.)	T THICKNESS (mm)	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
WPH-3	H3	2.88	73	1.18	30	0.31	8	•	•
WPH-4	H4	3.34	85	1.18	30	0.31	8	•	•
WPH-5	H5	3.94	100	1.18	30	0.31	8	•	•
WPH-6	H6	5.51	140	1.79	45	0.39	10	•	•
WPH-7	H7	7.09	180	2.36	60	0.39	10	•	•

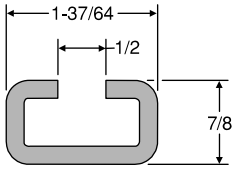
Material: Steel: 1020 steel, zinc-phosphate plated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

RH
Mounting Rail Heavy

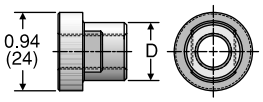


TUBE FITTING PART #	LENGTH	STANDARD FROM STOCK -S	-SS
R1H	3.28 ft. (1 meter)	•	•
R2H	6.56 ft. (2 meters)	•	•

Material: Steel: Unplated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

RNH
Mounting Rail Nut Heavy



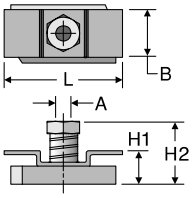
TUBE FITTING PART #	GROUP #	D DIAMETER (in.)	(mm)	THREAD	STANDARD FROM STOCK -S	-SS
RNH-10	H3, H4, H5	0.70	18	3/8 - 16 UNC	•	•
RNH-12	H6	0.78	20	7/16 - 14 UNC	•	•

Material: Steel: Zinc-phosphate plated
SS: 316 stainless steel

Note: To be used with mounting rail heavy (RH)

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

CRA
Channel Rail Adapter



TUBE FITTING PART #	THREAD "A" UNC	L in. (mm)	B in. (mm)	H1 in. (mm)	H2 in. (mm)	STANDARD FROM STOCK
CRA 3-5	3/8-16	1.37 (35)	0.86 (22)	0.73 (18.5)	1.08 (27.5)	•
CRA 6	7/16-14	1.77 (45)	0.98 (25)	0.67 (17)	1.08 (27.5)	•

Material: Steel, zinc plated

Note: To be used with channel rails (Parker does not supply these).

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

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Tube Fittings Division
Columbus, Ohio
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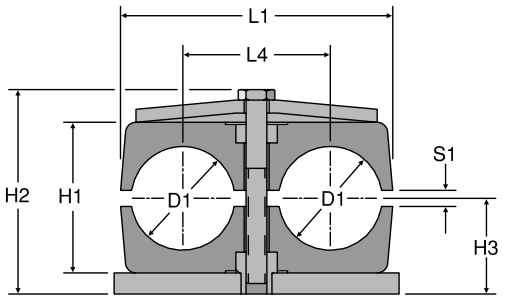
Clamp Halves

Twin Series



See note below

TUBE CLAMP HALVES											
PART #	TUBE SIZE	GROUP #	D1		H1	H2	H3	L1	L4	S1	STANDARD FROM STOCK
			in.	mm	in.	in.	in.	in.	in.	in.	
1064/64-PP	1/4	T1	0.25	6.4	0.79	1.18	0.59	1.41	0.78	0.02	•
1095/95-PP	3/8	T1	0.38	9.5	0.79	1.18	0.59	1.41	0.78	0.02	•
2127/127-PP	1/2	T2	0.50	12.7	1.06	1.73	0.71	2.08	1.14	0.03	•
2160/160-PP	5/8	T2	0.63	16.0	1.06	1.73	0.71	2.08	1.14	0.03	•
3190/190-PP	3/4	T3	0.75	19.0	1.45	2.17	0.93	2.63	1.41	0.03	•
3254/254-PP	1	T3	1.00	25.4	1.45	2.17	0.93	2.63	1.41	0.03	•
5320/320-PP	1 1/4	T5	1.25	32.0	2.09	2.83	1.26	4.17	2.20	0.03	•
5381/381-PP	1 1/2	T5	1.50	38.1	2.09	2.83	1.26	4.17	2.20	0.03	•

PIPE CLAMP HALVES											
PART #	PIPE SIZE	GROUP #	D1		H1	H2	H3	L1	L4	S1	STANDARD FROM STOCK
			in.	mm	in.	in.	in.	in.	in.	in.	
4266/266-PP	3/4	T4	1.05	26.6	1.77	2.36	1.02	3.14	1.77	0.03	•
5334/334-PP	1	T5	1.31	33.4	2.08	2.83	1.26	4.17	2.20	0.03	•

FOR USE WITH 100R1 HOSE											
PART #	HOSE SIZE	GROUP #	D1		H1	H2	H3	L1	L4	S1	STANDARD FROM STOCK
			in.	mm	in.	in.	in.	in.	in.	in.	
H3206/206-PP	1/2	T3	0.81	20.6	1.45	2.17	0.93	2.63	1.41	0.03	•
H5205/205-PP	1/2	T5	0.81	20.5	2.09	2.83	1.26	4.17	2.20	0.03	•
H5230/230-PP	5/8	T5	0.91	23.0	2.09	2.83	1.26	4.17	2.20	0.03	•
H5280/280-PP	3/4	T5	1.10	28.0	2.09	2.83	1.26	4.17	2.20	0.03	•

FOR USE WITH 100R2 HOSE											
PART #	HOSE SIZE	GROUP #	D 1		H1	H2	H3	L1	L4	S1	STANDARD FROM STOCK
			in.	mm	in.	in.	in.	in.	in.	in.	
H3190/190-PP	3/8	T3	0.75	19.0	1.45	2.17	0.93	2.63	1.41	0.03	•
H3222/222-PP	1/2	T3	0.87	22.2	1.45	2.17	0.93	2.63	1.41	0.03	•
H3250/250-PP	5/8	T3	0.98	25.0	1.45	2.17	0.93	2.63	1.41	0.03	•
H5295/295-PP	3/4	T5	1.16	29.5	2.09	2.83	1.26	4.17	2.20	0.03	•
H5372/372-PP	1	T5	1.46	37.2	2.09	2.83	1.26	4.17	2.20	0.03	•

Note: One clamp set includes two identical halves of polypropylene. Tube and pipe clamp halves are black in color. Hose clamp halves are green. Hardware shown in the illustration above is **not** included.

WARNING: This product can expose you to chemicals including 1,4-Dioxane which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

When selecting components, please reference and match the "Group#" column in each part table with the associated clamps.

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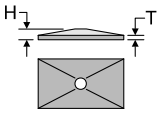
CPT
Cover Plate

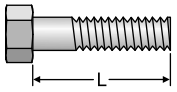


TUBE FITTING PART #	GROUP #	T THICKNESS (in.)	T THICKNESS (mm)	H HEIGHT (in.)	H HEIGHT (mm)	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
CPT-1	T1	0.06	1.5	—	–	•	•
CPT-2	T2	0.13	3.0	0.28	7.0	•	•
CPT-3	T3	0.13	3.0	0.28	7.0	•	•
CPT-4	T4	0.13	3.0	0.31	8.0	•	•
CPT-5	T5	0.13	3.0	0.31	8.0	•	•

Material: Steel: Zinc plated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

BCPT
Hexagon Head Bolt for Cover Plate

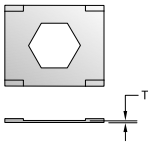


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	UNC THREAD	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
BCPT-1	T1	1.38	1/4 - 20	•	•
BCPT-2	T2	1.38	5/16 - 18	•	•
BCPT-3	T3	1.75	5/16 - 18	•	•
BCPT-4	T4	2.00	5/16 - 18	•	•
BCPT-5	T5	2.50	5/16 - 18	•	•

Material: Steel: Zinc clear chromate plated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

LPT
Locking Plate

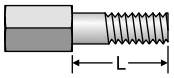


TUBE FITTING PART #	GROUP #	T THICKNESS (in.)	STANDARD FROM STOCK
LPT-1	T1	0.02	•
LPT-2	T2	0.02	•
LPT-3	T3	0.02	•
LPT-4	T4	0.02	•
LPT-5	T5	0.02	•

Material: Steel, zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

SBT
Stacking Bolt



TUBE FITTING PART #	GROUP #	L LENGTH (in.)	UNC THREAD	STANDARD FROM STOCK
SBT-1	T1	0.59	1/4 - 20	•
SBT-2	T2	0.78	5/16 - 18	•
SBT-3	T3	1.13	5/16 - 18	•
SBT-4	T4	1.69	5/16 - 18	•
SBT-5	T5	1.78	5/16 - 18	•

Material: Zinc plated, 1010 steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

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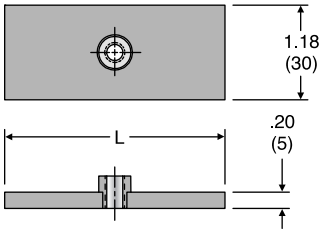
WPT
Weld Plate Twin

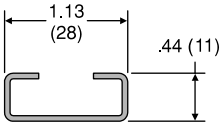


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	(mm)	STANDARD FROM STOCK -S	-SS
WPT-1	T1	1.47	37	•	•
WPT-2	T2	2.31	55	•	•
WPT-3	T3	2.75	70	•	•
WPT-4	T4	3.34	85	•	•
WPT-5	T5	4.34	110	•	•

Material: Steel: Zinc-phosphate plated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

R
Mounting Rail

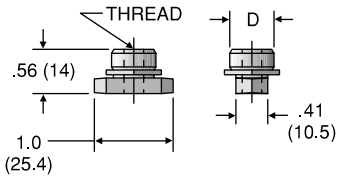


TUBE FITTING PART #	LENGTH	STANDARD FROM STOCK -S	-SS
R-1	3.28 ft. (1 meter)	•	•
R-2	6.56 ft. (2 meters)	•	•

Material: Steel: Unplated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

RNT
Mounting Rail Nut Twin



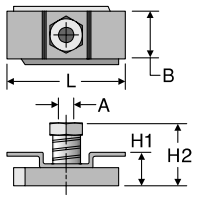
TUBE FITTING PART #	GROUP #	D DIAMETER (in.)	(mm)	THREAD	STANDARD FROM STOCK -S	-SS
RNT-1	T1	0.39	10	1/4 - 20 UNC	•	•
RNT-2-5	T2-T5	0.56	14	5/16 - 18 UNC	•	•

Material: Steel: Zinc plated
SS: 316 stainless steel

Note: to be used with mounting rail (R)

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

CRA
Channel Rail Adapter



TUBE FITTING PART #	THREAD "A" UNC	L in. (mm)	B in. (mm)	H1 in. (mm)	H2 in. (mm)	STANDARD FROM STOCK
CRA 2-3D	5/16-18	1.49 (38)	2.55 (65)	0.73 (18.5)	1.08 (27.5)	•

Material: Steel, zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Clamp Halves

Compact Spiral Hose Heavy Series

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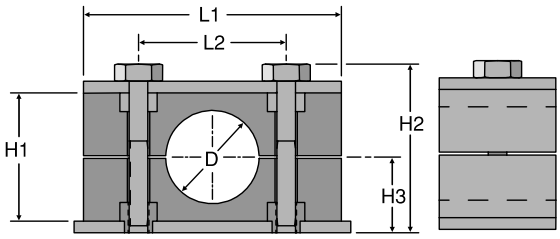

See note below

COMPACT SPIRAL HOSE CLAMP HALVES										
PART #	HOSE SIZE	GROUP #	D (in.)	D (mm)	H1 (in.)	H2 (in.)	H3 (in.)	L1 (in.)	L2 (in.)	STANDARD FROM STOCK
H4213-HPP	-8	H4	0.84	21.3	1.83	2.80	1.26	2.75	1.77	•
H4250-HPP	-10	H4	0.98	25.0	1.83	2.80	1.26	2.75	1.77	•
H4280-HPP	-12	H4	1.10	28.0	1.83	2.80	1.26	2.75	1.77	•
H6354-HPP	-16	H6	1.39	35.4	3.42	4.61	2.17	4.52	3.54	•
H6445-HPP	-20	H6	1.75	44.5	3.42	4.61	2.17	4.52	3.54	•
H6530-HPP	-24	H6	2.09	53.0	3.42	4.61	2.17	4.52	3.54	•
H6680-HPP	-32	H6	2.68	68.0	3.42	4.61	2.17	4.52	3.54	•

Note: One clamp set includes two identical halves of polypropylene. Hardware shown in the illustration above is **not** included.

WARNING: This product can expose you to chemicals including 1,4-Dioxane which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

When selecting components, please reference and match the "Group#" column in each part table with the associated clamps.

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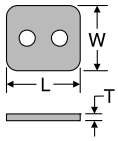
CPH
Cover Plate Heavy

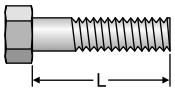


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	W WIDTH (in.)	T THICKNESS (in.)	T THICKNESS (mm)	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
CPH-4	H4	2.75	1.18	0.31	8	•	•
CPH-6	H6	4.52	1.77	0.39	10	•	•

Material: Steel: Zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

BCPH
Hexagon Head Bolt for Cover Plate
(2 required per clamp set)

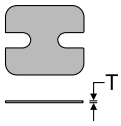


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	UNC THREAD	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
BCPH-4	H4	2.25	3/8 - 16	•	•
BCPH-6	H6	4.00	7/16 - 14	•	•

Material: Steel: Zinc clear chromate plated, Grade 5 bolt
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

LPH
Locking Plate Heavy

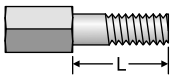


TUBE FITTING PART #	GROUP #	T THICKNESS (in.)	STANDARD FROM STOCK
LPH-4	H4	0.31	•
LPH-6	H6	0.39	•

Material: Steel: Zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

SBH
Stacking Bolt Heavy
(2 required per clamp set)

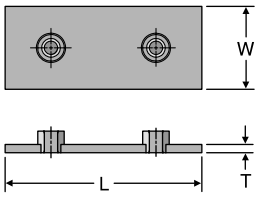


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	STANDARD FROM STOCK
SBH-4	H4	1.61	•
SBH-6	H6	3.27	•

Material: Steel: Zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

WPH
Weld Plate Heavy



TUBE FITTING PART #	GROUP #	L LENGTH (in.)	L LENGTH (mm)	W WIDTH (in.)	W WIDTH (mm)	T THICKNESS (in.)	T THICKNESS (mm)	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
WPH-4	H4	3.34	85	1.18	30	0.31	8	•	•
WPH-6	H6	5.51	140	1.79	45	0.39	10	•	•

Material: Steel: Zinc-phosphate plated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

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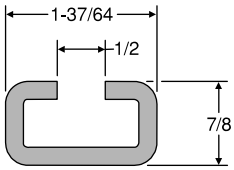
Mounting Rail Heavy



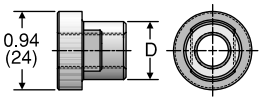
TUBE FITTING PART #	LENGTH	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
R1H	3.28 ft. (1 meter)	•	•
R2H	6.56 ft. (2 meters)	•	•

Material: Steel: Unplated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

RNH

Mounting Rail Nut Heavy



TUBE FITTING PART #	GROUP #	D DIAMETER (in.)	D DIAMETER (mm)	THREAD	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
RNH-10	H4	0.70	18	3/8 - 16 UNC	•	•
RNH-12	H6	0.78	20	7/16 - 14 UNC	•	•

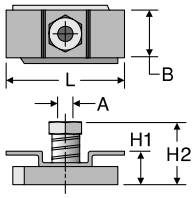
Material: Steel: Zinc plated
SS: 316 stainless steel

Note: To be used with mounting rail heavy (RH)

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

CRA

Channel Rail Adapter



TUBE FITTING PART #	GROUP #	THREAD "A" UNC	L in. (mm)	B in. (mm)	H1 in. (mm)	H2 in. (mm)	STANDARD FROM STOCK
CRA 3-5	H4	3/8-16	1.37 (35)	0.86 (22)	0.73 (18.5)	1.08 (27.5)	•
CRA 6	H6	7/16-14	1.77 (45)	0.98 (25)	0.67 (17)	1.08 (27.5)	•

Material: Steel: Zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

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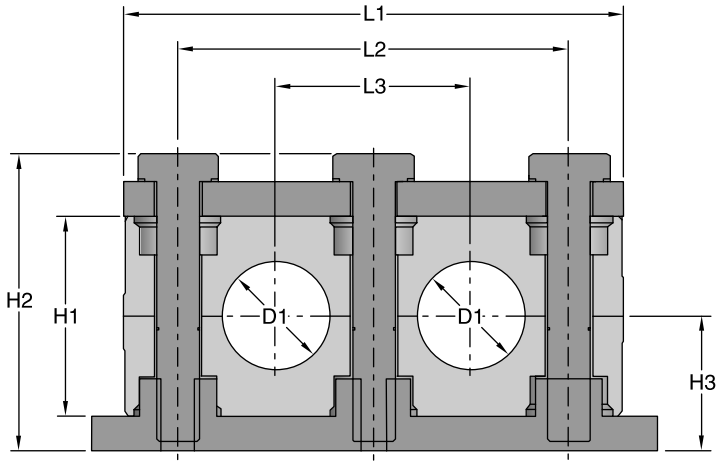
Clamp Halves

Compact Spiral Hose Heavy Twin Series



See note below

COMPACT SPIRAL HOSE CLAMP HALVES											
PART #	HOSE SIZE	GROUP #	D1 (in.)	D1 (mm)	H1 (in.)	H2 (in.)	H3 (in.)	L1 (in.)	L2 (in.)	L3 (in.)	STANDARD FROM STOCK
H4213/213-HPP	-8	HT4	0.84	21.3	1.89	2.77	1.26	4.53	3.54	1.77	•
H4250/250-HPP	-10	HT4	0.98	25.0	1.89	2.77	1.26	4.53	3.54	1.77	•
H4280/280-HPP	-12	HT4	1.10	28.0	1.89	2.77	1.26	4.53	3.54	1.77	•
H5354/354-HPP	-16	HT5	1.39	35.4	2.36	3.24	1.50	5.71	4.72	2.36	•

Note: One clamp set includes two identical halves of polypropylene. Hardware shown in the illustration above is **not** included.

WARNING: This product can expose you to chemicals including 1,4-Dioxane which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

When selecting components, please reference and match the "Group#" column in each part table with the associated clamps.

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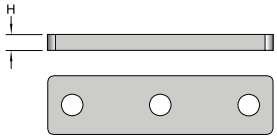
CPHT
Cover Plate

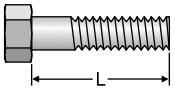


TUBE FITTING PART #	GROUP #	H HEIGHT (in.)	H HEIGHT (mm)	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
CPHT-4	HT4	0.31	8.0	•	•
CPHT-5	HT5	0.31	8.0	•	•

Material: Steel: Zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

BCPH
Hexagon Head Bolt for Cover Plate
(2 required per clamp set)

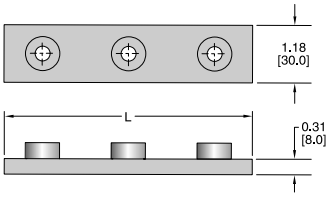


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	UNC THREAD	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
BCPH-4	HT4	2.25	3/8 - 16	•	•
BCPH-5	HT5	2.75	3/8 - 16	•	•

Material: Steel: Zinc clear chromate plated, Grade 5 bolt
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

WPHT
Weld Plate

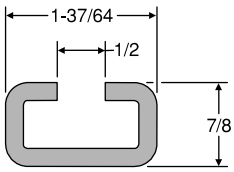


TUBE FITTING PART #	GROUP #	L LENGTH (in.)	L LENGTH (mm)	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
WPHT-4	HT4	5.12	130.0	•	•
WPHT-5	HT5	6.30	160.0	•	•

Material: Steel: Zinc-phosphate plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

RH
Mounting Rail Heavy

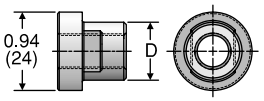


TUBE FITTING PART #	LENGTH	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
R1H	3.28 ft. (1 meter)	•	•
R2H	6.56 ft. (2 meters)	•	•

Material: Steel: Unplated
SS: 316 stainless steel

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

RNH
Mounting Rail Nut Heavy



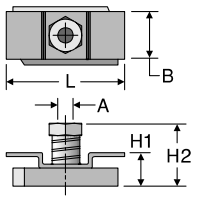
TUBE FITTING PART #	GROUP #	D DIAMETER (in.)	D DIAMETER (mm)	THREAD	STANDARD FROM STOCK -S	STANDARD FROM STOCK -SS
RNH-10	HT4, HT5	0.70	18	3/8 - 16 UNC	•	•

Material: Steel: Zinc plated

Note: To be used with mounting rail heavy (RH)

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

CRA
Channel Rail Adapter



TUBE FITTING PART #	GROUP #	THREAD "A" UNC	L in. (mm)	B in. (mm)	H1 in. (mm)	H2 in. (mm)	STANDARD FROM STOCK
CRA 3-5	HT4	3/8-16	1.37 (35)	0.86 (22)	0.73 (18.5)	1.08 (27.5)	•

Material: Steel: Zinc plated

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

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Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

0 METRIC CLAMPS

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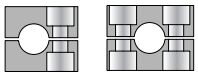
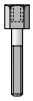
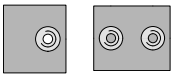
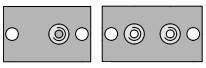
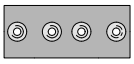
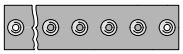
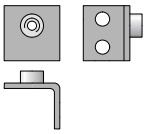
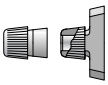
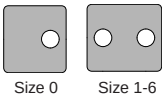
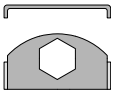
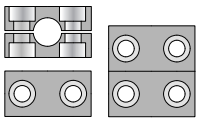
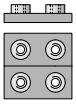
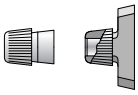
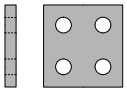
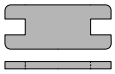
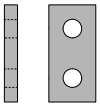
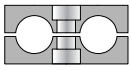
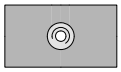
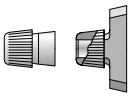
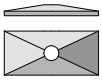
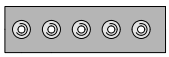
Standard Series Normal Mechanical Stress	**RAP/RAN/RAA** Clamp Halves  Size 0 Size 1-6 O4	**SLA** Slotted Screws  O5	**SSLA** Hex Head Bolt  O5	**ISA** Cap Screws  O5	**ASA** Stacking Bolts  O6
APKA Weld Plate-Short  Size 0 Size 1-6 O5	**APLA** Weld Plate-Long  Size 0 Size 1-6 O5	**APDA** Double Weld Plate  O5	**APRA** Weld Plate-Strip  O6	**APWA** Weld Plate Angled  O6	**TS** Mounting Rail  O6
TMA Lock Nut  O6	**DPA** Top Plate  Size 0 Size 1-6 O6	**SBA** Locking Plate  O6	**USA** Locking Washer  O6	**Heavy Series High Mechanical Stress**	**RCP/RCN/RCA/RCPD** Clamp Halves  O7
SSC Hex Head Bolts  O8	**ASC** Stacking Bolts  O8	**APC** Weld Plate  O8	**APDC** Double Weld Plate  O8	**ISC** Cap Screws  O9	**APLC** Weld/Screw Plate  O8
TSC Mounting Rail  O9	**TMC** Lock Nut  O9	**DPDC** Double Top Plate  O9	**SPC** Locking Plate  O9	**DPC** Top Plate  O10	**USC** Locking Washer  O10
Twin Series Normal Mechanical Stress	**RBP/RBN** Clamp Halves  O10	**SSB** Hex Head Bolt  O11	**ISB** Cap Screws  O11	**ASB** Stacking Bolts  O11	**APB** Weld Plate  O11
TMB Lock Nut  O11	**DPB** Top Plate  O11	**APRB** Strip Weld Plate  O12	**TS** Mounting Rail  O12	**SBB** Locking Plate  O12	**US** Locking Washer  O12

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Metric Clamps

The Parker Metric Clamp system is designed for restraining tube, pipe and hose assemblies against unwanted, and potentially harmful effects of mechanical shock and vibration forces that are common in fluid power systems.

The clamping system is the most commonly overlooked aspect of fluid power system design. Failure to properly restrain the fluid conducting system can result in leakage, downtime and system malfunction, as well as significantly reduced life of tube, pipe and hose assemblies. With the Parker Metric Clamp system, the risk of problems resulting from mechanical shock and vibration can be significantly reduced.

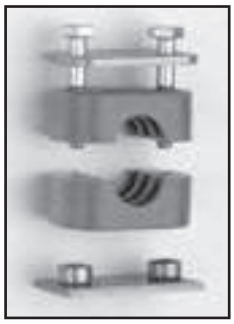

Fig. O1 – Weld Plate Assembly

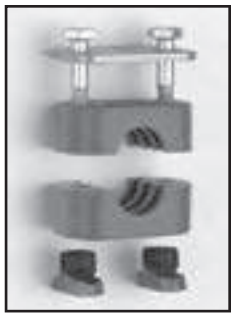

Fig. O2 – Mounting Rail Assembly

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How Metric Clamps Work

The Metric Clamp system has two primary methods for mounting: weld plates and mounting rails. Clamps may be mounted to secure a single layer of tube or stacked for securing multiple layers.

Clamps should be mounted to a rigid structure for optimum performance. Clamping tube, pipe or hose assemblies together without mounting them to a rigid structure, often called “floating clamps,” does not provide adequate support.

Proper design of a clamping system requires that the clamps be positioned appropriately on the tube, pipe or hose assemblies. See the Assembly and Installation section of the catalog for more information on clamp location and spacing.

Weld Plate Mounting (Fig. O1)

The weld plate mounting system allows the user to attach a single clamp assembly to a structure of similar material (steel to steel, etc) by welding the components together. Once the weld plate is attached to a structure, one clamp half can be placed onto the weld plate, followed by the tube, pipe or hose assembly. Next, the second plastic clamp half can be placed on the tube, pipe or hose assembly, followed by the cover plate. To complete the assembly, the Hex Head attachment bolts are inserted into the assembly and tightened.

Mounting Rail Mounting (Fig. O2)

Use of a mounting rail is another way to assemble the clamping system components onto a support structure. Using a mounting rail allows multiple clamps to be mounted side-by-side for restraining a group of tube, pipe, or hose assemblies. The mounting rail also provides the ability to move the location of the clamps in one direction for easier alignment. The rail can be attached to a support structure by welding or bolting. Once the mounting rail is in place, rail nuts can be slid into the rail. The first clamp half, followed by the tube, pipe or hose assembly, can then be installed over the corresponding rail nuts. After this, the second clamp half, the cover plate and the hex head attachment bolts can be installed to complete the assembly.

Stacking (Fig. O3)

A primary feature of the Metric Clamp system is its ability to accommodate stacking of a series of clamps to various heights, thus requiring a smaller footprint for mounting. To do this, simply use the stacking bolts to mount the first clamp assembly, then install a stacking plate over the first clamp and stacking bolts. The second clamp assembly can then be placed over the first clamp assembly. Complete the mounting by assembling a cover plate and using the hex head bolts to tighten the upper clamp assembly. **Note: When stacking, the clamps must be from the same series and group.**

Fig. O3 – Stacked Assembly

Reference Locations

Assembly and Installation: Please refer to Section R for the assembly and installation instructions for Metric Clamps.

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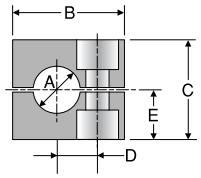
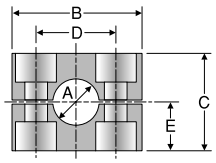
RAP / RAN / RAA

Clamp Halves

TUBE FITTING PART #	GROUP #	A Metric Tube Size	A Inch Pipe Size	A Inch Tube Size	B (mm)	C (mm)	D (mm)	E (mm)
RAP006X		6						
RAP006.4X		6.4		1/4				
RAP008X		8		5/16				
RAP009.5X		9.5		3/8				
RAP010X		10	1/8					
RAP012X	0	12			28	27	12.5	13.5
RAP106X		6						
RAP106.4X		6.4		1/4				
RAP108X		8		5/16				
RAP109.5X		9.5		3/8				
RAP110X		10	1/8					
RAP112X	1	12			34	27	20	13.5
RAP212.7X		12.7		1/2				
RAP213.5X		13.5	1/4					
RAP214X		14						
RAP215X		15						
RAP216X		16		5/8				
RAP217.2X		17.2	3/8					
RAP218X	2	18			40	33	26	16.5
RAP319X		19		3/4				
RAP320X		20						
RAP321.3X		21.3	1/2					
RAP322X		22						
RAP323X		23						
RAP325X	3	25		1	48	35	33	17.5
RAP426.9X		26.9	3/4					
RAP428X		28						
RAP430X	4	30			57	42	40	21
RAP532X		32		1 1/4				
RAP533.7X		33.7	1					
RAP535X		35						
RAP538X		38		1 1/2				
RAP540X		40						
RAP542X	5	42	1 1/4		70	58	52	29
RAP644.5X		44.5		1 3/4				
RAP645X		45						
RAP648X		48	1 1/2					
RAP650X		50						
RAP650.8X		50.8		2				
RAP652X		52						
RAP655X	6	55			86	66	66	33
RAP657X		57		2 1/4				



Group 0



Groups 1-6

Material codes for clamp halves:

Polypropylene - **RAP**
inside plain - **RAPG (for hose)**
Polyamide 6 - **RAN (Nylon)**
inside plain - **RANG (Nylon) (for hose)**
Aluminum - **RAA (Group 1 to 6 only)**

Note: One clamp set includes two identical halves.

When selecting components, please reference and match the "Group#" column in each part table with the associated clamps.

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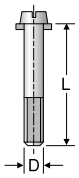
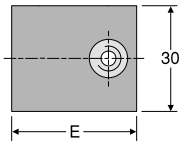
SLA
Slotted Screws



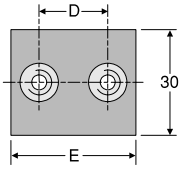
TUBE FITTING PART #	GROUP #	D (mm)	L (mm)
SLA0X	0,1	M6 x 1	20
SLA2X	2	M6 x 1	25
SLA3X	3	M6 x 1	30
SLA4X	4	M6 x 1	35
SLA5X	5	M6 x 1	50
SLA6X	6	M6 x 1	60

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

APKA
Weld Plate – Short



Group 0

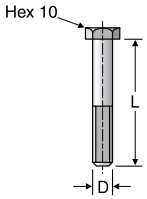


Groups 1-6

TUBE FIT-TING PART #	GROUP #	D (mm)	E (mm)
APKA0X	0	—	30
APKA1X	1	20	36
APKA2X	2	26	42
APKA3X	3	33	50
APKA4X	4	40	59
APKA5X	5	52	72
APKA6X	6	66	88

Thickness 3 mm

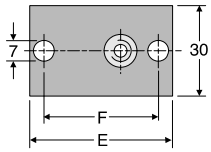
SSLA
Hex Head Bolt



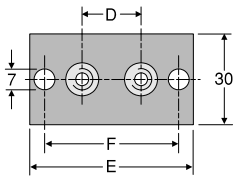
TUBE FITTING PART #	GROUP #	D (mm)	L (mm)
SSLA0X	0,1	M6 x 1	30
SSLA2/SSB1X	2	M6 x 1	35
SSLA3X	3	M6 x 1	40
SSLA4X	4	M6 x 1	45
SSLA5X	5	M6 x 1	60
SSLA6X	6	M6 x 1	70

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

APLA
Weld Plate – Long



Group 0

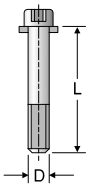


Groups 1-6

TUBE FITTING PART #	GROUP #	D (mm)	E (mm)	F (mm)
APLA0X	0	—	58	44
APLA1X	1	20	64	50
APLA2X	2	26	70	56
APLA3X	3	33	78	64
APLA4X	4	40	87	73
APLA5X	5	52	100	86
APLA6X	6	66	116	100

Thickness 3 mm

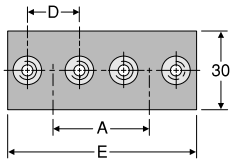
ISA
Cap Screws



TUBE FITTING PART #	GROUP #	D (mm)	L (mm)
ISA0X	0,1	M6 x 1	20
ISA2X	2	M6 x 1	25
ISA3X	3	M6 x 1	30
ISA4X	4	M6 x 1	35
ISA5X	5	M6 x 1	50
ISA6X	6	M6 x 1	60

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

APDA
Double Weld Plate



TUBE FITTING PART #	GROUP #	A (mm)	D (mm)	E (mm)
APDA0X	0	30	—	61
APDA1X	1	35	20	69
APDA2X	2	43	26	86
APDA3X	3	52	33	104
APDA4X	4	60	40	117
APDA5X	5	75	52	145
APDA6X	6	90	66	176

Thickness 3 mm

Dimensions and pressures for reference only, subject to change.

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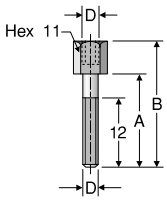
ASA
Stacking Bolts



TUBE FITTING PART #	GROUP #	A (mm)	B (mm)	D (mm)
ASA0X	0,1	20	34	M6 x 1
ASA2X	2	25	39	M6 x 1
ASA3X	3	30	44	M6 x 1
ASA4X	4	35	49	M6 x 1
ASA5X	5	50	64	M6 x 1
ASA6X	6	60	74	M6 x 1

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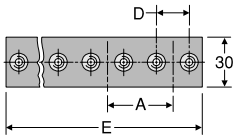
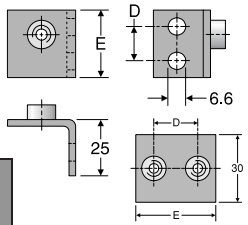
APRA
Weld Plate – Strip



TUBE FITTING PART #	GROUP #	D (mm)	A (mm)	E (mm)	NUMBER OF CLAMPS
APRA0X	0	—	30	298	10
APRA1X	1	20	35	349	10
APRA2X	2	26	43	427	10
APRA3X	3	33	52	516	10
APRA4X	4	40	60	297	5
APRA5X	5	52	75	370	5
APRA6X	6	66	90	446	5

Thickness 3 mm

APWA
Weld Plate – Angled

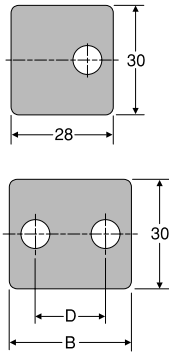


Groups 1-6

TUBE FITTING PART #	GROUP #	D (mm)	E (mm)
APWA0X	0	14	30
APWA1X	1	20	36
APWA2X	2	26	42
APWA3X	3	33	50
APWA4X	4	40	59
APWA5X	5	52	72
APWA6X	6	66	88

Thickness 3 mm

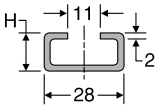
DPA
Top Plate



TUBE FITTING PART #	GROUP #	B (mm)	D (mm)
DPA0X	0	0	—
DPA1X	1	34	20
DPA2X	2	40	26
DPA3X	3	48	33
DPA4X	4	57	40
DPA5X	5	70	52
DPA6X	6	86	66

Thickness 3 mm

TS
Mounting Rail



TUBE FITTING PART #	GROUP #	H (mm)	LENGTH (meter)
TS11A/B1X	ALL	11	1
TS14A/B1X	ALL	14	1
TS30A/B1X	ALL	30	1
TS11A/B2X	ALL	11	2
TS14A/B2X	ALL	14	2
TS30A/B2X	ALL	30	2

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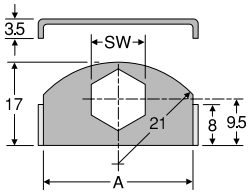
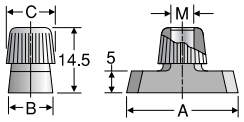
SBA
Locking Plate



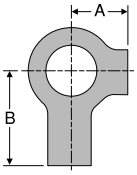
TUBE FITTING PART #	GROUP #	A (mm)	SW (mm)
SBAX	ALL	30	11

TMA
Lock Nut



TUBE FITTING PART #	GROUP #	A (mm)	B (mm)	C (mm)	M (mm)
TMA/TMB1VERZX	ALL	25.4	10.4	12	M6 X 1

USA
Locking Washer



TUBE FITTING PART #	GROUP #	A (mm)	B (mm)
USA/USB1X	ALL	9	18

Dimensions and pressures for reference only, subject to change.

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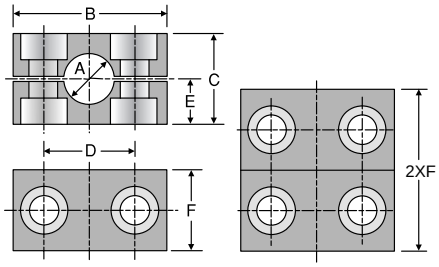
RCP / RCN / RCA / RCPG

Clamp Halves

TUBE FITTING PART #	GROUP #	A Metric Tube Size	A Inch Pipe Size	A Inch Tube Size	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
RCP108X		8		5/16					
RCP110X		10	1/8						
RCP112X		12							
RCP113.5X		13.5	1/4						
RCP114X	1	14			55	32	33	16	30
RCP115X		15							
RCP116X		16		5/8					
RCP117.2X		17.2	3/8						
RCP118X		18							
RCP220X		20							
RCP221.3X		21.3	1/2						
RCP222X		22							
RCP223X	2	23			70	48	45	24	30
RCP225X		25		1					
RCP226.9X		26.9	3/4						
RCP228X		28							
RCP330X		30							
RCP332X		32		1 1/4					
RCP333.7X		33.7	1						
RCP335X	3	35			85	60	60	30	30
RCP338X		38		1 1/2					
RCP340X		40							
RCP342X		42	1 1/4						
RCP438X		38		1 1/2					
RCP440X		40							
RCP442X		42	1 1/4						
RCP445X		45							
RCP448.3X		48.3	1 1/2						
RCP450X	4	50			115	90	90	45	45
RCP451X		51		2					
RCP452X		52							
RCP455X		55							
RCP457X		57		2 1/4					
RCP460.3X		60.3	2						
RCP463X		63		2 1/2					
RCP465X		65							
RCP470X		70							
RCP570X		70							
RCP576.1X		76.1	2 1/2	3					
RCP580X	5	80			152	120	122	60	60
RCP582.5X		82.5		3 1/4					
RCP588.9X		88.9	3	3 1/2					
RCP690X		90							
RCP6101.6X		101.6	3 1/2	4					
RCP6108X	6	108		4 1/4	205	170	168	85	80
RCP6114.3X		114.3	4	4 1/2					
RCP6127X		127		5					
RCP7127X		127		5					
RCP7133X		133		5 1/4					
RCP7140X		140	5	5 1/2					
RCP7152.4X	7	152.4	5 1/2	6	250	200	205	100	90
RCP7159X		159		6 1/4					
RCP7165.1X		165.1	6	6 1/2					
RCP7168.3X		168.3		6 5/8					
RCP8168.3X		168.3		6 5/8					
RCP8177.8X	8	177.8		7	320	270	265	135	120
RCP8193.7X		193.7		7 5/8					
RCP8219.1X		219.1	8	8 5/8					

Note: One clamp set includes two identical halves.



RCP

RCPD
(2 pairs of RCP)

Material codes for clamp halves:

Polypropylene - **RCP**
inside plain - **RCPG (for hose)**
Polyamide 6 - **RCN**
Aluminum - **RCA**

When selecting components, please reference and match the "Group#" column in each part table with the associated clamps.

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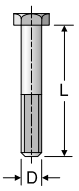
SSC
Hex Head Bolts



TUBE FITTING PART #	GROUP #	D (mm)	L (mm)
SSC1X	1	M10 x 1.5	45
SSC2X	2	M10 x 1.5	60
SSC3X	3	M10 x 1.5	70
SSC4X	4	M12 x 1.5	100
SSC5X	5	M16 x 2	130
SSC6X	6	M20 x 2	190
SSC7X	7	M24 x 2	220
SSC8X	8	M30 x 2	300

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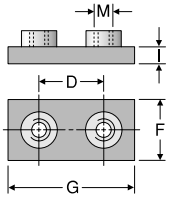
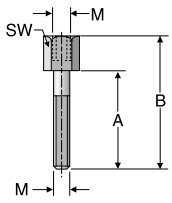
APC
Weld Plate



TUBE FITTING PART #	GROUP #	D (mm)	F (mm)	G (mm)	I (mm)	M (mm)
APC1X	1	33	30	73	8	M10 x 1.5
APC2X	2	45	30	85	8	M10 x 1.5
APC3X	3	60	30	100	8	M10 x 1.5
APC4X	4	90	45	140	10	M12 x 1.5
APC5X	5	122	60	180	10	M16 x 2
APC6X	6	168	80	225	15	M20 x 2
APC7X	7	205	90	270	15	M24 x 2
APC8X	8	265	120	340	25	M30 x 2

ASC
Stacking Bolts



TUBE FITTING PART #	GROUP #	M (mm)	SW (mm)	A (mm)	B (mm)
ASC1X	1	M10 x 1.5	15	25	51
ASC2X	2	M10 x 1.5	15	40	66
ASC3X	3	M10 x 1.5	15	50	76
ASC4X	4	M12 x 1.5	17	85	112
ASC5X	5	M16 x 2	21	110	146
ASC6X	6	M20 x 2	27	155	206
ASC7X	7	M24 x 2	30	185	245
ASC8X	8	M30 x 2	36	250	330

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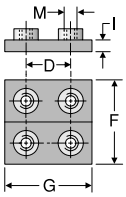
APDC
Double Weld Plate



TUBE FITTING PART #	GROUP #	D (mm)	F (mm)	G (mm)	I (mm)	M (mm)
APDC1X	1	33	60	73	8	M10 x 1.5
APDC2X	2	45	60	85	8	M10 x 1.5
APDC3X	3	60	60	100	8	M10 x 1.5
APDC4X	4	90	90	140	10	M12 x 1.5
APDC5X	5	122	120	180	10	M16 x 2
APDC6X	6	168	160	225	15	M20 x 2
APDC7X	7	205	180	270	15	M24 x 2
APDC8X	8	265	240	340	25	M30 x 2

Dimensions and pressures for reference only, subject to change.

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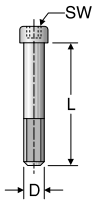
ISC
Cap Screws



TUBE FITTING PART #	GROUP #	D (mm)	L (mm)	SW (mm)
ISC1X	1	M10 x 1.5	45	8
ISC2X	2	M10 x 1.5	60	8
ISC3X	3	M10 x 1.5	70	8
ISC4X	4	M12 x 1.5	100	10
ISC5X	5	M16 x 2	130	14
ISC6X	6	M20 x 2	190	17
ISC7X	7	M24 x 2	220	19
ISC8X	8	M30 x 2	300	22

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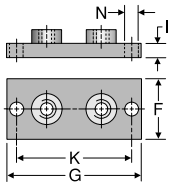
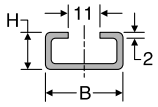
APLC
Weld / Screw Plate



TUBE FITTING PART #	GROUP #	F (mm)	G (mm)	I (mm)	K (mm)	N (mm)
APLC1X	1	30	113	8	85	11
APLC2X	2	30	125	8	97	11
APLC3X	3	30	140	8	112	11
APLC4X	4	45	190	10	160	14
APLC5X	5	60	240	10	205	18
APLC6X	6	80	310	15	270	22
APLC7X	7	90	370	15	320	26
APLC8X	8	120	450	25	390	33

TSC
Mounting Rail



TUBE FITTING PART #	GROUP #	B (mm)	H (mm)	LENGTH (meter)
TSC1X	ALL	40	22	1
TSC2X	ALL	40	22	2

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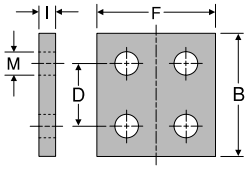
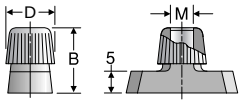
DPDC
Double Top Plate



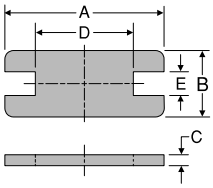
TUBE FITTING PART #	GROUP #	B (mm)	D (mm)	F (mm)	I (mm)	M (mm)
DPDC1X	1	55	33	60	8	11
DPDC2X	2	70	45	60	8	11
DPDC3X	3	85	60	60	8	11
DPDC4X	4	115	90	90	10	14
DPDC5X	5	152	122	120	10	18
DPDC6X	6	205	168	160	15	22
DPDC7X	7	250	205	180	15	26
DPDC8X	8	320	265	240	25	33

TMC
Lock Nut



TUBE FITTING PART #	GROUP #	B (mm)	D (mm)	M (mm)
TMC1X	1-3	20	17.8	M10 x 1.5
TMC4X	4	23	19.8	M12 x 1.5

SPC
Locking Plate



TUBE FITTING PART #	GROUP #	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
SPC1X	1	55	30	8	14	15.5
SPC2X	2	70	30	8	26	15.5
SPC3X	3	85	30	8	41	15.5
SPC4X	4	115	45	10	69	17.5
SPC5X	5	152	60	10	97	21.5
SPC6X	6	205	80	15	137	27.5
SPC7X	7	250	90	15	169	30.5
SPC8X	8	320	120	25	219	36.5

Dimensions and pressures for reference only, subject to change.

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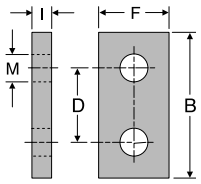
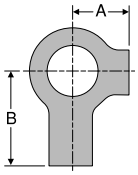
Top Plate



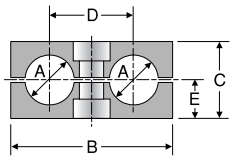
TUBE FITTING PART #	GROUP #	B (mm)	D (mm)	F (mm)	I (mm)	M (mm)
DPC1X	1	55	33	30	8	11
DPC2X	2	70	45	30	8	11
DPC3X	3	85	60	30	8	11
DPC4X	4	115	90	45	10	14
DPC5X	5	152	122	60	10	18
DPC6X	6	205	168	80	15	22
DPC7X	7	250	205	90	15	26
DPC8X	8	320	265	120	25	33

USC
Locking Washer



TUBE FITTING PART #	GROUP #	A (mm)	B (mm)
USC1X	1,2,3	13	22
USC4X	4	15	28
USC5X	5	18	32
USC6X	6	21	36
USC7X	7	25	42
USC8X	8	32	52

RBP / RBN
Clamp Halves



TUBE FITTING PART #	GROUP #	A Metric Tube Size	A Inch Pipe Size	A Inch Tube Size	B (mm)	C (mm)	D (mm)	E (mm)
RBP106X		6						
RBP106.4X		6.4		1/4				
RBP108X	1	8		5/16	36	27	20	13.5
RBP109.5X		9.5		3/8				
RBP110X		10	1/8					
RBP112X		12						
RBP212.7X		12.7		1/2				
RBP213.5X		13.5	1/4					
RBP214X		14						
RBP215X	2	15		5/8	53	26	29	13
RBP216X		16						
RBP217.2X		17.2	3/8					
RBP218X		18						
RBP319X		19		3/4				
RBP320X		20						
RBP321.3X	3	21.3	1/2		67	37	36	18.5
RBP322X		22						
RBP325X		25		1				
RBP426.9X		26.9	3/4					
RBP428X	4	28			82	42	45	21
RBP430X		30						
RBP532X		32		1 1/4				
RBP533.7X		33.7	1					
RBP535X	5	35			106	54	56	27
RBP538X		38		1 1/2				
RBP542X		42	1 1/4					

Material codes for clamp halves:
Polypropylene - **RBP**
inside plain - **RBPG (for hose)**
Polyamide 6 - **RBN**
Width 30 mm

Note: One clamp set includes two identical halves.

WARNING: This product can expose you to chemicals including 1,4-Dioxane which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

When selecting components, please reference and match the "Group#" column in each part table with the associated clamps.

Dimensions and pressures for reference only, subject to change.

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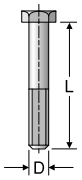
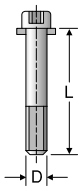
SSB
Hex Head Bolt



TUBE FITTING PART #	GROUP #	D (mm)	L (mm)	MATERIAL
SSLA2/SSB1X	1	M6 x 1	35	•
SSB2X	2	M8 x 1	35	•
SSB3X	3	M8 x 1	45	•
SSB4X	4	M8 x 1	50	•
SSB5X	5	M8 x 1	60	•

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

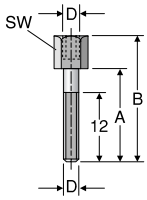
ISB
Cap Screws



TUBE FITTING PART #	GROUP #	D (mm)	L (mm)	MATERIAL
ISB1X	1	M6 x 1	35	•
ISB2X	2	M8 x 1	35	•
ISB3X	3	M8 x 1	45	•
ISB4X	4	M8 x 1	50	•
ISB5X	5	M8 x 1	60	•

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

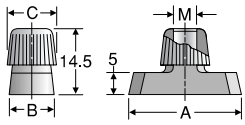
ASB
Stacking Bolts



TUBE FITTING PART #	GROUP #	D (mm)	A (mm)	B (mm)	SW (mm)
ASB1X	1	M6 x 1	20	34	11
ASB2X	2	M8 x 1	20	33	12
ASB3X	3	M8 x 1	29	44	12
ASB4X	4	M8 x 1	34	49	12
ASB5X	5	M8 x 1	47	62	12

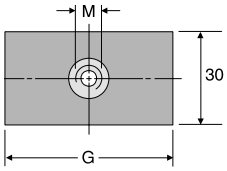
WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

TMB
Lock Nut



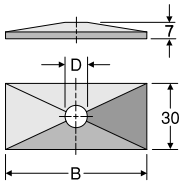
TUBE FITTING PART #	GROUP #	A (mm)	B (mm)	C (mm)	M (mm)
TMA/TMB1VERZX	1	25.4	10.4	12	M6 x 1
TMB2X	2-5	25.4	10.4	12	M8 x 1

APB
Weld Plate



THICKNESS	TUBE FITTING PART #	GROUP #	G (mm)	M (mm)
3	APB1X	1	37	M6 x 1
5	APB2X	2	55	M8 x 1
5	APB3X	3	70	M8 x 1
5	APB4X	4	85	M8 x 1
5	APB5X	5	110	M8 x 1

DPB
Top Plate



TUBE FITTING PART #	GROUP #	B (mm)	D (mm)
DPB1X	1	34	6.6
DPB2X	2	51	8.6
DPB3X	3	64	8.6
DPB4X	4	78	8.6
DPB5X	5	102	8.6

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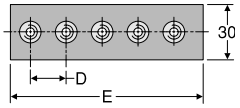
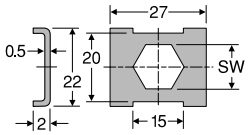
APRB
Weld Plate – Strip



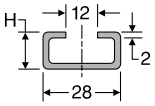
THICKNESS	TUBE FITTING PART #	GROUP #	D (mm)	E (mm)
3	**APRB1X**	1	40	196
5	**APRB2X**	2	58	288
5	**APRB3X**	3	72	358
5	**APRB4X**	4	90	446
5	**APRB5X**	5	112	558

SBB
Locking Plate



TUBE FITTING PART #	GROUP #	SW (mm)
SBB1X	1	11
SBB2X	2-5	12

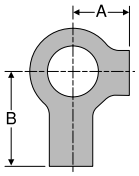
TS
Mounting Rail



TUBE FITTING PART #	GROUP #	B (mm)	H (mm)	LENGTH (meter)
TS11A/B1X	ALL	28	11	1
TS14A/B1X	ALL	28	14	1
TS30A/B1X	ALL	28	30	1
TS11A/B2X	ALL	28	11	2
TS14A/B2X	ALL	28	14	2
TS30A/B2X	ALL	28	30	2

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

US
Locking Washer



TUBE FITTING PART #	GROUP #	A (mm)	B (mm)
USA/USB1X	1	9	18
USB2X	2-5	11	20

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P METRIC TUBE

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Introduction

Parker offers three types of seamless metric tubes for hydraulic, pneumatic and instrumentation applications:

- Steel seamless cold drawn tube, phosphate and oil dipped for corrosion resistance
- Steel seamless cold drawn tube, zinc Chromium-6 free plating for corrosion resistance
- Stainless steel cold drawn tube

Conformance and Material Specifications

Tests and Certificates

All tubes are subjected to a non-destructive leak test and marked accordingly. This marking is used in lieu of a works certificate DIN EN 10204-2.2. Test Class 1 DIN EN 10216-5 Table 7 applies for tubes made of 1.4571 material.

Materials and Mechanical Properties

Steel Types, mechanical properties and conditions are listed in Table P1.

Welding Suitability and Weldability:

- Steel tubes of St. 37.4, R Series, are weldable according to usual techniques.
- Not recommended to weld St. 37.4, R-CF series, Zinc Chromium-6 Free plated tubes.

Stainless steel tubes of 1.4571 are suitable for arc welding. The welding filler should be selected in accordance with DIN EN1600 and DIN EN12072 Part 1 taking into account the type of application and the welding technique.

Assembly and Installation

Please refer to Section R for the assembly and installation instructions for Metric Tube fittings.

Applications

Recommended Bend Radius

A bend radius of 3 times the tube O.D. or greater is recommended for cold bending of Parker tubes with hand, mechanical and power bending equipment.

*Use of Tube Supports

The use of VH tube supports for EO and EO-2 fittings is required in certain thinner wall tubes to ensure proper assembly. Consult Fig. R45 & Fig. R46 on page R30.

Temperature Range

- Parker steel (St. 37.4) metric seamless tube can be used at the full rated working pressures without pressure rating reductions within the following temperature range: -40°C to +120°C. Maximum allowable operating temperature of +250°C.
- Parker stainless steel (1.4571) metric seamless tube can be used at full rated working pressures with-out pressure reductions within the following temperature ranges: -60°C to +20°C. Maximum allowable operating temperature of +400°C. Elevated temperature pressure reductions are as listed in Table P2.

As Delivered Conditions:

Standard Tube Lengths: 6 meters (approx. 20 ft)

Surface Finish:

- Steel (St. 37.4): Phosphated and oiled
  - I.D. dimensions 1.5 – 5 mm, outside and inside oiled
  - I.D. dimensions 6 mm and higher, outside and inside phosphated and oiled
- Steel (St. 37.4) R-CF Series: Zinc Chromium-6 Free

Parker Series	Material	Tensile Strength	Yield Strength	% Elongation	Condition
R Series	Steel, fine grain E235N acc. to EN10305-4 (St. 37.4 acc. to DIN1630	340 N/mm² min. 49,000 PSI	235 N/mm² min. 34,000 PSI	25% min.	Seamless, cold drawn normal annealed, DIN EN 10305-1 and -4
R-71 Series	Stainless steel, 1.4571 X6CrNiMoTi17122	500 N/mm² min. 72,500 PSI	245 N/mm² min. 35,500 PSI	35% min.	Seamless, cold drawn free of scale, heat treated in accordance with DIN EN 10216-5 tab. 6

Table P1 — Parker Steel tubes mechanical properties and conditions

Temperature	Material	-60° up to +20° C	50° C	100° C	200° C	300° C	400° C
Pressure reductions in %	1.4571	—	5.5	11.5	21.5	29	34

Note: Interpolation is acceptable for intermediate temperature levels.

Table P2 — Parker stainless tube elevated temperature derating factors

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Seamless EO Steel Tubes Material E235N (St. 37.4)

Tolerances DIN EN 10305-4

Order code		Tube O.D. (mm)	Tolerance	Wall thickness (mm)	Tube I.D. (mm)	Design pressure bar		Burst pressure bar	Weight kg/m
Phosphated and oiled	Cr(VI)-free					DIN 2413 I Static	DIN 2413 III Dynamic		
R04X0.5	R04X0.5CF	4		0.50	3.0	313	273	1160	0.047
	R04X0.75CF	4	±0.08	0.75	2.5	470	391	1820	0.063
R04X1	R04X1CF	4		1.00	2.0	627	500	2700	0.074
	R05X1CF	5	±0.08	1.00	3.0	501	416	2120	0.099
	R06X0.75CF	6		0.75	4.5	333	288	1150	0.103
R06X1	R06X1CF	6		1.00	4.0	444	372	1650	0.123
R06X1.5	R06X1.5CF	6	±0.08	1.50	3.0	666	526	2550	0.166
	R06X2CF	6		2.00	2.0	692	662	>3500	0.197
	R06X2.25CF	6		2.25	1.5	757	725	>3500	0.208
R08X1	R08X1CF	8		1.00	6.0	333	288	1175	0.173
R08X1.5	R08X1.5CF	8	±0.08	1.50	5.0	499	412	1925	0.240
R08X2	R08X2CF	8		2.00	4.0	666	526	2500	0.296
	R08X2.5CF	8		2.50	3.0	658	630	2650	0.339
R10X1	R10X1CF	10		1.00	8.0	282	248	900	0.222
R10X1.5	R10X1.5CF	10		1.50	7.0	423	357	1450	0.314
R10X2	R10X2CF	10	±0.08	2.00	6.0	564	458	2025	0.395
	R10X2.5CF	10		2.50	5.0	705	551	2675	0.462
	R10X3CF	10		3.00	4.0	666	638	>3500	0.518
R12X1	R12X1CF	12		1.00	10.0	235	209	750	0.271
R12X1.5	R12X1.5CF	12		1.50	9.0	353	303	1150	0.388
R12X2	R12X2CF	12	±0.08	2.00	8.0	470	391	1600	0.493
	R12X2.5CF	12		2.50	7.0	588	474	2025	0.586
	R12X3CF	12		3.00	6.0	705	551	2600	0.666
	R12X3.5CF	12		3.50	5.0	651	624		0.734
	R14X1.5CF	14		1.50	11.0	302	264	975	0.462
R14X2	R14X2CF	14		2.00	10.0	403	342	1325	0.592
	R14X2.5CF	14	±0.08	2.50	9.0	504	415	1650	0.709
R14X3	R14X3CF	14		3.00	8.0	604	485	2200	0.814
		14		3.50	7.0	705	551	2625	0.906
R15X1	R15X1CF	15		1.00	13.0	188	170	575	0.345
R15X1.5	R15X1.5CF	15		1.50	12.0	282	248	950	0.499
R15X2	R15X2CF	15	±0.08	2.00	11.0	376	321	1275	0.641
		15		3.00	9.0	564	458	2000	0.888
R16X1.5	R16X1.5CF	16		1.50	13.0	264	233	850	0.536
R16X2	R16X2CF	16	±0.08	2.00	12.0	353	303	1175	0.691
R16X2.5	R16X2.5CF	16		2.50	11.0	441	370	1500	0.832
R16X3	R16X3CF	16		3.00	10.0	529	433	1850	0.962
R18X1	R18X1CF	18		1.00	16.0	157	143	450	0.419
R18X1.5	R18X1.5CF	18		1.50	15.0	235	209	700	0.610
R18X2	R18X2CF	18	±0.08	2.00	14.0	313	273	975	0.789
R18X2.5	R18X2.5CF	18		2.50	13.0	392	333	1300	0.956
	R18X3CF	18		3.00	12.0	470	391	1575	1.111

Table P3 — Seamless EO steel tubes

Pressure Calculations:

Calculation pressures given are according to DIN 2413 Part 1 for **static stress**

$$P = \frac{20 \cdot K \cdot s \cdot c}{S \cdot da} \text{ (bar)}$$

Material characteristic value K=235 N/mm^2

and

DIN 2413 part III for **dynamic stress**

$$P = \frac{20 \cdot K \cdot s \cdot c}{S \cdot (da + s \cdot c)} \text{ (bar)}$$

Material characteristic value K=226 N/mm^2 (permanent fatigue strength)

Design correction value S=1.5 for static and dynamic stress.

Factor “c” for consideration of wall thickness **divergence for static and dynamic stress** =0.8 for tube o.d. 4 and 5; 0.85 for tube o.d. 6 and 8; 0.9 for larger tube o.d.

da = Tube O.D. in mm

s = Wall thickness in mm

Standard Tube Length:

- 6 m (19.7 ft.)

Conversion Factors:

- Bar x 14.5 = psig
- kg/m x 0.672 = lbs/ft
- N/mm^2 x 145 = lb/in^2

See Remarks on page P5.

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

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Seamless EO Steel Tubes Material E235N (St. 37.4) (continued)

Tolerances DIN EN 10305-4

Order code		Tube O.D. (mm)	Tolerance	Wall thickness (mm)	Tube I.D. (mm)	Design pressure bar		Burst pressure bar	Weight kg/m
Phosphated and oiled	Cr(VI)-free					DIN 2413 I Static	DIN 2413 III Dynamic		
	R20X1.5CF	20		1.50	17.0	212	190	675	0.684
R20X2	R20X2CF	20		2.00	16.0	282	248	900	0.888
R20X2.5	R20X2.5CF	20	±0.08	2.50	15.0	353	303	1100	1.079
R20X3	R20X3CF	20		3.00	14.0	423	357	1400	1.258
	R20X3.5CF	20		3.50	13.0	494	408	1650	1.424
	R20X4CF	20		4.00	12.0	564	458	2000	1.578
R22X1.5	R22X1.5CF	22		1.50	19.0	192	173	550	0.758
R22X2	R22X2CF	22	±0.08	2.00	18.0	256	227	775	0.986
R22X2.5	R22X2.5CF	22		2.50	17.0	320	278	1025	1.202
	R22X3CF	22		3.00	16.0	385	328	1175	1.406
R25X2	R25X2CF	25		2.00	21.0	226	201	725	1.134
R25X2.5	R25X2.5CF	25		2.50	20.0	282	248	850	1.387
R25X3	R25X3CF	25	±0.08	3.00	19.0	338	292	1025	1.628
R25X4	R25X4CF	25		4.00	17.0	451	378	1500	2.072
R25X4.5	R25X4.5CF	25		4.50	16.0	508	418	1625	2.275
R28X1.5	R28X1.5CF	28		1.50	25.0	151	138	425	0.980
R28X2	R28X2CF	28		2.00	24.0	201	181	600	1.282
R28X2.5	R28X2.5CF	28	±0.08	2.50	23.0	252	223	750	1.572
R28X3	R28X3CF	28		3.00	22.0	302	264	900	1.850
	R30X2CF	30		2.00	26.0	188	170	575	1.381
R30X2.5	R30X2.5CF	30		2.50	25.0	235	209	725	1.695
R30X3	R30X3CF	30	±0.08	3.00	24.0	282	248	850	1.998
R30X4	R30X4CF	30		4.00	22.0	376	321	1175	2.565
R30X5	R30X5CF	30		5.00	20.0	470	391	1600	3.083
R35X2	R35X2CF	35	±0.15	2.00	31.0	161	147	450	1.628
R35X2.5	R35X2.5CF	35		2.50	30.0	201	181	600	2.004
R35X3	R35X3CF	35		3.00	29.0	242	215	700	2.367
	R35X4CF	35		4.00	27.0	322	280	960	3.058
	R38X2.5CF	38		2.50	33.0	186	168	550	2.189
R38X3	R38X3CF	38		3.00	32.0	223	199	675	2.589
R38X4	R38X4CF	38	±0.15	4.00	30.0	297	260	900	3.354
R38X5	R38X5CF	38		5.00	28.0	371	318	1150	4.069
	R38X6CF	38		6.00	26.0	445	373	1425	4.735
	R38X7CF	38		7.00	24.0	519	427	1700	5.352
R42X2	R42X2CF	42	±0.2	2.00	38.0	134	123	375	1.973
R42X3	R42X3CF	42		3.00	36.0	201	181	575	2.885
R42X4	R42X4CF	42		4.00	34.0	269	237	850	3.749
R50X6		50	±0.2	6.00	38.0	338	292		6.511
R65X8		65	±0.3	8.00	49.0	347	299		11.246

Table P3 — Seamless EO steel tubes (cont'd.)

Remarks:

Corrosion — Additional allowances are not considered for the calculation of pressures

$$\frac{da\ (bar)}{dimax.} > 2$$

are calculated for static stress in accordance with DIN 2413 Part III, but with K = 235 N/mm²

When a specific design factor is required, calculations should be based upon the burst pressures shown in the above tables.

Temperature range: -40°C up to 120°C without pressure reductions.

Surface finish:

Tubes with I.D. 1.5 to 5 mm: outside and inside oiled.

Tubes from 6 mm I.D. and above: outside and inside phosphated and oiled.

For increased temperatures:

control calculation according to DIN 2413 required (static application above 120 °C).

$$P = \frac{20 \cdot K \cdot a \cdot c}{S \cdot (da + a \cdot c)}\ (bar)$$

Material strength K for increased temperatures:

Temperature in °C	$K_{(Nmm^2)}$
up to 200	185
up to 250	165

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

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Seamless EO Stainless Steel Tubes Material-No.: 1.4571

Tolerances EN 10305-1 / DIN 2391

Order code 1.4571	Tube O.D. (mm)	Tolerance	Wall thickness (mm)	Tube I.D. (mm)	1.4571 Design pressure bar DIN 2413 I Static	1.4571 burst pressure bar	Weight kg/m
R04X171	4	±0.08	1.0	2	735		0.075
R06X171	6	±0.08	1.0	4	490	1850	0.125
R06X1.571	6	±0.08	1.5	3	735	2900	0.169
R08X171	8	±0.08	1.0	6	368	1300	0.175
R08X1.571	8		1.5	5	551	2050	0.244
R10X171	10		1.0	8	294	950	0.225
R10X1.571	10	±0.08	1.5	7	441	1750	0.319
R10X271	10		2.0	6	588	2400	0.401
R12X171	12		1.0	10	245	850	0.275
R12X1.571	12	±0.08	1.5	9	368	1400	0.394
R12X271	12		2.0	8	490	1900	0.501
R14X1.571	14		1.5	11	315	1200	0.469
R14X271	14	±0.08	2.0	10	420	1550	0.601
R14X2.571	14		2.5	9	525	2100	0.720
R15X171	15		1.0	13	196	675	0.351
R15X1.571	15	±0.08	1.5	12	294	1100	0.507
R15X271	15		2.0	11	392	1400	0.651
R16X1.571	16	±0.08	1.5	13	276	950	0.545
R16X271	16		2.0	12	368	1300	0.701
R16X2.571	16	±0.08	2.5	11	459	1850	0.845
R16X371	16		3.0	10	551	2400	0.977
R18X1.571	18	±0.08	1.5	15	245	800	0.620
R18X271	18		2.0	14	327	1150	0.801
R20X271	20		2.0	16	294	1050	0.901
R20X2.571	20	±0.08	2.5	15	368	1400	1.095
R20X371	20		3.0	14	441	1800	1.277
R22X1.571	22	±0.08	1.5	19	200	650	0.770
R22X271	22		2.0	18	267	900	1.002
R25X2.571	25	±0.08	2.5	20	294	1050	1.408
R25X371	25		3.0	19	353	1275	1.653
R28X1.571	28	±0.08	1.5	25	158	550	0.995
R28X271	28		2.0	24	210	700	1.302
R30X2.571	30	±0.08	2.5	25	245	850	1.722
R30X371	30	±0.08	3.0	24	294	1150	2.028
R30X471	30		4.0	22	392	1500	2.605
R35X271	35	±0.15	2.0	31	168	550	1.653
R38X471	38	±0.15	4.0	30	309	1150	3.405
R42X271	42	±0.2	2.0	38	140	475	2.003
R42X371	42		3.0	36	210	750	2.930

Table P4 — Seamless EO stainless steel tubes

Pressure Calculation:

Pressure calculation given are according to DIN 2413 part I for **static stress**

$$P = \frac{20 \cdot K \cdot s \cdot c}{S \cdot da} \text{ (bar)}$$

Material characteristic value K=245 N/mm² (1.4571), K=245 N/mm² (1.4571) (1% proof stress)

Design factor S = 1.5

Factor “c” for consideration of wall thickness divergence: 0.9

da = Tube O.D. in mm

s = Wall thickness in mm

Remarks:

Corrosion — Additional allowances are not considered for the calculation of pressures.

Tubes with a diameter ratio da/di ≥ 1.35 are calculated according to DIN 2413 part III (formula see page P5) with above characteristic K value.

Conversion Factors:

- Bar x 14.5 = psig
- kg/m x 0.672 = lbs/ft
- N/mm² x 145 = lb/in²

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Dimensions and pressures for reference only, subject to change.

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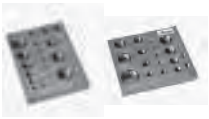
Portboards  Q57	**ITK** International Thread Kit  Q57	**Weights**	**Tube Fabricating Equipment Weight Chart** Q58-Q59		

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Hand Tube Benders – Inch

These are sturdy, easy-to-use hand tools for fast and accurate bending without kinks or visible flattening. Twelve individual sizes from -2 (1/8" O.D.) to -16 (1" O.D.) are available.

Medium Duty Inch Hand Tube Benders

Designed and built for fast, accurate bends and long service life.

These are individual benders for eight inch tube sizes (3/16", 1/4", 5/16", 3/8", 1/2", 5/8", 3/4"). All of these benders will bend copper, aluminum, annealed steel and stainless steel. These can be used in hands or mounted in a bench vise.

HOW TO USE: Simply align marks of the pressure arm and radius block, then bend to the desired angle (up to 180°) by pulling steadily on the slide block handle. Bend angles are indicated on the radius block, both front and back. (Detailed instructions are included with each bender.) See the table below for technical data and part numbers.

Fig. Q1 — Medium Duty Inch Hand Tube Bender

Size	Tube O.D. (in.)	Radius to Tube Centerline (in.)	Min. Wall Without Flattening (in.)	Recommended Max. Wall Thickness Copper, Aluminum (in.)	Recommended Max. Wall Thickness Steel, Stainless Steel (in.)	Part No.
3	3/16	5/8	0.020	Any	0.032	**3-2829**
4	1/4	5/8	0.028	Any	0.083	**4-2829**
5	5/16	15/16	0.032	Any	0.083	**5-2829**
6	3/8	15/16	0.032	Any	0.083	**6-2829**
8	1/2	1 1/2	0.042	Any	0.083	**8-2829**

Ratchet Hand Tube Benders

These are individual benders for three tube sizes, 5/8", 3/4" and 7/8", in copper, aluminum, annealed steel and stainless steel. They can be used in hands or mounted in a bench vise.

HOW TO USE: Position the tube in the bender, close the latch and pull the ratchet handle away from radius block handle until the desired angle (up to 180°) is formed. Bend angles are indicated on the radius block. (Detailed instructions are included with each bender.) See the table below for technical data and part numbers.

Fig. Q2 — Ratchet Hand Tube Bender

Size	Tube O.D. (in.)	Radius to Tube Centerline (in.)	Min. Wall Without Flattening (in.)	Recommended Max. Wall Thickness Copper, Aluminum (in.)	Recommended Max. Wall Thickness Steel, Stainless Steel (in.)	Part No.
10	5/8	3	0.042	Any	0.049	**10-2829**
12	3/4	3 3/4	0.049	Any	0.065	**12-2829**
14	7/8	3 3/4	0.049	Any	0.065	**14-2829**

Dimensions and pressures for reference only, subject to change.

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1” Hand Tube Bender
Part No. 16-2829

For 1” O.D. tube in soft copper and aluminum materials. This bender can be used in hands, but mounting in a bench vise is suggested, especially for heavier wall thickness tube.

HOW TO USE: Align marks and bend the tube to the desired angle (up to 180°) by pulling steadily on the operating handle. The handle may be re-positioned for maximum leverage. Bend angles are indicated on the radius block. (Detailed instructions are included with the bender.) See the table below for technical data and part numbers.

Fig. Q3 — 1” Hand Tube Bender

Size	Tube O.D. (in.)	Radius to Tube Centerline (in.)	Min. Wall Without Flattening (in.)	Recommended Max. Wall Thickness Copper, Aluminum (in.)	Steel, Stainless Steel (in.)	Part No.
16	1	3 1/2	0.065	Any	Not Recommended	**16-2829**

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Hand Tube Benders – Metric

These are sturdy, easy-to-use hand tools for fast and accurate bending without kinks or visible flattening. Individual sizes in ten models from size 5mm to 25mm are available.

Medium Duty Metric Hand Tube Benders

Designed and built for fast, accurate bends and long service life.

These are individual benders for six metric tube sizes (5mm, 6mm, 8mm, 10mm, 12mm and 14mm). All of these benders will bend copper, aluminum, annealed steel and stainless steel. These can be used in hands or mounted in a bench vise.

Fig. Q4 — Medium Duty Metric Hand Tube Bender

HOW TO USE: Simply align the marks on the slide block and radius block, then bend to the desired angle (up to 180°) by pulling steadily on the slide block handle. Bend angles are indicated on the radius block, both front and back. (Detailed instructions are included with each bender.) See the table below for technical data and part numbers.

Tube O.D. (mm)	Radius to Tube Centerline (mm)	Min. Tube Wall Thickness (mm)	Recommended Max. Wall Thickness Copper, Aluminum (mm)	Steel, Stainless Steel (mm)	Part No.
6	16	1.0	Any	1.5.....	**2829-6mm**
8	24	1.0	Any	1.5.....	**2829-8mm**
10	24	1.0	Any	2.0.....	**2829-10mm**
12	38	1.0	Any	2.0.....	**2829-12mm**

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Bench Mount Metric Hand Bender and Cutting Guide

This bender combines a tube cutting guide with the bender for sizes 6mm, 8mm, 10mm, and 12mm. There are three bender rollers that cover all sizes. The bender mounts easily to a work bench or table.

Part Description	Part No.
Bench Mount Tube Bender (6mm, 8mm, 10mm, 12mm)	**BAV06/12KPLX**

Fig. Q5 — BAV06/12KPLX

Vise Mount Metric Hand Benders

Vise Mount Metric Bender – 6/18mm

This bender has six interchangeable rollers to cover tube sizes 6mm, 8mm, 10mm, 12mm, 14mm, 15mm, 16mm, and 18mm.

Part Description	Part No.
Vise Mount Tube Bender (6mm, 8mm, 10mm, 12mm, 14mm, 15mm, 16mm, 18mm)	**BV06/18KPLX**

Fig. Q6 — BV06/18KPLX

Tube O.D. (mm)	Bend Radius (mm)	Max. Wall Thickness (mm)
6	33	2.5
8	34	2.5
10	36	2.5
12	37	2.5
14	37	2.0
15	44	2.0
16	44	2.0
18	52	2.0

Vise Mount Metric Bender – 20/25mm

This bender has three interchangeable rollers to cover tube sizes 20mm, 22mm, and 25mm. All bend radii are 86.5mm. Pressure arm is not included with the BV20/25KPLX, however it can be manufactured on site with a piece of tube, or it can be ordered separately with part number BV20/2510X. Maximum wall thickness for all sizes is 2.0mm.

Part Description	Part No.
Vise Mount Tube Bender (20mm, 22mm, 25mm)	**BV20/25KPLX**
Pressure Arm	**BV20/2510X**

Fig. Q7 — BV20/25KPLX

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Hand Crank & Hydraulic Tube Bender Capacity Guides

All benders listed in Tables Q1 through Q3 are capable of bending 1/2" O.D. and under fully annealed steel and stainless steel tube with no limit on wall thickness. For HARD copper and HIGH STRENGTH aluminum, use the wall thickness shown for stainless steel. Observe that VERY HARD materials may not be ductile enough to bend without fracture.

Inch Tube Sizes

Tube O.D.	Material	Tube Wall Thickness (in.)											
		0.035	0.049	0.058	0.065	0.072	0.083	0.095	0.109	0.120	0.134	0.156	0.188
		Bender Code*											
3/4"	S	ABCD	ABCD	ABCD	ABCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
	SS	ABCD	ABCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
1"	S	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD
	SS	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	BCD	CD	CD
1 1/4"	S	BCD	BCD	BCD	BCD	BCD	BCD	CD	CD	CD	CD	CD	CD
	SS	BCD	BCD	BCD	BCD	BCD	CD	CD	CD	CD	CD	C	C
1 1/2"	S	BCD	BCD	BCD	BCD	BCD	CD	CD	CD	CD	CD	CD	CD
	SS	BCD	BCD	CD	CD	CD	CD	CD	CD	CD	CD	C	C
2"	S	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD
	SS	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	—	—

Table Q1 — Hand Crank and Hydraulic Tube Benders Maximum Capacity Guide – Inch Sizes

Inch Pipe Sizes

Pipe Size	Material	Inch Pipe Schedule (IPS)	
		40	80
		Bender Code*	
1/2"	S	CD	CD
	SS	CD	CD
3/4"	S	CD	CD
	SS	CD	CD
1"	S	CD	CD
	SS	CD	CD
1 1/4"	S	CD	CD
	SS	CD	CD
1 1/2"	S	CD	CD
	SS	CD	CD
2"	S	D	D
	SS	D	—

Table Q2 — Hand Crank and Hydraulic Benders Maximum Capacity Guide – Inch Pipe Sizes

Metric Tube Sizes

Tube O.D. (mm)	Material	Tube Wall Thickness (mm)						
		1.5	2	2.5	3	3.5	4	5
		Bender Code*						
18	S	ABCD	ABCD	ABCD	ABCD	BCD	BCD	CD
	SS	BCD	BCD	BCD	BCD	BCD	BCD	CD
20	S	ABCD	ABCD	ABCD	BCD	BCD	BCD	CD
	SS	BCD	BCD	BCD	BCD	BCD	BCD	CD
22	S	BCD	BCD	BCD	BCD	BCD	BCD	CD
	SS	BCD	BCD	BCD	BCD	BCD	CD	CD
25	S	BCD	BCD	BCD	BCD	BCD	CD	CD
	SS	BCD	BCD	BCD	BCD	CD	CD	CD
28	S	BCD	BCD	BCD	BCD	CD	CD	CD
	SS	BCD	BCD	CD	CD	CD	CD	CD
30	S	BCD	BCD	BCD	BCD	CD	CD	CD
	SS	BCD	BCD	CD	CD	CD	CD	CD
32	S	BCD	BCD	CD	CD	CD	CD	CD
	SS	BCD	BCD	CD	CD	CD	CD	CD
35	S	BCD	CD	CD	CD	CD	CD	CD
	SS	BCD	CD	CD	CD	CD	CD	CD
38	S	BCD	CD	CD	CD	CD	CD	CD
	SS	CD	CD	CD	CD	CD	CD	CD
42	S	CD	CD	CD	CD	CD	CD	CD
	SS	CD	CD	CD	CD	CD	CD	—
50	S	CD	CD	CD	CD	CD	CD	—
	SS	CD	CD	CD	CD	CD	—	—

Table Q3 — Hand Crank and Hydraulic Tube Benders Maximum Capacity Guide – Metric Tube Sizes

***Codes:**

(A) Model 412 — Tube (1/4" thru 3/4" and 6mm thru 20mm) — Worm & Gear
(B) Model 424 — Tube (1/4" thru 1 1/2" and 6mm thru 38mm) — Worm & Gear
(C) Model HB632 — Tube (3/8" thru 2" and 10mm thru 50mm) — Hydraulic
(D) Model CP432 — Tube (1/4" thru 2") — Hydraulic

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

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Exactol® Crank-Operated Benders

Models 412/424

These portable benders are vise or bench mountable for easy action and fast accurate bending to 180°. Two models are available to bend tube sizes 4 (1/4") through 24 (1 1/2"). Exactol benders are designed with a worm-gear drive with a 60 to 1 gear ratio to allow accurate bending with minimum effort. They bend aluminum, copper, annealed steel and annealed stainless steel without kinks or wrinkles. Easy crank operation permits continuous production without excessive operator fatigue; for use in tube fabrication shops, in the field, or in factory maintenance departments.

Instructional video is available at discover.parker.com/TFDTubeFabEquipment.

See the 400 Series Bender manual, 4391-B400S.

Fig. Q8 — 412 Bender

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Exactol® Model 412

The Exactol Model 412 will bend tube from size 4 (1/4") through size 12 (3/4") and 6mm through 20mm inclusive and is completely portable. Accessories include a sturdy metal carrying case, which accommodates the 412 bender, slide block, and selected radius blocks. See page Q7 for wall thickness capabilities. May be held in a vise or bench mounted using the bench mounting adapter. Bulletin 4391-B400S is included with the bender, which describes the operation in detail.

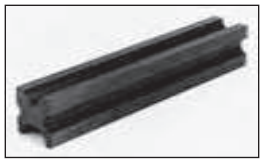

Fig. Q9 — Slide Block

NOTE: The 412 must be bench mounted if mandrels are used.

COMPONENTS REQUIRED

The minimum components required are a Model 412 Bender with a slide block and a radius block which match the tube O.D. to be bent.

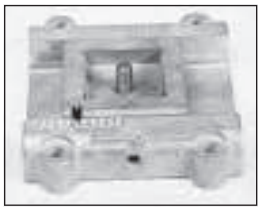

Fig. Q10 — Bench Mount Adapter

Part Name	Part No.
Exactol Model 412 Bender (for 1/4" through 3/4" O.D.)	**560569**
Slide Block (for sizes 4-5-6-8-10-12)	**550585**
Slide Block (for sizes 6mm-8mm-12mm-12mm-14mm)	**820091**
Slide Block (for sizes 15mm-16mm-18mm-20mm)	**820092**
Radius Blocks (for sizes 4-5-6-8-10-12 and 6mm thru 38mm)	See pages Q10 – Q11

OPTIONAL ACCESSORIES

Carrying Case (for bender, slide block and selected radius blocks)	**550572**
Bench Mounting Adapter	**550570**

Mandrel Bending Components

for 412 and 424 Benders	See pages Q16 – Q18

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

"Need help determining the correct tooling for your bending job? Use TFDtoolspec.com"

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Exactol® Model 412 Kit

This 412 kit contains all the basic tool requirements for bending tube from 1/4" through 3/4".

Part No.
412 KIT

The following part numbers are included in the kit:

Part Name	Part No.
Exactol Model 412 Bender	560569
Carrying Case	550572
Slide Block for 1/4" through 3/4" tube	550585
Radius Block – 1/4" O.D. tube	550579
Radius Block – 3/8" O.D. tube	550581
Radius Block – 1/2" O.D. tube	550582
Radius Block – 5/8" O.D. tube	550583
Radius Block – 3/4" O.D. tube	550584

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Fig. Q11 — 412 Kit

Exactol® Model 424

The Exactol Model 424 will bend tube from size 4 (1/4" O.D.) through size 24 (1 1/2" O.D.) and 6mm through 38mm inclusive. See page Q7 for wall thickness capabilities. It is completely portable and may be vise or bench mounted. Bulletin 4391-B400S is included with the bender, which describes the operation in detail.

NOTE: The 424 must be bench mounted if mandrels are used.

Instructional video is available at discover.parker.com/TFDTubeFabEquipment.

See the 400 Series Bender manual, 4391-B400S.

Fig. Q12 — 424 Bender

Fig. Q13 — Slide Block

COMPONENTS REQUIRED
The minimum components required are a Model 424 Bender with a slide block and a radius block that match the tube O.D. to be bent.

Part Name	Part No.
Exactol Model 424 bender (for 1/4" through 1 1/2" O.D.)	621044
Slide Block (for sizes 4-5-6-8-10-12)	550585
Slide Block (for sizes 14-16-18-20)	621045
Slide Block (for size 24)	870150
Slide Block (for sizes 6mm-8mm-10mm-12mm-14mm)	820091
Slide Block (for sizes 15mm-16mm-18mm-20mm)	820092
Slide Block (for sizes 22mm-25mm-28mm-30mm)	820093
Slide Block (for size 35mm)	820094
Slide Block (for size 38mm)	870150
Radius Blocks (for sizes -4 thru -24 and 6mm thru 38mm)	See pages Q10 – Q11

OPTIONAL ACCESSORIES

Bench Mounting Adapter	631156
Mandrel Bending Components for 412 and 424 Benders	See pages Q16 – Q18

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Exactol® Model 424 Kit

Part No. 424 Kit

This 424 Kit contains all the basic tool requirements for bending tube from 1/4" through 1 1/2". The following part numbers are included in the kit:

Part Name	Part No.
Exactol Model 424 bender (for 1/4" through 1 1/2" O.D.)	621044
Slide Block (for sizes 4-5-6-8-10-12)	550585
Slide Block (for sizes 14-16-18-20)	621045
Slide Block (for size 24)*	870150
Radius Blocks – 1/4" O.D. Tube*	550579
Radius Block – 3/8" O.D. Tube	550581
Radius Block – 1/2" O.D. Tube	550582
Radius Block – 5/8" O.D. Tube	550583
Radius Block – 3/4" O.D. Tube	550584
Radius Block – 1" O.D. Tube	621047
Radius Block – 1 1/4" O.D. Tube	621049
Radius Block – 1 1/2" O.D. Tube*	870149

Fig. Q14 — 424 Kit

* Items not shown in the photo, but which are included in the 424 Kit.

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Radius Blocks

For use with Exactol Models 412/424 benders.

The 412 and 424 bender radius blocks have built in tube clamps, therefore separate clamp blocks are not required. The radius blocks are interchangeable within bender size ranges. Close bend radius blocks utilize the small bend radii, but also allow the bend to begin closer to the end connection.

412 and 424 Bender – Small Bend Radius Blocks

Size	Tube O.D. (in.)	Bend Radius (in.)	Part No.
4	1/4	9/16	550573
5	5/16	11/16	550574
6	3/8	15/16	550575
8	1/2	1 1/4	550576
10	5/8	1 1/2	550577
12	3/4	1 3/4	550578

Fig. Q15 — Small Bend Radius Block

412 and 424 Bender – Large Bend Radius Blocks

Size	Tube O.D. (in.)	Bend Radius (in.)	Part No.
4	1/4	3/4	550579
5	5/16	1	550580
6	3/8	1 1/4	550581
8	1/2	2	550582
10	5/8	2 1/2	550583
12	3/4	3	550584
14	7/8	3 1/2	621046
16	1	4	621047
18	1 1/8	4 1/2	621048
20	1 1/4	5	621049
24	1 1/2	5	870149

Fig. Q16 — Large Bend Radius Block

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412 and 424 Bender – Close Bend Radius Blocks

These adapters are used when bends are needed close to the end of the tube after the flare has been made, ferrule has been pre-set, or flange has been made. For flared or Ferulok fittings, attach tube end by threading tube nut onto the radius block threaded pin. To use this block with Seal-Lok fittings, Close Bend Adapters for Seal-Lok must be used to attach the tube to the radius block.

Fig. Q17 — Close Bend Radius Block

Size	Tube O.D. (in.)	Bend Radius (in.)	Part No.
8	1/2	1 1/4	**590533**
10	5/8	1 1/2	**590535**
12	3/4	1 3/4	**590537**

Close Bend Adapters for Seal-Lok

These adapters are used when bends are needed close to the end of the tube after the flange has been made or the sleeve has been brazed onto the end of the tube.

HOW TO USE: Screw the Seal-Lok adapter into the internal thread* of the threaded pin on the radius block. Then attach the flanged or brazed tube by threading the tube nut to the Seal-Lok adapter on the radius block threaded pin.

* If the threaded pin does not have an internal thread, a new threaded pin is required.

Fig. Q18 — Seal-Lok Close Bend Adapter

Tube O.D. (in.)	Description	Part No.
1/2	Seal-Lok Adapter	**930421-8**
5/8	Seal-Lok Adapter	**930421-10**
3/4	Seal-Lok Adapter	**930421-12**
1/2	Threaded Pin (for Close Bend Radius Blocks)	**930420-8**
5/8	Threaded Pin (for Close Bend Radius Blocks)	**930420-10**
3/4	Threaded Pin (for Close Bend Radius Blocks)	**930420-12**

412 and 424 Bender – Metric Radius Blocks

Fig. Q19 — Radius Block

Tube O.D. (mm)	Bend Radius (mm)	Part No.
6	14	**820090-6mm**
8	18	**820090-8mm**
10	24	**820090-10mm**
12	32	**820090-12mm**
14	38	**820090-14mm**
15	38	**820090-15mm**
16	38	**820090-16mm**
18	44	**820090-18mm**
20	44	**820090-20mm**
22	89	**820090-22mm**
25	102	**820090-25mm**
28	102	**820090-28mm**
30	127	**820090-30mm**
32	127	**820090-32mm**
35	127	**820090-35mm**
38	127	**870149 (same as 1-1/2” Radius Block)**

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Hydraulic Tube Bender Model HB632

Hydraulic power does the work in bending tube of all materials in sizes from 6 (3/8" O.D.) through size 32 (2" O.D.), 10mm through 50mm, with wall thicknesses as great as .188 for annealed steel, and pipe sizes from 3/8" through 1-1/2". See page Q7 for wall thickness capabilities. The radius block, around which the tube is bent, is driven by a roller chain and sprocket powered by a cylinder and a separate hydraulic power unit.

Maximum bend angle is 180° with radii from 1 1/4" to 8". Close second bends can be performed in either direction. An adjustable stop controls the degree of bend to a maximum of 180° and is graduated in 1° increments. After the bend is completed and pressure is released, a spring returns the clamp arm to the zero starting position.

The clamp vise arm features a quick release speed screw for positioning the required clamp block. Each size of tube requires the proper sized radius block, clamp block and slide block.

Instructional video is available at discover.parker.com/TFDTubeFabEquipment.

See the HB632 Tube Bender manual, 4391-B26.

HB632 radius blocks, slide blocks and clamp blocks will work with the following benders as well: 624, 824, 832 and 848.

NOTE: For size 28 (1 3/4" O.D. tube) through 32 (2" O.D. tube) radius blocks, an adapter plate is required.

DIMENSIONS: L – 40" W – 11" H – 12"

COMPONENTS REQUIRED
Minimum components required are a Model HB632 Bender, hose assembly, hydraulic pump and a radius, slide and clamp block which match the tube/pipe O.D. to be bent.

Part Name	Part No.
Hydraulic Bender Model HB632 (without pump)	**631050**
Hydraulic Pump (10,000 psi, 110V AC)	**900085**
High Flow Hydraulic Pump (10,000 psi, 110V)	**974691**
Hose Assembly (3' long)	**910004**

One each of the following is required per tube O.D.:
Radius Block, Clamp Block, Slide Block.
Radius Block..... See pages Q13 – Q15

INCH TUBE SIZES

Clamp Block (for -6)	**864266**
Clamp Block (for -8, -12, -16, -24)	**631092**
Clamp Block (for -10, -14, -18, -20)	**631093**
Clamp Block (for -28)	**027418-28**
Clamp Block (for -32)	**027418-32**
Slide Block (for -6)	**864276**
Slide Block (for -8, -12, -16, -24)	**520516**
Slide Block (for -10, -14, -18, -20)	**520518**
Slide Block (for -28)	**631063**
Slide Block (for -32)	**631066**

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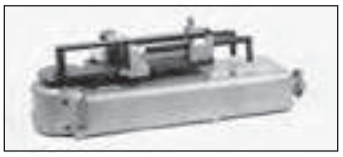
Fig. Q20 — HB632


Fig. Q21 — 900085 Pump


Fig. Q22 — High Flow Pump


Fig. Q23 — Clamp Block

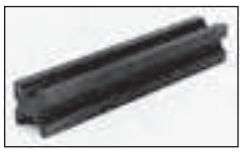
Fig. Q24 — Slide Block

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METRIC TUBE SIZES	Part No.
Clamp Block (for 10mm, 12mm, 14mm, 16mm)	**790017**
Clamp Block (for 15mm, 16mm, 18mm, 20mm)	**780195**
Clamp Block (for 22mm, 25mm, 30mm, 32mm)	**780196**
Clamp Block (for 35mm)	**974346**
Clamp Block (for 38mm)	**631092**
Clamp Block (for 42mm)	**974349**
Clamp Block (for 50mm)	**974352**
Slide Block (for 10mm, 12mm, 14mm, 16mm)	**790016**
Slide Block (for 15mm, 16mm, 18mm, 20mm)	**780192**
Slide Block (for 22mm, 25mm, 30mm, 32mm)	**780193**
Slide Block (for 35mm)	**820094**
Slide Block (for 38mm)	**520516**
Slide Block (for 42mm)	**974348**
Slide Block (for 50mm)	**974351**

INCH PIPE SIZES	
Clamp Block (for 3/8", 1/2", 3/4")	**974332**
Clamp Block (for 1")	**974338**
Clamp Block (for 1 1/4")	**974341**
Clamp Block (for 1 1/2")	**974343**
Slide Block (for 3/8", 1/2", 3/4")	**974331**
Slide Block (for 1")	**974336**
Slide Block (for 1 1/4")	**974340**
Slide Block (for 1 1/2")	**974342**

OPTIONAL ACCESSORIES

Radius Block Adapter Plate (for sizes 1 3/4", 42mm, 1 1/2 IPS and larger)	**660221**
Mandrel Bending Components for HB632	See pages Q16 – Q18

Fig. Q25 — Radius Block Adapter Plate

Radius Blocks

For use with HB632 Bender

Radius blocks for every standard tube size from size 6 (3/8" O.D.) to size 32 (2" O.D.), 10mm through 50mm, and inch pipe sizes 3/8" through 1-1/2" are available.

Standard Radius Blocks – Inch Sizes

Size	Tube O.D. (in.)	Radius (in.)	Part No.
6	3/8	1 1/8	**590512-18**
6	3/8	1 1/4	**540502**
8	1/2	1 1/4	**530763**
8	1/2	1 1/2	**590515-24**
10	5/8	1 1/2	**530764**
10	5/8	1 7/8	**590518-30**
12	3/4	1 3/4	**530765**
12	3/4	2 1/4	**590521-36**
14	7/8	2	**530766**
14	7/8	2 5/8	**590523-42**
16	1	3	**590524-48**
18	1 1/8	3 3/8	**590526-54**
18	1 1/8	3 1/2	**530768**
20	1 1/4	3 3/4	**590527-60**
24	1 1/2	4 1/2	**590530-72**
24	1 1/2	5	**530770**
28	1 3/4	7	**631057-112***
32	2	8	**631060-128***

* Requires the use of Radius Block Adapter Plate, Part No. 660221.

Fig. Q26 — Radius Block for use with HB632 Bender

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Radius Blocks – Metric Sizes

Tube O.D./ Size (mm)	Radius (mm)	Part No.
10	32	**810023**
12	32	**780175**
14	38	**780176**
15	38	**780177**
16	38	**780178**
18	44	**780179**
20	44	**780180**
22	89	**780181**
25	100	**780182**
30	128	**780183**
32	128	**780184**
35	105	**974344**
38	114	**590530-72**
42	128	**974347***
50	**150**	**974350***

Fig. Q27 — Radius Block for use with HB632 Bender

Radius Blocks – Inch Pipe Sizes

Inch Pipe Size (in.)	Bend Radius (in.)	Part No.
3/8	2 1/4	**974325**
1/2	2 5/8	**974326**
3/4	3 1/4	**974327**
1	4	**974328**
1 1/4	5	**974329**
1 1/2	6	**974330***

* Requires the use of Radius Block Adapter Plate, Part No. 660221.

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Close Bend Radius Blocks for HB632

These adapters are used when bends are needed close to the end of the tube after the flare has been made, ferrule has been pre-set, or flange has been made. For flared or Ferulok fittings, attach tube end by threading tube nut onto the radius block threaded pin. To use this block with Seal-Lok fittings, Close Bend Adapters for Seal-Lok must be used to attach the tube to the radius block.

Fig. Q28 — Close Bend Radius Block

Close Bend Radius Blocks – Inch Sizes

Size (in.)	Tube O.D. (in.)	Radius (in.)	Part No.
8	1/2	1 1/4	**530597**
10	5/8	1 1/2	**530601**
12	3/4	1 3/4	**530605**
14	7/8	2	**530609**
16	1	3	**530613**
20	1 1/4	3 3/4	**530621**
24	1 1/2	5	**530625**

Close Bend Adapters for Seal-Lok

These adapters are used when bends are needed close to the end of the tube after the flange has been made or the sleeve has been brazed onto the end of the tube.

HOW TO USE: Screw the Seal-Lok adapter into the internal thread* of the threaded pin on the radius block. Then attach the flanged or brazed tube by threading the tube nut to the Seal-Lok adapter on the radius block threaded pin.

* If the threaded pin does not have an internal thread, a new threaded pin is required.

Tube O.D. (in.)	Description	Part No.
1/2	Seal-Lok Adapter	**930421-8**
5/8	Seal-Lok Adapter	**930421-10**
3/4	Seal-Lok Adapter	**930421-12**
1	Seal-Lok Adapter	**930421-16**
1 1/4	Seal-Lok Adapter	**930421-20**
1 1/2	Seal-Lok Adapter	**930421-24**
1/2	Threaded Pin (for Close Bend Radius Blocks)	**930420-8**
5/8	Threaded Pin (for Close Bend Radius Blocks)	**930420-10**
3/4	Threaded Pin (for Close Bend Radius Blocks)	**930420-12**
1	Threaded Pin (for Close Bend Radius Blocks)	**930420-16**
1 1/4	Threaded Pin (for Close Bend Radius Blocks)	**930420-20**
1 1/2	Threaded Pin (for Close Bend Radius Blocks)	**930420-24**

Fig. Q29 — Seal-Lok Close Bend Adapter

Close Bend Radius Blocks – Metric Sizes

Tube O.D./ Size (mm)	Radius (mm)	Thread Size	Part No.
12	32	3/4-16	**780185**
14	38	7/8-14	**780186**
15	38	7/8-14	**780187**
16	38	7/8-14	**780188**
18	44	1 1/16-12	**780189**
20	44	1 1/16-12	**780190**
38	127	1 7/8-12	**530625**

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Bender Table (With Locking Casters) for HB632

Sturdy, heavy all steel construction, strongly braced to keep bender, mandrel rod, and mandrel rod stop assembly rigidly aligned. All holes are pre-drilled at factory to accommodate the HB632 bender and rod stop assembly.

DIMENSION: H – 36” W – 30” L – 10’

NOTE: Table is supplied with locking casters for ease of mobility.

Part Name	Part No.
Bender Table (with locking casters) for HB632	**520515**

Fig. Q30 — Bender Table (equipment not included)

Mandrel Bending Components

When bending thin wall tube it may be necessary to insert a mandrel into the tube to prevent excessive distortion or flattening. To accomplish such bending, a Mandrel, Mandrel Rod, and a Mandrel Rod Stop Assembly are required. The Rod Stop Assembly holds the end of the Mandrel Rod in proper alignment with the tube while the Mandrel, which is threaded onto the other end of the Mandel Rod, supports the tube on its I.D., thus preventing tube kinking or flattening during bending.

The following parts are required for mandrel bending with the 412 and 424 bender:

Part Name	Part No.
Mandrel Rod Stop Assembly	**550571** (See page Q18)
Stop Assembly Adapter Riser (424 only)	**631154** (See page Q18)
Mandrel Rods	See page Q17
Mandrel	See page Q17

The following parts are required for mandrel bending with the 632 bender:

Part Name	Part No.
Mandrel Rod Stop Assembly	**631141** (See page Q18)
Mandrel Rods	See page Q17
Mandrel	See page Q17

Example:
Tube O.D.: 2”
Wall Thickness: 0.095”
Centerline Radius: 8”

Vertical Axis = $\frac{8”}{2”} = 4$

Horizontal Axis = $\frac{2”}{.095”} \approx 21$

Answer: Plug Mandrel required

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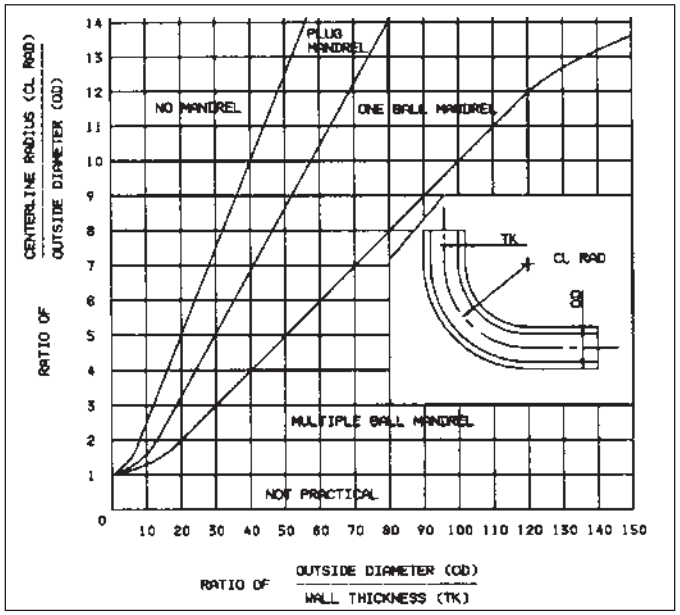

Fig. Q31 — Mandrel Graph Chart

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Mandrels (Plug Type)

For use with Exactol Models 412, 424 and the HB632 benders. Mandrels ensure smooth bends without kinking, or wrinkling when bending thin-walled tube, or when making short-radius bends. Mandrels support the tube wall from the inside to keep it fully open for a smooth bend.

A rule that is generally followed to determine whether or not a mandrel is necessary is as follows: When the wall thickness of the tube to be bent is 7 percent or more of the tube O.D., a mandrel is usually not necessary. On wall thicknesses that range between 4-6 percent of the tube O.D., it is necessary to use a mandrel to avoid wrinkling and flattening in the bend area. This rule is based on a bend radii of between three and four times the tube O.D.

Part Number Example: 924417-Size X Wall Thickness = **924417-12X058**

* See Fig. Q31 for mandrel usage.

To order mandrel, specify tube O.D. and wall thickness.

Fig. Q32 — Mandrel

Size	END SIZE (in.)	Wall Thickness (in.)	(in.)	(in.)	(in.)	(in.)
6	3/8	—	—	—	—	—
8	1/2	—	0.035	—	—	—
10	5/8	0.035	—	—	—	—
12	3/4	—	—	—	0.058	—
14	7/8	—	—	—	0.058	0.065
16	1	—	0.042	—	0.058	0.065
18	1 1/8	—	0.042	—	—	0.065
20	1 1/4	—	—	—	0.065	0.095
24	1 1/2	—	0.058	—	0.083	—

Table Q4 — Mandrel Sizes

Mandrel Rods

For use with the HB632 Model Bender and Exactol Models 412/424 benders. Mandrel rods (as well as a mandrel rod stop assembly) are required when using mandrels. Mandrel rod diameters are determined by tube I.D.

Fig. Q33 — Mandrel Rods

Mandrel Rod Sizes

Mandrel Rod Dia. (in.)	Tube I.D. (in.)	Part No.
5/8	1.49 to 1.87	**520509**

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Mandrel Rod Stop Assembly

For use with Model HB632 bender.

The Mandrel Rod Stop Assembly, when bolted to the end of a table opposite of the bender, keeps the mandrel rod in alignment with the tube when mandrel bending.

Part Name	Part No.
Mandrel Rod Stop Assembly (for bender Model HB632)	**631141**
Mandrel Rod Stop Adapter for 5/16" Mandrel Rod	**522398**
Mandrel Rod Stop Adapter for 1/4" Mandrel Rod	**550501**

Fig. Q34 — Mandrel Rod Stop Assembly /632

Mandrel Rod Stop Assembly

For use with Exactol 412/424 Model benders.

Part Name	Part No.
Mandrel Rod Stop Assembly	**550571**
Mandrel Rod Stop Adapter for 412/424 benders	**820029**

Fig. Q35 — Mandrel Rod Stop Assembly 412/424

Part Name	Part No.
Stop Assembly Adapter/Riser for 424	**631154**

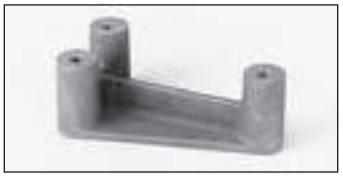

Fig. Q36 — Stop Assembly Adapter/Riser

Universal Side Angle Indicator

For use with Model HB632 bender.

Accurately determines angle between tube bends in different planes. Keeps out of plane angles accurate, when making repeated bends. Large, easy-to-read vernier dial. Maximum 3/4" O.D. tube can be used if the tube must be extended through the indicator. Maximum 1 1/2" O.D. tube can be used if end of tube is held in clamp jaw.

Part Name	Part No.
Universal Side Angle Indicator	**520520**

Fig. Q37 — Universal Side Angle Indicator

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CP432 Tube and Pipe Bender

A 90 psi air supply does all the work for bending steel and stainless steel tube and pipe. This bender utilizes a center push bending method which is easy to master. Offered in an all inclusive kit. A separate accessory kit of tooling for bending 10mm through 50mm tube is also available. See page Q20 for part number information.

Part Name	Part No.
CP432 Tube and Pipe Bender Kit	**CP432**

Includes all tooling necessary for bending 1/4" thorugh 2" tube and 1/2 through 2" pipe.

See Bulletin 4391-CP432 for more information.

Fig. Q38 — CP432 Bender Kit

Fig. Q39 — Pump

Fig. Q40 — Multi-Size Tube Radius Block

Fig. Q41 — Multi-Size Tube Slide Block

REPLACEMENT COMPONENTS

Part Name	Part No.
Air/Hydraulic Pump	**PAT-1102N**
Hose Assembly	**975222****
Quick Coupler, Receptacle	**3050-3**
Quick Coupler, Nipple	**3010-3**
Hydraulic Cylinder	**RC-1010**
Radius Blocks	See below
Slide Blocks	See below

Radius Blocks for CP432 – Inch Tube Sizes

Tube O.D. (in.)	Bend Radius (in.)	Part No.
1/4	9/16	**975179**
3/8	1 1/4	**975179**
1/2	1 1/2	**975179**
5/8	1 7/8	**975180**
3/4	2 1/4	**975180**
1	3	**975181**
1 1/4	3 3/4	**975182**
1 1/2	4 1/2	**975183**
2	8	**975184**

Slide Blocks for CP432 (2 required) – Inch Tube Sizes

Tube O.D. (in.)	Part No.
1/4	**975185**
3/8	**975185**
1/2	**975185**
5/8	**975186**
3/4	**975186**
1	**975187**
1 1/4	**975187**
1 1/2	**975188**
2	**975188**

*For inch pipe size radius blocks and slide blocks refer to Table Q4 to right.

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Pipe Size	Bend Radius)	Radius Block Part #	Slide Block Part # (2 req.'d.)	Drive Pin
1/2	3-3/16	BZ-12011	BZ-12071	A-12
3/4	5	BZ-12021		
1	5-7/8	BZ-12031		
1-1/4	7-1/4	BZ-12041		
1-1/2	8	BZ-12051		
2	9-1/2	BZ-12061		

Table Q5 - Inch Pipe Sizes

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Radius Blocks for CP432 – Metric Tube Sizes

Tube O.D. (mm)	Bend Radius (mm)	Part No.
10	34	**976503-Block**
12	34	**976503-Block**
14	38	**976503-Block**
15	38	**976505**
16	38	**976505**
18	42	**976508**
20	42	**976508**
22	89	**976510**
25	100	**976510**
30	100	**976512**
32	100	**976515**
35	105	**976516**
38	114	**976517**
42	128	**976518**
50	200	**976519**

Fig. Q42 — Typical Radius Block

Fig. Q43 — Typical Slide Block

Slide Blocks for CP432 (2 required) – Metric Tube Sizes

Tube O.D. (mm)	Part No.
10	**976504**
12	**976504**
14	**976504**
15	**976506**
16	**976506**
18	**976509**
20	**976509**
22	**976511**
25	**976511**
30	**976513**
32	**976513**
35	**976520**
38	**976520**
42	**976521**
50	**976521**

ACCESSORIES

Part Name	Part No.
Metric Tooling Kit (10-50mm)	***CP432-MM TOOL KIT**

*Bender & pump is not included. CP432 is also needed.

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Kloskut® Tube Cutters

These adjustable tube cutters are designed to produce square cut ends with no external burr and minimum internal burr when used on fully annealed copper, brass, aluminum, and steel tube. Both feature a hardened and burnished tool-steel cutting wheel, flare cut-off grooves in rollers for removal of old flares and a swing-away reamer for removing internal burrs. The handle feeds and adjusts the cutting wheel to uniformly cut tube as the cutter is rotated.

NOTE: Tube cutters are **not recommended** for use with stainless steel tube because of the work hardening effect. The use of a hacksaw with a "Tru-Kut" Sawing Vise or a rotary teeth saw is recommended for stainless steel.

Fig. Q44 — 218B Medium Kloskut Tube Cutter

Medium Kloskut

Part Description	Part No.
Tube cutter for 1/8" to 1 1/8" O.D.	**218B**
Cutter Wheel for 218B	**218B Wheel**
Cutter Shaft	**218B Shaft**

Fig. Q45 — 1232 Large Kloskut Tube Cutter

Large Kloskut

Part Description	Part No.
Tube Cutter for 3/4" to 2" O.D.	**1232**
Cutter Wheel for 1232	**1232 Wheel**

Tru-Kut® Sawing Vise

This hacksaw guide will accommodate tube, pipe and hose from sizes 3 (3/16" O.D.) to 32 (2" O.D.), assuring square cut-offs within ± 1°. For use with a fine tooth hacksaw blade for smooth cuts.

HOW TO USE: Mount in a vise or bolt to a bench. Clamp tube, pipe or hose into the Tru-Kut vise and cut off; guide ensures accurate square cuts.

Part Description	Part No.
Tru-Kut Sawing Vise	**710439**

Fig. Q46 — Tru-Kut Sawing Vise

Cut-Off Saw

The 974250 Cut-Off Saw is designed to operate at low speed to prevent work hardening the tube end. The saw will assure a square cut on the tube with minimum burrs. The saw will cut 1/4" through 2 3/4" copper, brass, aluminum, steel and stainless steel tube. An adequate supply of cutting fluid is provided by an internal recirculating pump. The unit is designed for bench or stand mounting and operates on 110V, 15 amp power supply.

Part Description	Part No.
Cut-Off Saw	**974250**

Accessories

Saw Base	**AF160026**

Replacement Parts

Cutting Lubricant (Approx. 1 gal. container)	**Saw Lube**
Saw Blade – 250 mm x 2.0 mm thick (all purpose)	**987036**
Saw Blade – 200 mm x 2.0 mm thick (all purpose)	**987037**

Fig. Q47 — Cut-Off Saw (shown on Saw Base)

⚠ **WARNING:** This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

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Tube Deburring Tool 226B

A quick twist of the wrist will deburr either the O.D. or the I.D. of the tube end. Parker's In-Ex deburrer can be used on annealed steel, stainless steel, copper and aluminum, for tube sizes 1/8" to 1 5/8" O.D.

Part Description	Part No.
Deburring Tool	**226B**

Fig. Q48 — Deburr Tool 226B

Power Deburr Tool

The Parker Power Deburr Tool is designed for deburring the I.D. and O.D. of 1/4" through 2" steel, stainless steel, copper and aluminum tube. The lightweight unit incorporates a modular design which allows Parker's Cut-Off Saw, part number 974250, to be easily mounted on the top. The Power Deburr Tool requires 110V/10A power supply.

Dimensions: L – 20", W – 18", H – 9".

Part Description	Part No.
Power Deburr Tool	**972125**

Replacement Parts

I.D. Deburr Cone	**971816**
O.D. Deburr Blades (six blade set)	**910485**

Fig. Q49 — Power Deburr Tool

FastSeal Assembly Tools

Patent-pending FastSeal is a revolutionary new way to make O-ring Face Seal tube connections. Assembly and maintenance teams can quickly preset the sleeve onto the tube end for a permanent flat-face connection with no need for brazing or flanging equipment. The two tools that are recommended, but not required, for FastSeal assembly are a mandrel and gauge (marking tool). Part numbers correspond with the FastSeal part number being used and are shown in shown in table below. View FastSeal assembly instructions in the Assembly section of the catalog or on ***the FastSeal Assembly Instructions page (Parker FastSeal™ Assembly Instructions).***

Tube OD (in.)	Part Numbers		
	FastSeal	Mandrel	Marking Tool
1/4	4 TLFA-S	4 TLFA Mandrel	4 TLFA Gauge
3/8	6 TLFA-S	6 TLFA Mandrel	6 TLFA Gauge
1/2	8 TLFA-S	8 TLFA Mandrel	8 TLFA Gauge

Parker's patent-pending FastSeal creates quick leak-free permanent ORFS tube end connections with just a wrench. Get more details on this new technology now.

Fig. Q50— FastSeal Mandrel

Fig. Q51 — FastSeal Gauge

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http://www.parker.com/tfd

Parflange® 1025

Bench-Top 90° Flanging and 37° Flaring System

Tooling must be ordered separately

- Eliminates braze joint
- Compact, lightweight design
- Bench mountable
- Easy to operate
- Available in 110-volt single-phase or 440-volt 3-phase (please specify by ordering 1025/110 or 1025/440)
- Flanges or flares tube in less than 20 seconds
- For tube sizes 1/4" O.D. thru 1-1/2" O.D. (steel); and 1/4" O.D. thru 1" O.D. (stainless steel) − Flanging/flaring of tube sizes 1” & greater results in heavy machine vibration. Therefore, this machine is only recommended for occasional use for preparing tube ends 1” or larger.

  Tooling is also available for comparable metric tube sizes.

Electrical Power: 110V/20A single-phase, or 440V/3-phase/2.1A

Power Cable Length: 8 feet long (2.5 meters)

Dimensions: Height: 18 1/8 inches (460mm)
Width: 15 3/8 inches (390mm)
Depth: 26 3/8 inches (670mm)

Weight: Basic Unit: 175 lbs. (80 kg.)
Each Die (typical): 4 lbs. (1.8 kg.)

Flanging Pin Lubrication Fluid: **LB2000**

Instructional video is available at discover.parker.com/TFDTubeFabEquipment.

View the Parflange Equipment Overview and Comparison Guide.

Fig. Q52 — Parflange® 1025 Machine

CAUTION: Extension cords are ***not*** recommended and could cause damage to the machine due to a lack of power supply.

Fig. Q53 — Flanging Pin

Fig. Q54 — Flanging Die Set

Fig. Q55 — LB 2000

COMPONENTS REQUIRED

Part Name	Part No.
Parflange 1025 (110 volt)	**1025/110**
Parflange 1025 (440 volt)	**1025/440**
Flanging Pin	See page Q23
Flanging Die Set	See page Q23
Flaring Pin	See page Q37
Flaring Die Set	See page Q37
Lubrication Fluid	**LB 2000**
Die Adjustment Shims (Old Style Dies Only)	**Shim Kit**

REPLACEMENT PART

Part Name	Part No.
Tube Stop	**1025/0281014**

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Inch and Metric Flanging Tooling for 1025

Tube Size O.D. x Wall Thickness (in.)	Tooling for 90°/180° Tube Flanging		Available Flanging Tooling	
	Pin Part Number	Die Part Number	1025 -S	1025 -SS
1/4 x .028	B4004X028180	M4004X028180	•	
1/4 x .035	B4004X035180	M4004X035180	•	•
1/4 x .049	B4004X049180	M4004X049180	•	
3/8 x .035	B4006X035180	M4006X035180	•	•
3/8 x .049	B4006X049180	M4006X049180	•	•
3/8 x .065	B4006X065180	M4006X065180	•	•
1/2 x .035	B4008X035180	M4008X035180	•	•
1/2 x .049	B4008X049180	M4008X049180	•	•
1/2 x .065	B4008X065180	M4008X065180	•	•
1/2 x .083	B4008X083180	M4008X083180	•	•
5/8 x .049	B4010X049180	M4010X049180	•	•
5/8 x .065	B4010X065180	M4010X065180	•	•
5/8 x .083	B4010X083180	M4010X083180	•	•
5/8 x .095	B4010X095180	M4010X095180	•	•
5/8 x .109	B4010X109180	M4010X109180	•	
5/8 x .120	B4010X120180	M4010X120180	•	
3/4 x .049	B4012X049180	M4012X049180	•	•
3/4 x .065	B4012X065180	M4012X065180	•	•
3/4 x .083	B4012X083180	M4012X083180	•	•
3/4 x .095	B4012X095180	M4012X095180	•	•
3/4 x .109	B4012X109180	M4012X109180	•	•
3/4 x .120	B4012X120180	M4012X120180	•	
1 x .065	B4016X065180	M4016X065180	•	•
1 x .083	B4016X083180	M4016X083180	•	•
1 x .095	B4016X095180	M4016X095180	•	
1 x .109	B4016X109180	M4016X109180	•	
1 x .120	B4016X120180	M4016X120180	•	
1 x .134	B4016X134180	M4016X134180	•	
1 x .148	B4016X148180	M4016X148180		
1 x .156	B4016X156180	M4016X156180		
1 x .188	B4016X188180	M4016X188180		
1 1/4 x .065	B4020X065180	M4020X065180	•	
1 1/4 x .083	B4020X083180	M4020X083180	•	
1 1/4 x .095	B4020X095180	M4020X095180	•	
1 1/4 x .109	B4020X109180	M4020X109180	•	
1 1/4 x .120	B4020X120180	M4020X120180	•	
1 1/4 x .134	B4020X134180	M4020X134180		
1 1/4 x .148	B4020X148180	M4020X148180		
1 1/4 x .156	B4020X156180	M4020X156180		
1 1/4 x .188	B4020X188180	M4020X188180		
1 1/2 x .065	B4024X065180	M4024X065180	•	
1 1/2 x .083	B4024X083180	M4024X083180	•	
1 1/2 x .095	B4024X095180	M4024X095180	•	
1 1/2 x .109	B4024X109180	M4024X109180		
1 1/2 x .120	B4024X120180	M4024X120180		
1 1/2 x .134	B4024X134180	M4024X134180		
1 1/2 x .148	B4024X148180	M4024X148180		
1 1/2 x .156	B4024X156180	M4024X156180		
1 1/2 x .188	B4024X188180	M4024X188180		

Note: Use "-SS" suffix after part number for flanging tools for stainless steel tube. Contact the Tube Fittings Division for sizes and/or materials not listed, or for additional SS sizes released for limited use.

Table Q6 — Pin & Die Part Numbers for Inch Sizes

Tube Size O.D. x Wall Thickness (mm)	Tooling for 90°/180° Tube Flanging		Available Flanging Tooling	
	Pin Part Number	Die Part Number	1025 S	1025 SS
6 x 1	B3018006X1M	M4018006X1M	•	
6 x 1.5	B3018006X1.5M	M4018006X1.5M	•	
8 x 1	B3018008X1M	M4018008X1M	•	
8 x 1.5	B3018008X1.5M	M4018008X1.5M	•	
10 x 1	B3018010X1M	M4018010X1M	•	
10 x 1.5	B3018010X1.5M	M4018010X1.5M	•	
10 x 2	B3018010X2M	M4018010X2M	•	
12 x 1	B3018012X1M	M4018012X1M	•	
12 x 1.5	B3018012X1.5M	M4018012X1.5M	•	•
12 x 2	B3018012X2M	M4018012X2M	•	
15 x 1.5	B3018015X1.5M	M4018015X1.5M	•	
15 x 2	B3018015X2M	M4018015X2M	•	
16 x 1	B3018016X1M	M4018016X1M	•	
16 x 1.5	B3018016X1.5M	M4018016X1.5M	•	
16 x 2	B3018016X2M	M4018016X2M	•	•
16 x 2.5	B3018016X2.5M	M4018016X2.5M	•	
18 x 1	B3018018X1M	M4018018X1M	•	
18 x 1.5	B3018018X1.5M	M4018018X1.5M	•	
18 x 2	B3018018X2M	M4018018X2M	•	
20 x 2	B3018020X2M	M4018020X2M	•	•
20 x 2.5	B3018020X2.5M	M4018020X2.5M	•	
20 x 3	B3018020X3M	M4018020X3M	•	
22 x 1.5	B3018022X1.5M	M4018022X1.5M	•	
22 x 2	B3018022X2M	M4018022X2M	•	
22 x 2.5	B3018022X2.5M	M4018022X2.5M	•	
22 x 3	B3018022X3M	M4018022X3M	•	
25 x 2	B3018025X2M	M4018025X2M	•	
25 x 2.5	B3018028X2.5M	M4018028X2.5M	•	
25 x 3	B3018030X2M	M4018030X2M	•	
25 x 3.5	B3018025X3.5M	M4018025X3.5M	•	
25 x 4	B3018025X4M	M4018025X4M		
28 x 2	B3018028X2M	M4018028X2M	•	
28 x 2.5	B3018028X2.5M	M4018028X2.5M	•	
30 x 2	B3018030X2M	M4018030X2M	•	
30 x 3	B3018030X3M	M4018030X3M	•	
30 x 3.5	B3018030X3.5M	M4018030X3.5M		
30 x 4	B3018030X4M	M4018030X4M		
32 x 3	B3018032X3M	M4018032X3M	•	
32 x 4	B3018032X4M	M4018032X4M		
35 x 3	B3018035X3M	M4018035X3M	•	
38 x 3	B3018038X3M	M4018038X3M		
38 x 4	B3018038X4M	M4018038X4M		
38 x 5	B3018038X5M	M4018038X5M		

Note: Flanging tools (90°/180°) listed are for carbon steel tube. Contact the Tube Fittings Division for metric flanging tools for tube materials other than carbon steel or for sizes not listed.

Table Q7 — Pin & Die Part Numbers for Metric Sizes

Dimensions and pressures for reference only, subject to change.

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Parflange® ECO 25

Bench-Top 90° Flanging and 37° Flaring System

Tooling and Hydraulic Pump must be ordered separately

- Eliminates braze joints
- More efficient than traditional flaring methods
- Only requires one die per tube size for both flanging and flaring
- For tube sizes 1/4" O.D. through 1-1/2" O.D. in both Steel and Stainless Steel
- Dies not dependent on wall thickness or tube material
- Uses same Parflange pins as 1025 and PRO 50 models
- Utilizes proven Parflange orbital process for consistent flanges and flares
- Burnishes flanges and flares for superior surface finish
- Compact, lightweight design
- Easy to operate
- Used with hand hydraulic pump
- 110-volt single-phase power
- Tooling also available in comparable metric sizes

Fig. Q56 — Parflange ECO 25

Electrical Power: 110V/20A single-phase

Power Cable Length: 8 feet long (2.5 meters)

Dimensions: Height: 20.5 inches (520mm)
Width: 15 inches (381mm)
Depth: 20.5 (520mm)

Weight: 190 lbs. (86.4 kg.)

CAUTION: Extension cords are ***not*** recommended and could cause damage to the machine due to a lack of power supply.

See Bulletin 4391-ECO25 for more information and instructions for use.

Instructional video is available at discover.parker.com/TFDTubeFabEquipment.

View the Parflange Equipment Overview and Comparison Guide.

COMPONENTS REQUIRED

Part Name	Part No.
*ECO 25 Basic Unit	**ECO 25**
*Hand Hydraulic Pump	**900086**
Flanging Pin	See page Q26
Flaring Pin	See page Q31
Flanging/Flaring Dual Function Die Set	See page Q26 & Q38
*Lubrication Fluid	**LB 2000**
*Hose Assembly (for hand pump)	**910133****
*Pressure gauge (0 - 10,000 psi)	**900044*****
*Hydraulic Pump Adapter	**6-6 FLO-S**
*Hydraulic Pump Tee	**6 R6LO-S**
*Pressure Gauge Adapter	**6 G6L-S**
*Hose Conversion Adapter (#1)	**6 G6L-S**
*Hose Conversion Adapter (#2)	**6-6 G6L-S**

Fig. Q57 — Hand Pump

*Included in ECO 25 kit (Part Number ECO 25 KIT)

WARNING: ***This product can expose you to chemicals including Hex Chromium 6 which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

ECO 25 Kit

Part Name	Part No.
ECO 25 Kit (includes hand pump)	**ECO 25 KIT**

(Kit includes basic unit, hand hydraulic pump, hose assembly, pressure gauge, hydraulic pump adapter, hydraulic pump tee, pressure gauge adapter, hose conversion adapters #1 & #2, Lubrication fluid, and operation manual.)

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Dimensions and pressures for reference only, subject to change.

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Inch Flanging Tooling for ECO25

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Tube O.D. (in.)	Die Set Part Number
1/4	M2504
3/8	M2506
1/2	M2508
5/8	M2510
3/4	M2512
1	M2516
1 1/4	M2520
1 1/2	M2524

Table Q8 — Flanging Die Set, Inch Sizes

Tube O.D. (in.)	Wall Thickness (in.)	Flanging Pin Steel Tube	Flanging Pin Stainless Tube
1/4	0.028	B4004X028180	-
1/4	0.035	B4004X035180	B4004X035180SS
1/4	0.049	B4004X049180	B4004X049180SS
3/8	0.035	B4006X035180	B4006X035180SS
3/8	0.049	B4006X049180	B4006X049180SS
3/8	0.065	B4006X065180	B4006X065180SS
1/2	0.035	B4008X035180	B4008X035180SS
1/2	0.049	B4008X049180	B4008X049180SS
1/2	0.065	B4008X065180	B4008X065180SS
1/2	0.083	B4008X083180	B4008X083180SS
1/2	0.095	B4008X095181	B4008X095180SS
5/8	0.049	B4010X049180	B4010X049180SS
5/8	0.065	B4010X065180	B4010X065180SS
5/8	0.083	B4010X083180	B4010X083180SS
5/8	0.095	B4010X095180	B4010X095180SS
5/8	0.120	B4010X120180	-
3/4	0.049	B4012X049180	B4012X049180SS
3/4	0.065	B4012X065180	B4012X065180SS
3/4	0.083	B4012X083180	B4012X083180SS
3/4	0.095	B4012X095180	B4012X095180SS
3/4	0.104	-	B4012X104180SS
3/4	0.109	B4012X109180	B4012X109180SS
3/4	0.120	B4012X120180	B4012X120180SS
1	0.065	B4016X065180	B4016X065180SS
1	0.083	B4016X083180	B4016X083180SS
1	0.095	B4016X095180	B4016X095180SS
1	0.109	B4016X109180	B4016X109180SS
1	0.120	B4016X120180	B4016X120180SS
1	0.134	B4016X134180	B4016X134180SS
1	0.139	-	B4016X139180SS
1 1/4	0.065	B4020X065180	-
1 1/4	0.083	B4020X083180	B4020X083180SS
1 1/4	0.095	B4020X095180	B4020X095180SS
1 1/4	0.109	B4020X109180	B4020X109180SS
1 1/4	0.120	B4020X120180	B4020X120180SS
1 1/4	0.134	B4020X134180	-
1 1/2	0.065	B4024X065180	-
1 1/2	0.083	B4024X083180	-
1 1/2	0.095	B4024X095180	B4024X095180SS
1 1/2	0.109	B4024X109180	B4024X109180SS
1 1/2	0.120	B4024X120180	B4024X120180SS

Table Q9 — Flanging Pin, Inch Sizes

Fig. Q58 — Flanging Pin

Fig. Q59 — Dual Function Die Set (Flaring and Flanging)

Parflange® Pro 50

The Parflange® Pro 50 is a production WorkCenter for orbital flaring and flanging of high pressure tube connections. The unique feature of the Parflange® process is that the deformation of the tube end is achieved by rolling rather than by just pushing a tool into the tube end.

The Parflange® machine smoothly compresses the tube material and achieves a high strength joint with a polished surface of the tube end. Seal-Lok and SAE flange sleeves are firmly fixed onto the tube end, resulting in a very rigid high-pressure tube connection.

The Pro 50 is the heavy-duty mass production WorkCenter of the Parflange® machine program. It is recommended for industrial production of all sizes Triple-Lok® and required Seal-Lok tube connections. Maximum tube capacity is 2" tube O.D / 50 mm.

The powerful drive and the fast, automatic process allow short cycle times for efficient production. Its advantage is the quick and easy change of tooling and the simple operation without manual adjustments or programming. Tube clamping and tool lubrication are done automatically.

The Pro 50 comes ready to be used. Parflange® tools have to be purchased separately. For each tube dimension, special clamping dies and Parflange® pins are required. The machine can be moved on wheels, by forklift truck and crane. For basic use, just an electric power supply is required.

Fig. Q60 — Parflange Pro 50

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Instructional video is available at discover.parker.com/TFDTubeFabEquipment.

View the Parflange Equipment Overview and Comparison Guide.

Part Name	Part No.
Parflange Pro 50	**PRO 50**

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Pro 50 Machine Specification

Purpose:	180˚ Flanging for Seal-Lok and 37˚ Flaring for Triple-Lok®
Process:	Orbital flaring and flanging according to Parflange® process
Design:	WorkCenter for industrial production
Tube material:	Steel and stainless steel tube
Tube diameter:	Inch: 1/4" to 2" Metric: 6 to 50 mm
Min. U-bend:	4.72 mm
Maximum capacity:	Steel tube (ST 37, ST52,...) Inch: 2" x 0.120 (tube O.D. x wall thickness) Metric: 38 x 5 / 50 x 3 mm Stainless steel tube (1.4571, 316, ...) Inch: 1-1/2" x 0.156 Metric: 38 x 4 mm
Tube specification:	Fully annealed seamless cold drawn or welded and redrawn precision tube
Operation:	Automatic clamping, automatic flanging/flaring
Speed:	5-8 sec. flanging time / 15-20 sec. total cycle time

Economic production quantity:	max. 500 flarings per day
Tools:	See Tables 9 & 10 on page Q30
Tool compartments:	10 die sets, 10 pins
Tool clamping:	Automatic
Tool lubrication:	Automatic lubrication device
Lubricant:	EO-NIROMONT (filled when delivered)
Hydraulic oil:	HLP 46 (filled when delivered)
Installation:	Electrical power
Dimensions:	27.6 in x 33 in x 40.7 in
Platform for bins:	2 platforms,11.8 x 19.7 in, max. 11 lbs each
Weight:	838 lbs
Electrical power:	400 V, 3 Phase, 50 Hz, 4.5 kW
Transport options:	On wheels, by forklift truck, lifting attachments

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

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Parflange® Pro 50 with Feeder

For industrial mass production of Seal-Lok tube end connections, the Parflange Pro 50 with sleeve feed is available. This sleeve feeding device increases the productivity, particularly of high volume - single tube dimension jobs.

In “Feeder ON - mode”, Seal-Lok sleeves just need to be inserted into feeder rails. First cycle start is initiated by manually closing the safety cover. Then, all following cycles are started by pushing the tube into the pre-clamped dies. All other machine activities, like tube clamping, flanging, tube release, insertion of Seal-Lok sleeves into dies, pre-clamping of dies and the operation of safety cover run fully automatic. The operator just is handling the tubes and refilling the sleeve-feeder from times to times with Seal-Lok sleeves.

In “Feeder OFF - mode”, the Parflange® PRO 50 operates like the Parflange® PRO 50 without Seal-Lok sleeve feeder. This mode is useful for maximum size flexibility and Triple-Lok® assembly. For quick changeover and safety reasons, the Seal-Lok sleeve feeder is just switched OFF but not be removed from the Parflange® PRO 50 WorkCenter.

For operation of Parflange Pro 50, compressed air supply is required.

Part Name	**Part No.**
Parflange Pro 50 w/Feeder	**PRO 50 W/FEEDER**

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Fig. Q61 — Parflange Pro 50 w/Feeder

Pro 50 Machine Specification

Specific differences of PRO 50 versus PRO 50 with Feeder	
Design:	Parflange® PRO 50 with additional Seal-Lok sleeve feeder
Normal Operation:	Same as Parflange® 50 when feeder is switched off
Feeder Operation:	Work-cycle initiated by inserting tube end Automatic clamping, automatic flanging/flaring Automatic insertion of Seal-Lok sleeves into dies Automatic operation of safety cover Automatic pre-clamping of dies
Manual operation:	Like Parflange® PRO 50
Cycle time:	5-8 sec. flanging time / approx. 15 to 20 sec. total cycle time
Tools:	Same tools as Parflange® PRO 50 without feeder
Feeder:	Feeder is delivered in separate box and must be firmly attached to machine. Feeder can be switched ON and OFF but must not be removed.
Feeder rails:	Feeder rail kits must be ordered separately for each Seal-Lok sleeve size
Feeder setup:	Installation of matching rail kit by knurled nuts and adjustment of scale wheel according to chart
Installation:	Electrical power, for feeder type machines: compressed air supply (6 bar)
Dimensions:	2.30 ft x 2.76 ft x 6.66 ft
Weight:	904 lbs

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Ordering

Type	Order code
Parflange® 50 machine Ready to use, including operation manual, filled with hydraulic oil and lubricant Without Parflange® tools Basic machine Europe version (not prepared for Seal-Lok sleeve feeder)	
Purchase:	PRO 50
Rent (monthly)	e-mail TFDrental@parker.com for availability

Parflange® PRO 50

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Type	**Order code**
Parflange® 50 PRO machine Europe version including Seal-Lok sleeve feeder without feeder rails	
Purchase:	PRO 50 with Feeder
Rent (monthly)	e-mail TFDrental@parker.com for availability

Parflange® PRO 50 with Feeder for mass production of Seal-Lok assemblies

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Sleeve feeder rails for Parflange® 50 PRO	**Tube OD**	**Order code**
Seal-Lok sleeve feeding rail	6mm / 1/4"	1050RAIL04
Seal-Lok sleeve feeding rail	8, 10mm / 3/8"	1050/RAIL06
Seal-Lok sleeve feeding rail	12mm / 1/2"	1050/RAIL08
Seal-Lok sleeve feeding rail	14,15,16mm / 5/8"	1050/RAIL10
Seal-Lok sleeve feeding rail	18,20mm / 3/4"	1050/RAIL12
Seal-Lok sleeve feeding rail	22,25 / 1"	1050/RAIL16
Seal-Lok sleeve feeding rail	28,30,32 / 1-1/4"	1050/RAIL20
Seal-Lok sleeve feeding rail	35,38 / 1-1/2"	1050/RAIL24

Parflange® machines and feeders are shipped in special containers which should be kept for future transports to avoid damage. Please don't dispose of the transport boxes!

Inch and Metric Flanging Tooling for PRO 50

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Tube Size O.D. x Wall Thickness (in.)	Tooling for 90°/180° Tube Flanging		Available Flanging Tooling	
	Pin Part Number	Die Part Number	1025	
			-S	-SS
1/4 x .028	B4004X028180	M4004X028180	•	
1/4 x .035	B4004X035180	M4004X035180	•	•
1/4 x .049	B4004X049180	M4004X049180	•	
3/8 x .035	B4006X035180	M4006X035180	•	•
3/8 x .049	B4006X049180	M4006X049180	•	•
3/8 x .065	B4006X065180	M4006X065180	•	•
1/2 x .035	B4008X035180	M4008X035180	•	•
1/2 x .049	B4008X049180	M4008X049180	•	•
1/2 x .065	B4008X065180	M4008X065180	•	•
1/2 x .083	B4008X083180	M4008X083180	•	•
5/8 x .049	B4010X049180	M4010X049180	•	•
5/8 x .065	B4010X065180	M4010X065180	•	•
5/8 x .083	B4010X083180	M4010X083180	•	•
5/8 x .095	B4010X095180	M4010X095180	•	•
5/8 x .109	B4010X109180	M4010X109180	•	
5/8 x .120	B4010X120180	M4010X120180	•	
3/4 x .049	B4012X049180	M4012X049180	•	•
3/4 x .065	B4012X065180	M4012X065180	•	•
3/4 x .083	B4012X083180	M4012X083180	•	•
3/4 x .095	B4012X095180	M4012X095180	•	•
3/4 x .109	B4012X109180	M4012X109180	•	•
3/4 x .120	B4012X120180	M4012X120180	•	•
1 x .065	B4016X065180	M4016X065180	•	•
1 x .083	B4016X083180	M4016X083180	•	•
1 x .095	B4016X095180	M4016X095180	•	•
1 x .109	B4016X109180	M4016X109180	•	•
1 x .120	B4016X120180	M4016X120180	•	•
1 x .134	B4016X134180	M4016X134180	•	•
1 x .148	B4016X148180	M4016X148180	•	
1 x .156	B4016X156180	M4016X156180	•	
1 x .188	B4016X188180	M4016X188180	•	
1 1/4 x .065	B4020X065180	M4020X065180	•	
1 1/4 x .083	B4020X083180	M4020X083180	•	•
1 1/4 x .095	B4020X095180	M4020X095180	•	•
1 1/4 x .109	B4020X109180	M4020X109180	•	•
1 1/4 x .120	B4020X120180	M4020X120180	•	•
1 1/4 x .134	B4020X134180	M4020X134180	•	
1 1/4 x .148	B4020X148180	M4020X148180	•	
1 1/4 x .156	B4020X156180	M4020X156180	•	
1 1/4 x .188	B4020X188180	M4020X188180	•	
1 1/2 x .065	B4024X065180	M4024X065180	•	
1 1/2 x .083	B4024X083180	M4024X083180	•	
1 1/2 x .095	B4024X095180	M4024X095180	•	•
1 1/2 x .109	B4024X109180	M4024X109180	•	
1 1/2 x .120	B4024X120180	M4024X120180	•	•
1 1/2 x .134	B4024X134180	M4024X134180	•	
1 1/2 x .148	B4024X148180	M4024X148180	•	
1 1/2 x .156	B4024X156180	M4024X156180	•	
1 1/2 x .188	B4024X188180	M4024X188180	•	

Note: Use "-SS" suffix after part number for flanging tools for stainless steel tube. Contact the Tube Fittings Division for sizes and/or materials not listed, or for additional SS sizes released for limited use.

Table Q10 — Pin & Die Part Numbers for Inch Sizes

Tube Size O.D. x Wall Thickness (mm)	Tooling for 90°/180° Tube Flanging		Available Flanging Tooling	
	Pin Part Number	Die Part Number	1025	
			S	SS
6 x 1	B3018006X1M	M4018006X1M	•	
6 x 1.5	B3018006X1.5M	M4018006X1.5M	•	
8 x 1	B3018008X1M	M4018008X1M	•	
8 x 1.5	B3018008X1.5M	M4018008X1.5M	•	
10 x 1	B3018010X1M	M4018010X1M	•	
10 x 1.5	B3018010X1.5M	M4018010X1.5M	•	
10 x 2	B3018010X2M	M4018010X2M	•	
12 x 1	B3018012X1M	M4018012X1M	•	
12 x 1.5	B3018012X1.5M	M4018012X1.5M	•	•
12 x 2	B3018012X2M	M4018012X2M	•	
15 x 1.5	B3018015X1.5M	M4018015X1.5M	•	
15 x 2	B3018015X2M	M4018015X2M	•	
16 x 1	B3018016X1M	M4018016X1M	•	
16 x 1.5	B3018016X1.5M	M4018016X1.5M	•	
16 x 2	B3018016X2M	M4018016X2M	•	•
16 x 2.5	B3018016X2.5M	M4018016X2.5M	•	
18 x 1	B3018018X1M	M4018018X1M	•	
18 x 1.5	B3018018X1.5M	M4018018X1.5M	•	
18 x 2	B3018018X2M	M4018018X2M	•	
20 x 2	B3018020X2M	M4018020X2M	•	•
20 x 2.5	B3018020X2.5M	M4018020X2.5M	•	
20 x 3	B3018020X3M	M4018020X3M	•	
22 x 1.5	B3018022X1.5M	M4018022X1.5M	•	
22 x 2	B3018022X2M	M4018022X2M	•	
22 x 2.5	B3018022X2.5M	M4018022X2.5M	•	
22 x 3	B3018022X3M	M4018022X3M	•	
25 x 2	B3018025X2M	M4018025X2M	•	
25 x 2.5	B3018028X2.5M	M4018028X2.5M	•	
25 x 3	B3018030X2M	M4018030X2M	•	
25 x 3.5	B3018025X3.5M	M4018025X3.5M	•	
25 x 4	B3018025X4M	M4018025X4M		
28 x 2	B3018028X2M	M4018028X2M	•	
28 x 2.5	B3018028X2.5M	M4018028X2.5M	•	
30 x 2	B3018030X2M	M4018030X2M	•	
30 x 3	B3018030X3M	M4018030X3M	•	
30 x 3.5	B3018030X3.5M	M4018030X3.5M		
30 x 4	B3018030X4M	M4018030X4M		
32 x 3	B3018032X3M	M4018032X3M	•	
32 x 4	B3018032X4M	M4018032X4M		
35 x 3	B3018035X3M	M4018035X3M	•	
38 x 3	B3018038X3M	M4018038X3M		
38 x 4	B3018038X4M	M4018038X4M		
38 x 5	B3018038X5M	M4018038X5M		

Note: Use "-SS" suffix after part number for flanging tools for stainless steel tube. Contact the Tube Fittings Division for sizes and/or materials not listed, or for additional SS sizes released for limited use.

Table Q11 — Pin & Die Part Numbers for Metric Sizes

All tooling info also available on www.TFDTOOLSPEC.com

Dimensions and pressures for reference only, subject to change.

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Columbus, Ohio
http://www.parker.com/tfd

Manual Flaring Tool Vise Block and Flaring Pin — Metric Tube

These 37° flaring tools are designed for use in a vise when flaring metric tube from 6mm O.D. to 38mm O.D.

From 20mm size tube and upward it is necessary to use a pre-flaring pin to start the flare.

- **Clamp tube flush in black halves**
- **Flare tube by hammering the flaring pin.**

A separate block and pin set is used for each tube size.

Fig. Q62 — Vise Block

Pre-Flaring Pins

Tube O.D. (mm)	Part No.
20	P1E
25	P1E
30	P1E
32	P1E
38	P1E

Fig. Q63 — Pre-Flaring Pins

Flaring Pins

Tube O.D. (mm)	Part No.
6	P17408
8	P17408
10	P17408
12	P17414
14	P17414
15	P17414
16	P17414
18	P17418
20	P17418
25	P17422
30	P17432
32	P17432
38	P17438

Fig. Q64 — Flaring Pin

Vise Blocks

Tube O.D. (mm)	Part No.
6	M27406
8	M27408
10	M27410
12	M27412
14	M27414
15	M27415
16	M27416
18	M27418
20	M27420
25	M27425
30	M27430
32	M27432
38	M27438

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

Rolo-Flair®

Manual Rotary Flaring Tool

(For soft metal tube)

Precision burnished 37° and 45° flares in tube sizes from 2 (1/8" O.D.) to 12 (3/4" O.D.) with an easy turn of the handle. For use with copper and aluminum alloys. A depth gauge allows proper positioning of tube for consistent flaring.

HOW TO USE: Open die, insert tube up to the gauge and clamp the tube in the die. Turn drive handle clockwise to flare, then counterclockwise for retracting flaring cone. Open clamping die by loosening wing nut and remove flared tube.

Fig. Q65 — Rolo-Flair

Part Name	Part No.
Rolo-Flair for 37° flares (for 1/8", 3/16", 1/4", 5/16", 3/8", 1/2", 5/8", 3/4", O.D.)	**212FB**
Rolo-Flair for 45° flares (for 1/8", 3/16", 1/4", 5/16", 3/8", 1/2",5/8", 3/4", O.D.)	**945TH**

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

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Hydra-Tool

Hydraulic Flaring and Pre-Setting Tool

Flaring

An efficient dependable device for 37° and 45° flaring of steel, stainless steel and copper tube. This task is made easy through hydraulic power provided by a hand or electric pump. The equipment is portable and easy to use.

This tool accommodates dies for tubes ranging in inch sizes from 4 through 32 (1/4" through 2" outside diameters) with wall thicknesses as great as .134", and metric sizes from 6mm through 50mm. The hydraulic "push" of the Hydra-Tool flares the tube to a 37° flare angle. A gauge can be provided to enable the operator to determine the pressure required to adequately flare any given material and wall thickness of the tube. Complete instructions are included with the Hydra-Tool.

See bulletin 4390-B10, or view the instructional video online at discover.parker.com/TFDTubeFabEquipment.

See the following for Hydra-Tool basic unit or kit, and choice of power sources and necessary tooling.

NOTE: Flaring die sets and other tooling are available in non-standard sizes upon request from the factory.

See Triple-Lok area of Assembly Section for flaring pressures.

COMPONENTS REQUIRED

Part Name	Part No.
*Hydra-Tool (basic unit)	**710400B**
*Hydra-Tool Male Adapter	**6-8 F5OLO-S**
*"T" Adapter for Gauge	**6 R6LO-S**
*Hose Assembly (for hand or electric pumps)	**910004**
*Adapter for Gauge	**6 G6L-S**
*Pressure Gauge (0 - 10,000 psi)	**900044****
Electric Hydraulic Pump (10,000 psi; 1/2 hp; 40-125 volt)	**900085**
Hand Hydraulic Pump (10,000 psi; 2 speed)	**900086**
Die Ring (1/4" - 1 1/4") (6mm - 32mm)	**710416A**
Die Ring (1 1/2" - 2") (35mm - 50mm)	**710412**
37° Flaring Cone (1/4" - 1 1/4") (6mm - 32mm)	**710419**
37° Flaring Cone (1 1/2" - 2") (35mm - 50mm)	**710411**
Die Retainer Assembly (1/4" - 1 1/4") (6mm - 32mm)	**710424-1**
Die Retainer Assembly (1 1/2" - 2") (35mm - 50mm)	**710424-2**
Flaring Die Sets	See pages Q34 – Q35
45° Flaring Cone (1/4" - 1")	**910312**

*Included in Hydra-tool kit (Part 720370B-3)

STP Lubricant is the only lubricant recommended for use with Hydra-Tool.

Hydra-Tool Kit

Part Name	Part No.
Hydra-Tool Kit (for use with electric or hand pump) Includes basic unit, gauge adapter, Hydra-Tool connector, lubricant, "T" adapter, carrying case, hose assembly, pressure gauge, p/n 900044, and operation manual.	**720370B-3**

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Fig. Q66 — Hydra-Tool

Fig. Q67 — Electric Pum

Fig. Q68 — Hand Pump

Fig. Q69 — Flaring Cone

Fig. Q70 — Die Ring

Fig. Q71 — Die Retainer

Fig. Q72 — Hydra-Tool Kit

Dimensions and pressures for reference only, subject to change.

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Hydra-Tool 37° Flaring Die Sets for Steel – Inch

Fig. Q73 — Flaring Die Set

Size	Tube O.D. (in.)	Part No.
4	1/4	710417-4
5	5/16	710417-5
6	3/8	710417-6
8	1/2	710417-8
10	5/8	710417-10
12	3/4	710417-12
14	7/8	710417-14
16	1	710417-16
20	1 1/4	710417-20
24	1 1/2	710415-24
32	2	710415-32

Hydra-Tool 37° Flaring Die Sets for Stainless Steel – Inch

Size	Tube O.D. (in.)	Part No.
4	1/4	710417-4 SS
5	5/16	710417-5 SS*
6	3/8	710417-6 SS
8	1/2	710417-8 SS
10	5/8	710417-10 SS
12	3/4	710417-12 SS
14	7/8	710417-14 SS*
16	1	710417-16 SS
20	1 1/4	710417-20 SS
24	1 1/2	710415-24 SS
32	2	710415-32 SS

* Non-standard.

Hydra-Tool 37° Flaring Die Sets – Metric

Tube O.D./ Size (mm)	Part No.
6	770106-6
8	770106-8
10	770106-10
12	770106-12
14	770106-14
15	770106-15
16	770106-16
18	770106-18
20	770106-20
22	770106-22
25	770106-25
28	770106-28
30	770106-30
32	770106-32
35	770095-35
38	770095-38
42	770095-42
50	770095-50

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Hydra-Tool 45° Flaring Die Sets – Inch

Size	Tube O.D. (in.)	Part No.
4	1/4	**977420-4**
6	3/8	**977420-6**
8	1/2	**977420-8**
10	5/8	**977420-10**
12	3/4	**977420-12**
14	7/8	**977420-14**
16	1	**977420-16**

REPLACEMENT PART

Part Name	Part No.
Tube Stop Assembly	**710420B**

Fig. Q74 — Carrying Case

OPTIONAL ACCESSORIES

Part Name	Part No.
Hydra-Tool Carrying Case	**720377**

Sturdy wood case for Hydra-Tool and tooling.
(Hydra-Tool Kit is shipped in this carrying case.)

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Q

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

Karryflare Portable Flaring Machine

The Karryfare is a portable flaring machine that is designed for fabricating 37 degree tube flares. It's lightweight, portable, and is capable of flaring 1/4" through 1-1/2" (6mm-38mm) steel & stainless steel tubing. It's telescopic handle and wheeled carrying case allows it to be easily transported from one work site location to another.

Part Name	Part No.
Karry Flare	**KarryFlare**

Hydraulic power is generated by a hand operated pump. A pressure gauge is provided which enables the operator to review the necessary pressure requirements for proper flaring of their specific tubing requirements (operating pressures are specific to the tubes O.D. and wall thickness). The complete unit is mounted on a wheeled base plate, with telescopic handle, and includes 37° cone and case cover.

Dimensions: H – 10" W – 14" L – 30"

Application range

The Karryflare machine is capable of flaring tube from 1/4" O.D. to 1 1/2" O.D. or from 6mm O.D. to 38mm O.D.

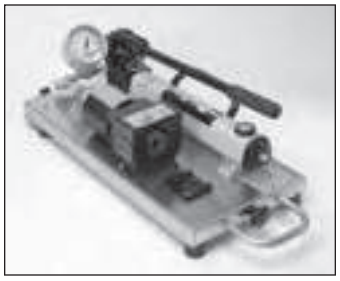

Fig. Q75 — KarryFlare

Fig. Q76— Flaring Die Set

FLARING COMPONENTS

Part Name	Part No.
Replacement 37° Flaring Cone	**Karryflare/FPIN**
37° Flaring Die Sets	See below

Tube Die Sets – Inch

Tube O.D. (in.)	Part No.
1/4	**M047415-1**
5/16	**M157408-1**
3/8	**M067415-1**
1/2	**M087415**
5/8	**M107415**
3/4	**M127415**
1	**M167415**
1 1/4	**M207415**
1 1/2	**M157438**

Tube Die Sets – Metric

Tube O.D. (mm)	Part No.
6	**M157406-1**
8	**M157408-1**
10	**M157410-1**
12	**M157412**
14	**M157414**
15	**M157415**
16	**M157416**
18	**M157418**
20	**M157420**
22	**M157422**
25	**M157425**
30	**M157430**
32	**M157432**
38	**M157438**

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Inch and Metric Flaring Tooling for 1025

Fig. Q77 — Parflange 1025

Parflange® 1025 37° Flaring and Flanging Systems

Parker's Parflange 1025 machine is designed to create 37° flared tube ends. For more detailed information on the machine and part numbers, refer to page Q23.

Tube Size O.D. x Wall Thickness (in.)	Tooling for 37°/74° Tube Flaring		Available Flaring Tooling
	Pin Part Number	Die Part Number	1025
1/4 x .020	B4004X020074	M4004074	•
1/4 x .028	B4004X028074	M4004074	•
1/4 x .035	B4004X035074	M4004074	•
1/4 x .049	B4004X049074	M4004074	•
1/4 x .065	B4004X065074	M4004074	•
3/8 x .020	B4006X020074	M4006074	•
3/8 x .028	B4006X028074	M4006074	•
3/8 x .035	B4006X035074	M4006074	•
3/8 x .049	B4006X049074	M4006074	•
3/8 x .065	B4006X065074	M4006074	•
1/2 x .028	B4008X028074	M4008074	•
1/2 x .035	B4008X035074	M4008074	•
1/2 x .049	B4008X049074	M4008074	•
1/2 x .065	B4008X065074	M4008074	•
1/2 x .083	B4008X083074	M4008074	•
5/8 x .035	B4010X035074	M4010074	•
5/8 x .049	B4010X049074	M4010074	•
5/8 x .065	B4010X065074	M4010074	•
5/8 x .083	B4010X083074	M4010074	•
5/8 x .095	B4010X095074	M4010074	•
3/4 x .035	B4012X035074	M4012074	•
3/4 x .049	B4012X049074	M4012074	•
3/4 x .065	B4012X065074	M4012074	•
3/4 x .083	B4012X083074	M4012074	•
3/4 x .095	B4012X095074	M4012074	•
3/4 x .109	B4012X109074	M4012074	•
1 x .035	B4016X035074	M4016074	•
1 x .049	B4016X049074	M4016074	•
1 x .065	B4016X065074	M4016074	•
1 x .083	B4016X083074	M4016074	•
1 x .095	B4016X095074	M4016074	•
1 x .109	B4016X109074	M4016074	•
1 x .120	B4016X120074	M4016074	•
1 1/4 x .049	B4020X049074	M4020074	•
1 1/4 x .065	B4020X065074	M4020074	•
1 1/4 x .083	B4020X083074	M4020074	•
1 1/4 x .095	B4020X095074	M4020074	•
1 1/4 x .109	B4020X109074	M4020074	•
1 1/4 x .120	B4020X120074	M4020074	•
1 1/2 x .065	B4024X065074	M4024074	•
1 1/2 x .083	B4024X083074	M4024074	•
1 1/2 x .095	B4024X095074	M4024074	•
1 1/2 x .109	B4024X109074	M4024074	•
1 1/2 x .120	B4024X120074	M4024074	•

Table Q12 — Parflange Flaring Tooling for Inch Sizes

Tooling suitable for 37°/74° flaring of steel, stainless steel, aluminum, monel, copper, and cupro-nickel tube materials. For 37°/74° flaring, one die covers each tube O.D.; a different pin is required for each tube wall. Setscrews in flaring dies may require slight adjustment for different tube materials and/or tube walls.

Tube Size O.D. x Wall Thickness (mm)	Tooling for 37°/74° Tube Flaring		Available Flaring Tooling
	Pin Part Number	Die Part Number	1025
6 x 1	B3007406X1M	M4007406M	•
6 x 1.5	B3007406X1.5M	M4007406M	•
8 x 1	B3007408X1M	M4007408M	•
8 x 1.5	B3007408X1.5M	M4007408M	•
10 x 1	B3007410X1M	M4007410M	•
10 x 1.5	B3007410X1.5M	M4007410M	•
12 x 1.5	B3007412X1.5M	M4007412M	•
12 x 2	B3007412X2M	M4007412M	•
15 x 1.5	B3007415X1.5M	M4007415M	•
15 x 2	B3007415X2M	M4007415M	•
16 x 1.5	B3007416X1.5M	M4007416M	•
16 x 2	B3007416X2M	M4007416M	•
18 x 2	B3007418X2M	M4007418M	•
20 x 2	B3007420X2M	M4007420M	•
20 x 2.5	B3007420X2.5M	M4007420M	•
25 x 2	B3007425X2M	M4007425M	•
25 x 2.5	B3007425X2.5M	M4007425M	•
25 x 3	B3007425X3M	M4007425M	•
30 x 2.5	B3007430X2.5M	M4007430M	•
30 x 3	B3007430X3M	M4007430M	•
32 x 3	B3007432X3M	M4007432M	•
38 x 3	B3007438X3M	M4007438M	•
38 x 4	B3007438X4M	M4007438M	

Table Q13 — Parflange Flaring Tooling for Metric Sizes

Tooling suitable for 37°/74° flaring of steel, stainless steel, aluminum, monel, copper, and cupro-nickel tube materials. Apply LB 2000 lube to flaring pin. Setscrews in flaring dies may require slight adjustment for different tube materials and/or tube walls.

Fig. Q78 — Flaring Pin

Fig. Q79 — Flaring Die

Dimensions and pressures for reference only, subject to change.

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Inch Flaring Tooling for ECO25

Parflange® ECO25 37° Flaring and Flanging Systems

Parker's Parflange ECO25 machine is designed to create 37° flared tube ends. For more detailed information on the machine and part numbers, refer to page Q25.

Fitting Dash Size	Tube O.D. (in.)	Die Set Part Number
4	1/4	M2504
6	3/8	M2506
8	1/2	M2508
10	5/8	M2510
12	3/4	M2512
16	1	M2516
20	1 1/4	M2520
24	1 1/2	M2524

Table Q14 — Flaring Die Set, Inch Sizes

Tube O.D. (in.)	Wall Thickness (in.)	Flaring Pin Part Number
1/4	0.028	B4004X028074
1/4	0.035	B4004X035074
1/4	0.049	B4004X049074
1/4	0.065	B4004X065074
3/8	0.020	B4006X020074
3/8	0.028	B4006X028074
3/8	0.035	B4006X035074
3/8	0.049	B4006X049074
3/8	0.065	B4006X065074
1/2	0.028	B4008X028074
1/2	0.035	B4008X035074
1/2	0.049	B4008X049074
1/2	0.065	B4008X065074
1/2	0.083	B4008X083074
5/8	0.035	B4010X035074
5/8	0.049	B4010X049074
5/8	0.065	B4010X065074
5/8	0.083	B4010X083074
5/8	0.095	B4010X095074
3/4	0.035	B4012X035074
3/4	0.049	B4012X049074
3/4	0.065	B4012X065074
3/4	0.083	B4012X083074
3/4	0.095	B4012X095074
3/4	0.109	B4012X109074
1	0.035	B4016X035074
1	0.049	B4016X049074
1	0.065	B4016X065074
1	0.083	B4016X083074
1	0.095	B4016X095074
1	0.109	B4016X109074
1	0.120	B4016X120074
1 1/4	0.049	B4020X049074
1 1/4	0.065	B4020X065074
1 1/4	0.095	B4020X095074
1 1/4	0.109	B4020X109074
1 1/4	0.120	B4020X120074
1 1/2	0.065	B4024X065074
1 1/2	0.083	B4024X083074
1 1/2	0.095	B4024X095074
1 1/2	0.109	B4024X109074
1 1/2	0.120	B4024X120074

Table Q15 — Flaring Pin, Inch Sizes

Fig. Q80 — Parflange ECO25

Fig. Q81 — Flaring Pin

Fig. Q82 — Dual Function Die Set (Flaring and Flanging)

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SAE Straight Thread Port Tapping Tools*

Taps are available for SAE J1926-1 female straight thread ports in sizes 2 through 32. Taps are bottoming type and made from high speed tool steel.

Fig. Q83 — SAE Straight Thread Port Tapping Tool

SAE Dash Size	Overall Length (in.)	Shank Dia. (in.)	Wrench Flat Size (in.)	Part No.
2	2 23/32	0.318	0.238	**5/16X24 UNF-2B**
3	2 15/16	0.381	0.286	**3/8X24 UNF-2B**
4	3 5/16	0.323	0.242	**7/16X20 UNF-2B**
5	3 3/8	0.367	0.275	**1/2X20 UNF-2B**
6	3 19/32	0.429	0.322	**9/16X18 UNF-2B**
8	4 1/4	0.590	0.442	**3/4X16 UNF-2B**
10	4 11/16	0.697	0.523	**7/8X14 UNF-2B**
12	5 1/8	0.896	0.672	**1 1/16X12 UNF-2B**
14	5 7/16	1.021	0.766	**1 3/16X12 UNF-2B**
16	5 3/4	1.108	0.831	**1 5/16X12 UNF-2B**
20	6 11/16	1.305	0.979	**1 5/8X12 UNF-2B**
24	7 5/16	1.519	1.139	**1 7/8X12 UNF-2B**
32	8 3/4	2.100	1.575	**2 1/2X12 UNF-2B**

SAE Straight Thread Port Counterboring Tools*

Parker offers counterboring tools for SAE J1926-1 female straight thread ports in sizes 2 through 32. Counterbores are 4-fluted high speed tool steel.

Fig. Q84 — SAE Straight Thread Port Counterboring Tool

SAE Dash Size	Shank Dia. (in.)	Shank Length (in.)	Overall Length (in.)	Recommended Pilot Drill or Bore Size (in.)	Part No.
2	1/2	1 1/2	2 1/2	0.266	**Y-34730**
3	1/2	1 1/2	2 1/2	0.328	**Y-34731**
4	1/2	1 1/2	2 41/64	0.377	**Y-34732**
5	1/2	1 1/2	2 41/64	0.438	**Y-34733**
6	3/4	1 1/2	2 47/64	0.500	**Y-34734**
8	3/4	1 1/2	2 53/64	0.672	**Y-34735**
10	1	2	3 29/64	0.797	**Y-34736**
12	1	2	3 19/32	0.969	**Y-34737**
14	1	2	3 41/64	1.095	**Y-34738**
16	1	2	3 41/64	1.220	**Y-34739**
20	1 1/2	2	3 37/64	1.530	**Y-34740**
24	1 1/2	2	3 37/64	1.780	**Y-34741**
32	1 1/2	2	3 49/64	2.405	**Y-34743**

*** See General Technical for recommended use of port tools.**

Dimensions and pressures for reference only, subject to change.

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BSPP Straight Thread Port Counterboring Tools*

Parker offers counterboring/spotfacing tools for DIN 3852-2 female straight thread port connections in sizes 1/8" through 1-1/2". Counterbores are carbide tipped.

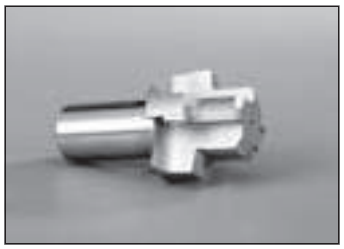

Fig. Q85 — BSPP Straight Thread Port Counterboring Tool

SAE Dash Size	Overall Length (in.)	Shank Dia. (in.)	Wrench Flat Size (in.)	Part No.
2	2 23/32	0.318	0.238	**5/16X24 UNF-2B**
3	2 15/16	0.381	0.286	**3/8X24 UNF-2B**
4	3 5/16	0.323	0.242	**7/16X20 UNF-2B**
5	3 3/8	0.367	0.275	**1/2X20 UNF-2B**
6	3 19/32	0.429	0.322	**9/16X18 UNF-2B**
8	4 1/4	0.590	0.442	**3/4X16 UNF-2B**
10	4 11/16	0.697	0.523	**7/8X14 UNF-2B**
12	5 1/8	0.896	0.672	**1 1/16X12 UNF-2B**
14	5 7/16	1.021	0.766	**1 3/16X12 UNF-2B**
16	5 3/4	1.108	0.831	**1 5/16X12 UNF-2B**
20	6 11/16	1.305	0.979	**1 5/8X12 UNF-2B**
24	7 5/16	1.519	1.139	**1 7/8X12 UNF-2B**
32	8 3/4	2.100	1.575	**2 1/2X12 UNF-2B**

BSPP Straight Thread Tapping Tools*

BSPP taps are available for ISO 228-1 threaded connections in sizes 1/8" through 1 1/2". All taps are bottoming type manufactured from high speed steel.

Fig. Q86 — BSPP Straight Thread Tapping Tool

	Shank Dia. (in.)	Shank Length (in.)	Overall Length (in.)	Recommended Pilot Drill or Bore Size (in.)	Part No.
G1/8	1/2	1 1/2	2 1/2	0.332	**974094-G1/8**
G1/4	1/2	1 1/2	2 1/2	0.438	**974094-G1/4**
G3/8	3/4	1 1/2	2 1/2	0.578	**974094-G3/8**
G1/2	3/4	2	3	0.728	**974094-G1/2**
G3/4	1	2	3	0.938	**974094-G3/4**
G1	1	2	3 1/2	1.181	**974094-G1**
G1-1/4	1 1/2	2	3 1/2	1.531	**974094-G1-1/4**
G1-1/2	1 1/2	2	3 1/2	1.750	**974094-G1-1/2**

BSPT Taper Pipe Thread Tapping Tools*

BSPT taps are available for ISO 7-1 taper thread connections in sizes 1/8" through 1 1/2". All taps are bottoming type manufactured from high speed steel.

Fig. Q87 — BSPT Taper Pipe Thread Tapping Tool

Size	Shank Dia. (in.)	Overall Length (in.)	Thread Size	Part No.
R1/8	0.438	2 1/8	1/8-28	**974243-R1/8**
R1/4	0.563	2 7/16	1/4-19	**974243-R1/4**
R3/8	0.700	2 9/16	3/8-19	**974243-R3/8**
R1/2	0.688	3 1/8	1/2-14	**974243-R1/2**
R3/4	0.906	3 1/4	3/4-14	**974243-R3/4**
R1	1.125	3 3/4	1-11	**974243-R1**
R1-1/4	1.313	4	1 1/4-11	**974243-R1-1/4**
R1-1/2	1.500	4 1/4	1 1/2-11	**974243-R1-1/2**

*** See General Technical for recommended use of port tools.**

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NPTF Thread Tapping Tools*

NPTF taps are available for taper pipe thread connections in sizes 1/8" through 1 1/2". All taps are bottoming type manufactured from high speed steel.

Fig. Q88 — NPTF Port Tap

Shank Dia. (in.)	Overall Length (in.)	Thread Size	Part No.
0.438	2 1/8	1/8-27	**974244-1/8**
0.563	2 7/16	1/4-18	**974244-1/4**
0.700	2 9/16	3/8-18	**974244-3/8**
0.688	3 1/8	1/2-14	**974244-1/2**
0.906	3 1/4	3/4-14	**974244-3/4**
1.125	3 3/4	1-11 1/2	**974244-1**
1.313	4	1 1/4-11 1/2	**974244-1-1/4**
1.500	4 1/4	1 1/2-11 1/2	**974244-1-1/2**

ISO 6149-1 Straight Thread Port Tapping Tools*

ISO 6149-1 female straight thread port taps are available for M8 to M48 port sizes. Taps are bottoming type and made from high speed steel.

Fig. Q89 — ISO 6149-1 Straight Thread Port Tap

Overall Length (in.)	Shank Dia. (in.)	Wrench Flat Size (in.)	Thread Size	Part No.
2 23/32	0.318	0.238	M8x1	**M8X1 D5 2FL**
2 15/16	0.381	0.286	M10x1	**M10X1-6H**
3 3/8	0.367	0.275	M12x1.5	**M12X1.5-6H TAP**
3 19/32	0.429	0.322	M14x1.5	**M14X1.5-6H-TAP**
3 13/16	0.400	0.360	M16x1.5	**M16X1.5-6H-TAP**
4 1/32	0.542	0.406	M18x1.5	**M18X1.5-6H-TAP**
4 11/16	0.697	0.523	M22x1.5	**M22X1.5-6H-TAP**
5 1/8	0.896	0.672	M27x2	**M27X2-6H-TAP**
5 3/4	1.108	0.831	M33x2	**M33X2-6H-TAP**
7	1.430	1.072	M42x2	**M42X2-6H-TAP**
7 5/8	1.644	1.233	M48x2	**M48X2-6H-TAP**

*** See General Technical for recommended use of port tools.**

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ISO 6149-1 Straight Thread Port Counterboring Tools — Small Spotface*

ISO 6149-1 female straight thread port counterboring tools are available with small spotface for M8 to M48 port sizes. Counterbores are 4-fluted*, carbide-tipped.

Fig. Q90 — ISO 6149-1 Straight Thread Port Counterboring Tool — Small Spotface

Shank Dia. (in.)	Shank Length (in.)	Overall Length (in.)	Recommended Pilot Drill or Bore Size (in.)	Use with Thread Size	Part No.
1/2	2	4 1/8	0.272	M8x1*	**R1449B**
1/2	2	4 1/8	0.348	M10x1*	**R1450B**
1/2	2	4 1/8	0.406	M12x1.5	**R 1451B-S**
1/2	2	4 1/8	0.484	M14x1.5	**R 1452B-S**
1/2	2	4 1/8	0.563	M16x1.5	**R 1453B-S**
1/2	2	4 1/8	0.641	M18x1.5	**R 1454B-S**
1/2	2	4 1/8	0.797	M22x1.5	**R 1455B-S**
3/4	2 1/2	5	0.969	M27x2	**R 1456B-S**
3/4	2 1/2	5	1.210	M33x2	**R 1457B-S**
3/4	2 1/2	5	1.565	M42x2	**R 1458B-S**
3/4	2 1/2	5	1.801	M48x2	**R1459B**

* M8 and M10 are 3-fluted

ISO 6149-1 Straight Thread Port Counterboring Tools with ID Groove*

ISO 6149-1 female straight thread port counterboring tools are available with identification groove for M8 to M48 port sizes. Counterbores are 4-fluted*, carbide-tipped.

Fig. Q91 — ISO 6149-1 Straight Thread Port Counterboring Tool with ID Groove

Shank Dia. (in.)	Shank Length (in.)	Overall Length (in.)	Recommended Pilot Drill or Bore Size (in.)	Use with Thread Size	Part No.
1/2	2	4 1/8	0.348	M10x1*	**R1450A**
1/2	2	4 1/8	0.406	M12x1.5	**R1451A**
1/2	2	4 1/8	0.484	M14x1.5	**R1452A**
1/2	2	4 1/8	0.563	M16x1.5	**R1453A**
1/2	2	4 1/8	0.641	M18x1.5	**R1454A**
1/2	2	4 1/8	0.797	M22x1.5	**R1455A**
3/4	2 1/2	5	0.969	M27x2	**R1456A**
3/4	2 1/2	5	1.210	M33x2	**R1457A**

* M10 are 3-fluted

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

*** See General Technical for recommended use of port tools.**

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Tube Fittings Division
Columbus, Ohio
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Ferulset® Pre-Setting Tool

For Ferulok® flareless tube fittings.

Ferulset provides a fast and easy way to manually pre-set the ferrule onto steel and stainless steel tube with the famous Ferulok "bite." Ferulset bodies are manufactured from hardened steel for withstanding repeated pre-sets. A separate tool is required for each size tube; size 2 (1/8" O.D.) through size 32 (2" O.D.).

Fig. Q92 — Ferulset®

HOW TO USE: Lubricate threads on tool, threads on nut, as well as tail and lead ends of ferrule with a suitable lubricant such as STP. Insert tube end with ferrule into tool until it bottoms against shoulder and thread the nut down until finger tight. Light wrenching may be required to get to a consistent starting position, especially with larger sizes. Hold tube steady against internal shoulder and tighten nut 1-3/4 turns. Loosen nut and inspect bite using inspection criteria outlined for Ferulok in the Assembly / Installation section.

Size	Tube O.D. (in.)	Part No.
2	1/8	**560576**
3	3/16	**560577**
4	1/4	**560578**
5	5/16	**560579**
6	3/8	**560580**
8	1/2	**560581**
10	5/8	**560582**
12	3/4	**560583**
14	7/8	**560584**
16	1	**560585**
20	1 1/4	**560586**
24	1 1/2	**560587**
32	2	**560589**

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VOMO Pre-Assembly Bodies

For EO and EO-2 Flareless Metric Tube Fittings

VOMO tools are made of hardened tool-steel, for standard assembly of steel fittings, stainless steel fittings and hose standpipes (BE).

Refer to the EO/EO2 Assembly and Installation section for use information (page R35).

NOTE: It is strongly recommended that a hydraulic tool be used to preset EO and EO-2 fittings in sizes 30S, 35L, 38S and 42L.

Fig. Q93 — VOMO Pre-Assembly Tool

Series	Tube O.D. (mm)	Part No.
LL	4	**VOMO04LLX**
LL	6	**VOMO06LLX**
LL	8	**VOMO08LLX**
LL	10	**VOMO10LLX**
LL	12	**VOMO12LLX**
L	6	**VOMO06LX**
L	8	**VOMO08LX**
L	10	**VOMO10LX**
L	12	**VOMO12LX**
L	15	**VOMO15LX**
L	18	**VOMO18LX**
L	22	**VOMO22LX**
L	28	**VOMO28LX**
L	35	**VOMO35LX**
L	42	**VOMO42LX**
S	6	**VOMO06SX**
S	8	**VOMO08SX**
S	10	**VOMO10SX**
S	12	**VOMO12SX**
S	14	**VOMO14SX**
S	16	**VOMO16SX**
S	20	**VOMO20SX**
S	25	**VOMO25SX**
S	30	**VOMO30SX**
S	38	**VOMO38SX**

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Hyferset

Parker Hydraulic Ferrule Pre-Setting Tool for Ferulok® Fittings and EO/EO-2 Metric Fittings

PORTABLE...EFFICIENT...EASY TO USE

The Hyferset is an efficient, dependable device for pre-setting Parker ferrules on tube of steel and stainless steel. This task is made easy through hydraulic power provided by a hand or electric pump. The equipment is portable, and has an optional sturdy wood carrying case.

In hydraulic pre-setting, little physical strength is required by the operator to set ferrules properly. Although the amount of force needed increases as the ferrule size increases, the pressure can be easily achieved.

This tool accommodates pre-setting dies for tubes ranging in size from 4 through 32 (1/4" through 2" outside diameter) and 6mm to 28mm O.D. metric sizes. The tube, with tube nut and ferrule, is positioned in the die. The hydraulic "push" of the Hyferset pre-sets the ferrule onto the tube — producing a visible ridge of metal, in front of the sleeve bite edge, that can be easily inspected.

Positive Stop Body Dies (For Ferulok Fittings Only)

The positive stop body die design eliminates the need for predetermined relief valve settings, pressure gauges or chart reading. Positive stop feature allows for uniform assemblies to be made on tube from 1/4" thru 2". One set of dies can be used on both steel and stainless steel tube. When used in conjunction with the Ferulok visible bite ferrules, the entire system is the most reliable method available for assembling a fitting to a piece of tube.

See Assembly for pre-setting pressures for EO and EO-2 steel fittings.

You will find instructions for proper use in the 4393-B1 user manual.

Instructional video is available at discover.parker.com/TFDTubeFabEquipment.

Fig. Q94 — Hyferset

Fig. Q95 — Electric Pump

Fig. Q96 — Hand Pump

COMPONENTS REQUIRED

Part Name	Part No.
*Hyferset (basic unit, no accessories)	**611011A**
*Hyferset Adapter	**6 FLO-S**
Gauge "T" Adapter	**6 R6LO-S**
*Hose Assembly	**910004**
Gauge Swivel Adapter	**6 G6L-S**
Pressure Gauge (0 - 10,000 psi)	**900044**
*Hand pump (10,000 psi, 2 speed)	**900086**
Electric pump (10,000 psi, 1/2 HP, 40-125 volt)	**900085**
Nut die set (1/4" to 2" O.D.)	See page Q46
Positive Stop body die (1/4" to 2" O.D.)	See page Q46
Nut Die Set (6mm to 28mm)	See page Q47
Body Die (6mm to 28mm)	See page Q47

* Included in Hyferset Kit

Part Name	Part No.
Hyferset Kit Includes basic unit, hand hydraulic pump, hose assembly, 1 adapter (6 FLO-S), wooden carrying case, and operation manual.	**611049C**

Fig. Q97 — Hyferset Kit

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

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OPTIONAL ACCESSORIES

Part Name	Part No.
Wooden carrying case	651085

Fig. Q98 — Hyferset Wood Carrying Case

Hyferset Body Dies for Ferulok Fittings

Size	Tube O.D. (in.)	Part No.
4	1/4	720105-4
6	3/8	720105-6
8	1/2	720105-8
10	5/8	720105-10
12	3/4	720105-12
14	7/8	720105-14
16	1	720105-16
20	1 1/4	720105-20
24	1 1/2	720105-24
32	2	720105-32

Fig. Q99 — Body Die

Hyferset Nut Dies for Ferulok Fittings

Size	Tube O.D. (in.)	Part No.
4	1/4	680370-4
6	3/8	680370-6
8	1/2	680370-8
10	5/8	680370-10
12	3/4	680370-12
14	7/8	680370-14
16	1	680370-16
20	1 1/4	680370-20
24	1 1/2	680370-24
32	2	680370-32

Fig. Q100 — Nut Die

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Hyferset Body Dies for EO / EO-2 Fittings

Series	Tube O.D. Size (mm)	Part No.
L	6	910290-6L
L	8	910290-8L
L	10	910290-10L
L	12	910290-12L
L	15	910290-15L
L	18	910290-18L
L	22	910290-22L
L	28	910290-28L
S	6	910289-6S
S	8	910289-8S
S	10	910289-10S
S	12	910289-12S
S	14	910289-14S
S	16	910289-16S
S	20	910289-20S
S	25	910289-25S

Fig. Q101 — Body Die

Hyferset Nut Dies for EO / EO-2 Fittings

Tube O.D. Size (mm)	Part No.
6	910291-6 mm
8	910291-8 mm
10	910291-10 mm
12	910291-12 mm
14	910291-14 mm
15	910291-15 mm
16	910291-16 mm
18	910291-18 mm
20	910291-20 mm
22	910291-22 mm
25	910291-25 mm
28	910291-28 mm

Fig. Q102 — Nut Die

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Hydra-Tool

Pre-Setting Components

COMPONENTS REQUIRED

Part Name	Part No.
*Hydra-Tool (basic unit) (Fig. Q102)	**710400B**
Hand pump (10,000 psi, 2 speed)	**900086**
Electric pump (10,000 PSI, 1/2 HP, 40-125 volt)	**900085**
*Hose Assembly	**910004**
Back-up Plate (sizes -4 to -32 and 6mm to 28mm)	**770102**
Back-up Plate (sizes 30 to 42mm)	See page Q49
Ram Insert (sizes -4 to -32)	**770101**
Small Ram Insert (EO & EO-2 only)	**971108**
Large Piston Stop Adapter (EO & EO-2 only)	**971107**
Nut die set (1/4" to 2" O.D.)	See below
Positive Stop body die (1/4" to 2" O.D.)	See below
Nut Die Set (6mm to 42mm)	See page Q49
Body Die (6mm to 42mm)	See page Q49
*Pressure Gauge (0 - 10,000 psi)	**900044****
*Male Adapter	**6-8 F5OLO-S**
*Adapter	**6 G6L-S**
*Hydra-Tool Gauge Adapter	**6 R6LO-S**

* Included in Kit

STP lubricant is the only lubricant recommended for use with the Hydra-Tool.

See Assembly for pre-setting pressures.

Instructional video is available at discover.parker.com/TFDTubeFabEquipment.

See the Hydra-Tool 4392-B10 manual.

Hydra-Tool Kit

Part Name	Part No.
Hydra-Tool Kit (for use with electric or hand pump)	**720370B-3**
Includes basic unit, gauge adapter, Hydra-Tool connector, lubricant, "T" adapter, carrying case, hose assembly, pressure gauge, p/n 900044, and operation manual.	

Hydra-Tool Body Dies for Ferulok Fittings

Size	Tube O.D. (in.)	Part No.
4	1/4	**720105-4**
6	3/8	**720105-6**
8	1/2	**720105-8**
10	5/8	**720105-10**
12	3/4	**720105-12**
14	7/8	**720105-14**
16	1	**720105-16**
20	1 1/4	**720105-20**
24	1 1/2	**720105-24**
32	2	**720105-32**

Hydra-Tool Nut Dies for Ferulok Fittings

Size	Tube O.D. (in.)	Part No.
4	1/4	**680370-4**
6	3/8	**680370-6**
8	1/2	**680370-8**
10	5/8	**680370-10**
12	3/4	**680370-12**
14	7/8	**680370-14**
16	1	**680370-16**
20	1 1/4	**680370-20**
24	1 1/2	**680370-24**
32	2	**680370-32**

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Fig. Q103 — Hydra Tool

Fig. Q104 — Ram Insert (Ferulok Only)

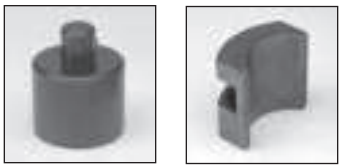

Fig. Q105 — Small Ram Insert and Stop Adapter (EO and EO-2 only)

Fig. Q106 — Hydra-Tool Kit

Fig. Q107 — Body Die

Fig. Q108 — Nut Die

Dimensions and pressures for reference only, subject to change.

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Series	Tube O.D. Size (mm)	Part No.
L	6	910290-6L
L	8	910290-8L
L	10	910290-10L
L	12	910290-12L
L	15	910290-15L
L	18	910290-18L
L	22	910290-22L
L	28	910290-28L
L	35	910290-35L
L	42	910290-42L
S	6	910289-6S
S	8	910289-8S
S	10	910289-10S
S	12	910289-12S
S	14	910289-14S
S	16	910289-16S
S	20	910289-20S
S	25	910289-25S
S	30	910289-30S
S	38	910289-38S

Fig. Q109 — Body Die

Fig. Q110 — Back up Plate

Hydra-Tool Nut Die / Split Back-up Plate Sets for EO / EO-2 Fittings

Tube O.D. Size (mm)	Part No.
6	910291-6 mm
8	910291-8 mm
10	910291-10 mm
12	910291-12 mm
14	910291-14 mm
15	910291-15 mm
16	910291-16 mm
18	910291-18 mm
20	910291-20 mm
22	910291-22 mm
25	910291-25 mm
28	910291-28 mm
30	970135-30 mm
35	970135-35 mm
38	970135-38 mm
42	970135-42 mm

Fig. Q111 — Split Nut Dies

Fig. Q112 — Nut Die

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EO-Karrymat

The EO-Karrymat is a dependable device for safe and efficient bite-type pre-setting. It allows pre-assembly of all sizes of EO, EO-2 and Ferulok fittings without the need for electric power.

The EO-Karrymat consists of a hydraulic drive, Handpump and pressure gauge, all firmly attached to a carrying case.

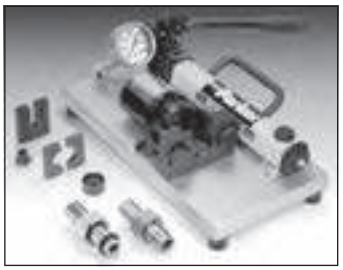

Fig. Q113 — EO-Karrymat

Part Name	Part No.
EO-Karrymat	**EOKarrymat**

EO-Karrymat Body Dies for EO / EO-2 Fittings

Series	Tube O.D. (mm)	Part No.
LL	4	**MOK04LLX**
LL	6	**MOK06LLX**
LL	8	**MOK08LLX**
LL	10	**MOK10LLX**
LL	12	**MOK12LLX**
L	6	**MOK06LX**
L	8	**MOK08LX**
L	10	**MOK10LX**
L	12	**MOK12LX**
L	15	**MOK15LX**
L	18	**MOK18LX**
L	22	**MOK22LX**
L	28	**MOK28LX**
L	35	**MOK35LX**
L	42	**MOK42LX**
S	6	**MOK06SX**
S	8	**MOK08SX**
S	10	**MOK10SX**
S	12	**MOK12SX**
S	14	**MOK14SX**
S	16	**MOK16SX**
S	20	**MOK20SX**
S	25	**MOK25SX**
S	30	**MOK30SX**
S	38	**MOK38SX**

Fig. Q114 — MOK Body Die

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EO-Karrymat Nut Dies for EO / EO-2 Fittings

Series	Tube O.D. (mm)	Part No.
LL	4	GHP04X
LL	6	GHP06X*
LL	8	GHP08X*
LL	10	GHP10X*
LL	12	GHP12X*
L	6	GHP06X*
L	8	GHP08X*
L	10	GHP10X*
L	12	GHP12X*
L	15	GHP15X
L	18	GHP18X
L	22	GHP22X
L	28	GHP28X
L	35	GHP35X
L	42	GHP42X
S	6	GHP06X*
S	8	GHP08X*
S	10	GHP10X*
S	12	GHP12X*
S	14	GHP14X
S	16	GHP16X
S	20	GHP20X
S	25	GHP25X
S	30	GHP30X
S	38	GHP38X

* Nut Dies for 6-12mm are identical in LL, L and S series.

Fig. Q115 — GHP Nut Die

EO-Karrymat Body Dies for Ferulok Fittings

Tube Size (in.)	Part No.
1/4	976521-4
3/8	976521-6
1/2	976521-8
5/8	976521-10
3/4	976521-12
7/8	976521-14
1	976521-16
1 1/4	976521-20
1 1/2	976521-24
2	976521-32

Fig. Q116 — EO-Karrymat Body Die for Ferulok

EO-Karrymat Back-up Plates for Ferulok Fittings

Tube Size (in.)	Part No.
1/4	975867-4
3/8	975867-6
1/2	975867-8
5/8	975867-10
3/4	975867-12
7/8	975867-14
1	975867-16
1 1/4	975867-20
1 1/2	975867-24
2	975867-32

Fig. Q117 — EO-Karrymat Back-up Plates for Ferulok

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O-Ring Pick

Plastic O-ring pick allows for easy removal of O-rings without causing damage to the fitting.

Part Name	Part No.
O-Ring Pick	**O-Ring Pick**

Fig. Q118— O-Ring Pick

Captive O-Ring Assembly Tool

The captive O-ring (CORG) assembly tool utilizes a Parker patented method for inserting O-rings in ORFS fittings, such as Seal-Lok, without causing O-ring damage. These tools can be used both as a hand tool and a bench-mounted tool. All CORG tools have a #8-32 tapped hole to allow easy mounting.

Fitting Size	L (in.)	D1 (in.)	D2 (in.)	O-Ring Size	Part No.
-4	1.4	0.8	0.6	2-011	**CORG-4**
-6	1.5	0.9	0.6	2-012	**CORG-6**
-8	1.5	1.1	0.8	2-014	**CORG-8**
-10	1.6	1.3	0.9	2-016	**CORG-10**
-12	1.9	1.4	1.1	2-018	**CORG-12**
-16	1.9	1.7	1.3	2-021	**CORG-16**
-20	2.1	1.9	1.6	2-025	**CORG-20**
-24	2.1	2.3	1.9	2-029	**CORG-24**
-32	2.2	2.8	2.4	2-135	**CORG-32**

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Fig. Q119 — Captive O-Ring Assembly Tool

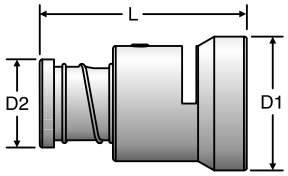

Fig. Q120 — Captive O-Ring Assembly Tool dimensions

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Braze Flux

Black braze flux can be used for brazing either steel or stainless steel components. When applied liberally this flux helps the flow of the silver braze alloy and prevents oxidation.

Part Name	Part No.
Black Flux	**Black Flux 1/2 lb**
Black Flux	**Black Flux 1 lb**

Fig. Q121 — Braze Flux

Post Braze Cleaner

This cleaner is used to clean the assembly after brazing. Once the silver braze alloy has solidified, immediately immerse the joint into the braze cleaner solution. The cleaner combined with the sudden change in temperature removes the flux from the assembly. Braze cleaner does not provide corrosion protection. See "Corrosion Protection After Brazing" in the Assembly / Installation section, page R17.

Available in sizes 2 1/2 lb. and 5 lb. jars. When ordering simply denote quantity after Braze Cleaner.

Part Name	Part No.
Braze Cleaner	**Braze Cleaner 2 1/2 lb**
Braze Cleaner	**Braze Cleaner 5 lb**

Fig. Q122 — Post Braze Cleaner

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Lubricants

Lubricants act as friction reducers to ease forming processes, fitting assembly and prevent galling, corrosion and seizing of components. The use of the correct lubricant for various purposes is critical to achieve maximum tool life during forming processes and performance of threaded connections.

Parflange® Lubricants

Lubricants are used to maximize tool life during the flanging process. Selection of the appropriate lubricant for the type of Parflange machine is critical to its proper operation.

Part Description	Part No.
Recommended for use with steel or stainless steel	**LB 2000** (8 oz.)

Fig. Q123 — Parflange Lubricant, LB 2000

EO / EO-2 Fitting Lubricants

EO Niromont lubricants are specifically developed for lubrication of threads prior to assembly of EO and EO-2 fittings.

Part Description	Part No.
EO Niromont – Liquid 250cc bottle	**Niromont Liquid**
EO Niromont – Paste 130 g. tin	**Niromont Paste**

Fig. Q124 — EO Niromont

O-Ring Lubricants

Parker O-Lube

O-Lube is an outstanding general-purpose grease intended for use with O-rings and other seals in hydraulic and pneumatic systems. The temperature range is from -29°C to +82°C (-20°F to +180°F).

Part Description	Part No.
O-ring Lubricant 2 oz.	**OLUBE-884-2-TFD**

Fig. Q125 — Parker O-Lube

Parker Super O-Lube

Super O-Lube is an all-purpose O-ring lubricant. It is not a grease, but rather a high-viscosity silicone oil. The temperature range is -54°C to +204°C (-65°F to +400°F).

Part Description	Part No.
O-ring Lubricant	**SLUBE-884-2-TFD**

Fig. Q126 — Parker Super O-Lube

Dimensions and pressures for reference only, subject to change.

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Thread Sealants

Thread sealants seal and secure metal pipes and fittings by filling the space between the threaded metal parts. Thread sealants harden to prevent leakage caused by vibration loosening, solvent evaporation, damaged threads and temperature cycling. Designed for low and high pressure applications, thread sealants seal quickly for on-line low pressure testing. When fully cured, they seal to the burst strength of most systems. Thread sealants are easily remove with basic hand tools. Thread sealants can be used on pipe thread fittings.

Threadmate™ Sealant/Lubricant

Threadmate™ is an extreme-duty lubricant developed to reduce galling during the assembly of pipe thread fittings. Threadmate™ promotes reliable sealing of pipe threads, even at high pressure. Recommended for use on stainless steel pipe threads.

Size available	**Part No.**
4 oz. tube	**MTM04T-TFD**

Fig. Q127 — Threadmate Sealant/Lubricant

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Click here for Support Resources or to Configure Parts Online

Tube Preparation Centers

Parker offers five different styles of tube preparation centers to meet various user's needs, from the basic TP-1 unit which includes a cabinet and deburr unit, to the TP1025 which offers the ability to cut, deburr, Parflange and flare tube.

Utilizing a sturdy steel cabinet with bins for fitting storage, tooling shelves and heavy duty casters to ease mobility, Parker Tube Preparation Centers cover almost every tube preparation need. All machines require 110V, 20A power supply.

Fig. Q128 — Tube Preparation Center TP1025

Part Description	Part No.
Tube Prep Center with Deburr Unit	**TP-1**
Tube Prep Center with Deburr and Saw	**TP-974250**
Tube Prep Center with Deburr, Saw and Hydratool	**TP432**
Tube Prep Center with Deburr, Saw and Hyferset	**TP-611011A**
Tube Prep Center with Deburr, Saw and Karryflare Tool	**TP-Karryflare**
Tube Prep Center with Deburr, Saw and 1025 Parflange	**TP1025**

Replacement Parts	Part No.
I.D. Deburr Cone	**971816**
O.D. Deburr Blades (set of 6)	**910485**
Cutting Lubricant	**Saw Lube**
Saw Blade – 250 mm x 2.0 mm thick (all purpose)	**987036**
Saw Blade – 200 mm x 2.0 mm thick (all purpose)	**987037**
Flaring tooling for TP432	See page Q33 – Q35
Presetting tooling for TP432 and TP-611011A	See page Q45 – Q47
Karryflare Flaring tooling	See page Q36
Flanging tooling for TP1025	See page Q24
Flaring tooling for TP1025	See page Q37
Lubricant for TP1025	**LB 2000**

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

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Thread Identification Kit

The Thread Identification Kit can be used to identify metric, BSP, SAE and NPT threads, as well as SAE flanges. It con-tains thread gauges, calipers, thread profiles, and an instruction booklet that details most thread forms and connection styles found in fluidpower systems worldwide.

Part Name	Part No.
Thread Identification Kit	**MIK-1**

WARNING: This product can expose you to chemicals including Diisononyl Phthalate which is known to the State of California to cause cancer. For more information go to www.p65warnings.ca.gov.

Fig. Q129 — Thread Identification Kit

Need help identifying threads?
See our article: Four Easy Steps to Identify Hydraulic Threads.
http://blog.parker.com/four-easy-steps-to-identify-hydraulic-threads

Portboards

The Portboards can be used for identification of ISO, SAE, BSP and NPT ports and port threads. They are machined with female threads for quick and easy identification by screwing in the male port end.

Portboard A (SAE Straight Thread -2 through -32 and NPT 1/8 through 1 1/2).

Part Name	Part No.
Portboard A	**Portboard A**

Fig. Q130 — Portboard A

Portboard B (Metric 8mm through 48mm and BSP 1/8 through 1 1/2).

Part Name	Part No.
Portboard B	**Portboard B**

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Fig. Q131 — Portboard B

International Thread Kit

Parker's International Thread Kit offers the necessary tools to identify almost any thread you may encounter. The new ITK has LL, L and S series plugs to identify female DIN threads such as EO style hose ends. It also includes the MIK-1 and BSPP plugs in order to identify BSPP hose ends from 1/8" to 2".

Part Name	Part No.
International Thread Kit	**ITK**

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov.

Fig. Q132 — International Thread Kit (ITK)

Dimensions and pressures for reference only, subject to change.

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Tube Fabricating Equipment Weights	
Part No.	**Approx. Ship Weight (lbs.)**
Rolo-Flare Tool	
945 TH	4.00
212FB	4.00
Hydra-Tool	
710400B	62.00
720370B-3	85.00
Accessories (Hydra-Tool)	
900044*	1.00
910004	1.50
720377	16.00
710416	4.00
710412	3.00
710419	2.00
710411	2.00
710424-1	4.00
710424-2	4.00
710417-4	2.00
710417-5	2.00
710417-6	2.00
710417-8	2.00
710417-10	2.00
710417-12	2.00
710417-14	2.00
710417-16	2.00
710417-20	2.00
710415-24	2.00
710415-32	2.00
Power Source (Pumps)	
900085	30.00
900086	10.00
Flaring Dies - Metric (Hydra-Tool)	
770106-6	2.00
770106-8	2.00
770106-10	2.00
770106-12	2.00
770106-16	2.00
770106-18	2.00
770106-20	2.00
770106-25	2.00
770106-30	2.00
770106-32	2.00
Hydra-Tool Ferulok Pre-Set Tooling	
770101	5.00
770102	3.00

Tube Fabricating Equipment Weights	
Part No.	**Approx. Ship Weight (lbs.)**
Ferulset Tools (Ferulok Pre-Set Tool)	
560576	0.50
560577	0.50
560578	0.50
560579	0.50
560580	0.50
560581	0.50
560582	0.50
560583	0.50
560584	0.50
560585	0.50
560586	0.50
560587	1.00
560589	1.00
Hyferset (Ferulok Pre-Set Tool)	
611011A	35.00
Hyferset Accessories	
900086	10.00
910004	2.00
651085	15.00
Hyferset and Tooling	
611049C	53.00
680370-4	3.50
720105-4	0.50
680370-6	3.00
720105-6	0.50
680370-8	3.00
720105-8	0.50
680370-10	2.50
720105-10	0.50
680370-12	2.50
720105-12	0.50
680370-14	2.50
720105-14	0.50
680370-16	1.50
720105-16	1.00
680370-20	2.00
720105-20	1.00
680370-24	1.50
720105-24	1.00
680370-32	1.50
720105-32	1.00
Straight Thread Taps and Counterbores	
7/16-20 UNF-2B	1.00
9/16-18 UNF-2B	1.00
3/4-16 UNF-2B	1.00
7/8-14 UNF-2B	1.50
1 1/16-12 UN-2B	1.75
1 3/16-12 UN-2B	2.00
1 5/16-12 UN-2B	2.00
1 5/8-12 UN-2B	2.50
1 7/8-12 UN-2B	2.50
2 1/2-12 UN-2B	3.00

Tube Fabricating Equipment Weights	
Part No.	**Approx. Ship Weight (lbs.)**
Straight Thread Taps and Counterbores (Cont'd)	
Y-34730	0.50
Y-34731	0.50
Y-34732	0.50
Y-34733	0.75
Y-34734	1.00
Y-34735	1.00
Y-34736	1.50
Y-34737	1.50
Y-34738	1.75
Y-34739	2.00
Y-34740	2.00
Y-34741	2.50
Y-34743	2.50
Tube Cutters	
218B	1.00
1232	3.00
Parker Tru-Kut Sawing Vise	
710439	9.00
974250	198.00
Deburring Tools	
226A	1.00
972125	90.00
Hand Tube Benders	
2-2829S	2.00
3-2829S	2.00
4-2829S	2.50
5-2829S	2.50
6-2829S	3.00
8-2829S	3.00
10-2829	8.00
12-2829	15.00
14-2829	15.00
16-2829	16.00
4-2829AH	1.20
6-2829AH	3.70
8-2829AH	7.60
Exactol Tube Benders (412 & 424)	
560569	18.50
550570	5.00
550572	25.50
621044	38.00
631156	10.00
412 Kit	42.00
424 Kit	—
Slide Blocks (412 & 424)	
550585	3.50
621045	5.00
870150	5.00

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(Continued on next page)

Table Q16 — Tube Fabricating Equipment Weight Chart

Tube Fabricating Equipment Weights	
Part No.	**Approx. Ship Weight (lbs.)**
Radius Blocks (412 & 424)	
550579	1.00
550580	1.00
550581	2.50
550582	3.00
550583	4.00
550584	5.00
621046	7.00
621047	9.00
621048	9.50
621049	10.00
870149	11.00
Small Radius Blocks (412 & 424)	
550573	2.00
550574	2.00
550575	2.50
550576	2.50
550577	3.00
550578	4.00
Close Bend Radius Blocks	
590533	2.00
590535	3.00
590537	3.00
Metric Slide Blocks (412 & 424)	
820091	3.00
820092	5.00
820093	5.00
Metric Radius Blocks (412 & 424)	
820090-6mm	1.00
820090-8mm	2.00
820090-10mm	2.00
820090-12mm	3.00
820090-14mm	3.00
820090-15mm	4.00
820090-16mm	4.50
820090-18mm	6.50
820090-20mm	7.00
820090-22mm	9.00
820090-25mm	9.50
820090-28mm	10.00
820090-30mm	10.50
820090-32mm	11.00
Tube Preparation Centers	
TP432	560.00
TP1025	880.00
EO Presetting Tooling	
Nut Die	1.75
Body Die	.75
EO-Karrymat	55.00

Tube Fabricating Equipment Weights	
Part No.	**Approx. Ship Weight (lbs.)**
HB632 Hydraulic Tube Bender	
631050 (632)	245.00
660221	8.00
900085	30.00
Radius Blocks (HB632)	
540502	3.00
530763	3.50
530764	4.00
530765	6.00
530766	10.00
530768	14.00
530770	54.00
590512-18	35.00
590515-24	4.00
590518-30	6.00
590521-36	7.00
590523-42	8.00
590524-48	10.00
590526-54	12.00
590630-72	16.00
631060-128	50.00
Close Bend Radius Blocks for HB632	
530597	3.50
530601	5.00
530605	6.00
530609	8.00
530613	10.50
530621	12.00
530625	13.00
Metric Radius Blocks for HB632	
810023	3.00
780175	3.50
780176	4.00
780177	4.00
780178	5.00
780179	6.00
780180	8.00
780181	9.00
780182	10.50
780183	12.00
780184	13.00
CP432 Parflange Machines	225.00
1025	175.00
Metric Close Bend Radius Blocks for HB632	
780185	3.50
780186	3.50
780187	4.00
780188	5.00
780189	6.00
780190	6.50

Tube Fabricating Equipment Weights	
Part No.	**Approx. Ship Weight (lbs.)**
Clamp Blocks for HB632	
864266	4.00
631092	3.00
631093	3.00
027418-28	5.00
027418-32	5.00
Metric Clamp Blocks for HB632	
790017	3.00
780194	4.00
780195	3.00
780186	4.00
Metric Slide Blocks for HB632	
790016	8.00
780191	11.00
780192	9.00
780193	8.00
Bender Table	
520515	470.00
Mandrel Rod Stop Assemblies	
550571	5.00
631141	20.00
Universal Side Angle Indicator	
520520	25.00
Karryflare	116.00
Inch Flaring Dies for Karryflare	
M 047415-1	4.00
M 157408-1	4.00
M 067415-1	4.00
M 087415	4.00
M 107415	3.50
M 127415	3.50
M 167415	3.50
M 207415	3.00
M 157438	3.00
Parflange Tooling	
Pin and Die Set (1025)	4.50
Pin (1025)	.75
Die (1025)	3.75
Parflange Pro 50	
Pro 50	838.00

WARNING: This product can expose you to chemicals including Lead and Lead Compounds which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.p65warnings.ca.gov

Table Q16 — Tube Fabricating Equipment Weight Chart (continued from previous page)

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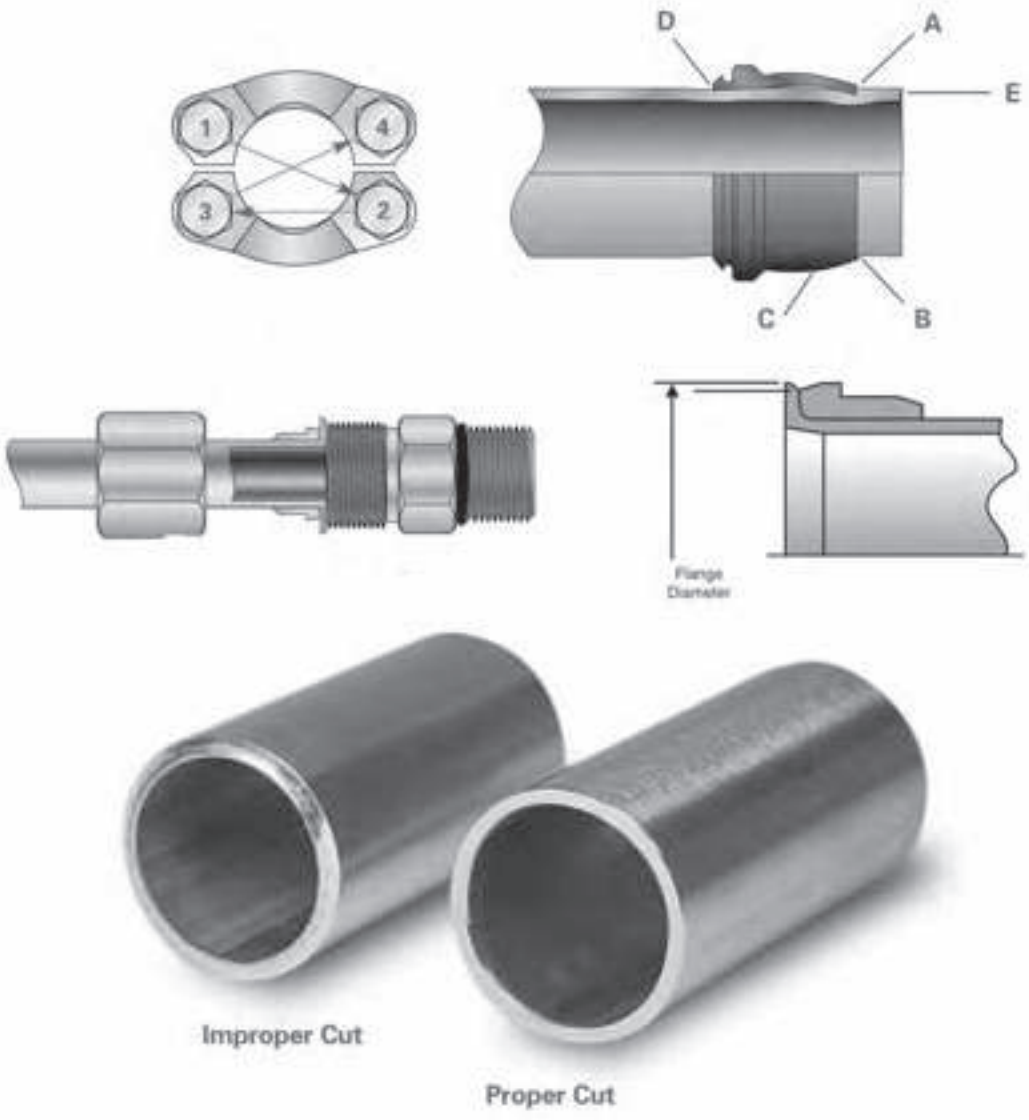
R ASSEMBLY/INSTALLATION



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Port End Assembly

The three common types of port ends used in the United States with tube fittings, pipe fittings and hose fittings are:

1. Parallel thread
2. Tapered Thread
3. Flanges

1. Parallel Thread Ports

Unlike tapered threads, parallel thread ports do not require sealing by the threads. The seal is obtained by other means, typically an elastomeric seal. When assembled properly, parallel thread ports provide the best leak-free port connection available.

Parker tube fittings are available with several types of parallel thread port studs (ends):

- SAE straight threads (SAE J1926 / ISO 11926)
- ISO (ISO 6149)
- JIS (JIS B2351)
- BSPP flat face (ISO 1179)
- DIN Metric flat face (ISO 9974).

The SAE straight thread, ISO 6149 and JIS B2351 ports are all of similar design. The male end is fitted with an O-ring. On assembly, the O-ring is firmly sandwiched between the angular sealing surface of the female port, the male end undercut, and the shoulder or back-up washer of the male end. Sealing is thus made possible and maintained by the O-ring compression, as shown in Fig. R1. The straight threads do not offer sealing action; they provide the resistance (holding power) for service pressure. Port dimensions for SAE and ISO 6149 ports are given on pages S31 and S32 respectively. For JIS B2351 dimensions, please contact the Tube Fittings Division.

Fig. R1 – SAE / ISO / JIS B2351 Straight Thread Port O-Ring Upon Assembly

With the BSPP and metric flat face port ends, the sealing actually takes place on the top surface (spot face) of the port. Port dimensions can be found on pages S34 and S35 respectively. There are several sealing methods available for these ports. Port studs with type "E" sealing utilize Parker's EOlastic seal (ED) (see Fig. R2) and are recommended for higher pressures than the other types. Types "G" and "H" use an O-ring that is supported on the outside by a removable retaining ring (see Fig. R3). Type B (cutting face) is designed with a relatively sharp ridge of material that seals by coining the flat face of the female port (see Fig. R4). A fourth sealing method uses a bonded seal which consists of a metal ring with an elastomer bonded to the inside surface (often referred to as Dowty® seal) (see Fig. R5).

Fig. R2 – EOlastic Seal, Type E

Fig. R3 – O-Ring with Retaining Ring, Types G & H

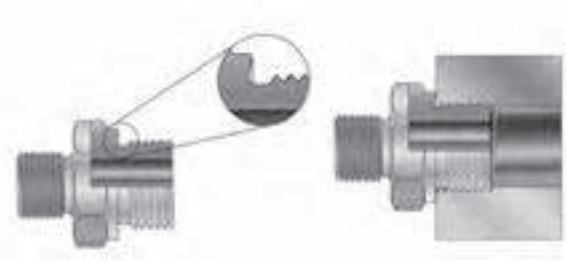

Fig. R4 – Cutting Face, Type B

Fig. R5 – Bonded Seal

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For assembly purposes, there are two main categories of parallel port ends: adjustable and non-adjustable. Adjustable port ends are commonly found on shaped fittings to allow for proper orientation of the fitting. Besides the elastomeric seal, adjustable port ends are assembled with a locknut and a back-up washer as shown in Fig. R6. Non-adjustable port ends are found on straight fittings.

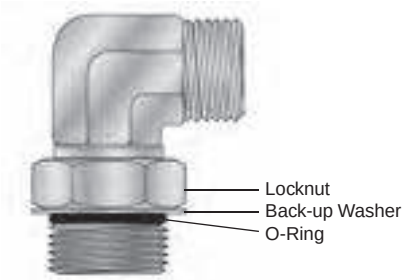
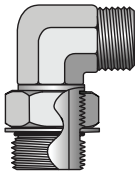


Fig. R6 – Adjustable Port End Assembly

The general assembly procedure for all adjustable parallel thread port ends is the same. Likewise, the assembly procedure is the same for all non-adjustable parallel thread port ends.

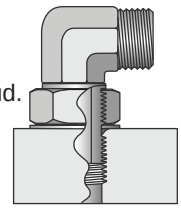
Adjustable Port End Assembly

1. Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks and scratches, or any foreign material.
2. If O-ring or seal is not pre-installed to fitting male port end, install proper size O-ring or seal, taking care not to damage it.
3. Lubricate O-ring with light coat of system fluid or a compatible lubricant to help the O-ring slide smoothly into the port and avoid damage.
4. Back off lock nut as far as possible. Make sure back-up washer is not loose Parker Robust Port Stud and is pushed up as far as possible.



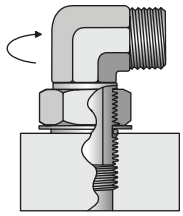
Step 4

5. Screw fitting into port until the back-up washer or the retaining ring contacts face of the port. Light wrenching may be necessary. **Over tightening may damage washer.** This potential damage is eliminated with Parker's Robust Port Stud.



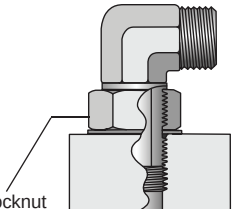
Step 5

6. To align the tube end of the fitting to accept incoming tube or hose assembly, unscrew the fitting by the required amount, but not more than one full turn.



Step 6

7. Using two wrenches, hold fitting in desired position and tighten locknut to the proper torque value from the appropriate table located on pages R5 - R6.
8. Inspect to ensure that O-ring is not pinched and that washer is seated flat on face of port.



Steps 7 and 8

Non-adjustable Port End Assembly

1. Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks, and scratches, or any foreign material.
2. If O-ring or seal is not pre-installed to fitting male port end, install proper size O-ring or seal, taking care not to damage it.
3. Lubricate O-ring with light coating of system fluid or a compatible lubricant to help the O-ring slide past the port entrance corner and avoid damaging it.
4. Screw fitting into port and tighten to proper torque from the appropriate table located on pages R5 - R6.

Fig. R7 — Non-Adjustable Port End Assembly

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SAE Straight Thread Port Assembly (SAE J1926)

SAE Dash Size	Thread Size UN/UNF	Assembly Torque (+10% -0)											
		Non-Adjustables				Adjustables				Plugs			
		Seal-Lok (Heavy Duty SAE J1926-2)		Triple-Lok Ferulok Adapters (Light Duty SAE J1926-3)		Seal-Lok (Heavy Duty SAE J1926-2)		Triple-Lok Ferulok Adapters (Light Duty SAE J1926-3)		Hollow Hex HP5ON-S (Light Duty SAE J1926-3)		Hex Head P5ON-S (Light Duty SAE J1926-3)	
		ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m
2	5/16-24	—	—	(85)	10	—	—	(60)	7	(60)	7	(85)	10
3	3/8-24	—	—	(155)	18	—	—	(100)	11	(100)	11	(155)	18
4	7/16-20	(310)	35	(260)	29	(180)	20	(180)	20	(180)	20	(260)	29
5	1/2-20	(360)	41	(280)	32	(360)	41	(250)	28	(250)	28	(280)	32
6	9/16-18	(420)	47	(350)	40	(420)	47	(350)	40	(350)	40	(350)	40
8	3/4-16	(720)	81	(620)	70	(720)	81	(620)	70	(620)	70	(620)	70
10	7/8-14	100	136	85	115	100	136	85	115	85	115	85	115
12	1 1/16-12	135	183	135	183	135	183	135	183	135	183	135	183
14	1 3/16-12	175	237	175	237	175	237	175	237	175	237	175	237
16	1 5/16-12	200	271	200	271	200	271	200	271	200	271	200	271
20	1 5/8-12	250	339	250	339	250	339	250	339	250	339	250	339
24	1 7/8-12	305	414	305	414	305	414	305	414	305	414	305	414
32	2 1/2-12	375	508	375	508	375	508	375	508	375	508	375	508

Table R1 – SAE J1926 Straight Thread Port Assembly Torques

Notes: Lubricate threads before assembly. Values in chart are for plated steel fittings in steel ports. For stainless steel fittings, use the upper limit of torque range. For brass and aluminum decrease torque value by 35%.

BSPP (Thread G) Port Assembly (ISO 1179 / DIN 3852-2)

Series	Tube O.D.	BSPP Thread G Size	Assembly Torque Nm +10% -0							
			Straight Male Stud Fittings			Non-Return Valves RHV / RHZ	Banjo Fittings		Plugs VSTI-ED	Straight and Adjustable Fittings
			Form A for Sealing Washer	Form B with Cutting Face	Form E with ED-Sealing	Form E with ED-Sealing	WH / TH	SWVE	Form E with ED-Sealing	O-Ring with Retaining Ring and Bonded Washer
	6	1/8 - 28	9	18	18	18	18	18	13	18
	8	1/4 - 19	35	35	35	35	45	40	30	35
	10	1/4 - 19	35	35	35	35	45	40	30	35
	12	3/8 - 19	45	70	70	50	70	65	60	70
L	15	1/2 - 14	65	140	90	85	120	90	80	90
	18	1/2 - 14	65	100	90	85	120	90	80	90
	22	3/4 - 14	90	180	180	140	230	125	140	180
	28	1 - 11	150	330	310	190	320	—	200	310
	35	1 1/4 - 11	240	540	450	360	540	—	400	450
	42	1 1/2 - 11	290	630	540	540	700	—	450	540
	6	1/4 - 19	35	55	40	45	45	40	—	40
	8	1/4 - 19	35	55	40	45	45	40	—	40
	10	3/8 - 19	45	90	80	60	70	65	—	60
	12	3/8 - 19	45	90	80	60	70	65	—	60
S	14	1/2 - 14	65	150	115	145	120	90	—	90
	16	1/2 - 14	65	130	115	100	120	90	—	90
	20	3/4 - 14	90	270	180	145	230	125	—	180
	25	1 - 11	150	340	310	260	320	—	—	310
	30	1 1/4 - 11	240	540	450	360	540	—	—	450
	38	1 1/2 - 11	290	700	540	540	700	—	—	540

Table R2 – Assembly Torques for ISO 1179-1 / DIN 3852-2 Port

Note: Lubricate threads before assembly! Tightening torques are for steel fittings assembled in steel components. Values in chart are for steel fittings in steel ports. For stainless steel fittings, use the upper limit of torque range. For brass and aluminum decrease torque value by 35%.

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Metric (ISO Thread M) Port Assembly (ISO 9974-1 / DIN 3852-1)

Series	Tube O.D.	Metric Thread M Size	Assembly Torque Nm +10% -0							
			Straight Male Stud Fittings			Non-Return Valves RHV / RHZ	Banjo Fittings		Plugs VSTI-ED	Straight and Adjustable Fittings
			Form A for Sealing Washer	Form B with Cutting Face	Form E with ED-Sealing	Form E with ED-Sealing	WH / TH	SWVE	Form E with ED-Sealing	O-Ring with Retaining Ring
	6	M 10 x 1	9	18	18	18	18	18	12	18
	8	M 12 x 1.5	20	30	25	25	45	35	25	25
	10	M 14 x 1.5	35	45	45	35	55	50	35	40
	12	M 16 x 1.5	45	65	55	50	80	60	50	55
L	15	M 18 x 1.5	55	80	70	70	100	80	65	70
	18	M 22 x 1.5	65	140	125	125	140	120	90	90
	22	M 27 x 2	90	190	180	145	320	130	135	180
	28	M 33 x 2	150	340	310	210	360	—	225	310
	35	M 42 x 2	240	500	450	360	540	—	360	450
	42	M 48 x 2	290	630	540	540	700	—	360	540
	6	M 12 x 1.5	20	35	35	35	45	35	—	35
	8	M 14 x 1.5	35	55	45	45	55	50	—	55
	10	M 16 x 1.5	45	70	70	55	80	60	—	70
	12	M 18 x 1.5	55	110	90	70	100	80	—	90
S	14	M 20 x 1.5	55	150	125	100	125	110	80	125
	16	M 22 x 1.5	65	170	135	125	135	120	—	135
	20	M 27 x 2	90	270	180	135	320	135	—	190
	25	M 33 x 2	150	410	310	210	360	—	—	310
	30	M 42 x 2	240	540	450	360	540	—	—	450
	38	M 48 x 2	290	700	540	540	700	—	—	540

Table R3 – Assembly Torques for ISO 9974-1 / DIN 3852-1 Port

Note: Lubricate threads before assembly. Values in chart are for steel fittings in steel ports. For stainless steel fittings, use the upper limit of torque range. For brass and aluminum decrease torque value by 35%.

Metric ISO Port Assembly (ISO 6149/DIN 3852-3)

Metric Thread M Size	Assembly Torque (+10% -0)[2]			
	ISO 6149-2 Stud Ends (S-Series) (Seal-Lok, EO & VSTI-OR Plugs)		ISO 6149-3 Stud Ends (L-Series) (Triple-Lok, EO, Ferulok & Pipe Adapters)	
	N.m.	ft. lbs.	N.m.	ft. lbs.
M8x1	10	7.5	8	6
M10x1	20	15	15	11
M12x1.5	35	26	25	18
M14x1.5	45	33	35	26
M16x1.5	55	41	40	30
M18x1.5	70	52	45	33
M20x1.5[3]	80	59	—	—
M22x1.5	100	74	60	44
M27x2	170	125	100	74
M30x2	235	175	130	95
M33x2	310	230	160	120
M38x2[1]	320	235	185	135
M42x2	330	245	210	155
M48x2	420	310	260	190
M60x2	500	370	315	230

Table R4 – ISO 6149 / DIN 3852-3 Port Assembly Torques

1) M38X2 is not covered in ISO 6149 standards.
2) These torques are for steel fittings, assembled lubricated, for brass and aluminum decrease torque value by 35%.
3) For cartridge valves only.

2. Tapered Thread Ports

Tapered thread ports include NPT/NPTF, BSPT and metric taper. The tapered threads in these ports serve two functions: 1) to hold the fitting in place while under pressure, and 2) to serve as the primary seal. The seal for NPTF threads is created by the metal-to-metal contact between the mating roots and crests of the male and female threads. With tapered threads, there is not always contact at the roots and crests. There can be a spiral gap which is small enough for a sealant to fill and provide an effective seal.

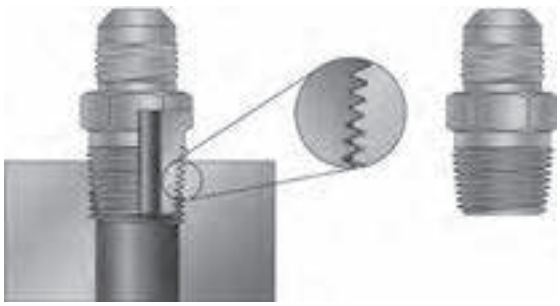

Fig. R8 – Tapered Thread Port

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The variety of thread forms available under taper threads include:

NPT – American Standard Taper Pipe Thread (ANSI B1.20.1).

NPTF – Dryseal American Standard Taper Pipe Thread (SAE J476, ANSI B1.20.3).

BSPT or JIS "PT" – British Standard Pipe, Tapered (BS21, JIS B 0203, ISO 7), also known as "R" for male and "Rc" for female.

M-Keg – Metric taper threads (DIN 158).

The vast majority of Parker Tube Fittings Division's standard pipe thread fittings are machined with the NPTF thread form. NPTF thread is also referred to as Dryseal Pipe Thread.

The full thread profile contact of NPTF threads is designed to give the tapered threads self-sealing ability without thread sealant. **However, variations in condition of mating threads, fitting and port materials, assembly procedures and operating conditions make self-sealing highly improbable. Therefore, some type of thread sealant is required to achieve proper seal and, in some cases, additional lubricity to prevent galling.**

Types of Sealant/Lubricant

Sealant/Lubricants assist in sealing and provide lubrication during assembly, reducing the potential for galling. Pipe thread sealants are available in various forms such as dry pre-applied, tape, paste and anaerobic liquid.

Pre-applied sealants, such as Vibraseal® and powdered PTFE are usually applied to connectors by the manufacturer. Connectors with some of these sealants may be remade a few times without needing additional sealant. Vibraseal may also help reduce loosening due to vibration.

PTFE tape, if not applied properly, can contribute to system contamination during assembly and installation. In addition, because of PTFE's high lubricity, fittings can be more easily over tightened; and it does not offer much resistance to loosening due to vibration.

Paste sealants, if not applied properly, can also contribute to system contamination. Generally they can be messy to work with and some types require a cure period after component installation prior to system start up.

Anaerobic liquids are available from several manufacturers and perform sealing as well as thread locking functions. They are applied to the connectors by the user and require a cure period prior to system start up. Some are soluble in common hydraulic fluids and will not contaminate the system. For proper performance they need to be applied to clean and dry components, carefully following the manufacturer's directions.

How many times can you reassemble a tapered thread pipe fitting? Read our article for what you need to know.

Tapered Thread Port Assembly

The proper method of assembling tapered threaded connectors is to assemble them finger tight and then wrench tighten further to the specified number of turns from finger tight (T.F.F.T.) given in Table R5. The following assembly procedure is recommended to minimize the risk of leakage and/or damage to components.

1. Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks, scratches, or any foreign material.
2. Apply sealant/lubricant to male pipe threads if not pre-applied. For stainless steel fittings, the use of Parker Thread-mate sealant/lubricant is strongly recommended. (Pre-applied dry sealants are preferred over other sealants). With any sealant, the first one to two threads should be left uncovered to avoid system contamination. If PTFE tape is used it should be wrapped 1-1/2 to 2 turns in clockwise direction when viewed from the pipe thread end.

   Caution: More than two turns of tape may cause distortion or cracking of the port.
3. Screw the connector into the port to the finger tight position.
4. Wrench tighten the connector to the appropriate T.F.F.T. values shown in Table R5, making sure that the tube end of a shaped connector is aligned to receive the incoming tube or hose assembly. **Never back off (loosen) pipe threaded connectors to achieve alignment.**
5. If leakage persists after following the above steps, check for damaged threads and total number of threads engaged.

If threads on the fitting are badly nicked or galled, replace the fitting. If port threads are damaged, re-tap, if possible, or replace the component. If the port is cracked, replace the component.

Normally, the total number of tapered threads engaged should be between 3-1/2 and 6. Any number outside of this range may indicate either under or over tightening of the joint or out of tolerance threads. If the joint is under tightened, tighten it further but no more than one full turn. If it is over tightened, check both threads, and replace the part which has out-of-tolerance threads.

As a general rule, pipe fittings with tapered threads should not be assembled to a specific torque because the torque required for a reliable joint varies with thread quality, port and fitting materials, sealant used, and other factors. Where many of these factors are well-controlled, such as particular jobs on an assembly floor, a torque range that produces the desired results may be determined by test and used in lieu of turns count for proper joint assembly.

Tapered Pipe Thread Size		T.F.F.T.
BSPT	NPTF	
1/8-28	1/8-27	2 - 3
1/4-19	1/4-18	2 - 3
3/8-19	3/8-18	2 - 3
1/2-14	1/2-14	2 - 3
3/4-14	3/4-14	2 - 3
1-11	1-11 1/2	1.5 - 2.5
1 1/4-11	1 1/4-11 1/2	1.5 - 2.5
1 1/2-11	1 1/2-11 1/2	1.5 - 2.5
2-11	2-11 1/2	1.5 - 2.5

Table R5 – Assembly Turns From Finger Tight (T.F.F.T) Values For Steel, Stainless Steel and Brass Pipe Fittings

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3. Flange Ports

Large threaded port connections, such as SAE straight thread, require very high torque to assemble. This makes assembly very difficult, especially where wrench clearance is limited. Split flange connections solve this problem by dividing the hydraulic load among four bolts each requiring much less torque, smaller wrenches and smaller wrench clearance.

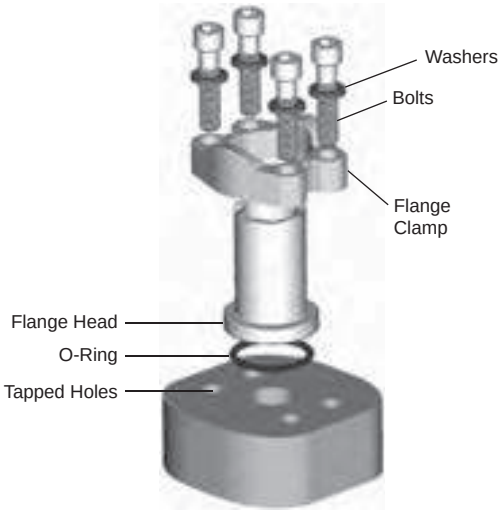

Fig. R9 – 4-Bolt Split Flange Components

There are two types of flange port connections:

1. ISO 6162
   - SAE Code 61 4-bolt split flange
   - SAE Code 62 4-bolt split flange
2. ISO 6164

The 4-Bolt Split Flange consists of four main components:

1. A body (flange head)
2. An O-ring
3. One captive or two split flange clamps
4. Four bolts and washer

The four-bolt port is simply a circular opening (flow passage) surrounded by four tapped holes in a certain pattern for acceptance of the flange clamping bolts. The flat surface of the port compresses the O-ring contained in the groove in the flange head when the clamp bolts are torqued. In some instances, the groove is in the port and not in the flange head. The bolts clamp down the flange head onto the flat surface of the port compressing and trapping the O-ring in the groove and leaving no gap for it to extrude under pressure. The hydraulic pressure is thus sealed by the compressed O-ring as long as the bolts are tightened enough to maintain solid metal to metal contact between the flange head at the outside diameter of the O-ring and the top of the port.

Flange Port Assembly

The steps to properly assemble the flange port clamping bolts are:

1. Inspect components to ensure that male and female port threads and sealing surfaces are free of burrs, nicks and scratches, or any foreign material.
2. Lubricate the O-ring.
3. Position flange and clamp halves.
4. Place lock washers on bolts and insert through clamp halves.
5. Hand tighten bolts.
6. Torque bolts in diagonal sequence (see Fig. R10) in small increments to the appropriate torque level listed in Table R6 or R7 below.

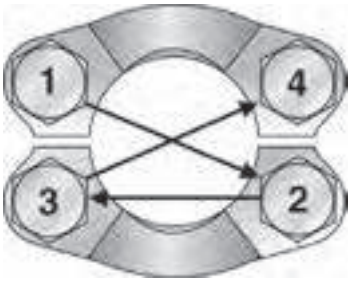

Fig. R10 – Flange Bolt Tightening Sequence

Dash Size	Flange Size	Inch Bolt (J518)	+10% -0 Torque ft. lbs.	Metric Bolt (ISO 6162)	+10% -0 Torque N-m
8	1/2	5/16-18	17	M8	24
12	3/4	3/8-16	31	M10	50
16	1	3/8-16	31	M10	50
20	1-1/4	7/16-14	52	M10	50
24	1-1/2	1/2-13	77	M12	92
32	2	1/2-13	77	M12*	92
40	2-1/2	1/2-13	77	M12	92
48	3	5/8-11	155	M16	210
56	3-1/2	5/8-11	155	M16	210
64	4	5/8-11	155	M16	210
80	5	5/8-11	155	M16	210

* Does not meet ISO 6162 specification.

Table R6 – Code 61 Flange Recommended Bolt Torque

Dash Size	Flange Size	Inch Bolt (J518)	+10% -0 Torque ft. lbs.	Metric Bolt (ISO 6162)	+10% -0 Torque N-m
8	1/2	5/16-18	17	M8	24
12	3/4	3/8-16	31	M10	50
16	1	7/16-14	52	M12	92
20	1-1/4	1/2-13	77	M14*	130
24	1-1/2	5/8-11	155	M16	210
32	2	3/4-10	265	M20	400

Table R7 – Code 62 Flange Recommended Bolt Torque

Socket Screw Bolt Circle (LK)	Socket Head Cap Screws	Tightening Torques N-m
LK35	M6	10
LK40	M6	10
LK55	M8	25

Table R8 – Hydraulic Flange Recommended Bolt Torque

* In general, variances of torque for soft metal ports/manifolds (ie: aluminum block - 66% of specified torque)

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Troubleshooting Port End Connections

60° Cone (Metric, BSPP and NPSM)

Read our blog post "Troubleshooting Leaks: Fixing a Port End Connection Issue"

CONDITION	PROBABLE CAUSE(S)	RECOMMENDATION
End of swivel nut contacts hex shoulder of adapter before cone and ball nose tightens	• Wrong combination of swivel nut and adapter	• Ensure that components are to the same specification (even with the same type, there are different designs for 60° cone fittings)
Thread engagement seems adequate and swivel nut is tight but leakage still occurs	• Scratches or nicks on sealing surface • Chatter marks on sealing surface	• Replace components. These fittings depend on metal-to-metal seal and require smooth mating surfaces to seal
There is leakage from the joint and the swivel nut is loose	• Inadequate make-up torque	• Use proper torque to create a seal as well as prevent vibration loosening
Swivel nut tightens, cone is tight but connection still leaks	• Inadequate or no chamfer in adapter	• Use components with proper chamfer (very common occurrence with NPTF/ NPSM 60° cone fittings). Male pipe end must have chamfer for proper sealing. Not all male pipe ends have chamfer as standard

Tapered Thread (including BSPT, NPT and metric taper)

CONDITION	PROBABLE CAUSE(S)	RECOMMENDATION
Thread galling	• Most common in stainless steel, caused by friction and lack of lubricant	• Replace fitting and apply proper thread sealant/lubricant to replacement fitting and tighten to appropriate TFFT
Fitting leaks, even after proper tightening	• Sealant omitted or inadequately applied • Damaged or cracked threads • Cracked port • Thread mixing of BSPT and NPT threads	• Re-apply sealant to appropriate TFFT and re-tighten • Replace fitting • Replace component • Determine port thread type and replace fitting with matching thread type
Insufficient thread engagement (3 to 6 threads of engagement required)	• Quality problem with port or adapter • Too much thread sealant (tape)	• Have port and adapter thread inspected; replace faulty parts • Remove all thread sealant and re-apply 1 to 2 layers of tape
Too much thread engagement (more than recommended 3 to 6 threads)	• Typically port or adapter machining or wear problem, or port could be cracked due to excessive torque	• Inspect port and adapter for proper tolerance or wear, replace faulty parts, retighten to appropriate TFFT
Poor-quality threads or damaged/nicked threads	• Larger sizes are more prone to having nicked threads due to handling damage	• Replace fitting with threads that are free of scratches and nicks

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Troubleshooting Port End Connections

Parallel (SAE, BSPP and metric)

CONDITION	PROBABLE CAUSE(S)	RECOMMENDATION
Washer is too loose (moves by its own weight or rocks too much on the undercut)	• Washer damaged	• Replace fitting
Fitting threads are distorted	• Over-torqued • Mixed threads	• Replace fitting and tighten to proper torque • Determine correct thread type
Several scratches or nicks on the port face	• Port face contaminated (dirty)	• Reface the port
Spot face of port is smaller than washer diameter	• Improper port tool was used • Wrong fitting selected for port	• Reface the port • Select a proper fitting
Port threads are distorted (yielded)	• Fitting over-torqued	• Replace component
Leakage persists after locknut has been torqued	• Damaged O-ring • Damaged washer • Improper assembly	• Replace O-ring with new quality O-ring (90 durometer) and reconnect fitting to proper torque • Replace fitting • Follow proper assembly procedure
Washer distorted, allowing opportunity for O-ring to extrude	• Exposed upper thread forced washer into port during assembly (over-torquing makes this more prevalent)	• Replace fitting, using proper installation techniques for adjustable port ends

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Troubleshooting Port End Connections

Flange (i.e., ISO 6162 4-Bolt)

CONDITION	PROBABLE CAUSE(S)	RECOMMENDATION
Missing or improper O-ring	• Assembly/re-assembly oversight	• Replace with proper O-ring and re-tighten connection using incremental alternating tightening procedure
O-ring pinched or extruded	• Improper tightening procedure	• Replace O-ring and re-tighten connection using incremental alternating tightening procedure
Evidence of yielded or cracked flange head, tube or hose end	• Misaligned tube or hose connection	• Re-bend or re-route hose/tube lines to eliminate misalignment
Components do not mate or gap is too large	• Proprietary flange or pressure series matching problem	• Properly identify all components—most proprietary flanges use standard Code 61/62 bolt patterns and threads but are not usually interchangeable
Port has severe scratches or nicks in seal area	• Mishandling or abuse	• Resurface the port to remove scratches and nicks
Clamp halves are bent	• Over-pressurization or over-torque	• Replace clamp halves and tighten to proper torque
Bolts are bent	• Bolts are too weak or over-torqued	• Replace bolts with grade 8 or better; retighten to proper torque

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Tube End Assembly

The assembly of the tube end consists of the following two steps:

1. Tube end preparation (cutting, deburring and cleaning)
2. Assembly and installation

Tube End Preparation

Tube end preparation is a very critical step to assure the integrity of a tube assembly. Failure to properly perform this function can result in leakage. The three steps in proper tube end preparation are: cutting, deburring and cleaning.

Cutting

Cut tube square (within +/- 1°) using a circular toothed cut-off saw (see Fig. R11), or a hacksaw with a fine tooth blade guided by a Tru-Cut Saw Guide (Fig. R12) or other mitre-type saw guide.

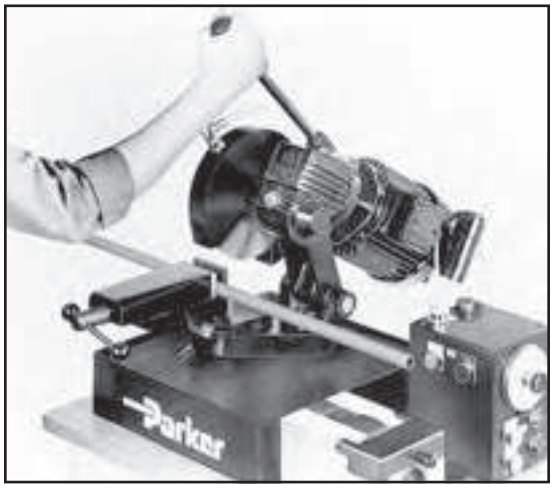

Fig. R11 – Cut-off Saw on Parker's TP432 or TP1025 Tube Preparation Center

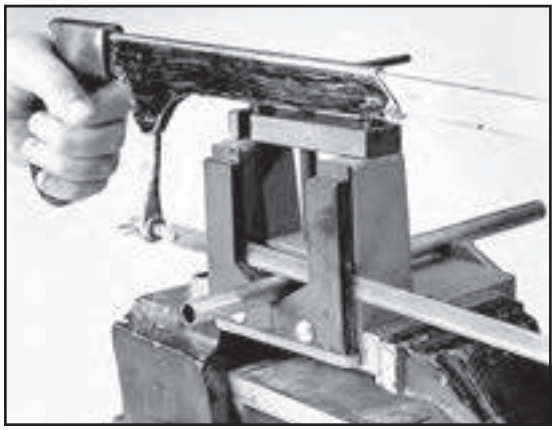

Fig. R12– Parker's Tru-Kut Sawing Vise used with hacksaw

A tube cutter may be used with soft tube such as copper and aluminum. It is not recommended for steel and stainless steel tube because it creates a large burr on the I.D., which is difficult to remove and creates flow restriction. Furthermore, if the tube needs to be flared or flanged, the build up on the ID can compromise the sealing surface. For a steel or stainless steel tube application, Fig. R13 illustrates a proper cut and an improper cut (with the improper cut performed by a tube cutter).

Fig. R13 – Samples of improper and proper cuts on steel tube

A square cut is essential to assure a leak-free connection. The following illustrations depict what will result from an uneven cut.

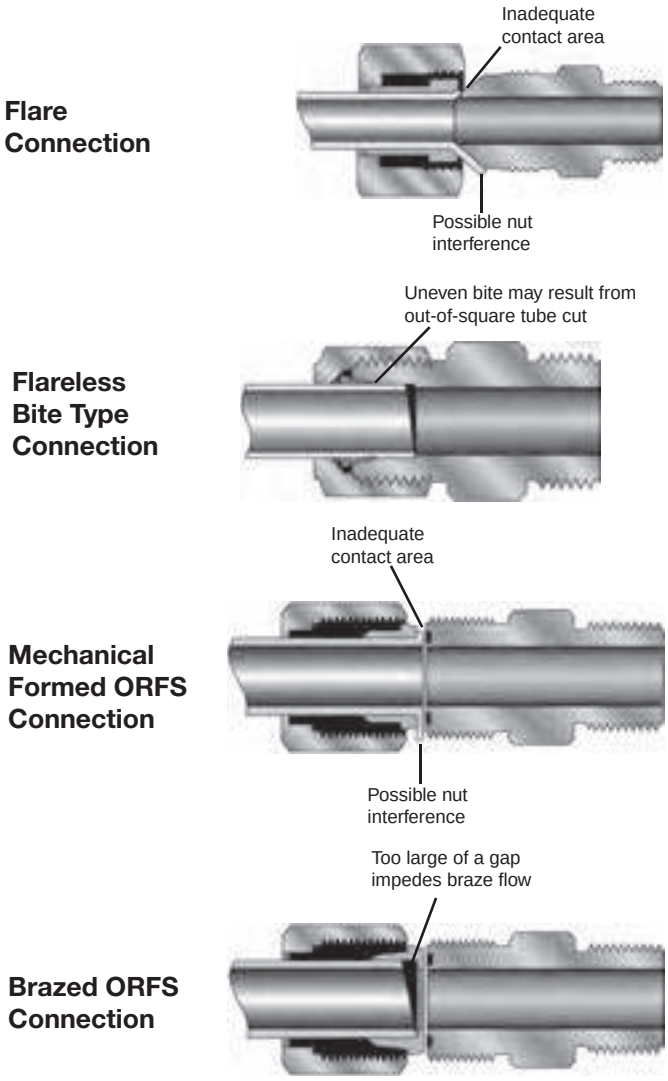

Fig. R14– Results of Uneven Tube Cuts

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Deburring

Lightly deburr the I.D. and O.D. of the tube end to remove burrs and sharp edges. Use a hand deburring tool or power deburring tool (shown on page Q22), or emery paper if using tube cutter (for soft tube). Use front mounted deburring tools if using TP432 or TP1025 tube preparation center found on page Q56.

Note: Point tube end downward during deburring to keep chips from entering the tube.

Cleaning

Remove metal chips from I.D. with a brush or compressed air. Wipe the I.D. and the O.D. of the deburred tube end with a clean rag. Debris present in the tube end can result in system contamination or can get embedded into the flange or flare, causing imperfections that are potential leak paths.

Seal-Lok O-Ring Face Seal Fittings

The proper assembly of the Seal-Lok fitting requires several steps, each important in guaranteeing a leak-free connection and a long service life:

1. Cutting, deburring and cleaning the tube
2. Sleeve Attachment
3. Inspection of sleeve attachment
4. Final installation

For cutting, deburring and cleaning see pages R12-R13, or refer to the detailed blog post and video on www.TFDtechconnect.com.

For recommended minimum and maximum tube wall thickness for Seal-Lok fittings, please refer to Table R9 and R10 on page R14.

Sleeve Attachment

Attaching the sleeve to the tube end is the next critical assembly step. This can be accomplished by two methods: flanging or brazing.

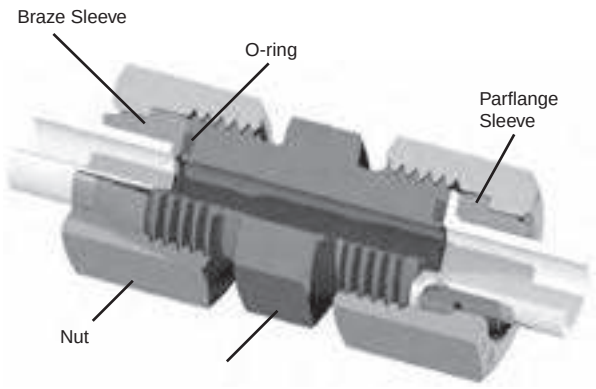

Fig. R15 – Seal-Lok Union cutaway with flanged and brazed assemblies

Flanging

The flanging method requires the use of an appropriate forming machine to create the flange or flat face on the tube end. Since the flat face of the flanged tube seals against the O-ring within the fitting groove, it is important that this surface be relatively smooth. Proper tube end preparation (cutting, deburring and cleaning) will help accomplish this goal.

The Parker Parflange® machines utilize an orbital cold forming process to produce a flat, smooth, rigidly supported 90° sealing surface on the tube end.

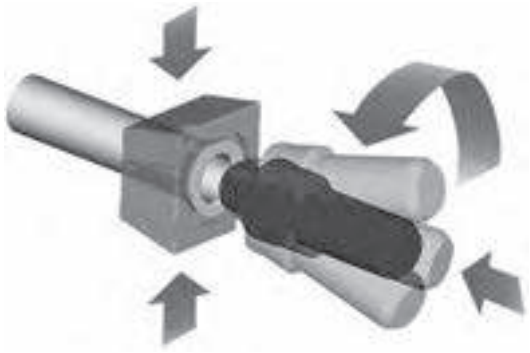

Fig. R16 – Parker's exclusive orbital spindle motion produces a perfect flange every time

Parker offers three Parflange machine options: ECO 25, 1025, and Pro 50. These models range in portability, cycle times, and tube size capability. For additional information on the Parflange machines and tooling, refer to section R of this catalog or see www.TFDToolSpec.com.

Fig. R17 – Parflange 1025 machine

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Flanging Steps:

1. Determine the extra cut-off length required for the Parflange process by referring to Tables R9 and R10. (Each table is only a guide. Variations in tube wall thickness and inconsistency in quality of tube cut-off may affect actual dimensions. User should verify actual extra tube cut-off length with one or two flanges prior to large scale flanging.)
2. Select the proper tooling for the tube size. The tube OD, wall thickness and material must be known for proper selection. Refer to Table R11 on page R15 for flanging capability by Parflange machine and availability of tooling
3. With the sleeve properly positioned within the die set, place the die set into the die holder of the machine.
4. Insert the tube through the die opening until it comes in contact with the tube stop. Do not forget to position the tube nut over the tube in the proper orientation, especially if the other tube end has already been flanged, or the tube has sharp bends.
5. Flange the tube as shown in Figure R17.

Note: For more information on Parflange procedures, machines, required tooling, etc., see www.TFDToolSpec.com.

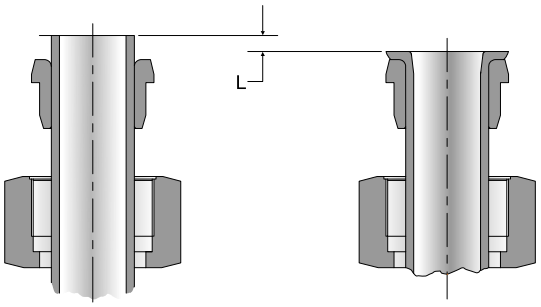

Fig. R18 – Extra cut-off length

Tube O.D. (in.)	Tube Wall Thickness – Inch										
	.028	.035	.049	.065	.083	.095	.109	.120	.134	.156	.188
1/4	3/16	13/64	7/32								
3/8		5/32	3/16	13/64	15/64	1/4					
1/2		9/64	9/64	3/16	13/64	9/32	19/64	19/64			
5/8			11/64	3/16	13/64	1/4	17/64	17/64			
3/4			11/64	3/16	7/32	7/32	1/4	17/64	9/32		
1				3/16	3/16	13/64	15/64	1/4	19/64		
1 1/4				11/64	3/16	13/64	15/64	1/4	19/64	19/64	21/64
1 1/2				13/64	15/64	15/64	1/4	17/64	19/64	23/64	3/8

Table R9 – Extra tube cut-off length guide for inch tube

Tube O.D. (in.)	Metric Tube Outside Diameter – (mm)								
	6	8	10	12	16	20	25	30	38
1.0	3/16 5.2	7/32 5.7	1/8 3.1	5/32 4.1	9/64 3.6				
1.5	17/64 6.7	15/64 5.9	13/64 5.1	7/32 5.4	11/64 4.2				
2.0			13/64 5.3	15/64 6.1	3/16 4.9	7/32 5.4	15/64 6.1	17/64 6.6	9/32 7.2
2.5				17/64 6.7	7/32 5.5	15/64 6.1	1/4 6.4	19/64 7.6	
3.0					15/64 5.8	17/64 6.7	9/32 7.2	5/16 7.9	19/64 7.7
3.5						17/64 6.9	19/64 7.5	21/64 8.5	
4.0						9/32 7.2	5/16 8.0	11/32 8.6	11/32 8.7
5.0							11/32 8.8		3/8 9.4

Table R10 – Extra tube cut-off length guide for metric tube

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Another consideration prior to flanging is the minimum straight length to the start of a 90° bend. Table R11 provides this information.

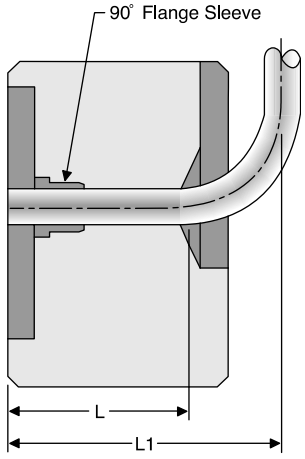

Fig. R19 – Minimum straight length to start of bend for 90° flanging

Tube O.D. Inch Sizes	Tube O.D. Metric Sizes	L* (in.)	L* (mm)	L1** (in.)	L1** (mm)
1/4”	6	1 5/16	35	3 1/8	79
5/16”	8	1 5/16	35	3 5/32	80
3/8”	10	1 5/16	40	3 3/16	81
1/2”	12	1 3/8	40	3 1/4	82
	15	1 3/8	40	3 5/16	84
5/8”	16	1 1/2	41	3 5/16	84
	18	1 5/8	42	3 11/32	85
3/4”	20	1 3/4	50	3 3/8	86
	22	1 7/8	50	3 7/16	87
	25	1 7/8	50	3 1/2	89
1”	28	1 7/8	50	3 9/16	90
	30	1 7/8	50	3 19/32	91
1 1/4”	32	1 7/8	50	3 5/8	92
	35	2	50	3 11/16	94
1 1/2”	38	2	50	3 3/4	95

Table R11 – Minimum straight length to start of bend for 90° flanging

Notes:

* L is the minimum straight length to the start of tube bend.

** L1 is the minimum centerline dimension necessary for 90° bent tube to clear the frame of the Parflange machine. In bending of the tubes, use radius blocks which will ensure that L1 dimensions are met or exceeded.

Flange Inspection

The flange should be inspected for proper diameter and sealing surface quality. Table R12 provides the flange diameters for the different sizes. The sleeve can also be used as a quick gauge of the flange diameter. Visually compare the flange diameter to the tapered surface located at the front end of the sleeve (right behind the flange). The large diameter and small diameters at each end of this surface serve as the maximum and minimum flange diameter limits, respectively.

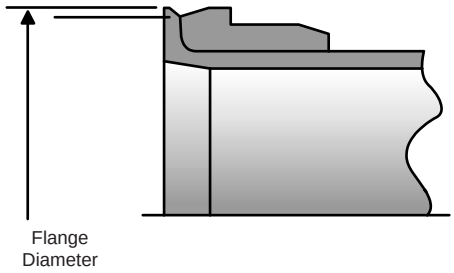

Fig. R20 — Flange diameter

Inch Tube O.D. (in.)	Metric Tube O.D. (mm)	Flange Diameter (in.)
1/4	6	.478 / .502
3/8	10	.594 / .620
1/2	12	.719 / .744
5/8	14, 15, 16	.875 / .923
3/4	18, 20	1.048 / 1.096
1	22, 25	1.298 / 1.346
1-1/4	28, 30, 32	1.549 / 1.597
1-1/2	38	1.861 / 1.909

Table R12 – Flange dimensions

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Over-flanging will result in tube nut interference, as well as thinning of the flange tube end. Under-flanging reduces the contact area for sealing against the O-ring in the fitting.

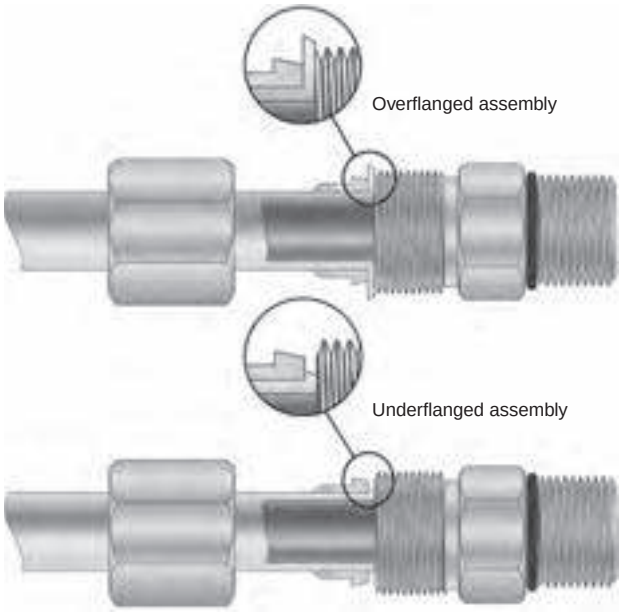

Fig. R21 – Overflanging and Underflanging

Advantages of Parflange process

There are numerous advantages to using the Parflange process over the braze or weld process:

- The Parflange process is several times faster than the brazing or welding methods. For instance, the 1025 model can produce flanges at a rate of 9 to 12 times the speed of comparable induction brazing.
- The Parflange process does not require any special pre- or post-flange cleaning of the tube and sleeve.
- Unlike brazing, the Parflange process does not require any flux, braze alloy, post braze cleaner or rust inhibitor. An environmentally safe lubricant applied to the flanging pin is the only additive associated with the Parflange.
- The Parflange process is inherently safe. It does not require open flame or any form of heating. Additionally, there is no emission of hazardous fumes, as is typical with welding and brazing.
- The Parflange process uses only a fraction of the energy needed for welding or brazing.
- The Parflange process accommodates the use of plated components (i.e., tube and sleeve), thus eliminating the need to electroplate assemblies after fabrication.
- The Parflange process eliminates the potential for leaks at the braze or weld joint.
- The Parflange process produces a burnished sealing surface, typically much smoother than the 125 micro-inch requirement of SAE J1453.

Brazing

Brazing is the other method of attaching the sleeve to the tube end. This process can be accomplished by using a multi-flame torch, as shown in Fig. R22, or an induction brazing unit. (Note: multi-flame torches and induction brazing units are not available through Tube Fittings Division). During the heating process, the pre-formed braze ring or wire-fed filler material is melted between the tube O.D. and the sleeve I.D., creating a strong bond between the two.

Fig. R22 – Multi-flame torch brazing

Brazing Steps:

1. Determine the tube length allowance using Table S13.

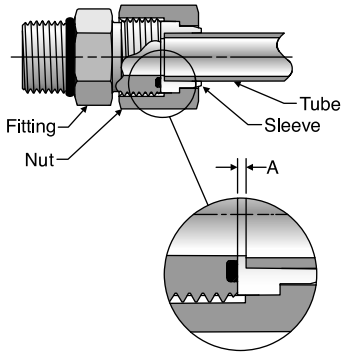

Fig. R23 – Tube length allowance

Nominal Tube O.D.		A (in.)
Inch	Metric	
1/4	6	0.04
3/8	8, 10	0.04
1/2	12	0.04
5/8	14, 15, 16	0.06
3/4	18, 20	0.06
1	22, 25	0.06
1 1/4	28, 30, 32	0.06
1 1/2	35, 38	0.06

Table R13 – Tube length allowance

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2. **Cleaning the tube end:** All oil and oxide build-up must be removed from the tube end for at least the length of the braze joint. Oil may be removed by using an oil-free solvent. Oxide build-up may be removed by pickling or by lightly sanding with an aluminum-free emery paper.
3. **Fixturing the parts for brazing:** Care should be taken so the braze fixture allows the sleeve to settle and bottom on the tube completely during heating. Since the Seal-Lok fitting sleeve is designed for a slip fit, this should happen easily. Short tubes can be brazed in the vertical position. On longer tubes, the joint may need to be in the horizontal position, requiring a slight nudge to seat the sleeve on the tube.
4. **Applying flux:** Apply proper flux to tube end (about 1½ sleeve lengths) and sleeve's face and outside surface. Insert appropriate braze ring in the sleeve and place the sleeve on end of the tube. The flux helps protect the parts from oxidizing and promotes braze flow.
5. **Heating the part:** Apply heat uniformly to the joint by using a multi-flame torch as shown in Fig. R22 or with an induction braze unit. Proper brazing involves heating the assembly to brazing temperature and flowing the filler metal through the joint. Heat should be applied broadly and uniformly to the tube as well as the Seal-Lok sleeve. Keep in mind that thicker fitting and tubing sections take longer to heat. The entire assembly should heat to brazing temperature at about the same time. The braze alloy will always flow towards the area of higher temperature. The pre-formed braze ring has been placed inside the joint area—the last area to reach melting temperature. Therefore, when you see the braze material flow to the outside of the joint, you know the joint is complete. If the sleeve does not settle, a slight pressure will cause the sleeve to settle, completing the braze joint.
6. **Cleaning the brazed joint:** After stopping heat application, allow about 10 seconds for the braze alloy to solidify. Then, immerse the joint in hot water (approx. 140°F.). To make cleaning easier, add braze cleaner to the hot water. This sudden cooling cracks the braze flux residue, making it easier to remove. Any remaining residue can be removed by careful wire brushing, making sure not to scratch the sealing surface of the sleeve.
7. **Corrosion protection after brazing:** This is an extremely important step following brazing and even more so following the use of a braze cleaner. Braze cleaners available from Parker are used to facilitate the removal of residual flux after brazing, however are generally corrosive. The residue left on the surface by the cleaner, especially on the I.D. of the tube, can cause rusting in carbon steel tubes rather quickly, if it is not neutralized. Therefore, it is important to neutralize the cleaner residue after cleaning with a solution such as Bernite 136[2] (mix 4 ounces of Bernite 136 with one gallon of water). If the brazed parts are not to be used soon after brazing, a coating of rust inhibitors such as WD-40[3] or SP-350[4] is recommended for the braze and heat affected area.

2) Products of Bernite Products, Inc. 84 New York, Westbury, NY 11500 (516) 338-4646.
3) A product of WD-40 Company, San Diego, CA 92220.
4) A product of CRC Chemicals, USA, Warminister, PA 18974 (215) 674-4300

Inspection of Brazing

Inspect the braze for a fillet all the way around the tube at the far end (small diameter) of the sleeve.

Caution: If there are gaps in the fillet, the joint may not be sound. In this case, rebrazing is recommended. Remove the sleeve and rebraze a new one in its place.

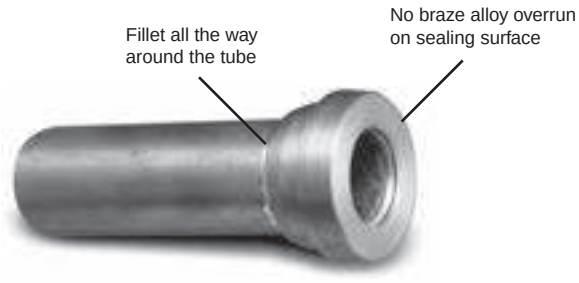

Fig. R24 – Brazed fitting

Inspect the sealing surface. There should be no braze alloy overrun or build-up on this surface. If there is build-up, remove it with emery paper, being careful not to scratch the seal surface. If this is not possible, remove the old sleeve and rebraze a new one in its place.

Final Installation

The following steps are required for final installation of the Seal-Lok fitting:

1. Ensure that the seal is properly installed in the groove of the face seal. Parker provides Seal-Lok fittings with pre-installed trap seals on the grove of the face seal. However, if the seal is being replaced, standard round O-Ring face seal O-rings can be found on page M4, in section M. Since Seal-Lok is machined with the Captive O-ring Groove (CORG), it is recommended that a CORG assembly tool be utilized, as shown in Fig. R25. To properly use the assembly tool, follow these steps

- Position the O-ring inside the CORG assembly tool against the pusher.
- Position the tool over the Seal-Lok tube end until the end is bottomed in the tool.
- Push the plunger of the tool until the O-ring is inserted and seated into the groove.

Fig. R25 – O-Ring installation using the CORG assembly tool

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2. Place the tube assembly against the fitting body so that the flat face of the flange tube (or braze sleeve) comes in full contact with the O-ring. Thread the nut onto the fitting body by hand and tighten it to the recommended torque represented in Table R14. If torque wrenches are not available, an alternate method of assembly is the Flats From Wrench Resistance (F.F.W.R.) method. Wrench tighten the nut onto the fitting body until light wrench resistance is reached. Tighten further to the appropriate F.F.W.R. value.

Note: A second wrench may be required to prevent the fitting from moving during assembly.

Caution: The torque method of assembly is the preferred method of assembly for Seal-Lok fittings. It reduces the risk of human error during assembly that is more prevalent in the Flats From Wrench Resistance (F.F.W.R.) method. To ensure the most accurate assembly of the Seal-Lok fitting, it is strongly recommended that the torque method be utilized.

O.D.		SAE Dash Size	Tube Side Thread Size (UN/UNF)	Tube Side Assembly Torque (+10% -0%)			Flats from Wrench Resistance (F.F.W.R.)	
(in.)	(mm)			in.-lb.	ft.-lb.	N-m	Tube Nuts	Swivel & Hose Ends
1/4	6	-4	9/16-18	220	18	25	1/4 to 1/2	1/2 to 3/4
3/8	8, 10	-6	11/16-16	360	30	40	1/4 to 1/2	1/2 to 3/4
1/2	12	-8	13/16-16	480	40	55	1/4 to 1/2	1/2 to 3/4
5/8	14, 15, 16	-10	1-14	—	60	80	1/4 to 1/2	1/2 to 3/4
3/4	18, 20	-12	1 3/16-12	—	85	115	1/4 to 1/2	1/3 to 1/2
1	22, 25	-16	1 7/16-12	—	110	150	1/4 to 1/2	1/3 to 1/2
1 1/4	28, 30, 32	-20	1 11/16-12	—	150	205	1/4 to 1/2	1/3 to 1/2
1 1/2	35, 38	-24	2-12	—	230	315	1/4 to 1/2	1/3 to 1/2
2	50	-32	2 1/2-12	—	375	510	1/4 to 1/2	1/3 to 1/2

Table R14 – Seal-Lok assembly torque and F.F.W.R. For brass, aluminum (and other soft metals) decrease torque value by 35%, however F.F.W.R. is the same.

Note: Assembly torque values are for unlubricated carbon steel components and properly lubricated stainless steel components. All stainless steel Seal-Lok tube nuts have an anti-seize lubricant to prevent galling during assembly. No additional lubricant is needed unless the tube nuts are washed or heated above 150°F.

FastSeal Assembly Instructions and Troubleshooting

FastSeal assembly consists of the following steps:

1. Prep - cutting, deburring and cleaning of the tube
2. Pre-set
3. Pre-set inspection
4. Final installation

1. Prep

To start, please select your tubing OD and wall thickness using Table R15.

Tube OD	Wall Thickness			
	0.035	0.049	0.065	0.083
1/4”	X	X		
3/8”		X	X	
1/2”		X	X	X

Table R15 – Recommended inch tube OD and wall thickness – carbon steel

See the proper tube end preparation steps provided previously in this Assembly and Installation section or ***watch our techConnect Tube End Preparation Video.***

⚠ CRITICAL STEP:

A heavy deburr, per Fig. R26 of at least 1 mm on the tube is recommended to prevent damage to the internal O-ring. Ensure tube is clean and all chips and debris have been removed from the tube. The deburr dimension can be checked visually (roughly the thickness of a coin) or with the depth gauge on the back end of the marking tool.

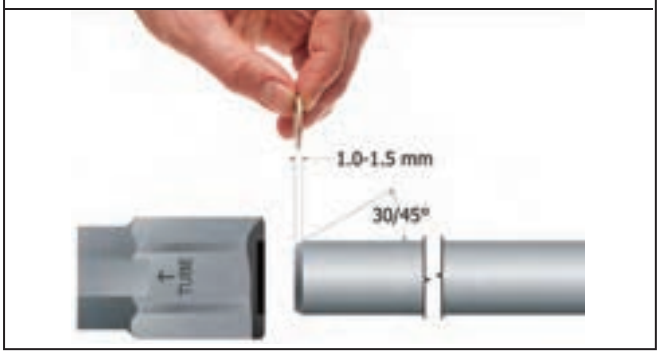

Fig. R26 – Recommended deburr

2. Pre-Set

FastSeal connections require pre-setting that can be accomplished by hand with a wrench and is best done with the assistance of a fixed vice.

Step 1 – Place marking tool on tube until it bottoms out. Mark around OD as shown. If marking tool is not available, use insertion depths shown in **Table R16.**

Step 2 – Thread FastSeal nut onto fitting body or mandrel hand tight. This is best completed with the assistance of a fixed vice if available.

Step 3 – Lubricate the end of the tube with hydraulic oil to help with insertion in the next step.

Step 4 – Insert the tube into the **FastSeal** nut to the tube depth mark. Twist and push tube to aid the insertion. You will feel the tube pop past the O-ring and bottom out.

Step 5 – Mark the nut and body as shown to assist with the FFFT preset.

Step 6 – Tighten the nut to specified FFFT of 7-8 flats. You should feel a perceptible torque rise around 7 flats.

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Tube OD	Depth - in (mm)
1/4”	0.62 (16)
3/8”	0.66 (17)
1/2”	0.71 (18)

Table R16 – Tube Insertion Depths

3. Pre-set Inspection

The gap closure is an important visual inspection to make after presetting the **FastSeal** nut. A “closed gap” can vary from 0-0.01” (0-0.25mm). This small gap may be caused by spring back of the material and will close when the parts are tightened at final assembly.

Loosen and back off nut to inspect the sleeve gap to ensure it has closed. (see Fig. R27).

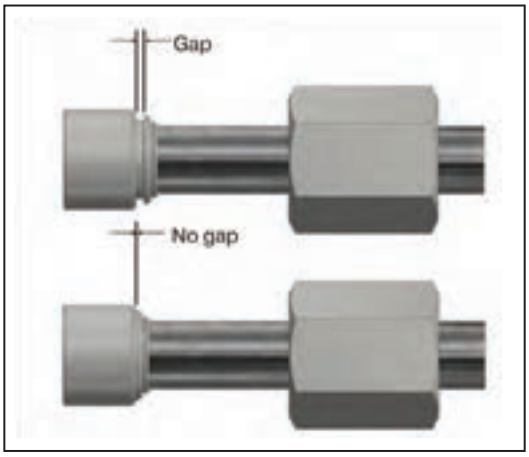

Fig. R27 – Gap Closure Inspection Reference

4. Installation

Once the gap is confirmed closed, assemble tube to fitting body and torque to the values shown in Table R17.

Tube OD	Torque – in-lb (Nm)
1/4”	220 (25)
3/8”	360 (40)
1/2”	480 (55)

Table R17 – Final Assembly Torque

Parker’s patent-pending FastSeal creates quick leak-free permanent ORFS tube end connections with just a wrench. Get more details on this new technology now.

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FastSeal Troubleshooting

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Unsure if tube is bottomed	Use tube marking tool or insertion depths in Table R16 to mark tube prior to insertion and to identify if you have met appropriate depth when tube is inserted into nut.
Unable or difficult to push tube into nut	Tube may be oversized or oval. Use tube making gauge to check for correct size and ovality. If tube does not fit in gauge do not use, select another tube and use gauge to verify the size and ovality before using. **OR** Ensure nut was not tightened more than hand tight onto fitting or mandrel body before inserting tube. Do not wrench tighten nut before tube is fully inserted this may cause bite ring to begin to preset, interfering with tube insertion.
Tube will not push to marked depth on tube	Avoid O-ring damage, **DO NOT FORCE TUBE**. Remove tube and ensure tube is properly deburred to at least 0.040in (1.0 mm) and is cleaned thoroughly. Inspect the tube to ensure it is round, within dimensional specs (should easily fit in tube marking gauge). Ensure a small amount of oil is applied to end of tube before inserting, use slight twist when inserting. **DO NOT FORCE, DO NOT USE A HAMMER.**
Gap not closed after presetting	If gap of more than 0.01in (0.25mm) is detected, reassemble to last marked position, tighten nut ½ additional flat, inspect gap for closure.
Leaks at low pressure	Internal O-ring may be damaged. Contact Division for assistance.
Leaks at high pressure	Inspect the ferrule and sleeve to confirm there was no gap after presetting. Ensure connection was tightened to proper Seal-Lok assembly torque per table S14 4300 catalog. Confirm Seal-Lok trap seal is not damaged or missing. Internal O-ring may be damaged. Contact Division for assistance.
Tube moves in nut after presetting or final assembly	Preset was not done correctly. **DO NOT USE CONNECTION.** Remake tube assembly.
Tube pulls out of nut after preset	Preset was not done correctly, tube too hard. **DO NOT USE CONNECTION.** Check tube material, wall thickness and size. FastSeal nuts are intended for use with low carbon steel seamless or DOM tube intended for hydraulic applications (reference SAE J524/J525).
Unsure what tubes to use	FastSeal nuts are intended for use with low carbon steel seamless or DOM tube intended for hydraulic applications (reference SAE J524/J525). Use of the correct tube wall is critical to meet performance criteria. Recommended tube walls can be found in **Table R15**.

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Universal Push-to-Connect (UPTC)

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Assembly and Installation

UPTC Seal-Lok subassembly utilizes standard Seal-Lok assembly torques, as shown in Table R18.

Size	Torque (+/-10%)		
	in.-lb.	ft.-lb.	N-m
-4	220	18	25
-6	360	30	40
-8	480	40	55
-10	—	60	80
-12	—	85	115

Table R18 – UPTC Seal-Lok Assembly Torque

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Seal-Lok Troubleshooting Guide

O-Ring Face Seal

CONDITION	PROBABLE CAUSE(S)	RECOMMENDATION
Immediate leakage when system is pressurized	• Improper tightening of joint	• Check for O-ring damage and re-tighten connection to the recommended torque value
Under-flanged assembly	• Undersized tube diameter resulting in tube slippage during flanging • Die gripping surface is worn or dirty	• Verify that the O.D. is correct; if undersized, replace tube. • Inspect die gripping surface; if clogged or excessively worn, clean or replace.
Over-flanged assembly	• Sleeve is positioned incorrectly in die	• Check for proper positioning of sleeve in die; if over-flanged, replace tubing
Flange out-of-round	• Tubing was not cut properly • Tube was not properly supported during flanging • Tubing is eccentric	• Cut tubing within 90° ±1° • Support tubing so that tube end is perpendicular to tube stop during flanging • Replace with quality tubing • Replace out-of-round flanges
Cracked flange	• Tubing too hard	• Replace tubing using recommended quality tube
Scored, pitted flange	• Improper deburring and cleaning of tube prior to flanging • Flange pin not cleaned and lubricated properly	• Replace flange using proper deburring and cleaning recommendations • Keep flanging pin clean and working surfaces well lubricated.
Leakage at braze joint	• Poor braze joint/improper joint clearance • Mixing of sleeve and tube material • Improper/inadequate flux, braze alloy overrun, or buildup on face • Improper/inadequate braze temperature	• Flux and reheat the joint, remove and replace with new sleeve • Always use steel sleeves with steel tubing and stainless sleeves with stainless tubing • Apply flux liberally to sleeve and tube end prior to brazing. Use recommended flux, braze alloy and brazing temperature.
Leakage at face-seal end	• Misalignment or improper fit • Damaged, pinched, improper, or missing O-ring • Extruded O-ring • Damaged fitting • Braze overflow on sealing surface	• Align tube end and connecting fitting properly before tightening tube nut, holding the flat face of the mating fitting against O-ring while tightening • Replace O-ring, properly installing it in the face seal groove • Replace O-ring and check for proper alignment and pressure surges exceeding rated pressure of fitting; tighten the nut to recommended torque or replace fitting if threads or sealing surface is grossly damaged. • Remove and replace sleeve which has braze overflow on its sealing surface.

Table R19 – Seal-Lok Troubleshooting guide

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Triple-Lok 37° Flare Fittings

For leak-free performance, the Triple-Lok fitting requires the following steps:

1. Cutting, deburring and cleaning of the tube
2. Flaring
3. Flare inspection
4. Installation

> **Caution:** Use only seamless or welded and drawn tube that is fully annealed for flaring and bending. (See page S17 for tube/fitting material compatibility information.)

For proper tube end preparation see pages R12-R13, or refer to the detailed blog post and video on www.TFDtechconnect.com.

For the recommended minimum and maximum tube wall thickness for Triple-Lok fittings, please refer to Table S16 on page S27.

Flaring

Several flaring methods are available, ranging from simple hand flaring to hydraulic/electric power flaring. Various tools for flaring are shown on pages Q31 through Q34. Power flaring is the preferred method as it is quicker and produces more accurate and consistent flares. Hand flaring should be limited to places where power flaring tools are not readily available. The Parflange machines shown on page Q23 also flare tube with an orbital flaring process and provide the best flare for steel and stainless steel tube.

Prior to flaring, determine the tube length allowance using Table R20. This tube length allowance should be added to the cut tube length to allow for the "loss" of tube caused by flaring.

Nominal Tube O.D. (in.)	Nominal Tube O.D. mm	A (in.)
1/8	—	0.07
3/16	—	0.08
1/4	6	0.09
5/16	8	0.08
3/8	10	0.08
1/2	12	0.12
5/8	14, 15, 16	0.13
3/4	18, 20	0.15
7/8	22	0.15
1	25	0.15
1 1/4	30, 32	0.20
1 1/2	38	0.18
2	42	0.28

Table R20 — Tube length allowance

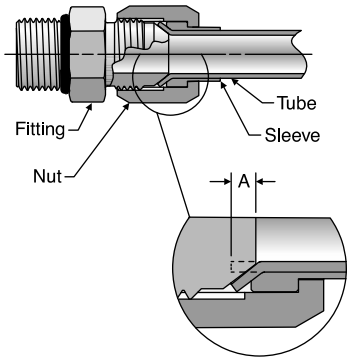


Fig. R28 — Tube length allowance

Flare tube end using one of the flaring tools and following its operating instructions or see www.TFDToolSpec.com. Fig. R29 shows flaring with Hydra-Tool.

> **Note:** Be sure to insert a nut and a sleeve in proper sequence and orientation before flaring either end of a bent tube, or second end of a straight tube (see Fig. R29).

Fig. R29 – Flaring with Hydra-Tool

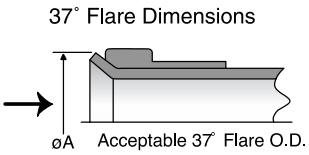
Fig. R30– Nuts and sleeves assembled before flaring

Flare Inspection

Inspect flare for dimensions and surface quality. Table R21 shows the proper flare dimensions. The sleeve can also be used for a quick check of the flare dimensions as shown in Fig. R31.

Inch Tube O.D. (in.)	Metric Tube O.D. (mm)	37° Flare Diameter ØA (in.)
1/4	6	.340/.360
5/16	8	.400/.430
3/8	10	.460/.490
1/2	12	.630/.660
5/8	15 & 16	.760/.790
3/4	18 & 20	.920/.950
1	25	1.170/1.200
1 1/4	30 & 32	1.480/1.510
1 1/2	38	1.700/1.730

Table R21 — 37° Flare Dimensions



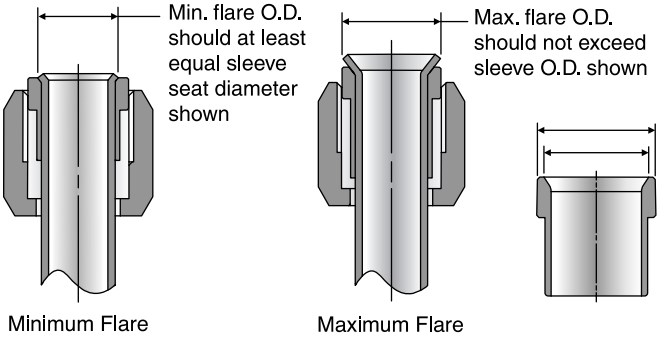


Fig. R31 – Comparing flare O.D. with sleeve seat and O.D.

Underflaring (see Fig. R32) reduces contact area causing excessive nose collapse and leakage in extreme cases the tube may pull out under pressure.

Overflaring (see Fig. R32) causes tube nut thread interference, either preventing assembly altogether, or giving a false sense of joint tightness resulting in leakage.

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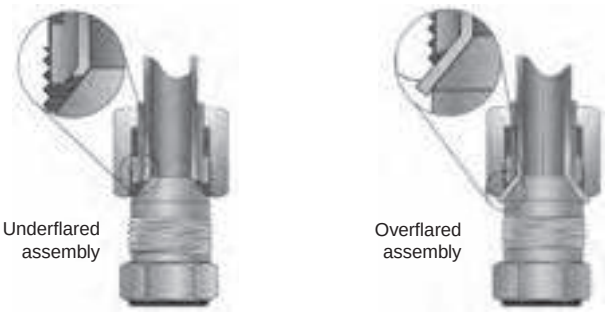

Fig. R32 – Underflaring and overflaring

The flare must be reasonably square and concentric with the tube O.D. Its surface must be smooth, free of rust, scratches, splits, weld beads, draw marks, embedded chips, burrs or dirt. If the flare does not meet the above requirements, cut it off, determine the probable cause from the troubleshooting guide shown in Table R26, take corrective action and re-flare.

Installation

Proper installation is critical for a trouble free operation. Improper flaring or installation causes over half of the leakage with flared fittings.

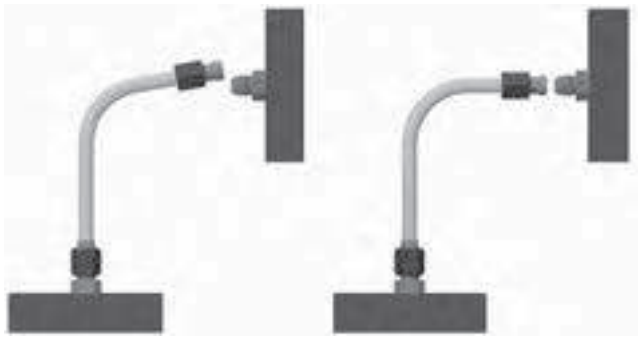

Fig. R33 – Improper bend and short tube

Align the tube on the flare (nose) of the fitting body and tighten the nut using one of two methods described below.

1. Flats from Wrench Resistance (FFWR) or "Flats" method
2. Torque method

> **Note:** Do not force an improperly bent tube into alignment (Fig. R31) or draw-in too short a tube using the nut. It puts undesirable strain on the joint leading, eventually, to leakage.

Flats Method

Tighten the nut lightly with a wrench (approximately 30 in.lb.), clamping the tube flare between the fitting nose and the sleeve. This is considered the Wrench Resistance (WR) position. Starting from this position, tighten the nut further by the number of flats from Table R23. A flat is referred to as one side of the hexagonal tube nut and equates to 1/6 of a turn.

This Flats method is more forgiving than the torque method. It circumvents the effects of differences in plating, lubrication, surface finishes, etc., that greatly influence the torque required to achieve proper joint tightness or clamping load. Therefore, it is recommended to use this method wherever possible, and especially where the plating combination of components is not known, and during maintenance and repair where the components may be oily. Use Table R22 as a guide for proper tightening method.

Condition	Recommended Tightening Method
1. Plating of all components is the same.	Either method is acceptable. Use Table R23.
2. Plating is mixed.	Use FFWR method.
3. Plating of nut and sleeve or hose end is unknown.	Use FFWR method.
4. Parts are oily.	Use FFWR method.
5. Stainless or brass components.	Use FFWR method.

Table R22 – Joint tightening method guide

Parker also recommends that wherever possible, the step of marking the nut position relative to the body should be done. This step serves as a quick quality assurance check for joint tightening. To do this, at the initial wrench resistance position, make a longitudinal mark on one of the flats of the nut and continue it on to the body hex with a permanent type ink marker as shown in Fig. R34a. Then, at the properly tightened position, extend the previous mark on the nut hex to the body hex, as shown in Fig. R34b.

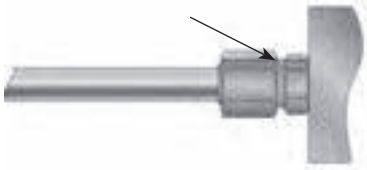

Fig. R34a – Tighten Joint to Wrench Resistance (Approximately 30 in-lb). Make reference mark on nut and fitting body.

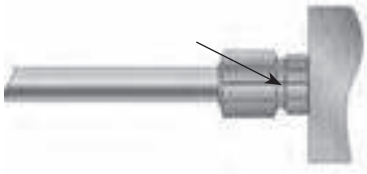

Fig. R34b – For initial assembly only, tighten by number of flats recommended in Table R23. Make a second reference mark on fitting body, lined up with mark on nut; 1 FFWR shown. See page R26 for reassembly procedure.

These marks serve two important functions:

1. The displaced marks serve as a quick quality assurance check that the joint has been tightened.
2. The second mark on the body serves as a proper tightening position after a joint has been loosened.

The flats method is slower than the torque method, but it has the two distinct advantages described earlier: circumvention of plating differences and a quick visual check for proper joint tightening.

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Torque Method

With proper tube flare alignment with the nose of the fitting, tighten the nut to appropriate torque value in Table R23. This method is fast and accurate when preset torque wrenches are used. Consistent component selection is recommended so that the effects of dissimilar plating is not an adverse factor in joint integrity. This makes it desirable for high production assembly lines. However, a joint assembled using the torque method can only be checked for proper tightening by torquing it again.

> **Note:** This method should not be used if the type of plating on the fitting and mating parts (sleeve + nut or hose swivel) is not known. The torque method should not be used for lubricated or oily parts as improper clamping forces may result. Over-tightening and fitting damage may occur as a result.

Triple-Lok Reassembly Method

Prior to loosening the joint, make a reference mark as seen in Fig. R34b. After the joint is loosened, this reference mark will represent the correct tightening position upon reassembly. When tightening the joint, ensure the mark on the nut lines up with, or is slightly past, the mark on the fitting body. Torque method is not recommended for reassembly.

How many times can you reassemble a 37-degree flare fitting? Read our article for what you need to know.

Tube O.D. (in.)	Tube O.D. (mm)	SAE Dash Size	Thread Size	Assembly Torque* (+10% -0) in. lb.	Assembly Torque* (+10% -0) ft. lb.	Tube Connection FFWR	Swivel Nut or Hose Connection FFWR
1/8	–	-2	5/16-24	35	3	—	—
3/16	–	-3	3/8-24	65	5	—	—
1/4	6	-4	7/16-20	155	13	2 1/2	2
5/16	8	-5	1/2-20	165	14	2	2
3/8	10	-6	9/16-18	265	22	2	1 1/2
1/2	12	-8	3/4-16	505	42	2	1 1/2
5/8	14, 15, 16	-10	7/8-14	720	60	1 1/2	1 1/2
3/4	18	-12	1 1/16-12	1000	84	1 1/2	1 1/4
7/8	22	-14	1 3/16-12	1200	100	1 1/2	1 1/4
1	25	-16	1 5/16-12	1415	118	1 1/2	1
1 1/4	28, 30, 32	-20	1 5/8-12	2015	168	1	1
1 1/2	35, 38	-24	1 7/8-12	2340	195	1	1
2	42, 50	-32	2 1/2-12	3180	265	1	1
2 1/2	–	-40	3-12	—	—	1	1

Table R23 – Triple-Lok assembly torques and FFWR

Notes:

1. Assembly Torque: Torque values are for unlubricated carbon steel components and properly lubricated stainless steel components. All stainless steel Triple-Lok tube nuts have an anti-seize lubricant to prevent galling during assembly. No additional lubricant is needed unless the tube nuts are washed or heated above 150°F. Stainless steel fittings use the upper limit of torque range.
2. FFWR: The Flats From Wrench Resistance or "Flats" method is recommended for steel, stainless steel and brass components. Torque and FFWR: Torques and FFWR shown in the chart are for use with the tube materials, wall thickness, etc. recommended by Parker Hannifin Tube Fittings Division for use with Parker Triple-Lok fittings.
3. For brass and aluminum fittings, use approximately 65% of the torque values shown, unlubricated, however FFWR is same for all materials.
4. Reference Fig. R34a and R34b for example of FFWR method.
5. FFWR values are for initial assembly only.

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Recommended Flaring Pressures For Metric Tube

Size (mm)	Material	Tube Wall Thickness 1.0	1.5	2.0	2.5	3.0	Min. Straight Length to Start of Bend
6	SS	400	700	1100			1-5/8
	Steel	300	500	800			
	Copper	150	200	350			
	Aluminum	150	200	350			
8	SS	500	800	1300			1-5/8
	Steel	400	600	1000			
	Copper	150	250	400			
	Aluminum	150	250	400			
10	SS	600	900	1500			1-5/8
	Steel	500	700	1100			
	Copper	200	300	500			
	Aluminum	200	300	500			
12	SS	800	1200	2000	2500		2-3/16
	Steel	600	900	1500	1900		
	Copper	250	350	600	750		
	Aluminum	250	350	600	750		
16	SS	900	2000	2500	2800	3000	2-5/16
	Steel	680	1500	1900	2100	2300	
	Copper	275	600	750	800	900	
	Aluminum	275	600	750	800	900	
18	SS	1000	1700	2500	3100	3500	2-5/16
	Steel	750	1300	1900	2300	2700	
	Copper	300	500	750	900	1100	
	Aluminum	300	500	750	900	1100	
20	SS		1500	2400	3000	3400	2-7/16
	Steel		1100	1800	2300	2600	
	Copper		500	700	900	1000	
	Aluminum		500	700	900	1000	
25	SS			2400	3000	3400	2-7/16
	Steel			1800	2300	2600	
	Copper			700	900	1000	
	Aluminum			700	900	1000	
30	SS			2800	3400	4000	2-1/2
	Steel			2100	2600	3000	
	Copper			800	1000	1200	
	Aluminum			800	1000	1200	
32	SS				4000	4500	2-7/8
	Steel				3000	3400	
	Copper				1200	1300	
	Aluminum				1200	1300	
38	SS				4500	5800	2-7/8
	Steel				3400	4400	
	Copper				1300	1700	
	Aluminum				1300	1700	
42	SS				4700	6500	2-7/8
	Steel				3600	5200	
	Copper				1500	1900	
	Aluminum				1500	1900	
50	SS				5200	7200	2-7/8
	Steel				3900	6100	
	Copper				1900	2300	
	Aluminum				1900	2300	

Table R24 — Recommended Flaring Pressures, Metric Tube

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Recommended Flaring Pressures For Inch Tube

Size	Material	Tube Wall Thickness 0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.134	Minimum Straight Length To Start of Bend
4	SS	400	700	1100						1-5/8
	Steel	300	500	800						
	Copper	150	200	350						
	Aluminum	150	200	350						
5	SS	500	800	1300						1-5/8
	Steel	400	600	1000						
	Copper	150	250	400						
	Aluminum	150	250	400						
6	SS	600	900	1500						1-5/8
	Steel	500	700	1100						
	Copper	200	300	500						
	Aluminum	200	300	500						
8	SS	800	1200	2000	2500					2-3/16
	Steel	600	900	1500	1900					
	Copper	250	350	600	750					
	Aluminum	250	350	600	750					
10	SS	900	2000	2500	2800	3000				2-5/16
	Steel	680	1500	1900	2100	2300				
	Copper	275	600	750	800	900				
	Aluminum	275	600	750	800	900				
12	SS	1000	1700	2500	3100	3500	4000			2-5/16
	Steel	750	1300	1900	2300	2700	3000			
	Copper	300	500	750	900	1100	1200			
	Aluminum	300	500	750	900	1100	1200			
14	SS		1500	2400	3000	3400	4200			2-7/16
	Steel		1100	1800	2300	2600	3200			
	Copper		500	700	900	1000	1300			
	Aluminum		500	700	900	1000	1300			
16	SS			2400	3000	3400	4200	4800		2-7/16
	Steel			1800	2300	2600	3200	3600		
	Copper			700	900	1000	1300	1400		
	Aluminum			700	900	1000	1300	1400		
20	SS			2800	3400	4000	4800	5300		2-1/2
	Steel			2100	2600	3000	3600	4000		
	Copper			800	1000	1200	1400	1600		
	Aluminum			800	1000	1200	1400	1600		
24	SS				4000	4500	5300	5800		2-7/8
	Steel				3000	3400	4000	4400		
	Copper				1200	1300	1600	1700		
	Aluminum				1200	1300	1600	1700		
32	SS					3300	4000	5000	6300	3
	Steel					2500	3000	3800	4700	
	Copper					1000	1200	1500	1900	
	Aluminum					1000	1200	1500	1900	

Table R25 — Recommended Flaring Pressures, Inch Tube

Note: If tube size and wall thickness are not shown on this chart, see page S25, Table S14 for recommended tube size for use with 37° flare fittings.

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Triple-Lok Troubleshooting Guide

37° Flare

CONDITION	PROBABLE CAUSE(S)	RECOMMENDATION
Tube nut binds to tube flare Tube nut cannot engage the fitting body	• Flare too large or tube wall too heavy	• Flare new tube end using proper flare diameters
Flare is out-of-round (lopsided)	• Tube cut at an angle	• Re-cut tube, reasonably square, to 90° ± 1° and flare new tube end
Nicks, scratches, pock marks on tube flare of fitting	• Contaminants on tube ID or flaring cone/pin prior to flaring • Worn/damaged flaring cone/pin • Poor-quality tube	• Flare new tube end using proper tube preparation techniques • Assure that flare cone is clean • Replace poor-quality tube
Tube crack on flare	• Poor-quality welded tube; work-hardened tube; tube not annealed (too hard)	• Flare new tube end using appropriate tube (e.g.,fully annealed) and tube cutting methods
Tube nut bottoms out before seats are mated properly	• Unintentional use of 45° flare tube nut, or tube sleeve was omitted	• Use appropriate 37° flare components (body, nut and sleeve)
Immediate leakage from tube nut	• Connection may not be tightened properly (if at all)	• Check joint for appropriate FFWR or torque; retighten as appropriate
Tube nut continues to back off or loosen	• Damaged Fitting • Excessive vibration • Improper assembly torque	• Replace damaged fitting • Re-route or clamp properly • Assemble to appropriate torque
Damaged fitting and/or nose collapse, flow reduction	• Frequent assembly and disassembly or over-tightening	• Fitting should be replaced and tightened properly; avoid frequent assembly/disassembly

Table R26 — Triple-Lok Troubleshooting guide

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Ferulok Flareless Bite Type Fittings

Ferulok fitting assembly consists of the following steps:

1. Cutting, deburring and cleaning of the tube
2. Ferrule pre-set
3. Pre-set inspection
4. Final installation

For proper tube end preparation see pages R12-R13, or refer to the detailed blog post and video on www.TFDtechconnect.com.

For the recommended minimum and maximum tube wall thickness for Ferulok fittings, please refer to Table S16 on page S27.

Prior to pre-setting, determine the tube length allowance "A" using Table R27.

Nominal Tube O.D.	A
1/8	0.19
3/16	0.23
1/4	0.23
5/16	0.25
3/8	0.25
1/2	0.31
5/8	0.35
3/4	0.35
7/8	0.35
1	0.42
1 1/4	0.42
1 1/2	0.49
2	0.49

Table R27 — Tube length allowance

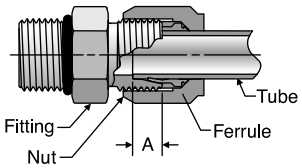


Fig. R35 — Tube length allowance

Ferrule Pre-set

Prior to final installation, the Ferulok fitting requires a pre-setting operation that creates a bite by the ferrule into the outer surface of the tubing. Pre-setting can be accomplished by two different methods: manually using a hardened Ferulset tool or the fitting body, or hydraulically using a Hyferset Tool or a Hydra-Tool.

When using the Hyferset or Hydra-Tool method, the pressure build-up "bites" the ferrule into the tubing. When using the Ferulset or fitting body, thread the connection to finger tight and wrench an additional 1-3/4 turns. This will "bite" the ferrule into the tube.

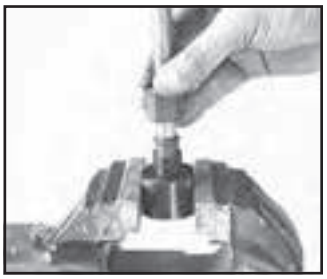
Pre-setting using Ferulset Tool or Fitting Body

Ferulset pre-setting tools made from hardened steel are available for sizes 2 through 32. (See page Q43.) They are recommended over the fitting body because they can be used repeatedly to perform the pre-set operation. The fitting body can be used only once for pre-setting and should be used during final installation with the pre-set tube line. The following steps are required for proper pre-set of the ferrule using the Ferulset tool or fitting body.

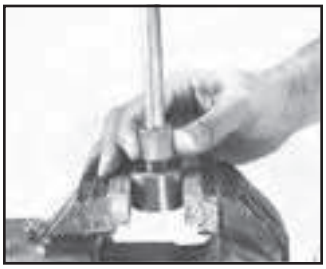
Step 1 – Lubricate thread and cone of Ferulset Tool (or fitting body).

Step 2 – Slip nut and ferrule over deburred tube end. Be sure the long, straight end of the ferrule points toward tube end.

Step 3 – Lubricate ferrule with system fluid or a compatible lubricant. This ensures that the tooling won't stick to the ferrule.



Step 4 – Bottom tube end firmly on internal shoulder of Ferulset Tool (or fitting body).



Step 5 – Manually screw nut onto Ferulset Tool or fitting body until finger tight.

Step 6 – Make reference mark on nut and tube.

Step 7 – Hold tube steady against internal shoulder of Ferulset Tool or fitting body and tighten nut an additional **1-3/4 turns.**

Step 8 – Loosen nut and check for proper pre-set. Use the following inspection criteria.

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Pre-setting with Hyferset Tool or Hydra-Tool

Pre-setting with hydraulic equipment (Hyferset or Hydra-Tool) is preferred for fittings larger than size 8 or large production quantities in any sizes.

For full instruction on the use of the Hyferset Tool (see Fig. R36), please refer to Bulletin 4393-B1, which is included with each shipment of the Hyferset Kit #611049C. For full instructions on the use of the Hydra-Tool, please refer to Bulletin 4392-B10. A22toolspec Bulletins and videos can be found at www.parker.com/TFD or www.TFDToolSpec.com.

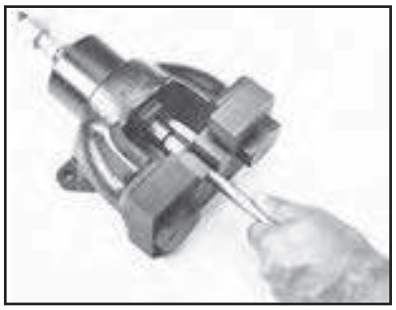

Fig. R36 – Hyferset tool

Pre-Set Inspection

All Ferulok fitting presets must be disassembled and inspected for proper ferrule pre-set before final installation. The following detailed inspection procedures must be followed regardless of the method used to pre-set the ferrule to the tube. (Refer to Fig. R37 for the five inspection points discussed below).

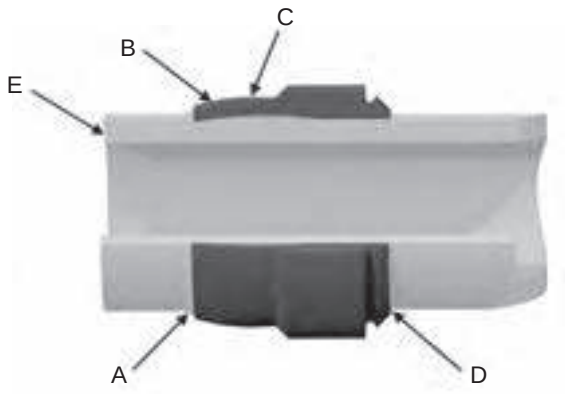

Fig. R37 – Ferulok preset inspection points

1. A ridge of metal (A) has been raised above the tube surface to a height of at least 50% of the thickness of the ferrule's leading edge, completely around the tube.
2. While the leading edge of the ferrule may be coined flat (B) there is a slight bow to the balance of the pilot section (C).
3. The tail or back end of the ferrule is snug against the tube (D).
4. There is a slight indentation around the end of the tube (E) that indicates the tube was bottomed in the tool or fitting during pre-setting.
5. Avoid rotating the ferrule. Steel ferrules should not be capable of moving back and forth along the tube beyond the bite area (a stainless steel ferrule will move more than steel because of it's spring back characteristics).

Caution: Wrench torque should never be used as the gauge for reliable Ferulok pre-set and/or assembly. The reliability of the pre-set and assembly of bite type fittings is dependent on the ferrule traveling a prescribed distance into the tapered fitting throat in order to bite into the tube and effect a strong grip and seal.

Installation

Use one of the following installation procedures, depending on the tooling used earlier to pre-set the ferrule to the tubing.

1. **Fitting body, Hyferset, Hydra-Tool, or Ferulset used to pre-set ferrule** – If the fitting body was used for pre-setting the ferrule, complete the final installation with the **same** fitting body. If one of the tools was used, select the compatible fitting body and lubricate* the threads. Tighten the nut until a sudden and noticeable wrench resistance is achieved. Then wrench an additional **1/6 to 1/4 turn** to complete the final assembly.
2. **Swivel nut assembly procedure (R6BU, C6BU and S6BU)** – For final assembly of swivel nut, a **3/4** turn from finger tight is required for all sizes.

*No additional lubrication is required with stainless steel fittings as the nuts are pre-lubricated.

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Hydra-Tool Pre-Setting Pressures for Ferulok Fittings[1) 2) 3)]

Tube Size	Wall Thickness – Steel							Wall Thickness – Stainless Steel						
	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.035	0.049	0.065	0.083	0.095	0.109	0.120
4	300	300	500	600	600	600		300	300	500	700	700	700	
6	300	500	600	700	700	700	700	300	500	700	700	700	700	800
8		500	700	800	900	1,000	1,000		600	700	1,000	1,000	1,100	1,100
10			700	900	1,000	1,100	1,100			800	1,000	1,100	1,300	1,300
12			900	1,000	1,100	1,100	1,300			1,000	1,100	1,300	1,300	1,500
14			1,000	1,100	1,100	1,300	1,500			1,000	1,300	1,300	1,500	1,600
16				1,100	1,300	1,500	1,600				1,500	1,500	1,600	1,600
20					1,500	1,600	1,800					1,600	2,000	2,000
24					1,800	2,000	2,300					2,100	2,300	2,300
32					2,800	2,900	3,300					3,100	3,300	3,300

Table R28 — Hydra-Tool Recommended Pre-Setting Pressures for Inch Tube

1) These values are provided as a guide only and normally will produce a satisfactory bite.
2) Ferulok pre-setting dies are positive stop dies. Use of above pressures is optional.
3) For wall thicknesses greater than those listed, contact the Tube Fittings Division.

Hyferset Pre-Setting Pressures for Ferulok Fittings[1)]

Tube Size	Wall Thickness — Steel							Wall Thickness — Stainless Steel						
	0.035	0.049	0.065	0.083	0.095	0.109	0.120	0.035	0.049	0.065	0.083	0.095	0.109	0.120
4	800	900	1,400	1,800	1,800	1,800		900	1,000	1,500	2,000	2,000	2,000	
6	900	1,400	800	2,000	2,000	2,000	2,200	1,000	1,500	2,000	2,000	2,000	2,000	2,500
8		1,600	2,000	2,500	2,700	3,000	3,200		1,800	2,200	3,000	3,000	3,500	3,500
10			2,200	2,700	3,000	3,500	3,500			2,500	3,000	3,500	4,000	4,000
12			2,700	3,000	3,500	3,500	4,000			3,000	3,500	4,000	4,000	4,500
14			3,000	3,500	3,500	4,000	4,500			3,000	4,000	4,000	4,500	5,000
16				3,500	4,000	4,500	5,000				4,500	4,500	5,000	5,000
18				4,000	4,500	4,500	5,000				4,500	5,000	5,000	5,500
20					4,500	5,000	5,500					5,000	6,000	6,000
24					5,500	6,000	7,000					6,500	7,000	7,000
28					7,000	7,500	8,000					7,500	8,000	8,500
32					8,500	9,000	10,000					9,500	10,000	10,000

Table R29 — Pre-Setting Pressures for Ferulok Fittings

1) Ferulok pre-setting dies are positive stop dies. Use of above pressures is optional.

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Ferulok Troubleshooting Guide

Problems with bite type hydraulic fittings are most often traced to faulty Pre-Set/Assembly procedure.

Problem / Probable Cause	Remedy
Tube not bottomed	Check for the indentation on the tube end or compare the length from the end of the tube to the front end of the ferrule of a known good assembly to that of the assembly in question. This assembly should be scrapped. (Fig. R38)
Shallow bite	Inspect for turned up ridge of material. A failure to achieve this ridge can be traced either to the nut not being tightened enough or the tube not being bottomed against the stop which allowed the tube to travel forward with the ferrule. In some instances this assembly may be re-worked. (Fig. R39)
Over-set ferrule	Too much pressure or more than 1 3/4 turns from finger tight were used to pre-set ferrule, or the nut was severely over-tightened in final assembly. This assembly should be scrapped. (Fig. R40)
Ferrule cocked on tube	The ferrule may become cocked on the tube when the tube end is not properly lined up with the body. Generally, this condition is caused by faulty tube bending. All bent tube assemblies should drop into the fitting body prior to make up. This assembly should be scrapped. (Fig. R41)
No bite	If all of the prior checks have been made and the ferrule still shows no sign of biting the tube, it may be that the tube is too hard. This assembly should be scrapped. (Fig. R42)

Table R30 – Ferulok fitting troubleshooting guide

Caution: Pre-set tools such as the Ferulset and Hyferset are preferred for pre-setting ferrules prior to final assembly. However, when an actual fitting body is used to pre-set the ferrule, that body should be connected only to the specific ferrule it was used to pre-set.

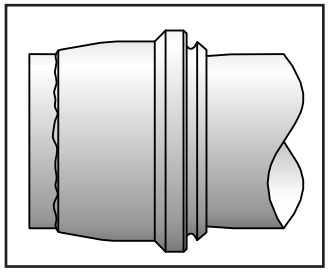

Fig. R38 – Tube not bottomed

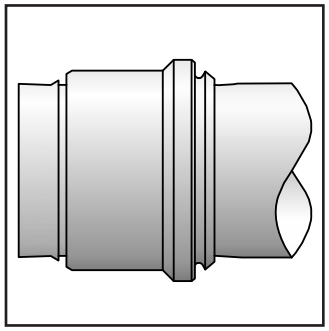

Fig. R39 – Shallow bite

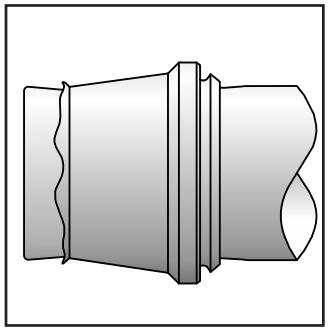

Fig. R40 – Over-set ferrule

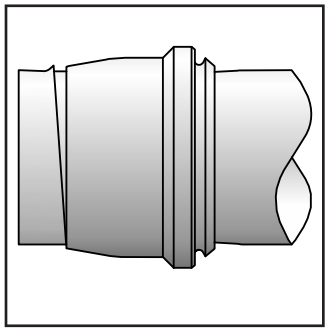

Fig. R41 – Ferrule cocked on tube

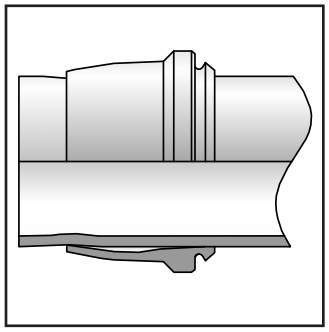

Fig. R42– No bite

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24° Flareless Bite

CONDITION	PROBABLE CAUSE(S)	RECOMMENDATION
Immediate leakage when system is pressurized	• Improper ferrule/bite ring orientation	• Reset ferrule to ensure that the leading edge of ferrule/bite ring is pointing towards end of tube and seat of the mating fitting
Additional/excessive stress apparent on bite	• Non-square tube cut; tube not being properly supported in seat of adapter	• Re-cut tube to 90° ± 1°
Flexural stresses allow tube to“rock” back and forth	• Tube not fully supported in fitting’s body seat	• Reset tube end. This time ensure that the tube is bottomed in the presetting tool or fitting body
Poor ferrule/bite ring pre-set and/or tube collapse	• Tube may be too hard; or preset pressure or torque might be too high • Tube is too thin	• Use fully annealed tube max hardness R_B 72 for steel, R_B 90 for stainless steel • Consult manufacturer's minimum tube wall thickness requirements; tube supports must be used with certain thin-walled steel or stainless-steel tube. Review preset requirements
Tube not bottoming out in fitting body	• Improper preset or wrong tool used for presetting	• In the presetting process, it is important to exert axial force on the tube to keep it fully bottomed in the tool. Check for indentation on end of the tube
Shallow bite of ferrule or cut ring into tube	• Worn preset tool • Too low preset pressure or torque • Tube too hard • Tube not bottomed against stop initially in preset	• Replace preset tool • Observe manufacturer’s recommendation for proper preset • Ensure that tube is of correct hardness or material • Hold tube against stop in preset
Tube pulls out of fitting in application and ferrule skives end of tube	• Improper preset • Tube too hard • Excessive internal pressure • Excessive axial load on tube • Inadequate make up	• Preset must be inspected for evidence of proper preset, such as raised ridge of metal in front of leading edge • Ensure that tube is of proper hardness and material • Ensure that internal pressure is within rating of fitting (tube might be of a higher rating) • Avoid additional axial load than that caused by internal pressure • Follow proper presetting and assembly procedures
Fitting nut is tight but leakage still occurs	• Overset ferrule • Cracked tube • Damaged components	• Excessive force used in presetting of ferrule can cause it not to spring back and effect a seal. Follow manufacturer’s recommendation for preset • Check tube for circumferential crack due to fatigue • Check components for damage such as nicks, scratches and cracks

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EO Metric Bite Type FIttings

The proper make-up and assembly of EO bite type fittings, as with other fittings, is critical to their proper functioning. Proper assembly consists of the following steps:

1. Cutting, deburring and cleaning of the tube
2. Pre-set of progressive ring
3. Pre-set inspection
4. Installation

For proper tube end preparation see pages R12-R13, or refer to the detailed blog post and video on www.TFDtechconnect.com.

Pre-set of Progressive Ring

The EO fitting requires a pre-set operation that creates a bite by the progressive ring into the outer surface of the tube. There are two methods of achieving the pre-set:

- Manually with the fitting body or hardened pre-assembly tool (not recommended for stainless steel tube).
- Hydraulically with the EO-Karrymat, Hydra Tool or Hyferset

Pre-set Using the Fitting Body or Hardened Pre-assembly Tool

Pre-setting with the fitting body is only recommended for small diameter steel and copper tubes. For frequent pre-setting, stainless steel tube and hose standpipe fittings, a hardened pre-assembly tool (VOMO) is strongly recommended (see Fig. R43).

Steps for pre-set using the fitting body or the hardened pre-assembly tool.

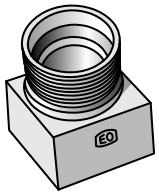
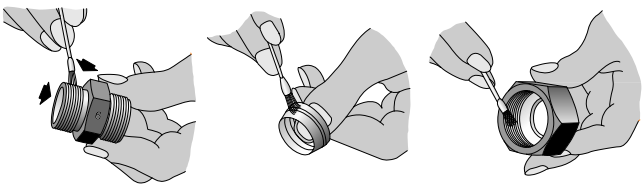


Fig. R43 – VOMO pre-assembly tool

1. Lubricate thread and cone of fitting body or hardened pre-assembly tool, as well as the progressive ring and nut threads.

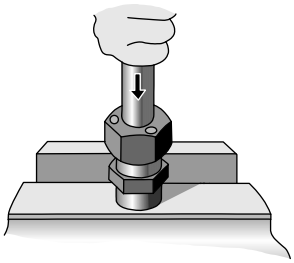


2. Slip nut and progressive ring over tube, assuring that they are in the proper orientation.

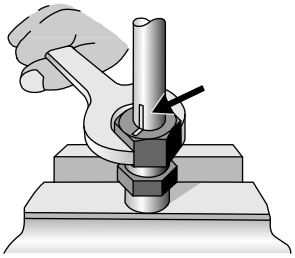
Correct

Incorrect

3. Screw nut onto fitting body or hardened pre-assembly tool until finger-tight or light wrench resistance. Hold tube against the shoulder in the cone of the fitting body or hardened pre-assembly tool.



4. Mark nut and tube in the finger-tight or light wrench-resistant position.



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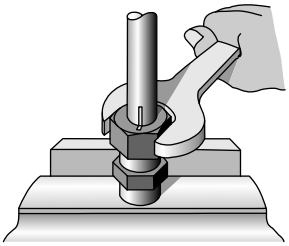
5. Tighten nut 1½ turns if using the fitting body or hardened pre-assembly tool. The tube must not turn with the nut. The stop edge in the progressive ring limits over tightening by sharply increasing the tightening torque.



Pre-set Using EO-Karrymat, Hydra-Tool or Hyferset

When pre-setting EO fittings larger than sizes 18 mm, it is recommended that a hydraulic tool be used. The EO-Karrymat, Hydra-Tool or the Hyferset (shown in Fig. R44) are recommended for low to medium volume production.

Fig. R44 – Hyferset tool

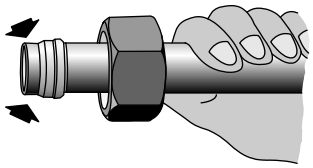
Fig. R45 – EO Karrymat

For full instruction on the use of these hydraulic tools, please refer to www.TFDToolSpec.com for the bulletins indicated below:

- EO-Karrymat – Bulletin 4044-T1/UK/DE/FR/T
- Hyferset - Bulletin 4393-B1
- Hydra-Tool – Bulletin 4392-B10

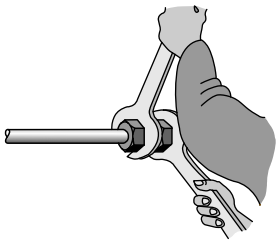
Pre-set Inspection

To inspect the pre-set, remove the nut and tube from the fitting and check if a visible collar fills the space completely in front of first cutting edge. If not, tighten slightly more. It does not matter if ring can be rotated on tube end.



Installation

To install the pre-set tube assembly to the fitting body, wrench-tighten nut to wrench resistance (light wrenching). From this position, tighten nut another 1/12 turn or 1/2 flat (30°) of the nut. Another wrench must be used to prevent movement of the fitting body.



Assembly with Support Sleeve (VH)

If the tube wall thickness is small relative to the tube O.D., this may lead to tube collapse. As a rule, the tube collapse (reduction in diameter) should not exceed 0.3 mm for tubes up to 16 mm O.D. and 0.4 mm for tubes from 18 mm O.D. and above.

When assembling thin walled tube, there is insufficient cross sectional rigidity where the progressive ring cuts. This will have a detrimental effect on the sealing efficiency. For this, internal support sleeves (VH) are available which are inserted in the tube to prevent tube collapse and also increase the cross-sectional rigidity.

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The shape of the tube supports allows them to be inserted easily in the tube. One end of the EO support sleeve is enlarged on its external diameter by a knurl. On insertion, this knurl forces itself into the interior wall of the tube and secures the sleeve against shifting or falling out during assembly and without widening the tube end.

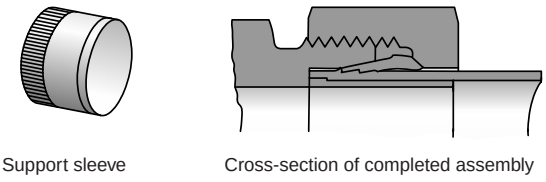


Fig. R46 — EO fitting completely assembled with support sleeve

Steel tubes made of 37.4 or soft metal tubes can be checked in accordance with Figs. R47 and R48, respectively, to see if they require support sleeves; for plastic tubes, (support) sleeves are always necessary (see Page D21 for E type sleeves).

For stainless steel tubes of material 1.4571/1.4541, refer to Fig. R44 to determine the need for a support tube.

For thin-walled steel tube of material St.37.4 and stainless steel tubes of material 1.4571/1.4541.

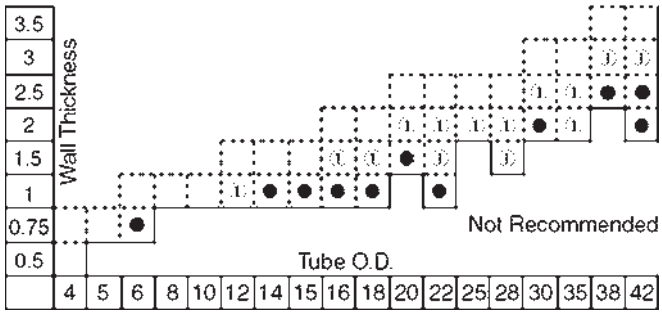


Fig. R47 — Recommended Tube Wall Thicknesses, Steel, SS

● Use of VH necessary

① Use of VH is recommended especially in case of frequent loosening and with heavy-duty tubes (vibrations)

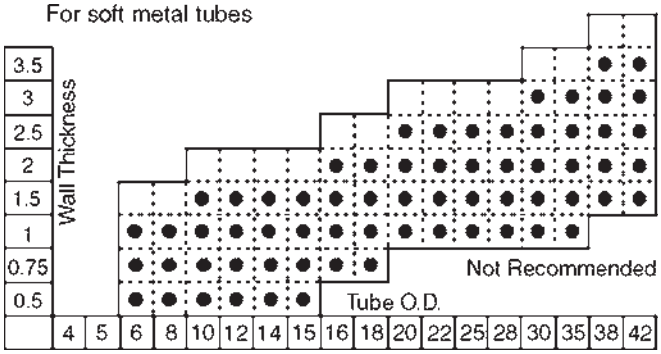


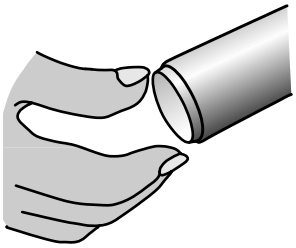
Fig. R48 — Recommended Tube Wall Thicknesses, Soft Metal Tubing

● Use of VH necessary

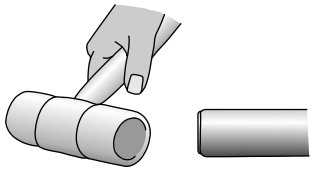
① Use of VH is recommended especially in case of frequent loosening and with heavy-duty tubes (vibrations)

Steps for Proper Assembly of Support Sleeve (VH)

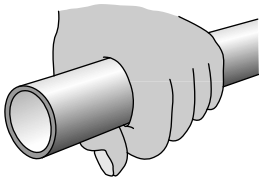
Step 1 – Insert support sleeve up to knurl.



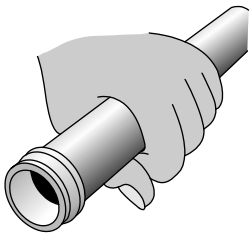
Step 2 – Drive knurled end of support into tube.



Step 3 – Ensure that support sleeve is flush with tube end.



Step 4 – Pre-set progressive ring following one of the pre-setting methods covered earlier (page R33). The support sleeve prevents collapse of tube.



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EO Troubleshooting Guide

Problems with bite type hydraulic fittings are most often traced to faulty pre-set/assembly procedure.

Problem	Solution
Tube not bottomed	Check for a visible mark on the tube end with EO fitting. (Fig. R49)
Shallow bite	Inspect for turned up ridge of material (collar). A failure to achieve this ridge can be traced either to the nut not being tightened enough or the tube not being bottomed against the stop which allowed the tube to travel forward with the ferrule. In some instances this assembly may be re-worked. (Fig. R50)
Over-set ferrule	Too much pressure or more than recommended turns from finger tight were used to pre-set ferrule, or the nut was severely over-tightened in final assembly. This assembly should be scrapped. (Fig. R51)
Ferrule cocked on tube	The ferrule may become cocked on the tube when the tube end is not properly lined up with the body. Generally, this condition is caused by faulty tube bending. All bent tube assemblies should drop into the fitting body prior to make up. This assembly should be scrapped. (Fig. R52)
No bite	If all of the prior checks have been made and the ferrule still shows no sign of biting the tube, it may be that the tube is too hard. This assembly should be scrapped. (Fig. R53)

Table R31 — EO Fitting troubleshooting guide

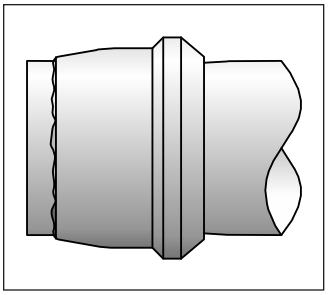

Fig. R49 — Tube not bottomed

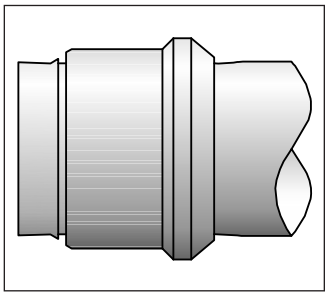

Fig. R50 — Shallow bite

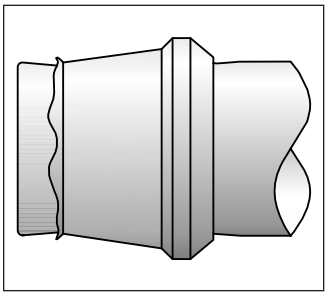

Fig. R51 — Over-set ferrule

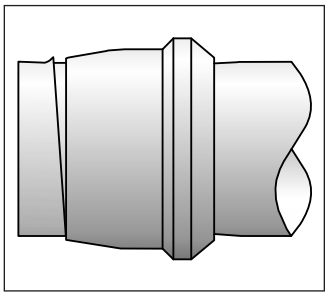

Fig. R52 — Ferrule cocked on tube

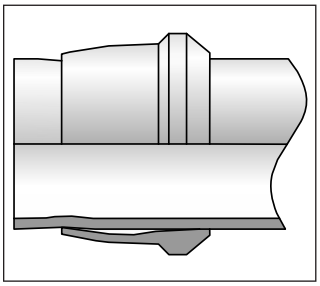

Fig. R53 — No bite

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EO-2 Metric Bite Type Fittings

The steps for the proper assembly of the EO-2 fittings are similar to those of the EO fitting:

1. Cutting, deburring and cleaning of the tube
2. Pre-set of the retaining ring
3. Inspection of the pre-set
4. Installation

For proper tube and preparation see pages R12-R13, or refer to the detailed blog post and video on www.TFDtechconnect.com.

Pre-set of the Retaining Ring

The EO-2 functional nut consists of the nut, the sealing ring and the retaining ring. Unlike the EO fitting, the sealing and holding functions are performed by two separate components: the sealing ring and the retaining ring. The retaining ring must be pre-set to create the necessary bite on the tube O.D. The two methods to pre-set the retaining ring are:

- Manually with the fitting body or hardened pre-assembly tool (VOMO)
- Hydraulically with the EO-Karrymat, Hydra Tool or Hyferset

Pre-set Using the Fitting Body or Hardened Pre-Assembly Tool

1. Prepare the fitting or hardened pre-assembly tool by lubricating the threads of the following sizes:

   Steel Fittings:
   20, 22, 25, 28 Lubrication is recommended for ease in assembly

   Stainless Steel Fitting:
   For all sizes, lubrication is recommended for ease in assembly

   High quality Niromont (liquid or paste) is recommended for lubrication of the fitting body threads.

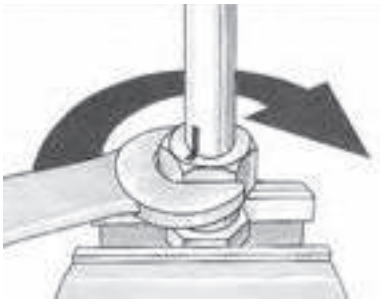
   It is strongly recommended that a hydraulic tool be used to preset EO-2 fittings in sizes 30S, 35L, 38S and 42L.

2. Insert tube into the EO-2 fitting body or hardened pre-assembled tool and press hard against the stop in the inner cone.

   Note: A faulty assembly will result if the tube is not against the tube stop in the fitting body or hardened pre-assembly tool. To achieve the necessary assembling force, an additional wrench leverage may be necessary for tube O.D.'s 20mm and larger.

3. Turn nut until wrench resistance is felt. Tighten nut further 1 to 1-1/2 turns. As a recommended process control, mark the position of the nut relative to the fitting body.

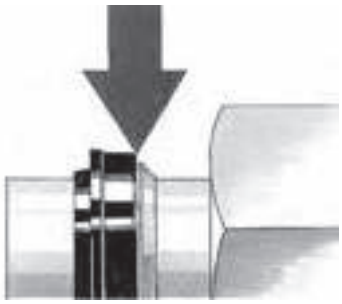
Pre-set Inspection



Loosen the nut and check that the gap between the sealing ring and retaining ring is fully closed. A slight gap (up to 0.2mm) due to spring back is acceptable.

*Refer to Fig. R47 and R48 for required support sleeves.

Pre-set Using EO-Karrymat, Hyferset, Hydra-Tool and EOMAT III



EO-Karrymat: Recommended for use with EO-2 fittings from 6mm through to 42mm.

Hyferset: Recommended for use with EO-2 fittings from 6mm through to 28mm.

Hydra-Tool: Recommended for use with EO-2 fittings from 6mm through to 42mm.

For instructions on operating one of these machines, refer to www.TFDToolSpec.com for the following bulletins:

- EO-Karrymat – Bulletin 4044-T1/UK/DE/FR/IT
- Hyferset – Bulletin 4393-B1
- Hydra-Tool – Bulletin 4392-B10

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Hydra-Tool Pre-Setting Pressures for EO and EO-2 Steel Fittings

Pressures for Steel EO Fittings Using Stop Adapter (971107 & 971108)

Pre-Setting Pressues (psi) for EO Fittings Wall Thickness (mm)							
Size	**Series**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**4.0**
6	L	500	500	500			
6	S	500					
8	L	500		500			
8	S	500	500				
10	L		500				
10	S		500				
12	L	300	300	500			
12	S		300				
14	S			1,500			
15	L		500	800			
16	S			1,200		1,300	
18	L		1,000			1,300	
20	S				2,000		
22	L		1,500	1,500			
25	S					2,000	2,000
28	L			2,000			
30	S					3,000	
35	L			3,000		3,300	
38	S						3,500
42	L					4,000	

Table R32 — Pre-Setting Pressures for Steel EO Fittings

NOTE: The values provided in this chart are provided as a guide only and normally will produce a satisfactory bite when using the Parker Hydra-Tool.

Pressures for Steel EO-2 Fittings Using Stop Adapter (971107 & 971108)

Hydra-Tool Pre-Setting Pressures (psi) for EO-2 Fittings in Steel and Stainless Steel Using the Stop Adapter		
Size	Series	psi
6	L	1,100
6	S	1,100
8	L	1,300
8	S	1,300
10	L	1,800
10	S	1,800
12	L	2,000
12	S	2,000
14	S	2,300
15	L	2,300
16	S	3,000
18	L	3,000
20	S	4,100
22	L	3,100
25	S	5,500
28	L	3,700
30	S	6,600
35	L	5,300
38	S	8,400
42	L	7,600

Table R33 — Pre-Setting Pressures for Steel and Stainless Steel EO-2 Fittings

NOTE: The values provided in this chart are provided as a guide only and normally will produce a satisfactory bite when using the Parker Hydra-Tool.

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Hyferset Pre-Setting Pressures for EO Steel Fittings[2)]

Pre-Setting Pressures (psi) for EO Fittings					
Tube Size (mm)	Wall Thickness (mm)				
	1.0	1.5	2.0	2.5	3.0
6-L	650	650			
6-S	650	650			
8-L	900	900			
8-S	900	900			
10-L	1,350	1,350	1,550		
10-S	1,350	1,350	1,550		
12-L	1,750	1,750	1,750	1,750	
12-S	1,750	1,750	1,750	1,750	
14-S		2,000	2,000	2,200	2,200
15-L	1,800	1,800			
16-S		2,200	1,450	1,450	
18-L	2,000	2,000	2,000		
20-S			3,300	3,500	
22-L		3,100	3,100		
25-S				4,000	4,000
28-L		3,500	3,500		

Table R34 — Pre-Setting Pressures for EO Fittings

2) EO and EO-2 pre-setting dies are not positive stop style. Pre-setting must be done using pressures given in these charts.

Hyferset Pre-Setting Pressures for EO-2 Steel Fittings[2)]

Hyferset Pre-Setting Pressures (psi) for EO-2 Fittings		
Size	Series	Any wall
6	L	1,150
6	S	1,150
8	L	1,450
8	S	1,450
10	L	2,450
10	S	2,450
12	L	2,800
12	S	2,800
14	S	3,500
15	L	2,800
16	S	3,900
18	L	3,200
20	S	5,600
22	L	4,950
25	S	6,400
28	L	5,600

Table R35— Pre-Setting Pressures for EO-2 Fittings

2) EO and EO-2 pre-setting dies are not positive stop style. Pre-setting must be done using pressures given in these charts.

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Connect tube and nut to fitting body. Holding the body rigid, tighten nut with a wrench until resistance is felt. Continue turning the nut approximately 1/6 to 1/4 turns (= 1 to 1-1/2 flats) to the same position as it was prior to disassembly.

If the assembled position was marked, reassemble until the marks match. To achieve the necessary assembling force, use an additional wrench leverage for tube O.D.'s 20 mm and larger.

Caution: Improper tightening may reduce the seal reliability, pressure capability and the vibration resistance of the connection.

Re-Assembly with Replacement of Sealing Ring (DOZ)

1. After the nut has been loosened, the sealing ring can be pulled off the tube end. It must be checked for damage and replaced if necessary.
2. Push new sealing ring onto the tube, with metal inner cone facing the retaining ring.
3. Re-install using the installation procedures previously covered in this section.

Step 1

Step 2

EO-2 Troubleshooting Guide

Problems with bite type hydraulic fittings are most often traced to faulty pre-set/assembly procedure.

Problem/ Probable Cause	Remedy
Tube not bottomed	The tube end is not in firm contact with the fitting body at assembly. The tubing was not completely inserted into the throat of the fitting body until it bottomed out. Failure to bottom out the tubing against the tube stop of the fitting body during the presetting procedure will allow the tube to travel forward with the ferrule resulting in a shallow bite. This assembly should be scrapped.
Shallow bite	After presetting, inspect to see that the gap between the bite ring and the sealing ring is closed. A failure to achieve a closed gap can be traced to the nut not being tightened enough. This assembly can be reworked by completing the assembly instructions as indicated in the catalog. Utilization of lubrication and wrench elongation may be necessary for larger sizes.
Damaged Seals	Check sealing area for contamination such as chips, zinc particles or other dirt. Also check the inner cone of the fitting body and tubing for damage. Replace DOZ sealing ring if necessary.
Fatigue Crack at Bite	Ensure proper assembly techniques are utilized. Utilize lubrication and wrench elongation for larger sizes. Check that the gap between the sealing ring and bite ring are closed.
Fatigue Crack at Rear Shoulder of Bite Ring	Check that the application does not have excessive vibration. Utilize rigid clamping, tension piping or hose assemblies if relative movements are evident.
Distorted FM Functional Nut at Hydraulic Pre-Assembly	Utilize a split die nut back up plate for presetting of 35L and 42L functional nuts.

Table R36 — EO-2 troubleshooting guide

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24° Flareless Bite

CONDITION	PROBABLE CAUSE(S)	RECOMMENDATION
Immediate leakage when system is pressurized	• Improper ferrule/bite ring orientation	• Reset ferrule to ensure that the leading edge of ferrule/bite ring is pointing towards end of tube and seat of the mating fitting
Additional/excessive stress apparent on bite	• Non-square tube cut; tube not being properly supported in seat of adapter	• Re-cut tube to 90° ± 1°
Flexural stresses allow tube to"rock" back and forth	• Tube not fully supported in fitting's body seat	• Reset tube end. This time ensure that the tube is bottomed in the presetting tool or fitting body
Poor ferrule/bite ring pre-set and/or tube collapse	• Tube may be too hard; or preset pressure or torque might be too high • Tube is too thin	• Use fully annealed tube max hardness R_B 72 for steel, R_B 90 for stainless steel • Consult manufacturer's minimum tube wall thickness requirements; tube supports must be used with certain thin-walled steel or stainless-steel tube. Review preset requirements
Tube not bottoming out in fitting body	• Improper preset or wrong tool used for presetting	• In the presetting process, it is important to exert axial force on the tube to keep it fully bottomed in the tool. Check for indentation on end of the tube
Shallow bite of ferrule or cut ring into tube	• Worn preset tool • Too low preset pressure or torque • Tube too hard • Tube not bottomed against stop initially in preset	• Replace preset tool • Observe manufacturer's recommendation for proper preset • Ensure that tube is of correct hardness or material • Hold tube against stop in preset
Tube pulls out of fitting in application and ferrule skives end of tube	• Improper preset • Tube too hard • Excessive internal pressure • Excessive axial load on tube • Inadequate make up	• Preset must be inspected for evidence of proper preset, such as raised ridge of metal in front of leading edge • Ensure that tube is of proper hardness and material • Ensure that internal pressure is within rating of fitting (tube might be of a higher rating) • Avoid additional axial load than that caused by internal pressure • Follow proper presetting and assembly procedures
Fitting nut is tight but leakage still occurs	• Overset ferrule • Cracked tube • Damaged components	• Excessive force used in presetting of ferrule can cause it not to spring back and effect a seal. Follow manufacturer's recommendation for preset • Check tube for circumferential crack due to fatigue • Check components for damage such as nicks, scratches and cracks

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Bulkhead Locknut Assembly

A bulkhead fitting allows one to connect tube or hose through a panel. This panel, often referred to as bulkhead, may be a structural element of the equipment, or an additional plate which is joined to the equipment, to facilitate convenient routing of hose and tube. Bulkhead fittings are also used as a transition point in a hydraulic system, such as connection of tube lines to hose lines or to a quick disconnect coupling.

The following steps are recommended for the proper assembly of the locknut for Triple-Lok, Ferulok and Seal-Lok bulkhead fittings.

1. Drill a pilot hole to dimension W + 0.015" (where W is shown in Tables R37 and R38).
2. Insert the bulkhead end of the fitting (without the locknut assembled) through the bulkhead opening and attach the locknut to the bulkhead end.
3. Finger tighten the locknut and wrench tighten further to the recommended torque shown in Table R37 for Seal-Lok fittings or Table R38 for Triple-Lok and Ferulok fittings.

TUBE FITTING PART #	THREAD SIZE UN/UNF	W*	ASSEMBLY TORQUE +10% - 0		
			in.-lb.	ft.-lb.	N-m
4 WLNL	9/16-18	0.56	180	15	20
6 WLNL	11/16-16	0.69	300	25	34
8 WLNL	13/16-16	0.81	—	55	75
10 WLNL	1-14	1.00	—	85	115
12 WLNL	1 3/16-12	1.19	—	135	180
14 WLNL	1 5/16-12	1.31	—	170	230
16 WLNL	1 7/16-12	1.44	—	200	270
20 WLNL	1 11/16-12	1.69	—	245	330
24 WLNL	2-12	2.00		270	365

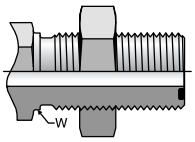
* Recommended clearance hole is W + 0.015"

Table R37 – Torque for Seal-Lok Bulkhead Fittings

TUBE FITTING PART #	THREAD SIZE UN/UNF	W*	ASSEMBLY TORQUE (+10 - 0)		
			in.-lb.	ft-lb	N-m
3 WLN	3/8-24	0.38	100	—	11
4 WLN	7/16-20	0.44	155	13	18
5 WLN	1/2-18	0.50	250	20	28
6 WLN	9/16-18	0.56	300	25	35
8 WLN	3/4-16	0.75	600	50	65
10 WLN	7/8-14	0.88		85	115
12 WLN	1 1/16-12	1.06		135	180
14 WLN	1 3/16-12	1.19		170	230
16 WLN	1 5/16-12	1.31		200	270
20 WLN	1 5/8-12	1.63		245	330
24 WLN	1 7/8-12	1.88		270	365
32 WLN	2 1/2-12	2.50		310	420

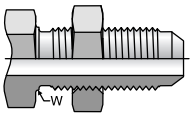
* Recommended clearance hole is W + 0.015"

Table R38 – Torque for Triple-Lok and Ferulok Bulkhead Fittings



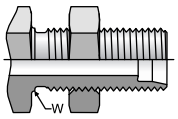
Seal-Lok Bulkhead Assembly

See page A8 for maximum bulkhead thickness.



Triple-Lok Straight Bulkhead

See page B8 for maximum bulkhead thickness.



Ferulok Straight Bulkhead

See page C6 for maximum bulkhead thickness.

Pipe Swivel Assembly (NPSM)

Unlike traditional pipe thread, these connections seal on the nose of the swivel end. The nose has a 60° inclusive angle that mates against a chamfer of the same angle on the male pipe thread end (also known as a 30° chamfer).

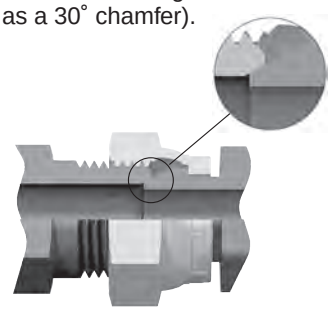


Fig. R52 - Illustration showing how swivel adapters seal on mating chamfer in male pipe thread end.

NPSM Pipe Swivels

Fig. R54

NPSM Pipe swivels, also known as Parker 07 Adapters, must connect with a male NPT/NPTF pipe thread with a 30° machined seat per SAE J514.

NPSM Size in.	Steel Assembly TORQUE (+10% - 0%)		
	in.-lb.	ft.-lb.	F.F.F.T.
1/8	106	9	1.0 - 1.5
1/4	156	13	1.0 - 1.5
3/8	192	16	1.0 - 1.5
1/2	396	33	1.0 - 1.5
3/4	580	48	2.0 - 2.5
1	1140	95	2.0 - 2.5
1 1/4	1420	118	2.0 - 2.5
1 1/2	2840	237	2.0 - 2.5
2	3720	310	2.0 - 2.5

Table R39– NPSM Pipe Swivel Torques

Steps:

1. Finger tight
2. Wrench tighten to torque specs in Table (R39)

Dimensions and pressures for reference only, subject to change.

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Routing and Clamping

Most hydraulic, pneumatic and lubrication systems require some form of tube line fabrication and fitting installation for completion. Proper fabrication and installation are essential for the overall efficiency, leak free performance, and general appearance of any system.

The following factors should be considered early in the design process, after sizing the tube lines and selecting the appropriate style of fitting:

1. Proper routing of tube lines
2. Adequate tube line support (clamping)

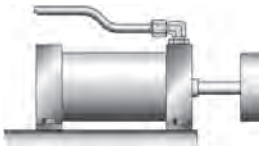
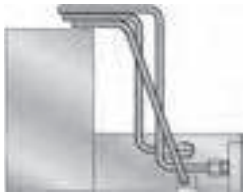
Routing of Lines

Routing of lines is one of the most difficult, yet most significant of these system design considerations. Proper routing involves getting a connecting line from one point to another through the most logical path, while considering other factors as discussed below.

The most logical path is not always the direct path and should have the following characteristics:

- **Avoid excessive strain on joint —** A strained joint will eventually leak. A straight line tube assembly (with no bends) or a joint that is forced into position are common examples of strain applied to tube assemblies.
- **Allow for expansion and contraction —** Use a “U” bend or a hose in long lines to allow for expansion and contraction due to pressure or temperature fluctuations.
- **Allow for motion under load —** Even some apparently rigid systems do move under load. Use an offset (“S”) bend.
- **Get around obstructions without using excessive amount of 90° bends —** Pressure drop due to one 90° bend is greater than that due to two 45° bends.
- **Keep tube lines away from components that require regular maintenance**.
- **Leave fitting joints as accessible as possible —** Inaccessible joints are more difficult to assemble and tighten properly, and more time consuming to service.
- **Have a neat appearance and allow for easy trouble-shooting, maintenance and repair**.

The following illustrations provide several examples of typical routing situations. The graphics show the preferred and non-preferred path along with an explanation.

Non-preferred Routing	Preferred Routing	Explanation
   	   	Avoid straight tube lines. There is no margin for error on a straight line, resulting in excess joint strain. Straight tube lines do not allow for expansion and contraction due to pressure and temperature fluctuations.
		Allow for expansion and contraction of lines by utilizing “U” bend.
		Offset (“S”) bend allows for motion under load.
		Avoid excessive pressure drop by getting around obstructions without using 90° bends. One 90° bend causes more pressure drop than two 45° bends.
		Avoid creating an obstruction by routing lines around areas that require service. Leave adequate clearance for wrenches.
		Route lines to allow for proper clamping. When done properly, several lines can typically be clamped together. Route lines to allow for trouble-shooting. Lines that cross and are not in logical order tend to be difficult to work with during maintenance.

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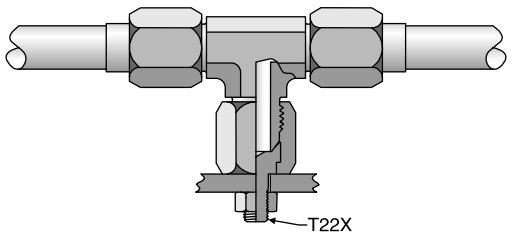
Tube Clamping

Tube line supports (clamps) serve two primary purposes in tube line systems: mounting and vibration dampening. Fatigue failure due to mechanical vibration accounts for the majority of tube line failures. Proper clamping of the tube also reduces system noise.

Use a clamping system such as Parker's ParKlamp series along with proper clamp spacing provided in Table R42.

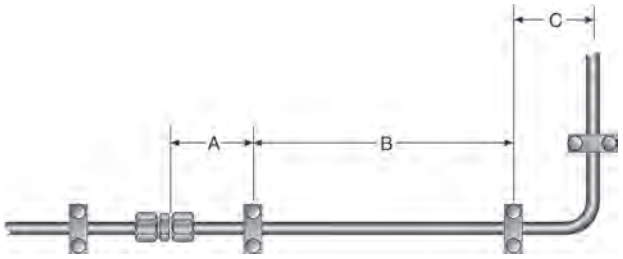
For tube clamps to dampen vibration effectively, they need to be anchored to a rigid structure. Clamping several tubes together, without rigid structural anchoring, does not provide effective dampening.

A mountie can be used in lieu of clamps in certain product lines by anchoring a tee fitting to the equipment's structure (see Fig. R55).



The Mountie Caps the End and Provides an Anchor

Fig. R55 — Mountie cap used with Triple-Lok for anchoring tube lines



Tube O.D. (in.)	Tube O.D. (mm)	A (in.)	B (ft.)	C (in.)
1/4	6	2	3	4
5/16	8			
3/8	10			
1/2	12	4	5	8
5/8	14			
3/4	18			
7/8	22			
1	25			
1-1/4	30	6	7	12
1-1/2	38			
2	50			

Table R42 — Recommended tube clamp spacing

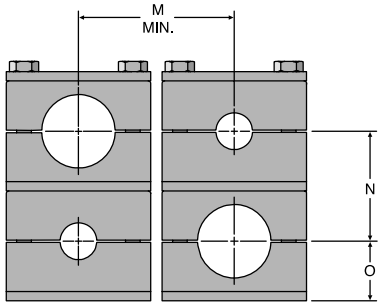
Layout Data for Tube, Pipe and Hose Clamps: Standard (Inch) and Series A (Metric)

Group #		Installation Dimensions M	P	N	O	R
1	in.	1 5/16	1 3/16	1 3/16	5/8	15/16
	mm	33	30	30	16.5	24.5
1a	in.	1 7/16		1 1/8	5/8	15/16
	mm	36		29	16	24.0
2	in.	1 11/16		1 7/16	3/4	1 1/16
	mm	42		36	19.5	27.5
3	in.	2		1 1/2	13/16	1 1/8
	mm	50		38	20.5	28.5
4	in.	2 3/8		1 3/4	15/16	1 1/4
	mm	60		45	24	32.0
5	in.	2 13/16		2 3/8	1 1/4	1 9/16
	mm	70		61	32	40.0
6	in.	3 1/2		2 11/16	1 7/16	1 3/4
	mm	88		69	36	44.0

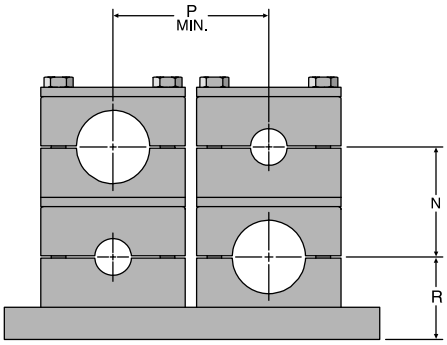
Table R40— ParKlamp Standard Series Installation Dimensions

Bolt Thread	Torque in.-lbs.	Torque Nm
1/4 - 20 UNC	70	8

Table R41 — ParKlamp Standard Series maximum tightening torque



With Weld Plate



Rail Mounting

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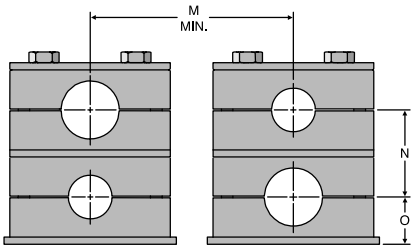
Layout Data for Tube, Pipe and Hose Clamps: Heavy Series (Inch) and Series C (Metric)

Group #		Installation Dimensions				
		M	N	O	P	R
H3	in.	2 15/16	1 9/16	15/16	2 5/16	1 1/2
	mm	74	40	24	58	38
H4	in.	3 1/2	2 3/16	1 1/4	2 7/8	1 13/16
	mm	89	56	32	73	46
H5	in.	4 1/16	2 11/16	1 1/2	3 7/16	2 1/16
	mm	103	68	38	87	52
H6	in.	5 7/8	3 7/8	2 1/8	4 5/8	2 5/8
	mm	150	98	54	118	66
H7	in.	7 1/8	5 1/16	2 3/4	N/A	N/A
	mm	180	129	69	N/A	N/A

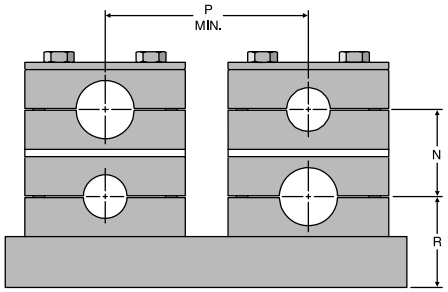
Table R43 — ParKlamp Heavy Series installation dimensions



With Weld Plate

Group #	Bolt Thread	Torque	
		in-Lb	Nm
H3, H4	3/8 - 16 UNC	106	12
H5	3/8 - 16 UNC	133	15
H6	7/16 - 14 UNC	265	30
H7	5/8 - 11 UNC	398	45

Table R44— ParKlamp Heavy Series maximum tightening torque

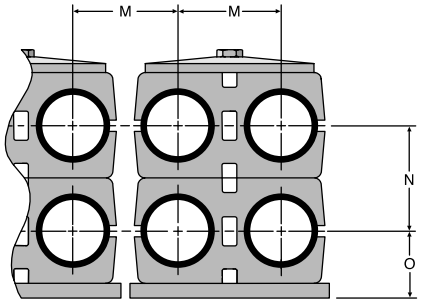


Rail Mounting

Layout Data for Tube, Pipe and Hose Clamps: Twin Series (Inch) and Series B (Metric)

Group #		Installation Dimensions			
		M	N	O	R
T1	in.	13/16	13/16	9/16	13/16
	mm	20	20	15	21
T2	in.	1 1/8	1	11/16	15/16
	mm	29	26	18	24
T3	in.	1 7/16	1 7/16	15/16	1 3/16
	mm	36	37	23.5	29.5
T4	in.	1 3/4	1 11/16	1	1 1/4
	mm	45	42	26	32
T5	in.	2 3/16	2 1/8	1 1/4	1 1/2
	mm	56	54	32	38

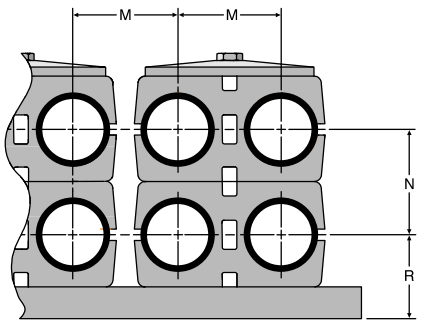
Table R45 — ParKlamp Twin Series installation dimensions



With Weld Plate

Group #	Bolt Thread	Torque	
		in.-lbs.	Nm
T1	1/4 - 20 UNC	45	5
T2 - T4	5/16 - 18 UNC	104	12
T5	5/16 - 18 UNC	70	8

Table R46 — ParKlamp Twin Series maximum tightening torque



Rail Mounting

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Tools for Tube Bending

For smooth, wrinkle free tube bending without excessive flattening, there are a number of benders that can be selected. Consult the specific bender's instruction bulletins for CLR (centerline radius), wall thickness, and tube material recommendations and limitations. For crank and hydraulic benders, utilize both the mandrel bending determination chart (Fig. R59) and the Parker Bender Capacity Guides on page Q7.

1. **Hand held lever type benders** (see pages Q4-Q6). Individually sized for tube sizes 1/8" through 1" and 6mm through 25mm.
2. **Manual crank, table mount, or pipe mount benders:**

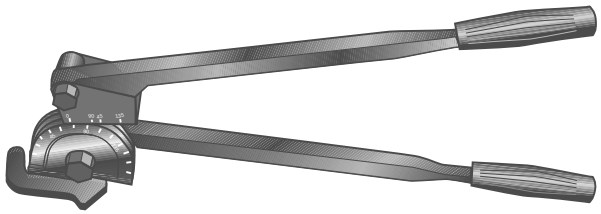

Fig. R56 — Hand held tube bender

1) Model 412 (page Q8). For bending 1/4" through 3/4" O.D. tube or 6mm through 20mm.
2) Model 424 (page Q9). For bending 1/4" through 1 1/2" O.D. tube or 6mm through 38mm.

3. **Hydraulically powered bender**

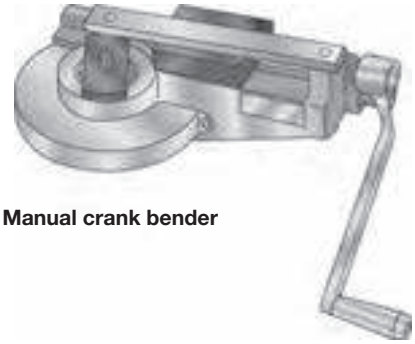

Fig. R57 — Manual crank bender

Model 632 (page Q12). For bending 3/8" through 2" O.D. tube or 10mm through 50mm.

Fig. R58 — Hydraulic bender with portable table for mandrel bending

Mandrel Bending Tools

When bending thin wall tube it may be necessary to insert a mandrel into the tube to prevent excessive distortion, flattening or wrinkling. To determine whether mandrel bending is required, see the Mandrel Bending Requirements Chart and example below.

To accomplish such bending, a mandrel, mandrel rod, and a mandrel rod stop assembly are required. The rod stop assembly holds the end of the mandrel rod in proper alignment with the tube while the mandrel, which is threaded onto the other end of the mandrel rod, supports the tube on its I.D., thus preventing tube kinking or flattening during bending.

Example: Determine if it's necessary to use mandrel for bending

Mandrel Bending Requirements Chart

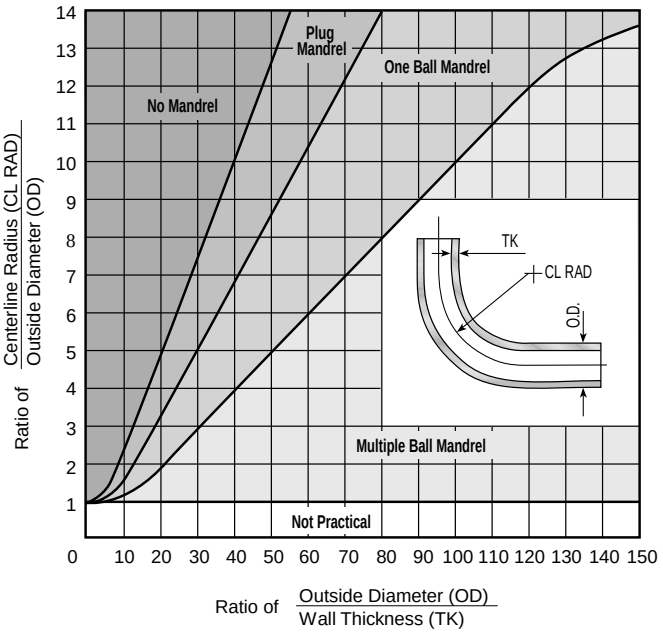

Fig. R59 — Mandrel bending requirements chart

3/4 x .049 steel tube through a 3" bend radius without excessive flattening.

Centerline Radius/Tube Outside Diameter = 3 / .75 = 4

Outside Diameter / Wall Thickness = .75/.049 = 15.3

Intersection of these two ratios on the graph falls within the area indicating that no mandrel is required. Note, however, that for the same tube O.D. at a smaller bend radius (e.g. 2") or with a thinner wall thickness (e.g. .035"), a mandrel would be required for preventing excessive flattening.

If the tube wall is very thin, then a plug mandrel alone may not be adequate to prevent wrinkling. In such cases, special ball type mandrels and wiper shoes may be necessary (See Fig. R49 for illustrations of plug and ball type mandrels). As a rule of thumb, if the tube wall thickness is less than 7% of the tube O.D. then mandrel bending is recommended.

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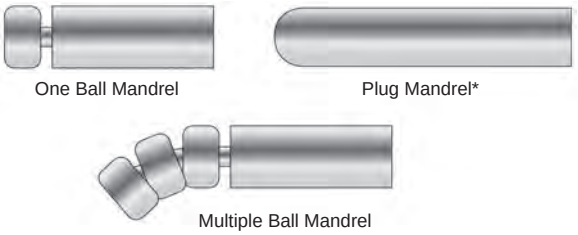

Fig. R60 — Types of mandrels

*Parker Tube Fittings Division offers only the plug mandrel.

Plumbing and Assembly Hints

Even after choosing the appropriate type of fitting for your application, there are certain instances when a particular style has advantages over others.

1. Straight thread adjustable elbows and tees have several advantages over similar shaped fittings using tapered pipe threads:

Adjustable straight thread connections:

- Permit exact positioning
- Provide leak free joint
- Eliminate distortion and cracking of boss due to over-tightening
- Are easier to maintain

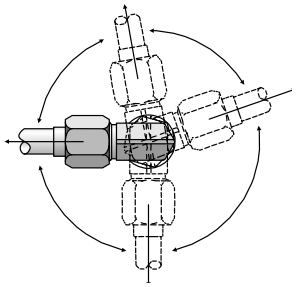

Fig. R61 — Top view of adjustable straight thread connection – allows for 360° positioning of fitting without losing its sealing capability

2. Swivel nut fitting should be used with a straight connector to allow for connections in tight spaces, where an elbow or tee fitting cannot be fully rotated (see Fig. R62).

This same combination of fittings, shown in Fig. R60, can also be used to stack tube lines or provide clearance for ports that are relatively close and within the same plane (see Fig. R63).

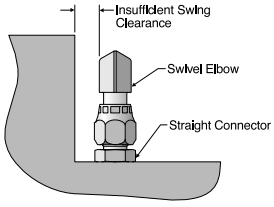

Fig. R62 — Swivel nut fitting used with straight connector in tight space

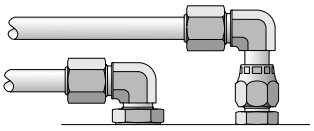

Fig. R63 — Swivel end fitting with straight connector provides clearance above regular elbow

3. Use reducers/expanders and jump size fittings.

   There are some instances when it becomes necessary to connect tube lines of different sizes or tube lines to ports of different sizes. This can be accomplished by using either tube reducers, port expanders, port reducers, or jump size fittings. Achieving the reduction or enlargement is the main concern, but this should be accomplished by using the minimum number of connections (potential leak points and wrenching requirements) possible.

4. Use conversion fittings and adapters.

   There are instances when it becomes necessary to use conversion adapters for connecting a fitting to a port with different style threads, for example, UNF thread fitting to a metric thread port. There are also some instances when it is necessary to connect tube ends or hose ends with different style terminations to one another or to a fitting. This can be achieved by using conversion fittings.

5. Use of other adapters and fittings for special applications are shown below.

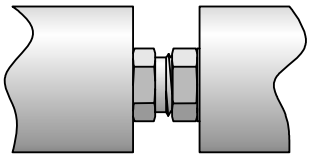

Fig. R64 — F5OHAO for close coupling of components with two SAE Straight thread ports

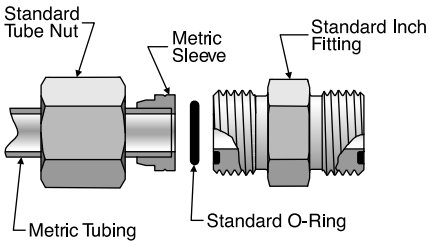

Fig. R65 — Metric sleeve adapts metric tube to standard Seal-Lok

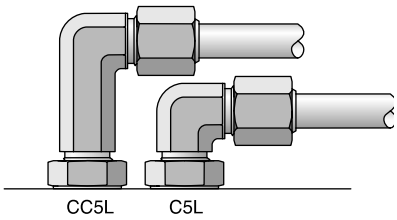

Fig. R66 — Long elbow (CC5L) stacks above regular elbow (C5L)

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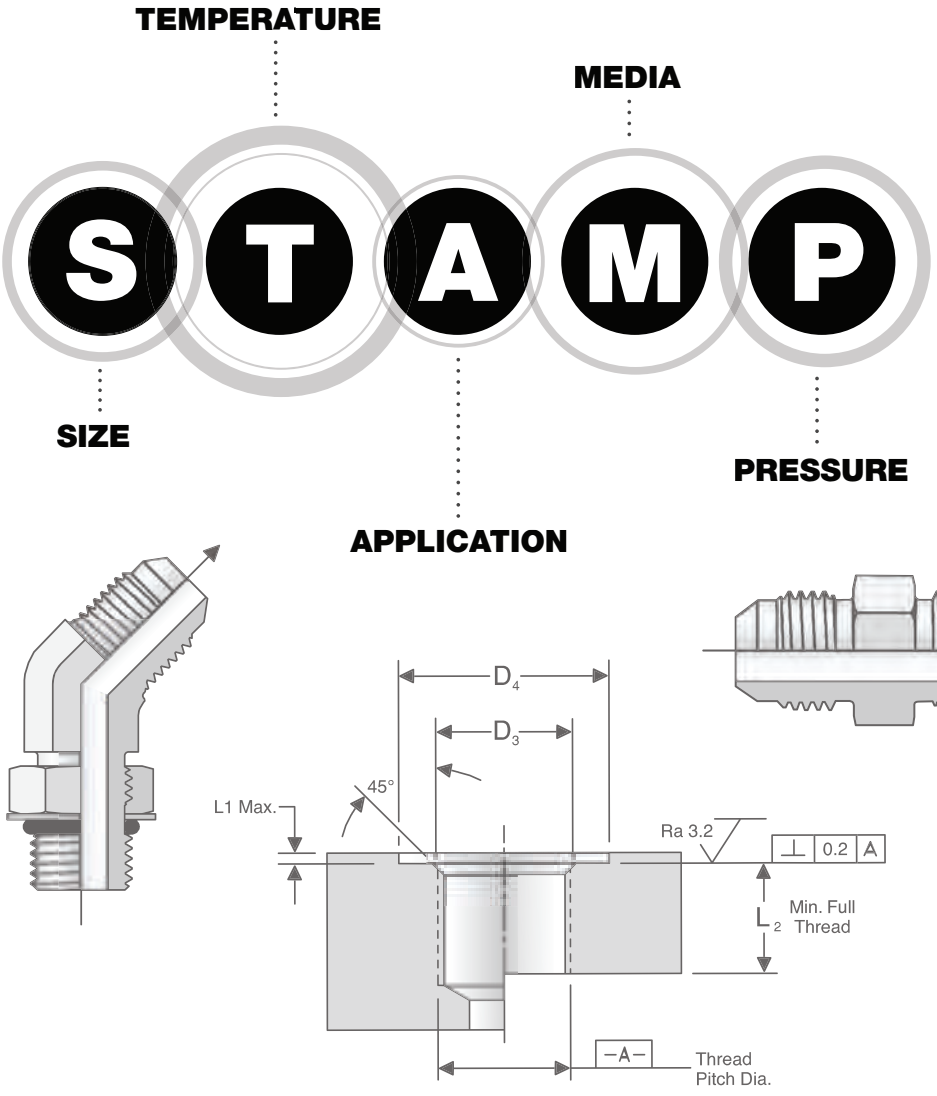

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STAMP OVERVIEW

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Tube Fitting and Adapter Selection Process

Critical information needed prior to tube fitting and adapter selection can start:

In general, even though a tube fitting or adapter is just a small component in a complex system, all the system information is needed to ensure the proper tube fitting or adapter selection. Without taking these into consideration, system issues will occur.

Below is the minimum system information needed to start this process:

- Flow rate
- Temperature range
- Media type
- Working pressure

With this information, a process named “STAMP” can be followed to choose a proper tube fitting or adapter. STAMP is an industry acronym that stands for Size, Temperature, Application, Media or Material, and Pressure. When STAMP is followed, the tube fittings and adapters with the proper size, appropriate material of construction and correct pressure rating for the application will result.

Below is an overview of each part of STAMP:

Size: Fitting and tube internal diameter (I.D.) and outside diameter (O.D.)
The I.D. can be calculated based on flow rate and velocity, and the O.D. will be determined based on pressure rating and considerations from other categories.

Temperature: System and environment temperature range.
Fitting and seal material types, connection types and pressure rating are temperature dependent.

Application: Severity of service, industry custom, regulation, standards, geographic region, serviceability, etc.
Severe, hazardous or critical to safety service needs more robust solutions. Some industries have special standards or regulation requirements. As well, certain regions tend to use specific types of products.

Media or Material: System and environment media, fitting and seal material type
Fitting and seal material must be compatible with system media and the environment. Incompatible material can result in excessive corrosion, system contamination, and leakage.

Pressure: System pressure requirements and fitting pressure rating
Fittings and tubes must meet the system pressure rating requirements.

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Tube Fitting and Adapter Selection Steps using STAMP S

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On the following pages, detailed steps on how to properly pick tube fittings and adapters for your system using STAMP are outlined.

The blank table below can be used to organize the information from each of the steps. This table can also be printed and used as a worksheet for any tube fitting and adapter selection. At the end of this section (page S31), a completed table has been filled out as an example.

Summary Information				
Size	**I.D.**		**O.D.**	
Temperature	**Material Conveyed**		**Environment**	
	Min.	**Max.**	**Min.**	**Max**
Application	**Industrial Standards**	**Connection Styles**	**Severity of Service**	**Other**
Material Media	**Internal Media**		**External Environment**	
Pressure	**Max. Working Pressure**		**Spikes**	**Vacuum**

Selection Process	
STAMP Process	**Explanation**

STEP 1: SIZE

The first step of fitting selection is to determine the size. Fitting size is driven by flow diameter or internal diameter (I.D.). System flow rate and flow velocity are needed to calculation flow diameter. Normally system flow rate is expressed in gallons per minute (GPM) or litters per minute (LPM). Flow velocity is expressed in feet per second (ft/sec) or meters per second (m/sec). The following formulae can be used to calculate the fitting I.D.

In hydraulic systems, the following maximum flow velocities are commonly used:

- Pressure lines: 25 ft/sec or 7.62 m/sec
- Return lines: 10 ft/sec or 3.05 m/sec
- Suction lines: 4 ft/sec or 1.22 m/sec

$$\text{Tube/Fitting I.D. (in)} = 0.64 \sqrt{\frac{\text{Flow in GPM}}{\text{Velocity in ft/sec}}}$$

OR

$$\text{Tube/Fitting I.D. (mm)} = 4.61 \sqrt{\frac{\text{Flow in LPM}}{\text{Velocity in m/sec}}}$$

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Recommended Flow Diameter — In Inches

For your convenience, the flowing tables have been prepared based on the formula and maximum flow velocities on the previous page.

Maximum Flow Rate GPM	Recommended Flow Diameter in Inches		
	Pressure Lines	Return Lines	Suction Lines
0.25	0.064	0.101	0.160
0.50	0.091	0.143	0.226
0.75	0.111	0.175	0.277
1.00	0.128	0.202	0.320
1.25	0.143	0.226	0.358
1.50	0.157	0.247	0.392
1.75	0.169	0.267	0.423
2.00	0.181	0.286	0.453
2.50	0.202	0.319	0.506
3.00	0.222	0.350	0.554
3.50	0.239	0.378	0.599
4.00	0.256	0.404	0.640
4.50	0.272	0.429	0.679
5.00	0.286	0.452	0.716
5.50	0.300	0.474	0.750
6.00	0.314	0.495	0.784
6.50	0.326	0.515	0.816
7.00	0.339	0.534	0.847
7.50	0.351	0.553	0.876
8.00	0.362	0.571	0.905
8.50	0.373	0.589	0.933
9.00	0.384	0.606	0.960
9.50	0.395	0.623	0.986
10.00	0.405	0.639	1.012
11.00	0.425	0.670	1.061
12.00	0.443	0.700	1.109
13.00	0.462	0.728	1.154
14.00	0.479	0.756	1.197
15.00	0.496	0.782	1.239
16.00	0.512	0.808	1.280
17.00	0.528	0.833	1.319
18.00	0.543	0.857	1.358
19.00	0.558	0.880	1.395
20.00	0.572	0.905	1.431
21.00	0.587	0.927	1.466

Maximum Flow Rate GPM	Recommended Flow Diameter in Inches		
	Pressure Lines	Return Lines	Suction Lines
22.00	0.600	0.947	1.501
24.00	0.627	0.990	1.568
26.00	0.653	1.030	1.632
28.00	0.677	1.069	1.693
30.00	0.701	1.106	1.753
32.00	0.724	1.143	1.810
34.00	0.746	1.178	1.866
36.00	0.768	1.212	1.920
38.00	0.789	1.245	1.973
40.00	0.810	1.278	2.024
42.00	0.830	1.309	2.074
44.00	0.849	1.340	2.123
46.00	0.868	1.370	2.170
48.00	0.887	1.399	2.217
50.00	0.905	1.428	2.263
55.00	0.949	1.498	2.373
60.00	0.991	1.565	2.479
65.00	1.032	1.629	2.580
70.00	1.071	1.690	2.677
75.00	1.109	1.749	2.771
80.00	1.145	1.807	2.862
85.00	1.180	1.862	2.950
90.00	1.214	1.916	3.036
95.00	1.248	1.969	3.119
100.00	1.280	2.020	3.200
110.00	1.342	2.119	3.356
120.00	1.402	2.213	3.505
130.00	1.459	2.303	3.649
140.00	1.515	2.390	3.786
150.00	1.568	2.474	3.919
160.00	1.619	2.555	4.048
170.00	1.669	2.634	4.172
180.00	1.717	2.710	4.293
190.00	1.764	2.784	4.411
200.00	1.810	2.857	4.525

Table S1 — Recommended Flow Diameters, in Inches

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Recommended Flow Diameter — In Millimeters

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Maximum Flow Rate LPM*	Recommended Flow Diameter in mm		
	Pressure Lines	Return Lines	Suction Lines
1.00	1.67	2.64	4.18
2.00	2.36	3.73	5.91
3.00	2.89	4.57	7.24
4.00	3.34	5.28	8.36
5.00	3.73	5.90	9.35
6.00	4.09	6.47	10.24
7.00	4.42	6.99	11.06
8.00	4.72	7.47	11.82
9.00	5.01	7.92	12.54
10.00	5.28	8.35	13.22
11.00	5.54	8.75	13.84
12.00	5.79	9.15	14.48
14.00	6.25	9.88	15.64
16.00	6.68	10.56	16.72
18.00	7.09	11.20	17.73
20.00	7.47	11.81	18.69
22.00	7.83	12.38	19.61
24.00	8.18	12.93	20.48
26.00	8.52	13.46	21.31
28.00	8.84	13.97	22.12
30.00	9.15	14.46	22.90
32.00	9.45	14.93	23.65
34.00	9.74	15.39	24.37
36.00	10.02	15.84	25.08
38.00	10.30	16.27	25.77
40.00	10.56	16.70	26.44
45.00	11.20	17.71	28.04
50.00	11.81	18.67	29.56
55.00	12.39	19.58	31.00
60.00	12.94	20.45	32.38
65.00	13.46	21.28	33.70
70.00	13.97	22.09	34.97
75.00	14.46	22.86	36.20

Maximum Flow Rate LPM*	Recommended Flow Diameter in mm		
	Pressure Lines	Return Lines	Suction Lines
80.00	14.94	23.61	37.39
85.00	15.40	24.34	38.54
90.00	15.84	25.05	39.66
95.00	16.28	25.73	40.74
100.00	16.70	26.40	41.80
110.00	17.52	27.69	43.84
120.00	18.29	28.92	45.79
130.00	19.04	30.10	47.66
140.00	19.76	31.24	49.46
150.00	20.45	32.33	51.19
160.00	21.12	33.39	52.87
170.00	21.77	34.42	54.50
180.00	22.41	35.42	56.08
190.00	23.02	36.39	57.62
200.00	23.62	37.34	59.11
220.00	24.77	39.16	62.00
240.00	25.87	40.90	64.76
260.00	26.93	42.57	67.40
280.00	27.94	44.18	69.95
300.00	28.93	45.73	72.40
320.00	29.87	47.23	74.77
340.00	30.79	48.68	77.08
360.00	31.69	50.09	79.31
380.00	32.55	51.46	81.48
400.00	33.40	52.80	83.60
450.00	35.43	56.00	88.67
500.00	37.34	59.03	93.47
550.00	39.17	61.91	98.03
600.00	40.91	64.67	102.39
650.00	42.58	67.31	106.57
700.00	44.18	69.85	110.59
750.00	45.74	72.30	114.47
800.00	47.24	74.67	118.23

Table S2 — Recommended Flow Diameters, in Millimeters

*LPM = Liters Per Minute

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Proceed to step 2 once size is determined.

For deeper understanding, the detailed information below explains the effect of tube fitting and adapter size. It is provided only as a reference for further understanding.

Effect of fitting size:

Fitting size directly affects system efficiency. Proper sizing for various parts of a hydraulic system results in an optimum combination of efficient and cost-effective performance.

A tube or fitting that is too small causes high fluid velocity, which has many detrimental effects. In suction lines, it causes cavitation which starves and damages pumps. In pressure lines, it causes high friction losses and turbulence, both resulting in high pressure drops, noise and heat generation. High heat accelerates wear in moving parts and rapid aging of seals and hoses, all resulting in reduced component life. High heat generation also means wasted energy, and hence, low efficiency.

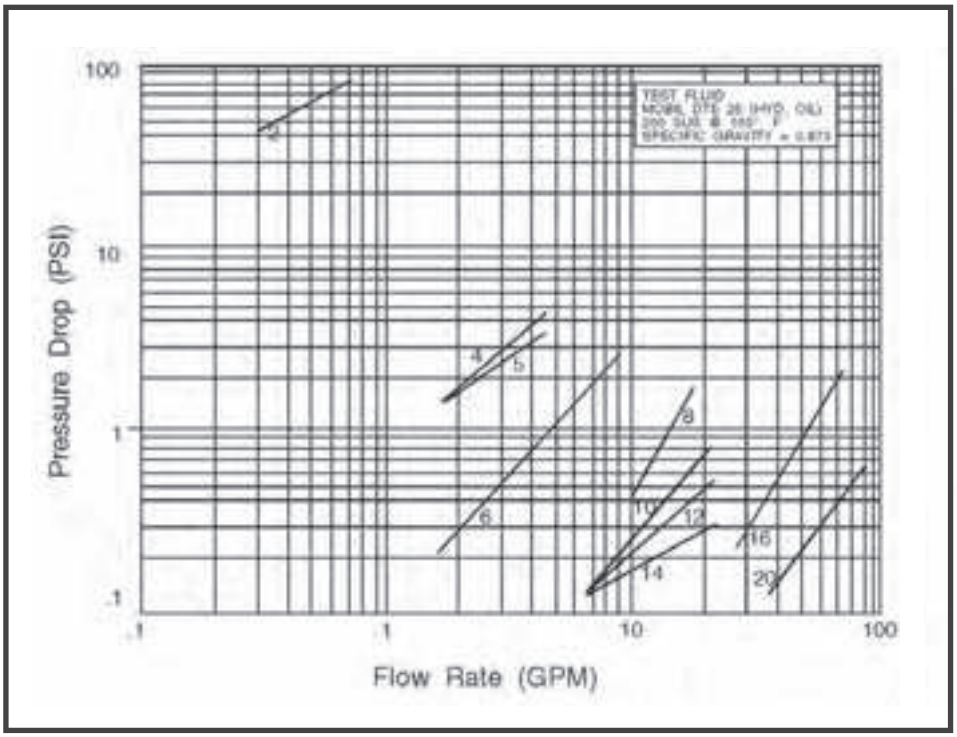
Too large of a tube or fitting increases system cost, weight and envelop size. Therefore, fitting size selection should balance considerations of efficiency, cost, weight and size.

Hydraulic systems efficiency can be simply measured by pressure drop. Pressure drop represents loss of energy and therefore should be kept to a minimum with the constraints of acceptable system cost and overall size. Pressure loss in straight tubing and fittings is mainly caused by the frictional resistance of the walls, while in shaped fittings it is mainly caused by changes in the magnitude or direction of the fluid velocity. Mathematical analysis of pressure drop, even though possible, may not be exact because of the interrelationship of factors such as fluid density, velocity, flow area and frictional coefficients.

The following pressure drop charts were derived from actual test data and may be used as a guide for determining pressure drops at various flow rates through fittings for fluid indicated. To determine pressure drop for a given flow, trace a vertical line up from the flow axis to the desired size line then trace a horizontal line from this intersection over to the pressure drop axis.

Example:

The Parker fitting 8 CTX (1/2" OD 90-degree elbow fitting), with oil similar to the test fluid, flowing through it at 4 gallons per minute, would cause a pressure drop of approximately 2.3 psi, as shown in Fig. 2. Conversions will have to be made for fluids which are not similar to the test fluid.



Examples:

Fig. 1 — Pressure Drop Chart for Straight Fittings and Run Legs of Tees and Crosses (Triple-Lok)

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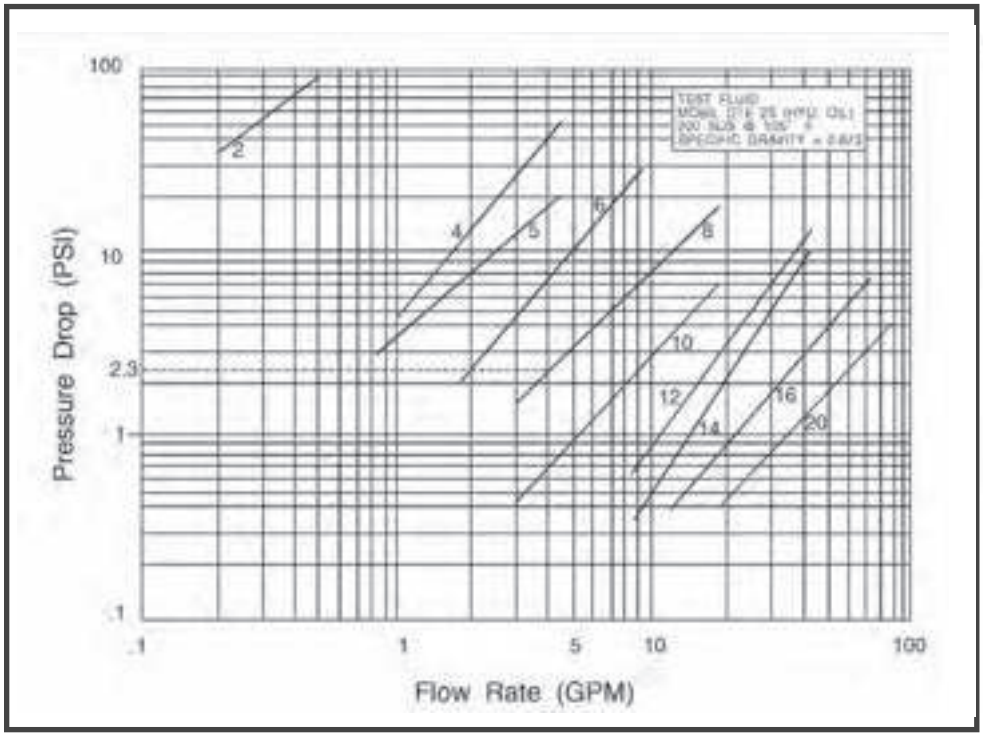


Example:

Examples:

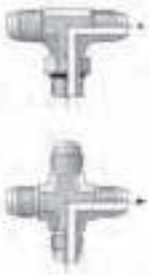
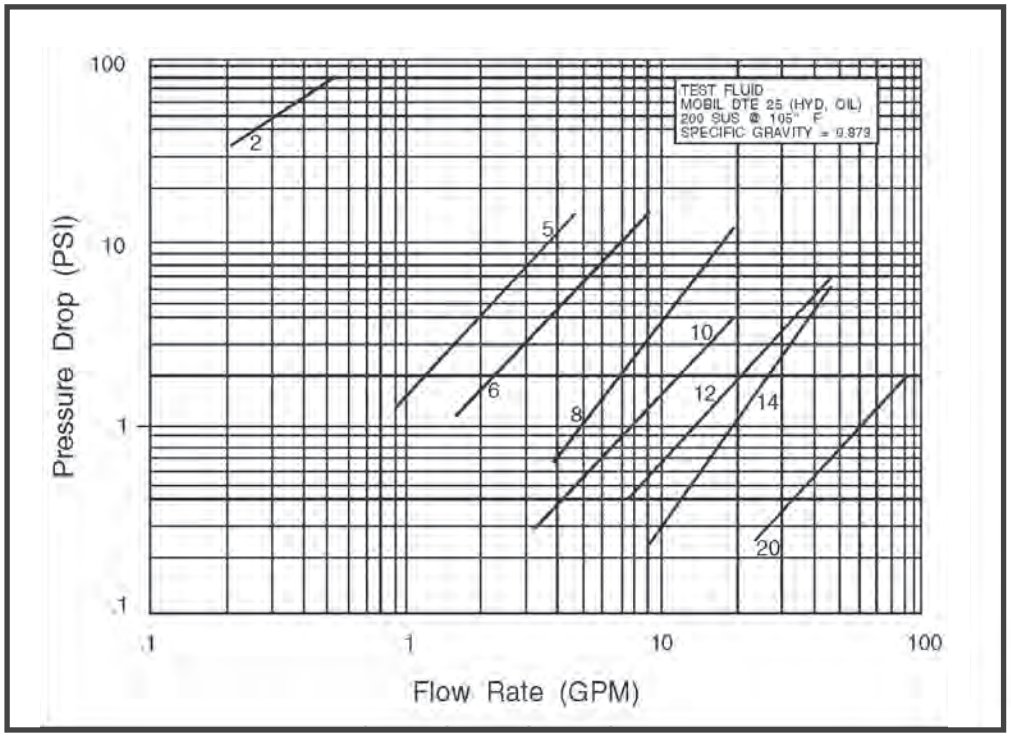


Fig. 2 — Pressure Drop Chart for 90° Fittings or Branch Path Through a Tee or Cross Fitting (Triple-Lok)



Example:

Fig. 3 — Pressure Drop Chart for 45° Elbow Fittings (Triple-Lok)

Dimensions and pressures for reference only, subject to change.

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Pressure Drops for Other Fittings:

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These pressure drop curves were established with Triple-Lok 37-degree flare fittings. The pressure drop values can be adjusted for other fittings of the same size by multiplying the value from the chart by the ratio of Triple-Lok flow diameter to that of the other fitting, raised to the 4th power.

Example: Find pressure drop for 6 C5L (Seal-Lok O-Ring Face Seal Fitting) at 5 gallons per minute flow rate:

From the chart, the pressure drop for 6 C5X is 10 psi.

Also, the ratio of 6 C5X to 6 C5L flow diameters is 0.297/0.264, or 1.125.

Therefore, the pressure drop for Seal-Lok O-Ring Face Seal fitting = 10 x $(1.125)^4$ = 16 psi.

Pressure Drops for Other Fluids:

Pressure drop through a fitting is mainly caused by change in direction and velocity of the fluid. Therefore, it is directly proportional to the specific gravity of the fluid. The drop due to friction, which is dependent on the viscosity of the fluid, is so small in this case that it can be ignored. Thus, the pressure drop with a different fluid can be estimated by multiplying the value from the graph above by the ratio of specific gravity of the two fluids, or:

$$\text{New Drop} = \text{Value from the graph} \times \frac{\text{Specific Gravity of New Fluid}}{\text{Specific Gravity of Test Fluid (0.873)}}$$

Read our TFD techConnect blog post "Sizing Tube to Maximize Hydraulic System Efficiency" for more details.

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STEP 2: TEMPERATURE

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Temperature range is a very import factor to consider during tube fitting and adapter selection. Both environment temperature and system media temperature should be considered. Ensure that the tube fitting or adapter, tube and seal material temperature ranges are adequate for the system temperature range.

Temperature range of common tube fitting, adapter, and seal materials can be found in Table S3 and S4.

Material	Specification	Construction	Condition	Max Hardness	Temperature Range
Carbon Steel C-1010	SAE J524 (ASTM A179)	Seamless	Fully Annealed	HRB 72	-65° to 500°F -55° to 260°C
	SAE J525 (ASTM A178)	Welded & Drawn			
	SAE J356	Welded & Flash Controlled			
Carbon Steel C-1021	SAE J2467	Welded & Flash Controlled	Fully Annealed	HRB 75	-65° to 500°F -55° to 260°C
	SAE J2435	Welded & Drawn			
Carbon Steel High Strength Low Alloy (HSLA)	SAE 2613	Welded & Flash Controlled	Sub-critically annealed	HRB 90	-65° to 500°F -55° to 260°C
	AE J2614	Welded & Drawn			
Alloy Steel 4130	ASTM A519	Seamless			-65° to 500°F -55° to 260°C
St 37.4 (Carbon Steel)	DIN 2391 Part 2 (Metric)	Seamless	Fully Annealed	HRB 72	-65° to 500°F -55° to 260°C
Stainless Steel 304 & 316	ASTM A213 ASTM A269	Seamless	Fully Annealed	HRB 90	-425° to 1200°F -255° to 650°C
	ASTM A249 ASTM A269	Welded & Drawn			
1.4571 1.4541 Stainless Steel	DIN 17458 Tab 8 (Metric)	Seamless	Fully Annealed	HRB 90	-425° to 1200°F -255° to 650°C
Copper	SAE J528 (ASTM B75)	Seamless	Soft Annealed Temper O	60 Max. Rockwell 15T	-325° to 400°F -200° to 205°C
Aluminum 6061	ASTM B210	Seamless	T6 Temper	HRB 56	-325° to 400°F -200° to 205°C
			O & T4 Temper	HRB 30	
Monel 400	ASTM B165	Seamless	Fully Annealed	HRB 70	-400° to 800°F -240° to 425°C
Nylon		Extruded	Flexibe & Semi-Rigid		-60° to 200°F -50° to 95°C
Polyethylene	ASTM D1248	Extruded	Instrument Grade		-80° to 150°F -60° to 65°C
PVC		Extruded	Instrument & Laboratory Grade		0° to 140°F -20° to 60°C
PFTE		Extruded & Cintered			-65° to 400°F -55° to 205°C

Table S3 — Temperature range for common tube and fitting materials

Polymer Family	Abbreviated Name	Parker Compound No.	Color	SAE J515 Type	Hardness Shore "A"[7]	Temperature Range (°F)	Recommended For	Not Recommended For
Nitrile-Butadiene	NBR	N1490/N0552	Black	CH[2]	90[6]	-30° to 250°	Petroleum base oils and fluids, mineral oils, ethylene glycol base fluids, silicone and di-ester base lubricants, air, water under 150°F, and natural gas.	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenated hydrocarbons, and methanol.
Nitrile-Butadiene	NBR	N0674	Black	—	70	-30° to 250°		
Nitrile-Butadiene	NBR	N0103	Black	—	70	-65° to 225°		
Nitrile-Butadiene (Low compression set)	NBR	N1059	Black	CH[2]	90	-30° to 275°		
Nitrile-Butadiene	NBR	N0507	Black	—	90	-65° to 225°	Meets FDA requirements for food products	
Nitrile-Butadiene	NBR	N0304	Black	—	75	-65° to 180°		
Nitrile-Butadiene	NBR	N0508	Black	—	75	-65° to 225°		
Nitrile-Butadiene	NBR	N0756	Black	—	75[6]	-35° to 250°		
Ethylene-Propylene	EPDM	E0540	Black	CA[3]	80	-65° to 275°	Phosphate ester base hydraulic fluids, hot water, steam to 400°F, silicone oils and greases, dilute acids and alkalis, ketones, alcohols and automotive brake fluids. CO2 climate control systems.	Petroleum base oils and di-ester base lubricants.
Ethylene-Propylene	EPDM	E0893	Purple[1]	CA[3]	80	-65° to 275°		
Ethylene-Propylene	EPDM	E0962	Black	—	90	-65° to 275°		
Neoprene	CR	C0873	Black	—	70	-45° to 250°	Refrigerants (freons, ammonia), high aniline point petroleum oils, mild acids, and silicate ester lubricants.	Phosphate ester fluids and ketones.
Neoprene	CR	C0944	Red[1]	—	70	-45° to 250°		
Fluorcarbon	FKM5) or FPM	V0747	Black	—	75	-15° to 400°	Petroleum base oils and fluids, some phosphate ester base fluids, silicone and silicate ester base lubricants, di-ester base lubricants, acids and halogenated hydrocarbons.	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, and hot hydrofluoric or chlorosulfonic acids.
		V0884	Brown[1]	—	75	-15° to 400°		
		V1412/V0894	Brown[1], 5)	HK[4]	90[6]	-15° to 400°		
Silicone	Si	S0604	Rust[1]	—	70	-65° to 450°	Dry Hear (air to 400°) and high aniline point oils.	Most petroleum fluids, ketones, water and steam.

1) These Parker "Chromassure" color assurance O-Rings are available from the Parker Hannifin O-Ring Division. They help eliminate assembly errors, reduce warranty costs and liability risks, and assure safety in aftermarket business.
2) Formerly SAE Type I.
3) Formerly SAE Type II.
4) Formerly SAE Type III.
5) "FKM" is the ASTM designation for fluorocarbon. Its ISO designation is "FPM". For "DIN" Fittings, color is green.
6) Standard compounds available from stock.
7) Use 90 durometer hard O-Rings for applications with 1500 psi or higher pressures.

Table S4 — Temperature range and media compatibility for common seal materials

Standard seals supplied with Parker tube fittings and adapters are 90 durometer hard nitrile (Buna-N) Parker compound **N1490, N0552 or similar.** These O-Rings are well suited for most industrial hydraulic and pneumatic systems. They have high extrusion resistance making them suitable for very high-pressure static applications. Optional high temperature fluorocarbon, Parker compound **V1412 or V0894**, is also available for higher temperature specifications.

Seals for other than normal hydraulic media or higher temperature applications can be selected from Table S4. The table should be used only as a general guide. Before making final selection for a given application, it is recommended that appropriate tests be conducted to assure compatibility with the fluid, temperature, pressure and other environmental conditions.

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High operating temperature also reduces allowable working pressure of fittings. Temperature derating factors for various metals are given in Table S5. Where applicable, temperature derating factors should be applied to the design pressure values to arrive at the maximum recommended working pressure. The derating factors are based on allowable design stress values at various temperatures per ASME B31.1 code for pressure piping.

Maximum Operating Temperature (°F)	Steel C-1010 and C-4130	Stainless Steel		Brass CA360 CA377	Copper	Aluminum 6061-T6	Monel Type 4000
		304	316				
100	1.00	1.00	1.00	1.00	1.00	1.00	1.00
150	1.00	0.91	1.00	0.94	0.85	1.00	0.97
200	1.00	0.84	1.00	0.90	0.80	1.00	0.94
250	1.00	0.79	1.00	0.87	0.80	0.94	0.91
300	1.00	0.75	1.00	0.83	0.78	0.80	0.88
350	0.99	0.72	0.99	0.80	0.67	0.60	0.86
400	0.98	0.69	0.97	0.40	0.50	0.43	0.85
500	0.96	0.65	0.90				0.84
600		0.61	0.85				0.84
700		0.59	0.82				0.84
800		0.57	0.80				0.83
900		0.54	0.78				
1000		0.52	0.77				
1100		0.47	0.62				
1200		0.32	0.37				

Table S5 — Temperature derating factor for common metals

STEP 3: APPLICATION

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The nature of applications must be carefully evaluated, such as vibration, side load, severity of service, external environment, regional custom and convention, industry standards, regulation, etc. Table S6 lists different service categories and their recommended design factors.

Severity of Service	Description	Design Factor	Derating Factor
A (Normal)	Moderate mechanical and hydraulic shocks.	4.00	1.00
B (Severe)	Severe hydraulic shocks and mechanical strain.	6.00	0.67
C (Hazardous)	Hazardous application with severe service conditions.	8.00	0.50

Table S6 — Severity of Service Design and Derating Factors

Today many different types of connectors are being used around the world. Most of these have come about through historical use and local preference for a certain design concept. Some of them are only used in a specific geographic region or a particular industry. Some connections of North American origin such as four bolt flange, SAE straight thread, and 37° flare have found some degree of acceptance and use in Europe and Japan as a result of the exports of U.S. machinery to the regions after World War II. But, most of the usage is made up of a variety of indigenous port and tube connections. A quick review of the commonly used connections around the world reveals that there are eight different port connections and eleven different tube/hose connections.

Port Connections

- ISO 6149 (Metric Straight Thread O-Ring Port)
- SAE Straight Thread (UN/UNF)
- NPTF
- 4-Bolt Flange
- ISO 1179 (BSPP)
- ISO 9974 (Metric)
- JIS-PT (BSPT)
- JIS-B2351 (BSPP similar to SAE)

Tube/Hose Connections:

- O-Ring Face Seal (SAE)
- 37° Flare (SAE)
- 24° Flareless, Inch Threads (SAE)
- 24° Cone, Metric (DIN)
- 60° Cone Swivel, NPSM (SAE)
- 60° Cone, BSPP (BSI)
- 60° Cone, BSPP (JIS)
- 60° Cone, Metric (JIS)
- 30° Flare, BSPP (JIS)
- 24° Flareless, Metric (JIS)
- 37° Flare, Metric (Russia)

To promote interchangeability and reduce complexity, the following table lists preferred connection types according to ISO recommendations. The preferred fitting styles should be selected when possible.

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Application	Port	Tube/Hose Connection			
		24° Cone Flareless (Din) (Bite Type)	37° Flare (Inch Threads)	ORFS	24° Cone Weld Nipple
For All Designs	Metric ISO 6149 (SAE J2244)	ISO 8434-1	ISO 8434-2	ISO 8434-3	ISO 8434-1
Not for New Designs in Hydraulic Fluid Power	Metric ISO 1179 (DIN 3852-2)	ISO 8434-1	ISO 8434-2	— —	ISO 8434-1
	Metric ISO 9974 (DIN 3852-1)	ISO 8434-1	— —	— —	ISO 8434-1
	UN/UNF ISO 11926 (SAE J1926)	— —	ISO 8434-2	— —	— —

Table S7 — ISO Standard Port and Tube/Hose Connection Combinations

Table S8 on the following page shows a summary of port connections

See our TFD techConnect blog post "Spatial Allowance for Fittings in Fluid and Gas Systems" for the seven questions Parker recommends asking when selecting fittings.

Learn the difference between AN 37 (degree sign) Flare vs Industrial 37 (degree sign) Flare Fittings in our TFD techConnect blog post.

Port End Summary

Port End Type and Seal Style	Illustration	Pressure — Dynamic	Pressure — Static	Temperature	Positioning	Contamination	Seal Reliability	Reusability	Fluid Compatibility
Tapered (NPT, NPTF, BSPT and Metric Taper)		Poor	Good	Excellent	Poor	Poor	Poor	Poor	Excellent
O-Ring in Chamfer (SAE J1926, ISO 6149 and JIS B2351)		Excellent	Excellent	Limited by Seal	Excellent	Very Good	Excellent	Excellent	Limited by Seal
Spot Face with ED Seal (ISO 1179-2 and ISO 9974-2)		Excellent	Excellent	Limited by Seal	Not Applicable	Very Good	Excellent	Excellent	Limited by Seal
Spot Face with Bonded Seal (ISO 1179 and ISO 9974)		Good	Good	Good	Not Applicable	Very Good	Good	Excellent	Limited by Seal
Spot Face with Cutting Face (ISO 1179-4 and ISO 9974-3)		Poor	Fair	Excellent	Not Applicable	Fair	Poor	Poor	Excellent
Spot Face with O-Ring and Retaining Ring (ISO 1179-3)		Good	Good	Good	Excellent	Very Good	Good	Excellent	Limited by Seal
Spot Face with Hard Metal Seal (ISO 1179 and ISO 9974)		Poor	Fair	Excellent	Not Applicable	Fair	Poor	Poor	Excellent
Spot Face with Soft Metal Seal (ISO 1179 and ISO 9974 with copper gasket)		Poor	Fair	Good	Not Applicable	Very Good	Poor	Fair	Excellent
4 Bolt Flange (SAE J518 and ISO 6162)		Excellent	Excellent	Good	Good	Very Good	Good	Excellent	Limited by Seal
4 Bolt Flange (ISO 6164)		Excellent	Excellent	Good	Good	Good	Good	Excellent	Limited by Seal

Table S8 — Application of Common Port Ends

Table S9 on the following page shows a summary of tube connections

Dimensions and pressures for reference only, subject to change.

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Tube End Summary

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Tube/Hose End Type	Illustration	Pressure — Dynamic	Pressure — Static	Seal Reliability	Vibration Resistance (in Rigid Systems)	Ease of Installation	Ease of Maintenance	Reusability	Temperature
Seal-Lok O-Ring Face Seal		Excellent	Excellent	Excellent	Very Good	Excellent	Excellent	Excellent	Limited by Seal
Triple-Lok 37°Flare		Very Good	Very Good	Good	Good	Good	Very Good	Good	Excellent
Ferulok Inch Bite Type		Very Good	Very Good	Very Good	Very Good	Good	Good	Very Good	Excellent
EO Metric Bite Type		Excellent	Excellent	Very Good	Very Good	Good	Good	Very Good	Excellent
EO-2 Soft Seal Metric Bite Type		Excellent	Excellent	Excellent	Very Good	Very Good	Good	Excellent	Limited by Seal
JIS 30°Flare		Good	Good	Very Good	Not Applicable	Very Good	Very Good	Very Good	Limited by Seal
JIS 60° Cone B8363		Good	Good	Very Good	Not Applicable	Very Good	Very Good	Very Good	Limited by Seal
Komatsu 30°Flare		Good	Good	Very Good	Not Applicable	Very Good	Very Good	Very Good	Limited by Seal
K4 BSP Adapters		Good	Good	Very Good	Not Applicable	Very Good	Very Good	Very Good	Limited by Seal
NPSM (Swivel)		Good	Good	Very Good	Not Applicable	Good	Good	Very Good	Very Good

Table S9 — Application of Common Tube Ends

Dimensions and pressures for reference only, subject to change.

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STEP 4: MEDIA OR MATERIAL

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In additional to temperature, proper selection of tube, fitting and adapter material will also depend on the system media and corrosive nature of the service environment. Table S10 can be used to select the proper fitting and seal material based on system media type.

This table is intended as a guide only and is not to be considered as a sole selection criteria when choosing Parker Tube Fittings and adapters for a specific application or with a specific fluid.

	Fitting Material			Seal Material			
Media	**Brass**	**Steel**	**316 SS**	**BUNA-N**	**Ethylene Propylene**	**Fluorocarbon**	**Neoprene**
Acetylene	NR	F	S	S	S	S	F
Air (oil free) @ 190°F	S	F	S	S	S	S	S
Air (oil free) @ 300°F	S	F	S	F	F	S	F
Air (oil free) @ 400°F	S	F	S	NR	NR	S	NR
Alcohol, Ethyl	S	NR	NR	NR	S	NR	S
Animal Oils (Lard Oil)	F	F	F	S	F	S	F
Aromatic Fuel - 50%	ID	ID	ID	F	NR	S	NR
Aromatic Solvents	ID	ID	F	F	ID	S	NR
Asphalt	NR	NR	S	F	NR	S	F
ASTM Oil #1	S	S	S	S	NR	S	S
ASTM Oil #2	S	S	S	S	NR	S	F
ASTM Oil #3	S	S	S	S	NR	S	NR
ASTM Oil #4	S	S	S	F	NR	S	NR
ATF Oil	S	S	S	S	NR	S	F
Automotive Brake Fluid	ID	ID	ID	NR	S	NR	F
Benzene	NR	F	NR	NR	NR	S	NR
Brine (Sodium Chloride)	NR	NR	S	S	S	S	S
Butane	NR	S	S	S	NR	S	S
Carbon Dioxide	S	F	S	S	S	S	S
Carbon Monoxide	S	S	S	S	S	S	F
Chlorine (Dry)	F	F	NR	NR	ID	F	F
Compressed Air	S	F	S	S	S	S	S
Crude Oil	NR	F	S	F	NR	S	NR
Cutting Oil	ID	S	S	S	NR	S	F
Diesel Fuel	S	S	S	S	NR	S	NR
Ethanol	S	NR	S	NR	S	NR	S
Ethers	S	S	S	NR	F	F	NR
Freon 11	S	ID	ID	F	NR	F	NR
Freon 12	S	S	NR	F	NR	S	S
Freon 22	S	NR	S	NR	NR	NR	S
Fuel Oil	NR	S	S	S	NR	S	F
Gasoline	S	F	S	S	NR	S	NR
Gas, Liquid Propane (LPG)	S	S	S	S	NR	S	F
Gas, Natural	F	S	S	S	NR	S	S
Helium	S	S	S	S	S	S	S
Hydraulic Oil, Petroleum Base	S	S	S	S	NR	S	S
Hydraulic Oil, Water Base	ID	S	S	F	S	NR	F
Hydrogen Gas	S	S	S	S	S	S	S
Jet Fuel	S	S	S	S	NR	S	NR
Kerosene	S	S	S	S	NR	S	F
Lubricating Oil SAE 10, 20, 30, 40, 50	S	S	S	S	NR	S	F
Methanol	S	S	S	S	S	NR	S
MIL-F-8192 (JP-9)	S	S	S	NR	NR	S	NR
MIL-H-5606	S	S	S	S	NR	S	F
MIL-H-6083	S	S	S	S	NR	S	S
MIL-H-7083	S	S	S	S	S	F	F
MIL-H-8446 (MLO-8515)	F	S	S	F	NR	S	S
Mil-L-2104 & 2104B	S	S	S	S	NRX	S	F

Table S10 — Fitting, Seal Material and Media Compatibility *(Cont'd)*

Codes: S = Satisfactory F = Fair NR = Not recommended ID = Insufficient Data

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	Fitting Material			Seal Material			
Media	Brass	Steel	316 SS	BUNA-N	Ethylene Propylene	Fluorocarbon	Neoprene
MIL-L-7808	NR	F	S	S	NR	S	NR
Mineral Oil	S	S	S	F	NR	S	F
Nitrogen	S	S	S	F	S	S	S
Petrolatum	S	S	S	S	NR	S	F
Petroleum Oil (<250°F)	S	S	S	S	NR	S	F
Propane	S	S	S	S	NR	S	F
R134A	S	S	S	NR	S	NR	NR
Sea Water	F	NR	S	S	S	S	F
Skydrol 500, Type 2	NR	S	S	NR	S	NR	NR
Skydrol 7000, Type 2	NR	S	S	NR	S	F	NR
Soap Solutions	NR	NR	S	S	S	S	F
Steam (<400°F)	F	S	S	NR	S	NR	NR
Stoddard Solvent	F	S	S	S	NR	S	F
Transmission Fluid (Type A)	S	S	S	S	NR	S	F
Trichloroethane	ID	F	S	NR	NR	S	NR
Water	S	F	S	S	S	F	F

Table S10 — Fitting, Seal Material and Media Compatibility *(Cont'd)*

Codes: S = Satisfactory F = Fair NR = Not recommended ID = Insufficient Data

In additional to being compatible with the media, tube fittings and adapters must also be compatible with tube material and type. Table S11 lists several common tube types with their recommended operating temperature ranges, general application, and fitting and adapter compatibility. Based on the fluid system parameters and media, select the appropriate tube fitting or adapter type and material. As a general rule, tube and fitting materials should be the same. Since operating conditions differ with applications, different material combinations in this table should be used only as a guide and not a firm recommendation. Before making a final decision on material combination, it should be sufficiently tested under appropriate conditions to assure suitability for the intended application.

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Tube Material	Specification	Construction	Condition	Max. Hardness	Temperature Range (7)	Application	Tube Material to Fitting & Material Compatibility										
							Seal-Lok ORFS (SAE J1453)			Triple-Lok 37°Flare (SAE J514)				Ferulok Flareless (SAE J514)			EO/EO-2 Flareless (ISO 8434-1)
							S	SS	B	S	SS	B	M	S	SS	M	S, SS ,B
Carbon Steel C-1010	SAE J524 (ASTM A179) (8)	Seamless	Fully Annealed	HRB 72	-65° to 500°F -55° to 260°C	High pressure hydraulic, air, & some specialty chemicals	E	NR	(6)	G	NR	(6)	NR	E	NR	NR	NR
	SAE J525 (ASTM A178) (8)	Welded & Drawn					E	NR	(6)	E	NR	(6)	NR	E	NR	NR	NR
	SAE J356	Welded & Flash Controlled					G	NR	(6)	NR	NR	(6)	NR	G	NR	NR	NR
Carbon Steel C-1021	SAE J2435	Welded & Flash Controlled	Fully Annealed	HRB 75	-65° to 500°F -55° to 260°C	High pressure hydraulic	E	NR	(6)	NR	NR	(6)	NR	E	NR	NR	NR
	SAE J2467	Welded & Drawn					E	NR	(6)	E	NR	(6)	NR	E	NR	NR	NR
Carbon Steel High Strength Low Alloy (HSLA)	SAE 2613	Welded & Flash Controlled	Sub-critically annealed	HRB 90	-65° to 500°F -55° to 260°C	High pressure hydraulic	E (10)	NR	(6)	NR	NR	(6)	NR	NR	NR	NR	NR
	SAE J2614	Welded & Drawn					E	NR	(6)	NR	NR	(6)	NR	NR	NR	NR	NR
Alloy Steel 4130	ASTM A519	Seamless			-65° to 500°F -55° to 260°C	High pressure hydraulics	E (4)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
St 37.4 (Carbon Steel)	DIN 2391 Part 2 (Metric)	Seamless	Fully Annealed	HRB 72	-65° to 500°F -55° to 260°C	High pressure hydraulic, air, & some specialty chemicals	E	NR	NR	G	NR	NR	NR	NR	NR	NR	E
Stainless Steel 304 & 316	ASTM A213 ASTM A269	Seamless	Fully Annealed	HRB 90	-425° to 1200° -255° to 650°C (3)	High pressure, high temperature, or generally corrosive media (1)	(6)	E	(6)	(6)	G	(6)	NR	(6)	E	NR	E
	ASTM A249 ASTM A269	Welded & Drawn					(6)	E	(6)	(6)	E	(6)	NR	(6)	E	NR	E
1.4571 1.4541 Stainless Steel	DIN 17458 Tab 8 (Metric)	Seamless	Fully Annealed	HRB 90	-425° to 1200° -255° to 650°C (3)	High pressure, high temperature, or generally corrosive media (1)	(6)	E	NR	(6)	G	NR	NR	NR	E	NR	E
Copper	SAE J528 (ASTM B75) (8)	Seamless	Soft Annealed Temper 0	60 Max. Rockwell 15T	-325° to 400°F -200° to 205°C	Low pressure, low temperature, water, oil & air	E	(6)	E	G	(6)	E	NR	G (2)	NR	NR	E
Aluminum 6061	ASTM B210	Seamless	T6 Temper	HRB 56	-325° to 400°F -200° to 205°C	Low pressure, low temperature, water,oil, air & some specialty chemicals	NR	NR	NR	G	NR	NR	NR	E (2)	NR	NR	NR
			0 & T4 Temper	HRB 30			E (5)	NR	NR	G	NR	NR	NR	E (2)	NR	NR	NR
Monel 400	ASTM B165	Seamless	Fully Annealed	HRB 70	-400° to 800°F -240° to 425°C	Sour gas, marine & general chemical processing media	NR	(6)	NR	NR	(6)	NR	E	NR	(6)	E	NR
Nylon		Extruded	Flexible & Semi-Rigid		-60° to 200°F -50° to 95°C	Lube lines, chemical process controls & air	NR	NR	NR	NR	NR	NR	NR	G (2)	G (2)	G (2)	G (2), (9)
Polyethylene	ASTM D1248	Extruded	Instrument Grade		-80° to 150°F -60° to 65°C	Instrumentation lines	NR	NR	NR	NR	NR	NR	NR	G (2)	G (2)	G (2)	G (2), (9)
PVC		Extruded	Instrument & Laboratory Grade		0° to 140°F -20° to 60°C	General purpose laboratory use	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
PFTE		Extruded & Cintered			-65° to 400°F -55° to 205°C	Very low pressure, high temperature, fuel, lube, chemical & air applications	NR	NR	NR	NR	NR	NR	NR	G (2)	G (2)	G (2)	G (2), (9)

Table S11 — Tube and Fitting Material Compatibility

Notes:

1) For highly corrosive media or service environment, contact the Tube Fittings Division.
2) Requires different assembly procedure. Contact the Tube Fittings Division.
3) Low temperature limit for stainless steel Ferulok fittings is -20°F (-30°C).
4) For brazing only. Grade 4130 not recommended with Parflange process.
5) For use with Parflange process only. Not recommended with brazing.
6) Use depends on specific application. Contact the Tube Fittings Division.
7) Applies to tube material.
8) Comparable specifications to SAE.
9) With metric version of tubing.
10) Not tested with Parflange. Contact the Tube Fittings Division.

Ratings Key:
NR Not Recommended
F Fair
G Good
E Excellent

Fitting Materials Code:
S Steel
SS Stainless Steel
B Brass
M Monel

S

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

If elastomer seals are used in a tube fitting or adapter, the seals must be compatible with the media and environment as well. Table S12 lists compatible seal material based on media type.

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Recommended for	Temperature Range	Not Recommended For	Polymer	Abbreviated Name	Parker Compound	No. Color	SAE J515 Type	Shore Hardness
Acids	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5] or FPM	V0747	Black	——	75
Acids	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5] or FPM	V0884	Brown[1]	——	75
Acids	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5] or FPM	V0894	Brown[1],[5]	HK[4]	90[6]
Air	-30° to 250°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0674	Black	——	70
Air	-30° to 250°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0552	Black	CH[2]	90[6]
Air	-30° to 275°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N1059	Black	CH[2]	90
Air	-65° to 225°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0103	Black	——	70
Alcohols	-65° to 225°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0540	Black	CA[3]	80
Alcohols	-65° to 225°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0893	Purple[1]	CA[3]	80
Automotive brake fluids	-65° to 225°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0540	Black	CA[3]	80
Automotive brake fluids	-65° to 225°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0893	Purple[1]	CA[3])	80
$C0^2$ Climate control systems	-65° to 225°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0962	Black	——	90
CNG Applications	-58° to 300°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	HNBR	KA183	Black	——	85
Di-ester base lubricants	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5] or FPM	V0747	Black	——	75
Di-ester base lubricants	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5] or FPM	V0884	Brown[1]	——	75
Di-ester base lubricants	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5] or FPM	V0894	Brown[1],[5]	HK[4]	90[6]
Dilute acids and alkalis	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0540	Black	CA[3]	80
Dilute acids and alkalis	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0893	Purple[1]	CA[3]	80
Dry heat (air to 400°F)	-65° to 450°F	Most petroleum fluids, ketones, water and steam	Silicone	Si	S0604	Rust[1]	——	70
Ethylene glycol base fluids	-30° to 250°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0674	Black	——	70

Table S12 – Seal and Media Compatibility *(Cont'd)*

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Recommended for	Temperature Range	Not Recommended For	Polymer	Abbreviated Name	Parker Compound	No. Color	SAE J515 Type	Shore Hardness
Ethylene glycol base fluids	-30° to 250°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0552	Black	CH[2)]	90[6)]
Ethylene glycol base fluids	-30° to 275°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N1059	Black	CH[2)]	90
Ethylene glycol base fluids	-65° to 225°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0103	Black	—	70
Food product applications (meets FDA requirements)	-35° to 250°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0508	Black	—	75
Halogenated hydrocarbons	-15° to 400°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Fluorocarbon	FKM[5)] or FPM	V0747	Black	—	75
Halogenated hydrocarbons	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5)] or FPM	V0884	Brown[1)]	—	75
Halogenated hydrocarbons	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5)] or FPM	V0894	Brown[1),5)]	HK[4)]	90[6)]
High aniline point oils	-65° to 450°F	Most petroleum fluids, ketones, water and steam	Silicone	Si	S0604	Rust[1)]	—	70
High aniline point petroleum oils	-45° to 250°F	Phosphate ester fluids and ketones	Neoprene	CR	C0873	Black	—	70
High aniline point petroleum oils	-45° to 250°F	Phosphate ester fluids and ketones	Neoprene	CR	C0944	Red[1)]	—	70
Hot water	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0540	Black	CA[3)]	80
Hot water	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0893	Purple[1)]	CA[3)]	80
Hydrogen Fuel Cells	-65° to 180°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0507	Black	—	90
Hydrogen Fuel Cells	-65° to 225°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0304	Black	—	75
Ketones	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0540	Black	CA[3)]	80
Ketones	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0893	Purple[1)]	CA[3)]	80
Mild Acids	-45° to 250°F	Phosphate ester fluids and ketones	Neoprene	CR	C0873	Black	—	70
Mild Acids	-45° to 250°F	Phosphate ester fluids and ketones	Neoprene	CR	C0944	Red[1)]	—	70
Mineral Oils	-30° to 250°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0674	Black	—	70
Mineral Oils	-30° to 250°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0552	Black	CH[2)]	90[6)]
Mineral Oils	-30° to 275°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N1059	Black	CH[2)]	90
Mineral Oils	-65° to 225°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0103	Black	—	70
Natural Gas	-30° to 250°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0674	Black	—	70
Natural Gas	-30° to 250°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0552	Black	CH[2)]	90[6)]

Table S12 – Seal and Media Compatibility *(Cont'd)*

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Dimensions and pressures for reference only, subject to change.

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Natural Gas	-30° to 275°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N1059	Black	CH[2)]	90
Natural Gas	-65° to 225°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0103	Black	—	70
Petroleum based oils and fluids	-30° to 250°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0674	Black	—	70
Petroleum based oils and fluids	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5)] or FPM	V0747	Black	—	75
Petroleum based oils and fluids	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5)] or FPM	V0884	Brown[1)]	—	75
Petroleum based oils and fluids	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5)] or FPM	V0894	Brown[1),5)]	HK[4)]	90[6)]
Petroleum based oils and fluids	-30° to 250°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0552	Black	CH[2)]	90[6)]
Petroleum based oils and fluids	-30° to 275°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N1059	Black	CH[2)]	90
Petroleum based oils and fluids	-65° to 225°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0103	Black	—	70
Phosphate ester base hydraulic fluids	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0540	Black	CA[3)]	80
Phosphate ester base hydraulic fluids	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0893	Purple[1)]	CA[3)]	80
Phosphate ester base hydraulic fluids (some)	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5)] or FPM	V0747	Black	—	75
Phosphate ester base hydraulic fluids (some)	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5)] or FPM	V0884	Brown[1)]	—	75
Phosphate ester base hydraulic fluids (some)	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5)] or FPM	V0894	Brown[1),5)]	HK[4)]	90[6)]
Refrigerants (freons, ammonia)	-45° to 250°F	Phosphate ester fluids and ketones	Neoprene	CR	C0873	Black	—	70
Refrigerants (freons, ammonia)	-45° to 250°F	Phosphate ester fluids and ketones	Neoprene	CR	C0944	Red[1)]	—	70
Silicate ester lubricants	-45° to 250°F	Phosphate ester fluids and ketones	Neoprene	CR	C0873	Black	—	70
Silicate ester lubricants	-45° to 250°F	Phosphate ester fluids and ketones	Neoprene	CR	C0944	Red[1)]	—	70
Silicone and di-ester base lubricants	-30° to 250°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0674	Black	—	70
Silicone and di-ester base lubricants	-30° to 250°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0552	Black	CH[2)]	90[6)]
Silicone and di-ester base lubricants	-30° to 275°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N1059	Black	CH[2)]	90
Silicone and di-ester base lubricants	-65° to 225°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0103	Black	—	70

Table S12 – Seal and Media Compatibility *(Cont'd)*

Dimensions and pressures for reference only, subject to change.

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Silicone and silicate ester based lubricants	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5] or FPM	V0747	Black	——	75
Silicone and silicate ester based lubricants	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5] or FPM	V0884	Brown[1]	——	75
Silicone and silicate ester based lubricants	-15° to 400°F	Ketones, skydrol fluids, amines (VDMH), anhydrous ammonia, low molecular weight esters and ethers, hot hydroflouric or chlorosulfuric acids	Fluorocarbon	FKM[5] or FPM	V0894	Brown[1],[5]	HK[4]	90[6]
Silicone oils and greases	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0540	Black	CA[3]	80
Silicone oils and greases	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0893	Purple[1]	CA[3]	80
Steam to 400°F	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0540	Black	CA[3]	80
Steam to 400°F	-65° to 275°F	Petroleum based oils and di-ester base lubricants	Ethylene-Propylene	EPDM	E0893	Purple[1]	CA[3]	80
Water under 150°F	-30° to 250°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0674	Black	——	70
Water under 150°F	-30° to 250°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0552	Black	CH[2]	90[6]
Water under 150°F	-30° to 275°F	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonall	Nitrile-Butadiene	NBR	N1059	Black	CH[2]	90
Water under 150°F	-65° to 225°	Phosphate ester base hydraulic fluids, automotive brake fluids, strong acids, ozone, freons, ketones, halogenergated hydrocarbons and methonal	Nitrile-Butadiene	NBR	N0103	Black	——	70

Table S12 – Seal and Media Compatibility

1) These Parker “Chromassure” color assurance O-Rings are available from the Parker Hannifin O-Ring Division. They help eliminate assembly errors, reduce warranty costs and liability risks, and assure safety in aftermarket business.
2) Formerly SAE Type I.
3) Formerly SAE Type II.
4) Formerly SAE Type III.
5) “FKM” is the ASTM designation for fluorocarbon. Its ISO designation is “FPM”. For “DIN” Fittings, color is green.
6) Standard compounds available from stock.
7) Use 90 durometer hard O-Rings for applications with 1500 psi or higher pressures.

Caution: When working with highly corrosive media, always consult the Tube Fittings Division

Other material considerations:

Protective coatings such as electroplated zinc and zinc phosphate are usually applied to steel fittings for extending their useful service life in corrosive environments. Zinc corrodes sacrificially, protecting the steel substrate from normal atmospheric rusting due to the common presence of oxygen, moisture and acidic gases. They are, however, rapidly attacked by many fluids including those containing acidic hydrogen and reactive fluorine, chlorine, bromine, iodine, and nitrogen. Zinc plating will further be attacked by strong bases or water with pH > 12. Zinc reacts with glycol-based fire-resistant fluids and forms a gelatinous compound that can plug up filters and be harmful otherwise, in a system with many zinc plated tube and hose fittings. Stainless-steel fittings, along with brass fittings in low pressure applications, are viable options.

The other option is to run the fluid through the system, without components with moving parts in it, with an auxiliary power source, to generate and flush the gelatinous compound. Then re-connect all components, change filters and charge the system with new fluid.

Zinc-Nickel plating offers enhanced performance over Chromium-6 Free zinc plating. Parker XTR plating increases protection in salt spray (ASTM B117) testing and in fertilizer (urea) applications.

Caution: Where low toxicity and low corrosion are required, as in food or beverage applications, steel coated with any form of zinc or other protective coatings is not recommended.

Tube and tube fitting and adapter materials should be similar when possible. If different materials must be used, galvanic corrosion prevention needs to be considered. The susceptibility of different base metals to corrosion while in contact, depends upon the difference between the contact potentials, or the electromotive voltages of the metals involved.

S

The electromotive potential of common metals is listed in table S13. The greater the potential difference is, the greater is the tendency for corrosion. The metal with the higher potential forms the anode and is corroded. In other words, the larger the separation distance in the electromotive chart between the two metals in contact, the higher the contact potential and chances for corrosion. For example, zinc and aluminum are very short distance apart in the chart. Therefore, potential for corrosion when these two metals are in contact is very low. On the other hand, aluminum and passivated 316 stainless steel are far apart; hence, when in contact, the potential for corrosion is very high. Aluminum, being more anodic metal, will corrode in this combination.

M

As a general guideline, if the metals are half the length of the chart or more apart, the combination should be avoided. Also, it is not a good idea to combine an anodic metal part with thin cross section, such as thin wall tubing, with a cathodic or less anodic metal part of a heavy cross section, such as a fitting. For example, a thin wall brass tube with steel fitting is a better, although not ideal, combination than a thin wall steel tube with brass fitting.

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Electromotive or Galvanic Series for Metals	
	Magnesium
	Magnesium Alloys
+ Anodic (least noble) corroded	Zinc (Parker steel fittings are zinc plated)
	Zinc-Nickel (Parker XTR Plating)
	Beryllium
	Aluminum 5052, 3004, 3003, 1100, 6053
	Cadmium
	Aluminum 2117, 2017, 2024 T4
	Mild steel (1018), wrought iron, free machining steel (12L14)
	Low alloy high strength steel, cast iron
	Chrome iron (active)
	430 Stainless (active)
	302, 303, 321, 347, 410, 416, stainless steel (active)
	Ni-resist
	316, 317 stainless steel (active)
	Carpenter 20Cb-3 stainless (active)
	Aluminum bronze (CA 687)
	Hastelloy C (active) Inconnel 625 (active) Titanium (active)
	Lead/Tin solder
	Lead
	Tin
	Inconnel 600 (active)
	Nickel (active)
	60 Ni-15 Cr (active)
	80 Ni-20 Cr (active)
	Hastelloy B (active)
	Naval brass (CA 464), Yellow brass (CA 268), Brass (CA360)
	Red brass (CA 230), Admiralty brass (CA 443)
	Copper (CA 102)
	Maganese bronze (CA 675), Tin bronze (CA 903, 905)
	410, 416 Stainless (passive) Phospher bronze (CA 521, 524)
	Silicon bronze (CA 651, 655)
	Nickel silver (CA 732, 735, 745, 752, 754, 757, 764, 770, 794)
	Cupro Ni 90-10
	Cupro Ni 80-20
	430 Stainless steel (passive)
	Cupro Ni 70-30
	Nickel aluminum bronze (CA 630, 632)
	Monel 400, K500
	Silver solder
	Nickel (passive)
	60 Ni 15 Cr (passive)
	Inconnel 600 (passive)
	80 Ni 20 Cr (passive)
	Chrome iron (passive)
	302, 303, 304, 321, 347 stainless steel (passive)
	316, 317 stainless steel (passive) (Parker stainless steel fittings are passivated)
	Carpenter 20 Cb-3 stainless (passive), Incoloy 825
	Silver
	Titanium (passive), Hastelloy C & C276 (passive), Inconnel 625 (passive)
- Cathodic (most noble) protected	Graphic
	Zirconium
	Gold
	Platinum

Electric current flows from plus to minus Direction of attack

Table S13 — Electromotive or Galvanic Series for Metals

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STEP 5: PRESSURE

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Finally, any selected tube fitting or adapter and tubing should have a pressure rating satisfying the system requirement. Pressure ratings shown on the product pages of Tube Fittings catalog are for dynamic systems with normal severity of service (see Table S6) at standard temperature range. A vast majority of systems where our tube fittings and adapters are used fall in this category. However, there are applications, such as hydraulic jacks, where the system pressure is essentially static once it is pressurized. For this type of an application the tube fittings and adapters can be used at higher pressures. On the other hand, there are applications where temperature is elevated, or service is severe or even hazardous. The pressure ratings in the catalog shall be de-rated accordingly.

Dynamic and static systems can be defined as follows:

Dynamic: A system in which the operating pressure fluctuates, in accordance with load, up to a maximum pressure limited by the relief valve. In addition, the system may also experience shocks, vibration and temperature excursions.

Example: A backhoe.

Static: A system, once pressurized, is essentially free of pressure fluctuations, shock, vibration and temperature excursions, with such pressurizations not exceeding 30,000 times in the life of the system.

Example: A hydraulic jack.

Dynamic pressure ratings are based on a minimum design factor of 4. In other words, the fitting is capable of holding a pressure equal to 4 times the rated pressure before leakage or failure. For static applications, the design factor can be 3. So, the static rating can be determined by multiplying the dynamic rating by 1.33.

Static pressure rating = 1.33 x Dynamic pressure rating

Example: Static pressure rating for a fitting rated at 6000 psi = 1.33 x 6000 = 8000 psi

Selected tubes should have enough wall thickness and I.D. to satisfy pressure and flow requirements. Once I.D. and wall thickness are determined, O.D. can be calculated. Tube fitting size should match selected tube O.D. size. Some fittings can only work with limited wall thickness ranges. Therefore, selected fittings should be able to accept the selected tube wall thickness. Tables S14 and S15 shows the wall thickness range for common fittings.

Tube Material / Size		Steel St. Steel Copper Aluminum	Steel St. Steel Monel	Steel Alloy Steel St. Steel Copper Monel	Copper Aluminum Plastics
O.D. (in.)	Dash #	SAE 37° Flare Triple-Lok	SAE Flareless Ferulok	SAE O-Ring Face Seal Seal-Lok	Intru-Lok
1/8	-2	.010 - .035	.010 - .035	—	.012 - .028
3/16	-3	.010 - .035	.020 - .049	—	.012 - .035
1/4	-4	.020 - .065	.028 - .065	.020 - .083	.020 - .049
5/16	-5	.020 - .065	.028 - .065	.020 - .095	.020 - .065
3/8	-6	.020 - .065	.035 - .095	.020 - .109	.028 - .065
1/2	-8	.028 - .083	.049 - .120	.028 - .148	.035 - .083
5/8	-10	.035 - .095	.058 - .120	.035 - .134	.035 - .083
3/4	-12	.035 - .109	.065 - .120	.035 - .148	.035 - .095
7/8	-14	.035 - .109	.072 - .120	.035 - .156	.049 - .095
1	-16	.035 - .120	.083 - .148	.035 - .188	.049 - .120
1 1/4	-20	.049 - .120	.095 - .188	.049 - .220	
1 1/2	-24	.049 - .120	.095 - .220	.049 - .250	
2	-32	.058 - .134	.095 - .220	.058 - .250	

1) Brazing to attach sleeve can be used for all wall thicknesses.
2) Thinner wall can be used for Ferulok with support of an insert.
3) Thicker wall can be used for Ferulok but pressure capability is limited by fittings.

Table S14 – Recommended Inch Tube Wall Thickness Ranges for Common Fittings

Read more about Pressure Ratings in our article The Truth About Pressure Ratings for Hydraulic Fittings and Adapters.

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Tube O.D. (mm)	Recommended Wall Thickness (mm)								
	Seal-Lok			Triple-Lok			EO/EO2		
	Fitting Size	Min.	Max.	Fitting Size	Min.	Max.	Fitting Size	Min.	Max.
6	-4	0.5	2.25	-4	0.5	2.0	6LL, 6L, 6S	1.0	2.0
8	-6	1.0	2.5	-5	0.5	2.0	8LL, 8L, 8S	1.0	2.5
10	-6	1.0	3.0	-6	0.5	2.0	10LL, 10L, 10S	1.0	3.0
12	-8	1.0	3.5	-8	1.0	2.0	12LL, 12L, 12S	1.5	3.5
14	-10	1.0	4.0	-10	1.0	2.5	14S	1.5	4.0
15	-10	1.0	3.0	-10	1.0	2.5	15L	1.5	4.0
16	-10	1.0	3.0	-10	1.0	2.5	16S	2.0	4.0
18	-12	1.0	3.0	-12	1.0	3.0	18L	2.0	4.0
20	-12	1.5	4.0	-12	1.0	3.0	20S	2.5	4.0
22	-16	1.0	3.0	-14	1.0	3.0	22L	2.5	4.0
25	-16	2.0	5.0	-16	1.0	3.0	25S	2.5	4.5
28	-20	1.5	5.0	-20	1.5	3.0	28L	2.5	4.5
30	-20	2.0	5.0	-20	1.5	3.0	30S	3.0	5.0
32	-20	2.0	2.5	-20	1.5	3.0	-	-	-
35	-24	2.0	6.0	-24	1.5	3.0	35L	3.0	5.0
38	-24	2.5	7.0	-24	1.5	3.0	38S	3.5	6.0
42	-	-	-	-	-	-	42L	3.5	7.0
50	-	-	-	-32	1.5	3.5	-	-	-

1) Brazing to attach sleeve can be used for all wall thicknesses.
2) Thinner wall can be used for EO/EO2 with support of an insert.
3) Thicker wall can be used for EO/EO2 but pressure capability is limited by fittings.

Table S15 – Recommended Metric Tube Wall Thickness Ranges for Common Fittings

One final consideration in choosing the right wall thickness for tubing is bending. If the tube will be bent, and bending without the use of a mandrel is desired, then wall thickness of less than 7% of the tube O.D. should not be used.

Some parts are capable of performing at higher pressures than those shown on the product pages. For information on higher ratings, contact Tube Fittings Division.

Additional Information

Tubing Pressure Ratings

Use Tables S16 and S17 to determine the tube O.D. and wall thickness combination that satisfies the following two conditions:

A. Has recommended design pressure equal to or higher than maximum operating pressure.
B. Provides tube I.D. equal to or greater than required flow diameter determined earlier.

Design pressure values in Tables S16 and S17 are based on the severity of service rating “A” (design factor of 4) in Table S6, and temperature derating factor of 1 in Table S5. If more severe operating conditions are involved, the values in Tables S16 and S17 should be multiplied by appropriate derating factors from Tables S5 and S6 before determining the tube O.D. and wall thickness combination. Contact the Tube Fittings Division when in doubt.

Inch Tube Pressure Ratings

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Inch Tubes*							Inch Tubes*						
			Design Pressure							Design Pressure			
Tube O.D. (in.)	Wall Thick. (in.)	Tube I.D. (in.)	Steel C-1010	Steel C-1021	Stainless Steel 304 & 316, 4130 HSLA	Copper K or Y	Tube O.D. (in.)	Wall Thick. (in.)	Tube I.D. (in.)	Steel C-1010	Steel C-1021	Stainless Steel 304 & 316, 4130 HSLA	Copper K or Y
0.125	0.010	0.105	1,900	2,550	3,200	1,000	0.625	0.058	0.509	2,250	3,000	3,750	1,200
0.125	0.020	0.085	4,100	5,500	6,850	2,200	0.625	0.065	0.495	2,550	3,400	4,250	1,350
0.125	0.028	0.069	5,950	7,950	9,950	3,150	0.625	0.083	0.459	3,350	4,450	5,600	1,750
0.125	0.035	0.055	7,550	10,100	12,650	4,050	0.625	0.095	0.435	3,900	5,200	6,500	2,050
0.188	0.010	0.168	1,250	1,650	2,100	650	0.625	0.109	0.407	4,500	6,050	7,550	2,400
0.188	0.020	0.148	2,600	3,500	4,400	1,400	0.625	0.120	0.385	5,050	6,700	8,400	2,700
0.188	0.028	0.132	3,800	5,050	6,350	2,000	0.625	0.134	0.357	5,700	7,600	9,500	3,000
0.188	0.035	0.118	4,850	6,500	8,150	2,600	0.750	0.035	0.680	1,050	1,450	1,800	550
0.188	0.049	0.090	7,000	9,400	11,750	3,750	0.750	0.049	0.652	1,550	2,050	2,600	800
0.250	0.020	0.210	1,900	2,550	3,200	1,000	0.750	0.058	0.634	1,850	2,450	3,100	1,000
0.250	0.028	0.194	2,750	3,700	4,650	1,450	0.750	0.065	0.620	2,100	2,800	3,500	1,100
0.250	0.035	0.180	3,350	4,750	5,900	1,900	0.750	0.083	0.584	2,750	3,650	4,550	1,450
0.250	0.049	0.152	5,150	6,900	8,600	2,750	0.750	0.095	0.560	3,150	4,250	5,300	1,700
0.250	0.058	0.134	6,200	8,300	10,350	3,300	0.750	0.109	0.532	3,700	4,950	6,150	1,950
0.250	0.065	0.120	7,000	9,350	11,700	3,750	0.750	0.120	0.510	4,100	5,500	6,850	2,200
0.250	0.083	0.084	8,950	11,950	14,900	4,750	0.750	0.134	0.482	4,650	6,200	7,750	2,450
0.313	0.020	0.273	1,500	2,000	2,500	800	0.750	0.148	0.454	5,200	6,950	8,650	2,750
0.313	0.028	0.257	2,150	2,900	3,600	1,150	0.750	0.188	0.374	6,750	9,000	11,250	3,600
0.313	0.035	0.243	2,750	3,700	4,600	1,450	0.875	0.035	0.805	900	1,200	1,550	500
0.313	0.049	0.215	4,000	5,350	6,700	2,150	0.875	0.049	0.777	1,300	1,750	2,200	700
0.313	0.058	0.197	4,850	6,450	8,100	2,550	0.875	0.058	0.759	1,550	2,100	2,600	800
0.313	0.065	0.183	5,500	7,350	9,150	2,900	0.875	0.065	0.745	1,750	2,350	2,950	950
0.313	0.083	0.147	7,150	9,550	11,950	3,800	0.875	0.083	0.709	2,300	3,100	3,850	1,200
0.313	0.095	0.123	8,200	10,950	13,700	4,350	0.875	0.095	0.685	2,650	3,600	4,500	1,400
0.375	0.020	0.335	1,250	1,650	2,100	650	0.875	0.109	0.657	3,100	4,150	5,200	1,650
0.375	0.028	0.319	1,800	2,400	3,000	950	0.875	0.120	0.635	3,450	4,650	5,800	1,850
0.375	0.035	0.305	2,250	3,050	3,800	1,200	0.875	0.134	0.607	3,900	5,250	6,550	2,100
0.375	0.049	0.277	3,300	4,400	5,500	1,750	0.875	0.148	0.579	4,350	5,850	7,300	2,300
0.375	0.058	0.259	3,950	5,300	6,600	2,100	1.000	0.035	0.930	800	1,050	1,350	400
0.375	0.065	0.245	4,500	6,000	7,500	2,400	1.000	0.049	0.902	1,150	1,500	1,900	600
0.375	0.083	0.209	5,900	7,850	9,850	3,150	1.000	0.058	0.884	1,350	1,800	2,300	700
0.375	0.095	0.185	6,800	9,100	11,400	3,650	1.000	0.065	0.870	1,550	2,050	2,550	800
0.375	0.109	0.157	7,850	10,500	13,150	4,200	1.000	0.083	0.834	2,000	2,650	3,350	1,050
0.500	0.028	0.444	1,300	1,750	2,200	700	1.000	0.095	0.810	2,300	3,100	3,850	1,200
0.500	0.035	0.430	1,650	2,200	2,800	850	1.000	0.109	0.782	2,700	3,600	4,500	1,400
0.500	0.049	0.402	2,400	3,200	4,000	1,250	1.000	0.120	0.760	3,000	4,000	5,000	1,600
0.500	0.058	0.384	2,900	3,850	4,800	1,500	1.000	0.134	0.732	3,350	4,500	5,650	1,800
0.500	0.065	0.370	3,250	4,350	5,450	1,750	1.000	0.148	0.704	3,750	5,050	6,300	2,000
0.500	0.083	0.334	4,300	5,700	7,150	2,250	1.000	0.156	0.688	4,000	5,350	6,700	2,100
0.500	0.095	0.310	4,950	6,650	8,300	2,650	1.000	0.188	0.624	4,900	6,550	8,200	2,600
0.500	0.109	0.282	5,800	7,750	9,700	3,100	1.000	0.220	0.560	5,850	7,800	9,750	3,100
0.500	0.120	0.260	6,450	8,600	10,750	3,400	1.250	0.049	1.152	900	1,200	1,500	450
0.500	0.134	0.232	7,250	9,650	12,100	3,850	1.250	0.058	1.134	1,050	1,450	1,800	550
0.500	0.148	0.204	8,000	10,700	13,350	4,250	1.250	0.065	1.120	1,200	1,600	2,050	650
0.500	0.188	0.124	9,900	13,250	16,550	5,300	1.250	0.083	1.084	1,550	2,100	2,650	800
0.625	0.028	0.569	1,050	1,400	1,750	550	1.250	0.095	1.060	1,800	2,450	3,050	950
0.625	0.035	0.555	1,300	1,750	2,200	700	1.250	0.109	1.032	2,100	2,800	3,550	1,100
0.625	0.049	0.527	1,900	2,500	3,150	1,000	1.250	0.120	1.010	2,350	3,150	3,900	1,250

Table S16 — Inch Tube Pressure Ratings
See Table S11 for tube specifications.

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Inch Tube Pressure Ratings (cont'd)

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Inch Tubes*						
			Design Pressure			
Tube O.D. (in.)	Wall Thick. (in.)	Tube I.D. (in.)	Pressure C-1010	Steel C-1021	Stainless Steel 304 & 316, 4130 HSLA	Copper K or Y
1.250	0.134	0.982	2,650	3,550	4,400	1,400
1.250	0.148	0.954	2,950	3,950	4,900	1,550
1.250	0.156	0.938	3,100	4,150	5,200	1,650
1.250	0.188	0.874	3,850	5,100	6,400	2,050
1.250	0.220	0.810	4,550	6,100	7,650	2,450
1.500	0.065	1.370	1,000	1,350	1,650	500
1.500	0.083	1.334	1,300	1,750	2,150	700
1.500	0.095	1.310	1,500	2,000	2,500	800
1.500	0.109	1.282	1,750	2,300	2,900	900
1.500	0.120	1.260	1,900	2,550	3,200	1,000
1.500	0.134	1.232	2,150	2,900	3,600	1,150
1.500	0.148	1.204	2,400	3,200	4,050	1,250
1.500	0.156	1.188	2,550	3,400	4,250	1,350
1.500	0.188	1.124	3,150	4,200	5,250	1,650
1.500	0.220	1.060	3,750	5,000	6,250	2,000
1.500	0.250	1.000	4,300	5,750	7,200	2,300
2.000	0.065	1.870	750	1,000	1,250	400
2.000	0.083	1.834	950	1,250	1,600	500
2.000	0.095	1.810	1,100	1,450	1,850	550
2.000	0.109	1.782	1,250	1,700	2,150	650
2.000	0.120	1.760	1,400	1,900	2,350	750
2.000	0.134	1.732	1,600	2,100	2,650	850
2.000	0.148	1.704	1,750	2,350	2,950	950
2.000	0.156	1.688	1,850	2,500	3,150	1,000
2.000	0.188	1.624	2,300	3,050	3,800	1,200
2.000	0.220	1.560	2,700	3,650	4,550	1,450
2.000	0.250	1.500	3,100	4,200	5,250	1,650
2.000	0.281	1.438	3,550	4,750	5,950	1,900

Table S16 — Inch Tube Pressure Ratings *(cont'd.)*

See Table S11 for tube specifications.

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Metric Tube Pressure Ratings

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Metric Tubes				
			Static Design Pressure (Bar)	
Tube O.D. (mm.)	Wall Thick. (mm.)	Tube I.D. (mm.)	Steel Low-Carbon St. 37.4	Stainless Steel 1.4571
4	0.5	3.0	313	
4	0.75	2.5	409	
4	1.0	2.0	522	600
5	1.0	3.0	432	
6	0.75	4.5	333	
6	1.0	4.0	389	426
6	1.5	3.0	549	600
6	2.0	2.0	692	
6	2.25	1.5	757	
8	1.0	6.0	333	368
8	1.5	5.0	431	472
8	2.0	4.0	549	
8	2.5	3.0	658	
10	1.0	8.0	282	294
10	1.5	7.0	373	389
10	2.0	6.0	478	498
10	2.5	5.0	576	
10	3.0	4.0	666	
12	1.0	10.0	235	245
12	1.5	9.0	353	368
12	2.0	8.0	409	426
12	2.5	7.0	495	
12	3.0	6.0	576	
12	3.5	5.0	651	
14	1.5	11.0	302	315
14	2.0	10.0	357	420
14	2.5	9.0	434	452
14	3.0	8.0	507	
14	3.5	7.0	576	
14	4.0	6.0	641	
15	1.0	13.0	188	196
15	1.5	12.0	282	294
15	2.0	11.0	336	392
15	3.0	9.0	478	
16	1.5	13.0	264	276
16	2.0	12.0	353	368
16	2.5	11.0	386	403
16	3.0	10.0	452	472
18	1.0	16.0	157	
18	1.5	15.0	235	245
18	2.0	14.0	313	327
18	2.5	13.0	392	

Metric Tubes				
			Static Design Pressure (Bar)	
Tube O.D. (mm.)	Wall Thick. (mm.)	Tube I.D. (mm.)	Steel Low-Carbon St. 37.4	Stainless Steel 1.4571
18	3.0	12.0	409	
20	1.5	17.0	212	
20	2.0	16.0	282	294
20	2.5	15.0	353	368
20	3.0	14.0	373	389
20	3.5	13.0	426	
20	4.0	12.0	478	
22	1.5	19.0	192	200
22	2.0	18.0	256	267
22	2.5	17.0	320	
22	3.0	16.0	343	
25	2.0	21.0	226	
25	2.5	20.0	282	294
25	3.0	19.0	338	353
25	4.0	17.0	394	
25	4.5	16.0	437	
25	5.0	15.0	478	
28	1.5	25.0	151	158
28	2.0	24.0	201	210
28	2.5	23.0	252	
28	3.0	22.0	302	
30	2.0	26.0	188	
30	2.5	25.0	235	245
30	3.0	24.0	282	294
30	4.0	22.0	336	392
30	5.0	20.0	409	
35	2.0	31.0	161	168
35	2.5	30.0	201	
35	3.0	29.0	242	
35	4.0	27.0	322	
38	2.5	33.0	186	
38	3.0	32.0	223	
38	4.0	30.0	297	309
38	5.0	28.0	332	
38	6.0	26.0	390	
38	7.0	24.0	446	
42	2.0	38.0	134	140
42	3.0	36.0	201	210
42	4.0	34.0	269	
50	6.0	38.0	338	
50	9.0	32.0	437	
65	8.0	49.0	347	

Table S17 — Metric Tube Pressure Ratings

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The pressure tables above are calculated using LAME's equation:

Design Pressure Formula (LAME'S)

$$P = S\left(\frac{D^2 - d^2}{D^2 + d^2}\right)$$ where:

D = Outside diameter of tube, in.
d = Inside diameter of tube (D-2T), in
P = Recommended design pressure, psi
S = Allowable stress for design factor of 4, psi
T = Tube wall thickness, in.

Table S18 — Design Pressure Formula

*For thin wall tubes (D/T ≥ 10) the following formula may be used: **P = 2ST/D**

The allowable stress for popular material in the equations is listed in table below. The design factor is generally applied to ultimate strength of material (or burst pressure of tubing) to provide a measure of design margin against the unknowns in material and operating conditions.

Material and Type	Allowable Design Stress for Factor of 4 at 72°F	Tube Specification
Steel C1010	11,250 PSI	SAE J356, J524, J525
Steel C1021	15,000 PSI	SAE J2435, L2467
Steel, High Strength Low Alloy (HSLA)	18,000 PSI	SAE J2613, J2614
Stainless Steel 304 & 316	18,800 PSI	ASTM A213, A249, A269
Alloy Steel C4130	18,800 PSI	ASTM A519
Copper, K or Y	6,000 PSI	SAE J528, ASTM B75
Aluminum 6061-T6	10,500 PSI	ASTM B210
Monel, 400	17,500 PSI	ASTM B165

Table S19 — Design Stress Values

FITTING AND TUBE SELECTION EXAMPLE:

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As mentioned at the beginning of this section, the form below can be used as a guide when determining the proper tube fittings and adapters for your system. Below outlines an example application and illustrates how the table could be filled out.

A hydraulic power unit for a factory press in the U.S. has the following operating parameters:

- Type of fluid: Petroleum based hydraulic fluid
- Operating temperature range: -20°F to +140°F
- Maximum operating pressure: 3500psi
- Maximum flow rate through each line: 10GPM
- Severity of service: normal

For clarity, the application information can be organized into the Summary Information section of the table, and the selection steps can be documented in the Selection Process section.

Summary Information				
Size	**I.D.**		**O.D.**	
	TBD		TBD	
Temperature	**Material Conveyed**		**Environment (in a typical factory)**	
	Min.	**Max.**	**Min.**	**Max**
	-20°F	+140°F	+32°F	+100°F
Application	**Industrial Standards**	**Connection Styles**	**Severity of Service**	**Other**
	SAE(U.S.)	TBD	normal	NA
Material/Media	**Internal Media**		**External Environment**	
	Petroleum based hydraulic fluid		Inside a factory	
Pressure	**Max. Working Pressure**		**Spikes**	**Vacuum**
	3500psi		Normal	Low in suction line

Selection Process	
STAMP Process	**Explanation**
Size I.D.: • 10 GPM flow rate • Pressure line I.D. = 0.405 • Return line I.D. = 0.639 • Suction line I.D. = 1.012 • O.D. and fitting size will be determined later	• Given • Use Table S1
Temperature: • Operating temperature range: -20°F to +140°F • Potential fitting material: steel, stainless steel or brass • Potential seal material: NBR, EPDM, CR or SI	• Given • Use Table S3 • Use Table S4

(Continued)

S

Application: • Hydraulic power unit • Severity of service: normal • Geographic region: U.S. • No extreme pressure spikes, excessive vibration, extreme temperature swings or hazardous environment • Potential fitting types: SAE fittings	• Given • Given • Given • Based on normal service and experience with the hydraulic power unit • For U.S. use
Material/Media: • Petroleum based hydraulic fluid • Environment: indoors factory setting • Fitting material: narrow down to steel • Seal material: narrow down to NBR	• Given • Given • Use Table S3 and S10 and cost, availability • Use Table S4 and S10 and cost, availability
Pressure: • System type: dynamic • Design factor: 4:1 • Derating factor: 1 • Pressure line: 3500psi o Tube: 5/8” O.D. x .083” wall, C1010 material (.095” and. 109” wall can also be used) o Fitting size: -10 o Fitting type: Seal-Lok • Return line: < 100psi o Tube: 3/4” O.D. x .035” wall, C1010 material (.049” wall can also be used) o Fitting Size: -12 o Fitting type: Seal-Lok • Suction line: low vacuum o Tube: 1 1/4” O.D. x .049” wall, C1010 material (thicker wall up to .083” can also be used) o Fitting Size: -20 o Fitting type: Seal-Lok	• Power unit for press is normally dynamic • Table S6 • Table S5 and S6 • Given • Use Table S27 • To connect to 5/8” O.D. tube • Table S11 and S14 pressure rating, superior performance and availability in the U.S. • Experience • Use table S27 • To connect to 3/4” O.D. tube • To be consistent with pressure line • Experience • Use Table S27 • To connect to 1 1/4” O.D. tube • To be consistent with pressure line

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1. Tube and Port Size Pairing:

Table S20 and S21 provides the optimum tube to port size pairing. When the listed pairs are selected, the flow diameters of tube and port are closely matched.

Tube O.D.			Port Thread			
Inch (Dash Size)		Metric (mm.)	SAE	ISO	NPTF	BSPP
1/8	(-2)	4	5/16-24	M8 x 1	1/16-27	G 1/8-28
3/16	(-3)	5	3/8-24	M10 x 1	1/8-27	G 1/8-28
1/4	(-4)	6	7/16-20	M10 x 1	1/8-27	G 1/8-28
5/16	(-5)	8	1/2-20	M12 x 1.5	1/8-27	G 1/4-19
3/8	(-6)	10	9/16-18	M14 x 1.5	1/4-18	G 1/4-19
1/2	(-8)	12	3/4-16	M16 x 1.5	3/8-18	G 3/8-19
—		15	3/4-16	M18 x 1.5	1/2-14	G 1/2-14
5/8	(-10)	16, 18	7/8-14	M22 x 1.5	1/2-14	G 1/2-14
3/4	(-12)	20	1 1/16-12	M27 x 2	3/4-14	G 3/4-14
7/8	(-14)	22	1 3/16-12	M27 x 2	3/4-14	G 3/4-14
1	(-16)	25, 28	1 5/16-12	M33 x 2	1-11 1/2	G 1-11
1 1/4	(-20)	30, 35	1 5/8-12	M42 x 2	1 1/4-11 1/2	G 1 1/4-11
1 1/2	(-24)	38, 42	1 7/8-12	M48 x 2	1 1/2-11 1/2	G 1 1/2-11
2	(-32)	50	2 1/2-12	M60 x 2	2-11 1/2	G 2-11

Table S20 — Tube to Port Pairing for Medium Pressure Applications

1) Ports are in accordance with the standards listed below:
   SAE J1926-1, ISO 6149-1, NPTF-SAE J476 and BSPP-ISO 1179-1
2) The pressure range covering all the sizes shown is 1000 to 5000 PSI.

Tube O.D.			Port Thread			
Inch (Dash Size)		Metric (mm.)	SAE	ISO	NPTF	BSPP
1/8	(-2)	4	5/16-24	M8 x 1	1/16-27	G 1/8-28
3/16	(-3)	5	3/8-24	M10 x 1	1/8-27	G 1/8-28
1/4	(-4)	6	7/16-20	M12 x 1.5	1/8-27	G 1/8-28
5/16	(-5)	8	1/2-20	M14 x 1.5	1/8-27	G 1/4-19
3/8	(-6)	10	9/16-18	M16 x 1.5	1/4-18	G 1/4-19
1/2	(-8)	12	3/4-16	M18 x 1.5	3/8-18	G 3/8-19
5/8	(-10)	14, 16	7/8-14	M22 x 1.5	1/2-14	G 1/2-14
3/4	(-12)	20	1 1/16-12	M27 x 2	3/4-14	G 3/4-14
7/8	(-14)	—	1 3/16-12	M30 x 2	3/4-14	G 3/4-14
1	(-16)	25	1 5/16-12	M33 x 2	1-11 1/2	G 1-11
1 1/4	(-20)	30	1 5/8-12	M42 x 2	1 1/4-11 1/2	G 1 1/4-11
1 1/2	(-24)	38	1 7/8-12	M48 x 2	1 1/2-11 1/2	G 1 1/2-11
2	(-32)	50	2 1/2-12	M60 x 2	2-11 1/2	—

Table S21 — Tube to Port Pairing for High Pressure Applications

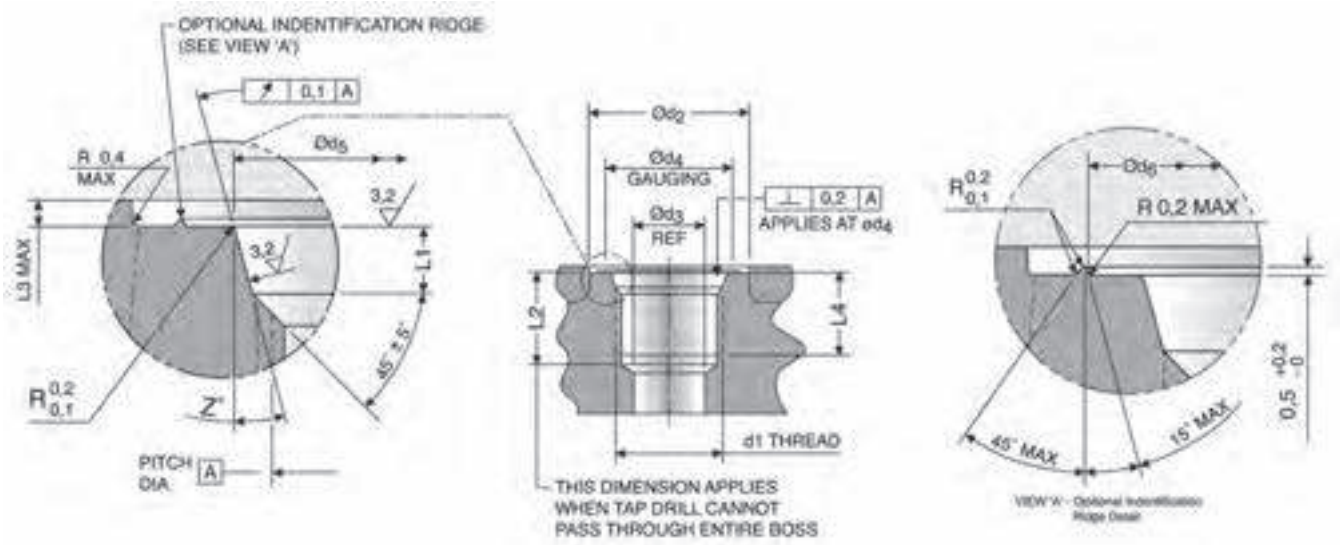
1) Ports are in accordance with the standards listed below:
   SAE J1926-1, ISO 6149-1, NPTF-SAE J476 and BSPP-ISO 1179-1
2) The pressure range covering all the sizes shown is 2500 to 9000 PSI

S

2. Common Port Details:

ISO 6149-1 — Metric Straight Thread O-Ring Port

(SAE 2244-1/DIN 3852, Part 3) Metric ISO 261, “M” Thread



Thread Size d1[1]	Large d2[2] min	Small d2[3] min.	d3[4] ref.	d4	d5 +0.1 0	d6 +0.5 0	L1 +0.4 0	L2[5] min.	L3 max	L4 min. full thread	Z° ±1°	Parker O-Ring Size[8]
M8 X 1	17	14	3	12.5	9.1	14	1.6	11.5	1	10	12°	M8 ISO O-Ring
M10 X 1	20	16	4.5	14.5	11.1	16	1.6	11.5	1	10	12°	M10 ISO O-Ring
M12 X 1.5	23	19	6	17.5	13.8	19	2.4	14	1.5	11.5	15°	M12 ISO O-Ring
M14 X 1.5[6]	25	21	7.5	19.5	15.8	21	2.4	14	1.5	11.5	15°	M14 ISO O-Ring
M16 X 1.5	28	24	9	22.5	17.8	24	2.4	15.5	1.5	13	15°	M16 ISO O-Ring
M18 X 1.5	30	26	11	24.5	19.8	26	2.4	17	2	14.5	15°	M18 ISO O-Ring
M22 X 1.5	33	29	14	27.5	23.8	29	2.4	18	2	15.5	15°	M22 ISO O-Ring
M27 X 2	40	34	18	32.5	29.4	34	3.1	22	2	19	15°	M27 ISO O-Ring
M30 X 2	44	38	21	36.5	32.4	38	3.1	22	2	19	15°	M30 ISO O-Ring
M33 X 2	49	43	23	41.5	35.4	43	3.1	22	2.5	19	15°	M33 ISO O-Ring
M42 X 2	58	52	30	50.5	44.4	52	3.1	22.5	2.5	19.5	15°	M42 ISO O-Ring
M48 X 2	63	57	36	55.5	50.4	57	3.1	25	2.5	22	15°	M48 ISO O-Ring
M60 X 2	74	67	44	65.5	62.4	67	3.1	27.5	2.5	24.5	15°	M60 ISO O-Ring
FOR CARTRIDGE VALVE CAVITIES ONLY (SEE ISO 7789)												
M20X1.5[7]	32	27	——	25.5	21.8	27	2.4	——	2	14.5	15°	M20 ISO O-Ring

Table S22 — Port Detail — ISO 6149-1

1) Per ISO 261 tolerance class 6H. Tap drill per ISO 2306 class 6H.
2) Spotface diameter with the optional identification ridge.
3) Spotface diameter without identification ridge. Port to be identified by marking “metric” or “M” next to it or “ISO 6149-1 Metric” on component name plate.
4) Reference only. Connecting hole application may require a different size.
5) Tap drill depths given require use of a bottoming tap to produce the specified full thread lengths. Where standard taps are used, increase tap drill depths accordingly.
6) Preferred for diagnostic port applications.
7) For cartridge valve cavity applications only.
8) 90 durometer nitrile is standard for hydraulic applications.

NOTE: For port tapping tools, see page S40. See page R5 for assembly torques.

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
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SAE J1926-1 — SAE Straight Thread O-Ring Port (ISO 11926-1)

UN/UNF Threads

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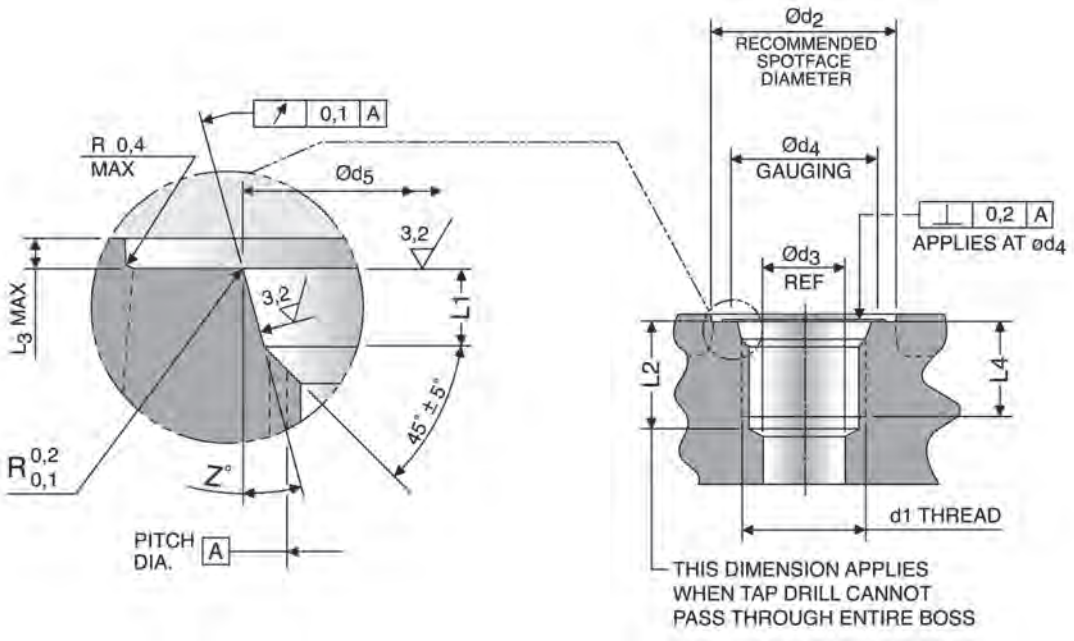

Nominal Tube OD[1]			Thread Size	d2 dia.[3]	d3 dia.	d4 dia.	d5 dia.[4]	L1	L2[5]	L3[3],[6]	L4	Z	
Nom[2] SAE Dash Size	Inch (in.)	Metric (mm.)	ANSI B1.1 (ISO 263) (in.)	(mm.)	min. (mm.)	min. (mm.)	+0.13 -0.00 (mm.)	+0.4 -0.00 (mm.)	min. (mm.)	max (mm.)	Full Thread min. (mm.)	±1° deg.	Parker O-Ring Size[7]
-2	1/8	———	5/16-24 UNF-2B	17	1.6	11	9.1	1.9	12.0	1.6	10.0	12°	3-902
-3	3/16	4	3/8-24 UNF-2B	19	3.2	13	10.7	1.9	12.0	1.6	10.0	12°	3-903
-4	1/4	6	7/16-20 UNF-2B	21	4.4	15	12.4	2.4	14.0	1.6	11.5	12°	3-904
-5	5/16	8	1/2-20 UNF-2B	23	6.0	16	14.0	2.4	14.0	1.6	11.5	12°	3-905
-6	3/8	10	9/16-18 UNF-2B	25	7.5	18	15.6	2.5	15.5	1.6	12.7	12°	3-906
-8	1/2	12	3/4-16 UNF-2B	30	10.0	22	20.6	2.5	17.5	2.4	14.3	15°	3-908
-10	5/8	14, 15, 16	7/8-14 UNF-2B	34	12.5	26	23.9	2.5	20.0	2.4	16.7	15°	3-910
-12	3/4	18, 20	1 1/16-12 UN-2B	41	16.0	32	29.2	3.3	23.0	2.4	19.0	15°	3-912
-14	7/8	22	1 3/16-12 UN-2B	45	18.0	35	32.3	3.3	23.0	2.4	19.0	15°	3-914
-16	1	25, 28	1 5/16-12 UN-2B	49	21.0	38	35.5	3.3	23.0	3.2	19.0	15°	3-916
-20	1 1/4	30, 32, 35	1 5/8-12 UN-2B	58	27.0	48	43.5	3.3	23.0	3.2	19.0	15°	3-920
-24	1 1/2	38, 42	1 7/8-12 UN-2B	65	33.0	54	49.8	3.3	23.0	3.2	19.0	15°	3-924
-32	2	50	2 1/2-12 UN-2B	88	45.0	70	65.7	3.3	23.0	3.2	19.0	15°	3-932

Table S23 — Port Detail — SAE J1926-1 (ISO 11926-1)

1) Nominal tube OD is shown for the standard inch sizes and the conversion to equivalent millimeter sizes. Figures are for reference only, as any boss can be used for a tubing size depending upon other design criteria.
2) See SAE J846 for more information.
3) If face of boss is on a machined surface, dimensions d2 and L3 need not apply as long as corner radius R0.2 is maintained.
4) Diameter d5 shall be concentric with thread pitch diameter within 0.004 in (0.1mm) FIM, and shall be free from longitudinal and spiral tool marks. Annular tool marks up to 100 µin (2.5µm) max. shall be permissible.
5) Tap drill depths given require use of bottoming taps to produce the specified full thread lengths. Where standard taps are used, the tap drill depths must be increased accordingly.
6) Maximum recommended spotface depth to permit sufficient wrench grip for proper tightening of the fitting or locknut.
7) 90 durometer nitrile is standard for hydraulic applications.

For assembly torques see page R5.

Learn more about the size differences of SAE J1926 port ends in our TFD techConnect blog "Important System Design Considerations for SAE J1926 Ports.

Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

ISO 6162 — Four-Bolt Flange Connection (Includes SAE J518)

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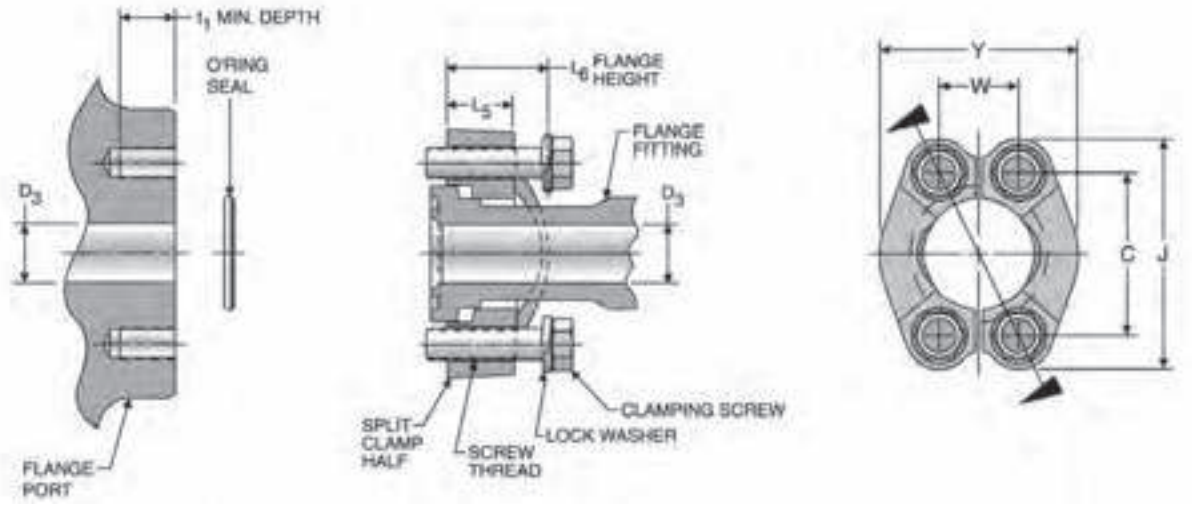


Nominal Flange Size D3		2.5 to 31.5 MPa Series[1] (SAE Code 61)											O-Rings[3]	
		Clamping Screws Screw Holes				Flange Half and Bolt Pattern								
		Type I		Type II[2] (SAE J518)		C	J		W	Y	L5	L6	ISO 3601-1 ID x Section	Parker O-Ring Size
(in.)	(mm.)	Thread	t_1Min. depth	Thread (UNC)	t_1Min. depth	± 0.25	max.	min.	± 0.25	Ref.				
1/2	13	M8 x 1.5	12.5	5/16 - 18	24	38.1	54.9	53.1	17.5	46	13	19	19 x 3.55	2-210
3/4	19	M10 x 1.5	16.5	3/8 - 16	22	47.6	65.8	64.3	22.3	52	14	22	25 x 3.55	2-214
1	25	M10 x 1.5	14.5	3/8 - 16	22	52.4	70.6	69.1	26.2	59	16	22	32.5 x 3.55	2-219
1 1/4	32	M10 x 1.5	16.5	7/16 - 14	28	58.7	80.3	78.5	30.2	73	14[4]	24	37.5 x 3.55	2-222
1 1/2	38	M12 x 1.75	19.5	1/2 - 13	27	69.9	94.5	93.0	35.7	83	16	25	47.5 x 3.55	2-225
2	51	M12 x 1.75	19.5	1/2 - 13	27	77.8	103.1	100.1	42.9	97	16	26	56 x 3.55	2-228
2 1/2	64	M12 x 1.75	21.5	1/2 - 13	30	88.9	115.8	112.8	50.8	109	19	38	69 x 3.55	2-232
3	76	M16 x 2	28.5	5/8 - 11	30	106.4	136.7	133.4	61.9	131	22	41	85 x 3.55	2-237
3 1/2	89	M16 x 2	28.5	5/8 - 11	33	120.7	153.9	150.9	69.9	140	22	28	97.5 x 3.55	2-241
4	102	M16 x 2	25.5	5/8 - 11	30	130.2	163.6	160.3	77.8	152	25	35	112 x 3.55	2-245
5	127	M16 x 2	27.5	5/8 - 11	33	152.4	182.6	185.7	92.1	181	28	41	136 x 3.55	2-253

Nominal Flange Size D3		40 MPa Series[1] (SAE Code 62)											O-Rings[3]	
		Clamping Screws Screw Holes				Flange Half and Bolt Pattern								
		Type I		Type II[2] (SAE J518)		C	J		W	Y	L5	L6	ISO 3601-1 ID x Section	Parker O-Ring Size
(in.)	(mm.)	Thread	t_1Min. depth	Thread (UNC)	t_1Min. depth	± 0.25	max.	min.	± 0.25	Ref.				
1/2	13	M8 x 12.5	14.5	5/16 - 18	21	40.5	57.2	55.6	18.2	48	16	22	19 x 3.55	2-210
3/4	19	M10 x 1.5	16.5	3/8 - 16	24	50.8	72.1	70.6	23.8	60	19	28	25 x 3.55	2-214
1	25	M12 x 1.75	21.5	7/16 - 14	27	57.2	81.8	80.3	27.8	70	24	33	32.5 x 3.55	2-219
1 1/4	32	M12 x 1.75	18.5	1/2 - 13	25	66.6	96.0	94.5	31.8	78	27	38	37.5 x 3.55	2-222
1 1/2	38	M16 x 2	25.5	5/8 - 11	35	79.3	114.3	111.3	36.5	95	30	43	47.5 x 3.55	2-225
2	51	M20 x 2.5	33.5	3/4 - 10	38	96.8	134.9	131.8	44.5	114	37	52	56 x 3.55	2-228

Table S24 — Port Detail — ISO 6162

1) 1 MPa = 10 bar = 145 PSI.
2) Not for new design.
3) 90 durometer nitrile is standard for hydraulic applications.

See page R5 for assembly torques.

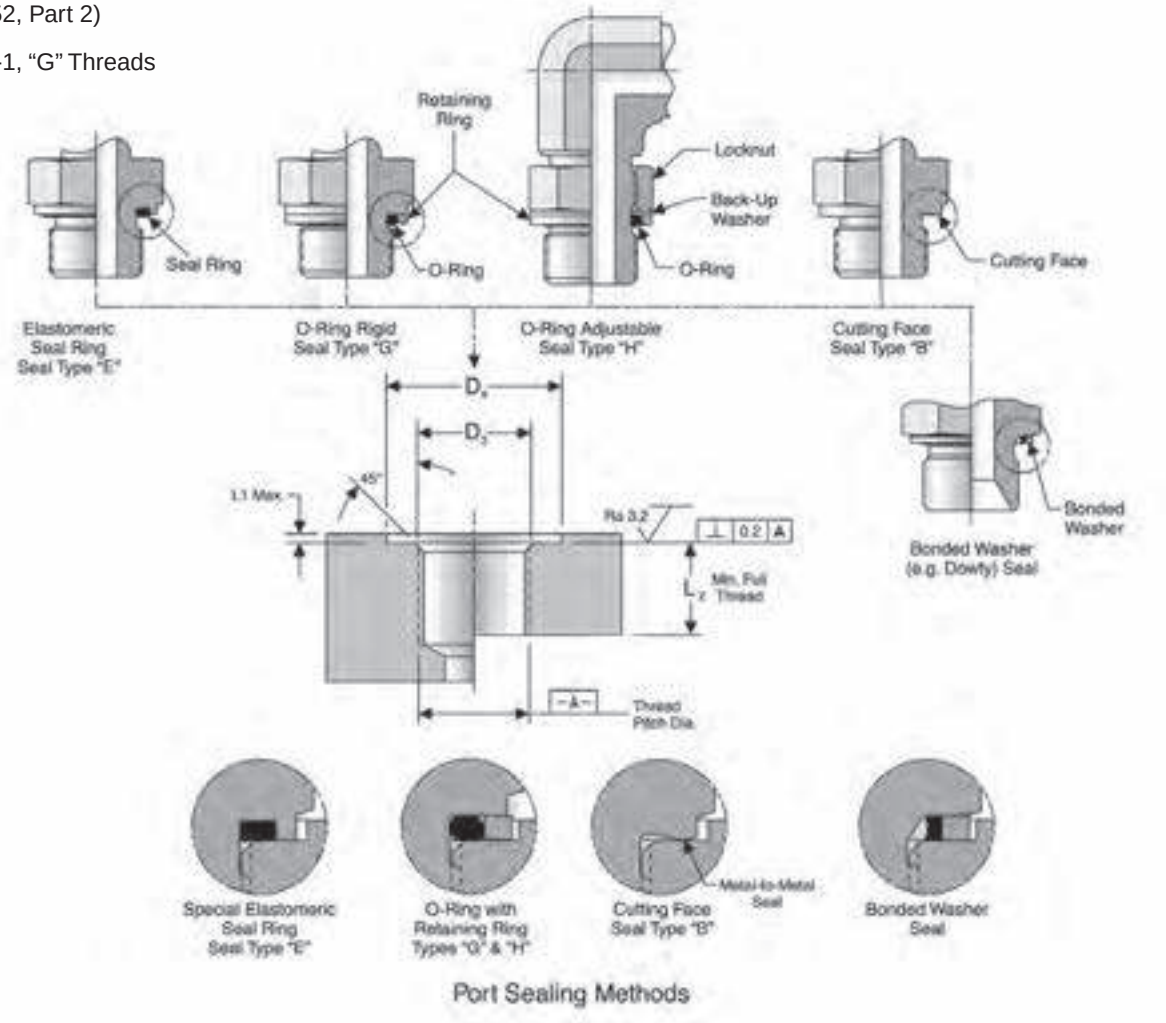
Dimensions and pressures for reference only, subject to change.

Parker Hannifin Corporation
Tube Fittings Division
Columbus, Ohio
http://www.parker.com/tfd

ISO 1179-1[1] — Flat Face Port with British Standard Pipe, Parallel (BSPP) Threads

(DIN 3852, Part 2)

ISO 228-1, "G" Threads



Port Sealing Methods

Thread Size (ISO 228-1)	D3 (mm.)	D4 (mm.)		L1 max. (mm.)	L2 min. (mm.)	EOlastic Seal (Type E)	O-Ring and Retaining Ring (Types G & H)			Bonded Washer Part No.[3]
		Narrow Types B & E	Wide Types G & H			Part No.	O-Ring Size[1]	O-Ring ID x section (mm.)	Retaining Ring Part No.	
G 1/8-28	9.9	15	17.2	1.0	8.5	ED10X1X	5-585	7.98 x 1.88	1/8 RR	D9DT-2
G 1/4-19	13.3	20	20.7	1.5	12.5	ED14X1.5X	2-111	10.77 x 2.62	1/4 RR	D9DT-4
G 3/8 19	16.8	23	24.5	2.0	12.5	EDR3/8X	2-113	13.94 x 2.62	3/8 RR	D9DT-6
G 1/2-14	21.1	28	34.0	2.5	14.5	EDR1/2X	5-256	17.96 x 2.62	1/2 RR	D9DT-8
G 3/4-14	26.6	33	40.0	2.5	16.5	ED26X1.5X	2-119	23.47 x 2.62	3/4 RR	D9DT-12
G 1-11	33.5	41	46.1	2.5	18.5	ED33X2X	2-217	29.74 x 3.53	1 RR	D9DT-16
G 1 1/4-11	42.2	51	54.0	2.5	20.5	ED42X2X	2-222	37.69 x 3.53	1 1/4 RR	D9DT-20
G 1 1/2-11	48.1	56	60.5	2.5	22.5	ED48X2X	2-224	44.04 x 3.53	1 1/2 RR	D9DT-24
G 2-11	59.9	69	73.3	3.0	26.0	—	—	—	—	D9DT-32

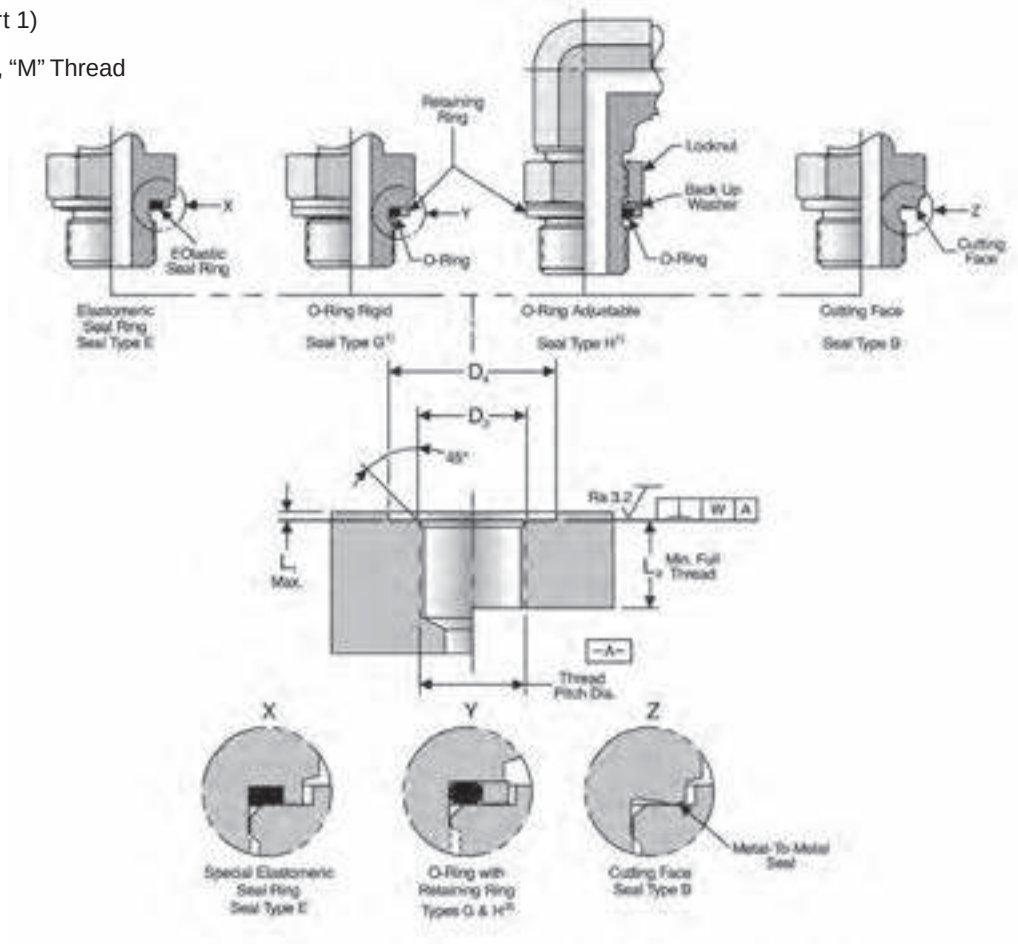
Table S25 — Port Detail — ISO 1179-1

1) 90 durometer nitrile is standard for hydraulic applications.
2) See page M6 for O-ring and retaining ring ordering information.
3) See page M3 for details.

ISO 9974-1 — Flat Face Port with Metric Threads

(DIN 3852, Part 1)

Metric ISO261, “M” Thread



(See Note 1)

ISO 9974 Port seal types available from Parker

Thread Size (ISO 261)	D3 (mm.)	D4 (mm.)	L1 max. (mm.)	L2 min. (mm.)	W (mm.)	EOlastic Seal (Type E)	O-Ring and Retaining Ring[1]		
						Part No.	O-Ring Size[2]	O-Ring ID x section (mm.)	Retaining Ring Part No.
M8 x 1	8 +0.2	13	1	8		ED8X1X	3-902	6.07 x 1.63	M8 RR
M10 x 1	10 +0.2	15	1	8		ED10X1X	6-074	8.00 x 1.50	M10 RR
M12 x 1.5	12 +0.2	18	1.5	12		ED12X1.5X	2-012	9.25 x 1.78	M12 RR
M14 x 1.5	14 +0.2	20	1.5	12	0.1	ED14X1.5X	2-013	10.82 x 1.78	M14 RR
M16 x 1.5	16 +0.2	23	1.5	12		ED16X1.5X	3-907	13.46 x 2.08	M16 RR
M18 x 1.5	18 +0.2	25	2	12		ED18X1.5XX	2-114	15.54 x 2.62	M18 RR
M20 x 1.5[3]	20 +0.2	27	2	14		ED20X1.5X	2-017	17.17 x 1.78	M20 RR
M22 x 1.5	22 +0.2	28	2.5	14		ED22X1.5X	2-018	18.77 x 1.78	M22 RR
M24 x 1.5[4]	24 +0.2	30	2.5	14		—	2-019	20.35 x 1.78	M24 RR
M26 x 1.5	26 +0.2	33	2.5	16		ED26X1.5X	2-118	21.89 x 2.62	M26 RR
M27 x 2	27 +0.2	33	2.5	16		ED26X1.5X	2-119	23.47 x 2.62	M27 RR
M33 x 2	33 +0.3	41	2.5	18	0.2	ED33X2X	2-122	28.24 x 2.62	M33 RR
M36 x 2[4]	36 +0.3	43	2.5	18		—	2-124	31.42 x 2.62	M36 RR
M42 x 2	42 +0.3	51	2.5	20		ED42X2X	2-128	37.77 x 2.62	M42 RR
M45 x 2[4]	45 +0.3	50	2.5	20		—	2-130	40.94 x 2.62	M45 RR
M48 x 2	48 +0.3	56	2.5	22		ED48X2X	2-132	44.12 x 2.62	M48 RR

Table S26 — Port Detail — ISO 9974-1

1) Seal types G and H are not covered in ISO 9974-1. See page M5 for retaining ring and O-ring ordering information.
2) 90 durometer nitrile is standard for hydraulic applications.
3) For diagnostic applications.
4) These sizes are not covered in ISO 9974-1.

Dimensions and pressures for reference only, subject to change.

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NPTF and BSPT Dimensions

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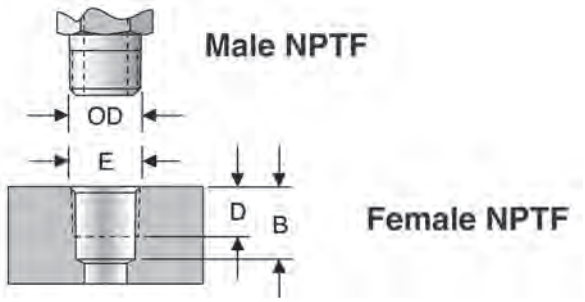
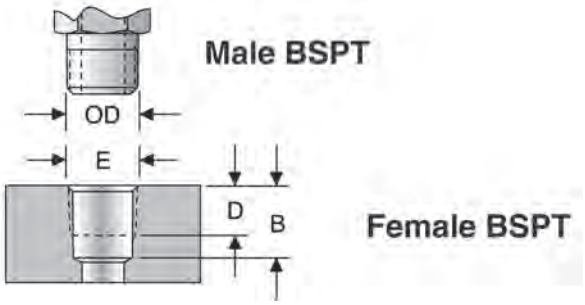


Thread Size NPTF	O.D. Male Thread Large Dia.	D Min.. Thread Length	B Min.. Tap Drill Depth[1)]	E Chmf. Dia.
1/8-27	0.41	0.31	0.38	0.42
1/4-18	0.55	0.44	0.47	0.55
3/8-18	0.68	0.47	0.53	0.69
1/2-14	0.85	0.59	0.69	0.85
3/4-14	1.06	0.63	0.75	1.06
1-11 1/2	1.33	0.75	0.84	1.34
1 1/4-11 1/2	1.67	0.78	0.84	1.68
1 1/2-11 1/2	1.91	0.81	0.88	1.92
2-11 1/2	2.39	0.81	0.91	2.39

Table S27 — NPTF Dimensions

1) For bottoming taps only.



Thread Size BSPT	O.D. Male Thread Large Dia.	D Min.. Thread Length	B Min.. Tap Drill Depth[1)]	E Chmf. Dia.
1/8-28	0.39	0.31	0.38	0.42
1/4-19	0.53	0.44	0.47	0.55
3/8-19	0.67	0.47	0.53	0.69
1/2-14	0.84	0.59	0.69	0.85
3/4-14	1.06	0.63	0.75	1.06
1-11	1.33	0.75	0.84	1.34
1 1/4-11	1.67	0.78	0.84	1.68
1 1/2-11	1.90	0.81	0.88	1.92
2-11	2.37	0.81	0.91	2.39

Table S28 — BSPT Dimensions

1) For bottoming taps only.
2) Male BSPT may be used with female BSPP ports.

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Recommended Use of Porting Tools

Parker recommends porting tools for machining precision ports (glands) conforming to DIN 3852-1, SAE J1926-1 (SAE straight thread port) and ISO 6149-1. Please see the equipment section for the available Parker porting tools.

Machining ports to accept Parker tube fittings is completed in three simple steps.

To begin, select the appropriate size port tooling for the fitting end in question. Next, follow these machining steps.

1. Pilot Hole Drilling.

First, make a pilot hole for the counterbore by using an appropriate drill or bore size. Make hole depth according to the port detail on pages S34, S35, S37 and S38.

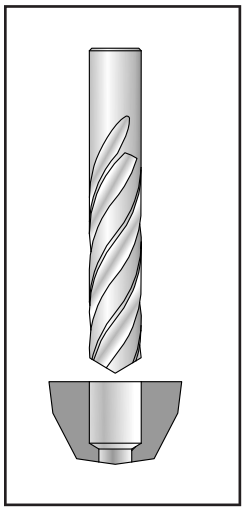

Fig. S4 — Pilot drilling for counterbore tool

2. Port Counterboring.

Run the counterbore tool into the pilot diameter created in step 1. All features and dimensions of the port and O-ring cavity are built into the counterboring tool except the depth. The depth of the counterbore machining may vary from a light spotface, up to the maximum spotface depth listed on the port detail on pages S34 and S35.

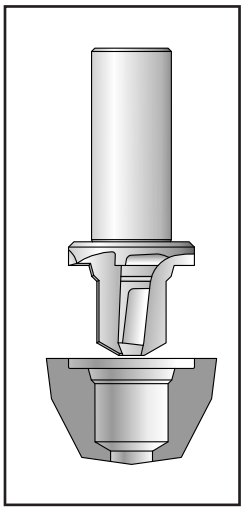

Fig. S5 — Counterboring tool

Note: It is necessary to create a spotface surface which is flat and perpendicular to the port, and with a smooth finish to prevent leakage or O-ring extrusion. Cast or forged surfaces must be spotface machined to meet these requirements. Even on smooth surfaces (machined surfaces), it is necessary to lightly touch the surfact to assure a smooth radius at the entrance of the port.

3. Thread Tapping.

Lastly, the machined port must be threaded to accommodate the fitting. Use the appropriate tap intended for the same thread type, size, and class.

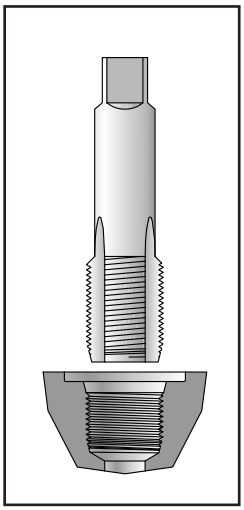

Fig. S6 — Tapping

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3. Common Tube End Thread Size

Tube End Connections

Thread Size Guide — Inch Thread

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			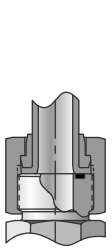	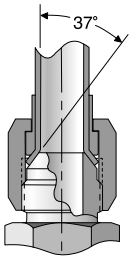	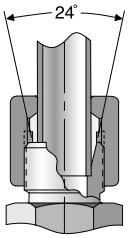	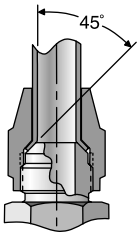
Tube O.D. or Adapter Size			**O-ring Face Seal (ORFS)**	**37° Flare**	**Inch 24° cone[3] Flareless**	**SAE 45° Flare[3]**
Nominal metric size[3]	**Nominal Inch**		**SAE J1453**	**SAE J514**	**SAE J514**	**SAE J512**
	size	**SAE dash size**	**"Seal-Lok"**	**"Triple-Lok"**	**"Ferulok"**	
(mm)	(in)		Inch ANSI B1.1, unified (ISO 263)	Inch ANSI B1.1, unified (ISO 263)	Inch ANSI B1.1, unified (ISO 263)	Inch ANSI B1.1, unified (ISO 263)
—	1/8	-2	—	5/16-24	5/16-24	5/16-24
4	—	—	—	—	—	—
5	3/16	-3	—	3/8-24	3/8-24	3/8-24
6	1/4	-4	9/16-18	7/16-20	7/16-20	7/16-20
8	5/16	-5	—	1/2-20	1/2-20	1/2-20
10	3/8	-6	11/16-16	9/16-18	9/16-18	5/8-18
12	1/2	-8	13/16-16	3/4-16	3/4-16	3/4-16
14	5/8	-10	1-14	7/8-14	7/8-14	7/8-14
15[1]	5/8	-10	1-14	7/8-14	—	—
16	5/8	-10	1-14	7/8-14	—	—
18[1]	3/4	-12	1 3/16-12	1 1/16-12	1 1/16-12	1 1/16-14
20	3/4	-12	1 3/16-12	1 1/16-12	—	—
22[1]	7/8	-14	—	1 3/16-12	1 3/16-12	—
25	1	-16	1 7/16-12	1 5/16-12	1 5/16-12	—
28[1]	1 1/4	-20	1 11/16-12	—	1 5/8-12	—
30	1 1/4	-20	1 11/16-12	1 5/8-12	—	—
32[2]	1 1/4	-20	1 11/16-12	1 5/8-12	—	—
38	1 1/2	-24	2-12	1 7/8-12	1 7/8-12	—
50	2	-32	2 1/2-12	2 1/2-12	2 1/2-12	—

Table S29 — Tube End Connections

1) Not preferred for high pressure applications.
2) Non-preferred size. Use 30mm size in place of 32mm size.
3) Metric tube sizes do not apply to "Ferulok" and 45° flare fittings.

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Tube End Connections
Thread Size Guide — Metric, BSPP and JIS Threads

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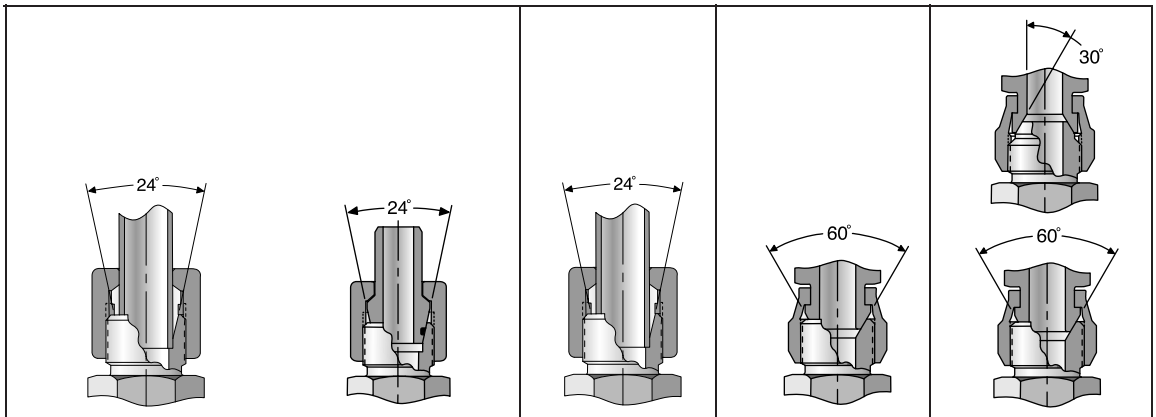

Tube O.D. or Adapter Size	Metric 24° cone Flareless DIN 3861 "EO" and "EO-2"		Weld Nipple DIN 3865	Metric 24° cone Flareless JIS B2351 "JIS"	60° Cone BS 5200	30° Flare and 60° Cone JIS B8363
	LL Series Metric ISO 261	L Series Metric ISO 261	S Series Metric ISO 261	Metric ISO 261 (JIS B0207)	ISO 228-1 (BSPP)[5]	ISO 228-1 (JIS B 0202) (BSPP)[5]
(mm)						
—	—	—	—	—	—	—
4	M8 x 1	—	—	—	—	—
5	M10 x 1[3]	—	—	—	—	—
6	M10 x 1	M12 x 1.5	M14 x 1.5	M12 x 1.5	G 1/8 A	G 1/4 B
8	M12 x 1	M14 x 1.5	M16 x 1.5	M14 x 1.5	G 1/4 A	—
9[2]	—	—	—	—	—	G 3/8 B
10	M14 X 1[4]	M16 x 1.5	M18 x 1.5	M16 x 1.5	G 3/8 A	—
12	M16 x 1[4]	M18 x 1.5	M20 x 1.5	M18 x 1.5	G 1/2 A	G 1/2 B
14	—	—	M22 x 1.5	—	—	—
15[1]	—	M22 x 1.5	—	—	—	—
16	—	—	M24 x 1.5	M24 x 1.5	G 5/8 A[6]	—
18[1]	—	M26 x 1.5	—	—	—	—
19[2]	—	—	—	—	—	G 3/4 B
20	—	—	M30 x 2	M28 x 1.5	G 3/4 A	—
22[1]	—	M30 x 2	—	—	—	—
25	—	—	M36 x 2	M35 x 1.5	G 1 A	G 1 B
28[1]	—	M36 x 2	—	—	—	—
30	—	—	M42 x 2	M40 x 1.5	G 1-1/4 A	—
32[2]	—	—	—	—	—	G 1-1/4 B
35[1]	—	M45 x 2	—	—	—	—
38	—	—	M52 x 2	M48 x 1.5	G 1-1/2 A	G 1-1/2 B
42[1]	—	M52 x 2	—	—	—	—
50	—	—	—	—	G 2 A	G 2 B

Table S30— Tube End Connections

1) Not preferred for high pressure applications.
2) Not preferred sizes. Use 10mm, 20mm and 30mm sizes in place of 9mm, 19mm and 32mm sizes, respectively.
3) Covered in ISO 8434-1. Non-standard with Parker.
4) Not part of DIN or ISO standards, but offered by Parker.
5) ISO 228-1 G threads and JIS B 0202 G or PF threads can be interchanged. "A" and "B" indicate different tolerance classes on the male threads, "A" having tighter tolerances than "B".
6) Non-preferred size.

Dimensions and pressures for reference only, subject to change.

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4. Conformance Standards:

Tube End Connections
Threads, Conformance Specifications and Use

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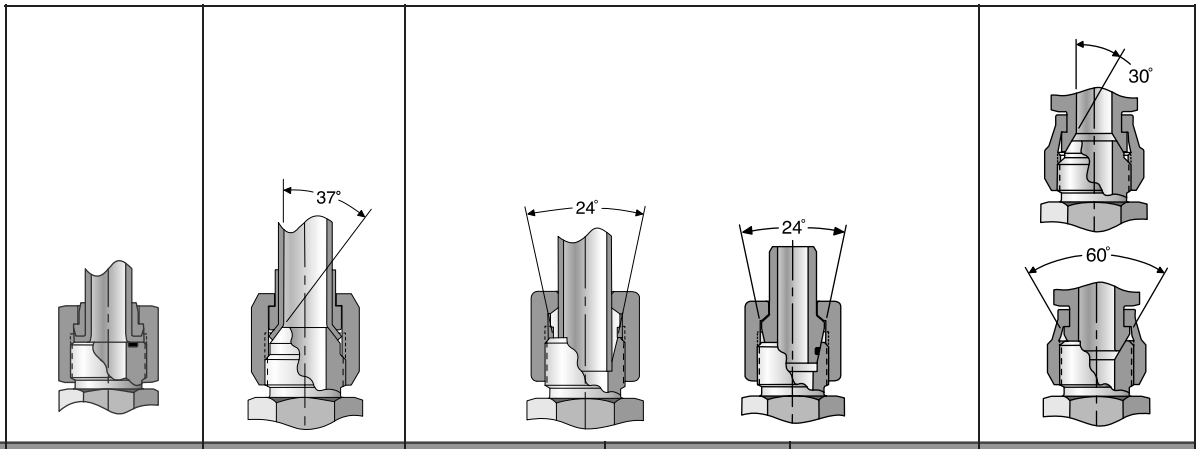

Description	O-Ring Face Seal (ORFS) "Seal-Lok"	37° Flare "Triple-Lok"	Inch 24° Cone Flareless "Ferulok"	Metric 24° Cone Flareless "EO" and "EO2"	Metric 24° Cone Flareless "JIS"	30° Flare and 60° Cone "JIS"
Thread Type	ISO 263 ANSI B1.1 unified	ISO 263 ANSI B1.1, unified	ISO 263 ANSI B1.1, unified	ISO 261 Metric fine	ISO 261 JIS B 0207	ISO 228-1 JIS B0202, BS2779
ISO No.	8434-3 (12151-1)[1]	8434-2 (12151-6)[1]	—	8434-1 & -4 (12151-2)[1]	—	—
SAE No.	J1453/J516[2]	J514/J516[2]	J514	—	—	—
DIN No.	—	—	—	3861, 3865 & 20078[2]	—	—
JIS No.	—	—	—	Similar to B2351	B2351	B8363[3]
BSI No.	—	—	—	—	—	Similar to BS 5200[4]
Current use	Mainly used in North America gaining acceptance in Europe and Japan.	Used throughout the world with major usage in North America.	Mainly used in North America.	Mainly used in Europe. Slowly gaining acceptance in North America.	Mainly used in Japan for hard plumbed systems.	Mainly used in Japan, U.K. and British common-wealth countries.

Table S31 — Tube End Connections

1) Hose fitting specification no.
2) Hose fitting specification no.
3) Adapter and hose fitting specification no.
4) 60° cone fittings only. See page S42 for more information.

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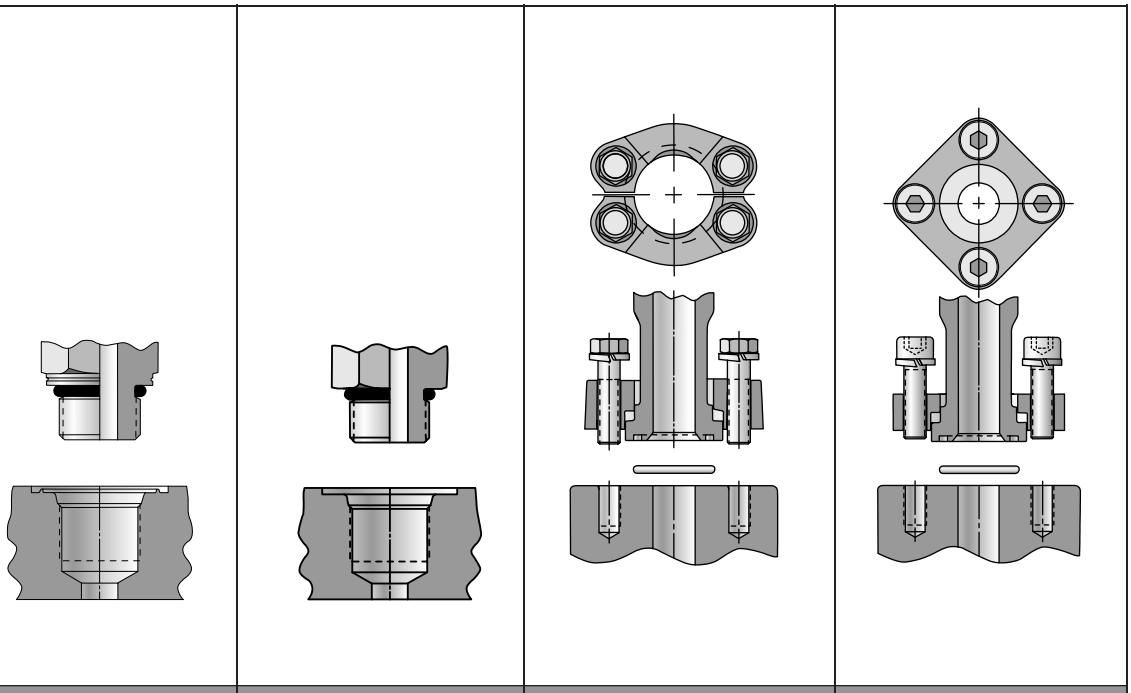
Port End Connections
Threads, Conformance Specifications, and Use



Port Description	Metric Straight Thread O-Ring Port	SAE Straight Thread O-Ring Port	Four Screw Split Flange	Four Screw One Piece Square Flange
Thread Type	ISO 261 Metric Fine	ISO 263 ANSI B1.1, Unified	Metric screws: ISO 261 Inch screws: ISO 263	ISO 261
ISO No.	6149	11926	6162	6164
SAE No.	J2244	J1926	J518	—
DIN No.	3852-3 Form “W”	—	—	—
JIS No.	—	—	B8363 (covers flange head only)	—
BSI No.	—	—	—	—
Current use	Gaining use in U.S. and western Europe. Widely used in former Soviet block countries.	Widely used in North America.	Widely used throughout the world.	Mainly used in Germany. Limited use elsewhere.

Table S32 — Port End Connections

Dimensions and pressures for reference only, subject to change.

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Port End Connections
Threads, Conformance Specifications, and Use

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	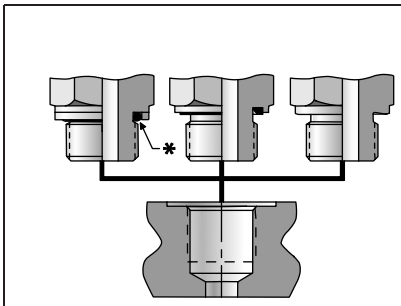	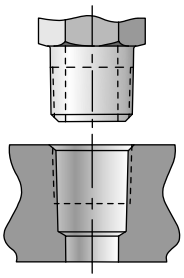	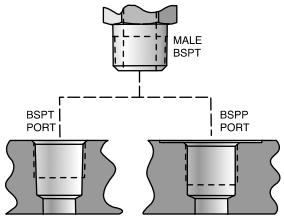	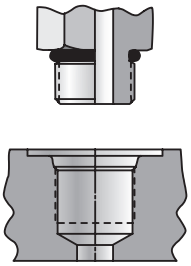	
Port Description	**British Standard Pipe Parallel (BSPP) Flat Face Port**	**Metric Straight Thread Flat Face Port**	**NPTF - Dryseal American Standard Taper Pipe**	**JIS/BSPT British Standard Pipe, Taper**	**JIS/BSPP British Standard Pipe, Parallel O-ring Port**
Thread Type	ISO 228-1 BS 2779	ISO 261 Metric Fine	ANSI B1.20.3	ISO 7 BS 21 JIS B 0203	ISO 228-1 BS 2779 JIS B 0202
ISO No.	1179	9974	—	—	—
SAE No.	—	—	J476	—	—
DIN No.	3852-2 Form X or Y	3852-1 Form X or Y	—	Similar to: 3852-2 form Z	—
JIS No.	—	—	—	B8363	B2351 Type “O”
BSI No.	—	—	—	—	Similar to BS 5380
Current use	Most popular in western Europe and former UK colonies. Limited use in rest of the world.	Moderate use in Europe, mainly in Germany.	Mainly used in North America some use in rest of the world.	Mainly used in Japan and parts of western Europe.	Mainly used in Japan. Some use in U.K. of similar port, BS5380.

Table S33 — Port End Connections

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Fitting Materials

Material				Product Type				
				Seal-Lok, Triple-Lok, Ferulok, Pipe, Port Adapters, JIS, Komatsu, Flanges				
Type	Condition	Standard	Grade	Body	Nut	Sleeve	Ferrule	Welding Parts
Steel[1]	Bar Stock	ASTM A108	12L14	•	•	•	•	
		ASTM A108	1215	•	•	•	•	
		ASTM A108	C1045	•	•	•		
		ASTM A108	C1018		•			•
	Cold Form	ASTM A576	C1008	•	•	•		
		ASTM A576	C1010	•	•	•		
		ASTM A576	C1012	•	•	•		
		ASTM A576	C1020			•		
	Forging	ASTM A576	1214	•				
		ASTM A576	1215	•				
		ASTM A576	C1045	•	•			
Stainless Steel[2]	Bar Stock	ASTM A479	316	•	•	•		
		ASTM A479	316L	•	•	•		•
		ASTM A564	630				•	
	Cold Form	ASTM A479	316	•	•	•		
		ASTM A479	316L	•	•	•		•
	Forging	ASTM A182	316	•	•			
		ASTM A182	316L	•	•			•
Brass[3]	Bar Stock	ASTM B16	CA360	•	•	•	•	
		ASTM B453	CA345	•	•			
		ASTM B371	CA694			•		
	Cold Form	ASTM B121	CA335	•	•			
		ASTM B111	CA443			•		
		ASTM B111	CA444			•		
	Forging	ASTM B124	CA377	•	•			
Aluminum	Bar Stock	ASTM B211	2024-T351	•	•	•		
		ASTM B211	6061-T6	•	•	•		
	Forging	AMS 4133	2014-T6	•				

Table S34 — Standard Material Specifications

[1] Standard steel products have silver/clear zinc chromium 6 free or grey zinc nickel plating. Brazing and welding products are not plated.
[2] Stainless steel fittings are passivated. Standard stainless steel nuts are coated to prevent galling during assembly.
[3] Brass is not available for Ferulok.

Material					Product Type		
					EO, EO2, K4		
Type	Condition	Standard	Grade	U.S. Equivalent grade	Body	Nut	Welding Parts
Steel[1]	Bar Stock	DIN EN 10277-3	1.0718	12L14	•		
		DIN EN 10277-3	1.0715	1213/1215	•		
		DIN EN 10277-3	1.0727	1146	•		
		DIN EN 10277-3	1.0401	C1015			•
	Cold Form	DIN EN 10263	1.0214	C1010		•	
	Forging	DIN 1651	1.0710		•		
		DIN EN 10087	1.0764		•		
		DIN EN 10083	1.0503	C1045 modified		•	
Stainless Steel	Bar Stock	DIN EN 10088	1.4571	316Ti	•	•	•
	Forging	DIN EN 10088	1.4571	316Ti	•	•	•
Brass	Bar Stock	DIN 17660	2.0540		•	•	
	Forging	DIN 17660	2.0540		•		

[1] Standard steel products have silver/clear zinc chromium 6 free or grey zinc nickel plating. Brazing and welding products are not plated.

Table S35 — Standard Material Specifications for EO and K4 Product

Fitting Designs:

Parker's tube fittings and adapters meets the following industrial standards:

Fitting Family	Specifications
Seal-Lok ORFS	SAE J1453
	ISO 8434-3
Triple-Lok 37-Degree Flare	SAE J514
	ISO 8434-2
Ferulok Flareless	SAE J514
EO and EO-2 Metric Flareless	ISO 8434-1
	ISO 8434-4
	DIN 3861
	DIN 3865
	DIN 3859
Flange Adapters and Hydraulic Flanges	SAE J518
	ISO 6162
	ISO 6164
JIS Adapters	JIS B8363 (with some exceptions)
K4 Adapters	ISO 8434-6
	BS 5200
Pipe Fittings and Adapters, and Swivels	SAE J514
Pipe Plugs	SAE J531
Straight Thread Plugs	SAE J1926

Fitting Performance:

Many Parker tube fittings meet various performance standards recognized by diverse organizations, among which are:

- American Bureau of Shipping (ABS)
- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- Canadian Technical Standards and Safety Registration (CRN)
- China Classification Society (CCS)
- Det Norske Veritas (DNV)
- Deutscher Verein des Gas- und Wasserfaches (DVGW)
- Germanischer Lloyd (GL)
- Lloyds Register of Shipping (LR)
- Russian Maritime Register of Shipping (RMS)

Attention:

Performance Type Approvals usually are limited to certain products, applications, working conditions, validity time or other restrictions. Please contact Tube Fittings Division for detailed information.

Surface Finish Type	Specification
Carbon Steel – Chromium 6 Free Zinc Plating	ASTM B633 Class Fe/Zn 8 Type V, JIS H8610 Grade 3
Carbon Steel – Zinc Nickel Plating	ASTM B841 Class 2, Type AN/E, Grade 8
Stainless Steel - Passivation	ASTM A967, ASTM A380

Test Methods	Specification
Leak, Proof, Burst, Impulse, Over-Torque, Vacuum, and Repeated Assembly	ISO 19879
Rotary Flexure Vibration	NFPA T3.8.3, ISO 19879, ISO 7257

Table S36— Conformance Standards

Some parts do not meet dimensional requirements.

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How to Order Seal-Lok, Triple-Lok, Ferulok, JIS and K4

TFD Standard Nomenclature Construction

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Box 1	Box 2	Box 3	Box 4	Box 5	Box 6
Size	Shape or Style	Sub-Style	Type	Material	Plating Options
1 to 4 sets of numbers from Box 1	Letter code from Box 2	Number/Letter code from Box 3	Number/Letter code from Box 4	Letter code from Box 5	Letter code from Box 6

Example: Steel Seal-Lok Adjustable Elbow Connector — 3/8" O.D. (-6) Tube to 7/16-20 UNF (-4) ORB = 6-4 C5L-S

(See the shading in the boxes below for the construction of this example)

Box 1 — Paired Tube and Port End Size Code Table

Tube End		Port End		Port End	
Dash Size	Tube O.D.	Dash Size	SAE Straight Thread	Dash Size	NPTF Pipe Thread
-2	1/8	-2	5/16-24	-2	1/8
-3	3/16	-3	3/8-24	-2	1/8
-4	1/4	-4	7/16-20	-2	1/8
-5	5/16	-5	1/2-20	-2	1/8
-6	3/8	-6	9/16-18	-4	1/4
-8	1/2	-8	3/4-16	-6	3/8
-10	5/8	-10	7/8-14	-8	1/2
-12	3/4	-12	1 1/16-12	-12	3/4
-14	7/8	-14	1 3/16-12	-12	3/4
-16	1	-16	1 5/16-12	-16	1
-20	1 1/4	-20	1 5/8-12	-20	1 1/4
-24	1 1/2	-24	1 7/8-12	-24	1 1/2
-32	2	-32	2 1/2-12	-32	2

Box 2 — Shape or Style

Straights	
B	Nut
F*	Male Connector
FF*	Long Male Connector or Pipe Nipple
FFF*	Extra Long Male Connector or Pipe Nipple
FN	Cap
G*	Female Connector
H	Union
HH	Long Union
HPN*	Plug, Straight Thread, Hol-low Hex
LH	Large Hex Union
PN*	Plug, Straight Thread. Hex Head
T	Sleeve or Ferrule
TP	Sleeve, Parflange
TR	Tube Reducer
T22	Mountie
W	Bulkhead Union
WF	Bulkhead Male
WG	Bulkhead Female
WLN	Bulkhead Locknut for Triple-Lok, Ferulok, and Intru-Lok
WLNL	Bulkhead Locknut for Seal-Lok

90° Elbows	
C*	Male Elbow Connector
CC*	Long Male Elbow
CCC*	Extra Long Male Elbow
D	Female Elbow
E	Union Elbow
WE	Bulkhead Union Elbow
45° Elbows	
N	Union Elbow
V*	Male Elbow Connector
WN	Bulkhead Union Elbow
Tees	
J	Union Tee
M	Female Run Tee
O	Female Branch Tee
R*	Male Run Tee
S*	Male Branch Tee
WJ	Bulkhead Branch Tee
WJJ	Bulkhead Run Tee
Cross	
K	Union Cross

Box 3 — Sub-Style Modifiers (Connectors, Swivels and Plugs)

Connectors (a)	
3	BSPT Port End
4**	BSPP Port End, O-ring & RR
5**	SAE Straight Thread Port End
8**	Metric Port End, O-ring & RR
9	SAE-ORB with Metal Seal
42	BSPP Port End, "ED" Seal
47**	BSPP O-ring Port, B2351
82	Metric Port End, "ED" Seal
87**	ISO 6149 Port End
J4 (e)	Banjo Connection, BSPP, Soft Seal
J8 (e)	Banjo Connection, Metric, Soft Seal
Swivel Unions (b)	
6	Female Swivel
Swivel Connectors (c)	
63	BSPT Port, Swivel Connector
64**	BSPP Port, Swivel Connector
642	BSPP, "ED" Seal, Swivel Connector
65**	SAE-ORB, Swivel Connector
68**	Metric Port, Swivel Connector
682	Metric Port, Swivel Connector
687**	ISO 6149, Swivel Connector
Straight Thread Plugs (d) (Modifiers for P)	
4, 5 ,8 ,9 and 87 as in Connectors above.	
Notes	
a. Modifiers for Connectors as noted with asterisk in Box 2.	
b. Modifier for C, V, R ,S ,H ,E and J in Box 2.	
c. Modifiers for F only in Box 2.	
d. Modifiers for P only in PN and HPN in Box 2.	
e. Applies to 90° elbows and tees only.	

Box 4 — Fitting Type

K4	60° Cone BSPP
L**	Seal-Lok
P4	JIS 60° Cone
T4	JIS 30° Flare
U	Ferulok
X	Triple-Lok

Box 5 — Material Code

B	Brass
CUNI	Cupro-Nickel (ex. CUNI 70/30)
D	Dural (Aluminum)
M	Monel
S	Steel w/ zinc plating
SS	Stainless Steel 316/316L passivated

Box 6 — Plating Options

ZJ	Parker XTR Plating

**Placing the letter "O" after these sub-style modifiers and fitting types will indicate that you would like an O-Ring on that corresponding end.

Use Parker's FittingFinder App to easily identify the part number of the fitting or adapter you need. Download Parker FittingFinder from the App Store or Google Play, or use the web app at https://divapps.parker.com/divapps/tfd/FittingFinder/

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How to Order 4-Bolt Hydraulic Flanges

TFD Standard Nomenclature Construction

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Box 1	Box 2	Box 3	Box 4	Box 5	Box 6	Box 7
Flange Size	Connection Description	Shape	Flange Connection Type	Mounting Style	Material	Kit Designation

Box 1 — Port/Tube/Pipe Flange Size

Symbol	Description
One-to-two digit codes	Size in inches x 16

One code is required if end connections are the same size. Two codes are required if they are different sizes (e.g., 16-12).

Box 2 — Port/Tube/Pipe Connection Description

Symbol	Description
B3	Braze Socket — silver braze
CP1	Connector Plate — Code 61
CP2	Connector Plate — Code 62
FCC1	Flange Clamp, Captive — Code 61
FCC2	Flange Clamp, Captive — Code 62
FCCT1	Flange Clamp, Captive with Tapped Holes — Code 61
FCCT2	Flange Clamp, Captive with Tapped Holes — Code 62
FCS1	Flange Clamp, Split — Code 61
FCS2	Flange Clamp, Split — Code 62
G	NPTF Port
G3	BSPT Port
G4	BSPP Port
G5	SAE Port
P	Plug (blanking end)
SP	Spacer w/o Gage Ports
SPG	Spacer w/ 1/4-18 NPTF Gage Port
SPG5	Spacer w/ 7/16-20 UNF Gage Port
SPGG5	Spacer w/ 1/4-18 NPTF & 7/16-20 UNF Ports
WSD1	Weld Saddle — Pipe
WSD2	Weld Saddle — Tube
W4	Flat Weld Socket — Tube
W4S	Flat Weld Socket — Tube (shallow)
W5	Flat Weld Socket — Pipe
W5S	Flat Weld Socket — Pipe (shallow)
W6	Extended Weld Socket — Tube
W6S	Extended Weld Socket — Tube (shallow)
W7	Extended Weld Socket — Pipe
W7S	Extended Weld Socket — Pipe (shallow)
WB1	Weld Butt — Schedule 40
WB3	Weld Butt — Schedule 80
WB5	Weld Butt — Schedule 160
WB7	Weld Butt — Schedule XXS
WBT	Weld Butt — Tank Pilot
WPL	Weld Plate
W	Weld Socket
W2	Weld Nipple
W3 or WB	Weld Nipple — Weld Butt, Tube

Box 3 — Shape Description

Symbol	Description
None	Block and Pad, Straight*
E	Elbow 90°
H	Barstock, Straight
J	Tee

*The “Block” has O-ring and drilled mounting holes, while the “Pad” has no O-ring groove and tapped mounting holes.

Box 4 — Flange Connection Type

Symbol	Description
Q1	Code 61 Flange Head w/ O-ring Groove
Q1N	Code 61 Flange Head w/o O-ring Groove
Q2	Code 62 Flange Head w/ O-ring Groove
Q2N	Code 62 Flange Head w/o O-ring Groove
Q1B	Code 61 Flange Block w/ O-ring Groove and Drilled Mounting Holes
Q1P	Code 61 Flange Block w/o O-ring Groove and Drilled Mounting Holes
Q2B	Code 62 Flange Block w/ O-ring Groove and Drilled Mounting Holes
Q2P	Code 62 Flange Pad w/o O-ring Groove and Tapped Mounting Holes
QSB	Square Flange Block w/ O-ring Groove and Drilled Mounting Holes
QSP	Square Flange Pad w/o O-ring Groove and Tapped Mounting Holes

Box 5 — Mounting Style

Symbol	Description
Omit	Inch Mounting Bolts (screws)
M	Metric Mounting Bolts (screws)

Box 6 — Material

Symbol	Description
S	Steel, Zinc Plated (braze or weld parts may not be plated)
SX	Steel, Oil Dipped
SS	Stainless Steel

Box 7 — Kit Designation

Symbol	Description
Omit	Flange Only
K	Kit (O-ring, 4 bolts and washers)

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How to Order EO and EO-2 Fittings and Accessories

TFD Standard Nomenclature Construction

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Box 1	Box 2	Box 3	Box 4	Box 5	Box 6	Box 7	Box 8	Box 9
Shape/Style	Tube Size (mm.)	EO-2 Designator	Pressure Series	Port Size/ Designator	Port Sealing Method Modifier	Modifier 1	Material	Modifier 2

Box 1 — Shape/Style Code			
Straights		**Tees**	
AS	Weld Connector	EL	Swivel Nut Run
AS__/	Weld Flange	ET	Swivel Nut Branch
BFG	Square Flange Connector	GMA1/	Union w/ Test Point, Pin
DA	Distance Adapter	GMA3/	Union w/ Test Point, M16x2
DG101/	Rotary Union	LEE	Adjustable Run
DG102/	Rotary Connector	T	Union
DG107/	Rotary Bulkhead Union	TEE	Adjustable Branch
DVGE	Plain Bearing Rotary	TH	High Pressure Banjo
EGE	Swivel Nut Connector	TR	Reducer Union
EGEO	ISO 6149 Swivel Nut Connector	WV	Alternating Valve
ESV	Weld Bulkhead Union	Cross	
G	Union	K	Union
GAI	Female Connector	Accessories	
GE	Male Connector	D	Cutting Ring
GEO	ISO 6149 Connector	DKI	Pressure Gage Seal
GFS__/	Flange Connector	DOZ	EO-2 Seal Ring
GR	Reducer Union	DPR	Progressive Ring
GZ	Swivel Union	E	Insert
GZR	Reducer Swivel Union	ED	EOlastic Seal
MAV	Gage Connector	FM	EO-2 Functional Nut
MAVE	Swivel Nut Gage Connector	GM	Bulkhead Locknut
RED	Tube End Reducer	KD	Plastic Seal
SKA	Weld Adapter	M	Tube Nut
SV	Bulkhead Union	OR	O-ring
VKA1/	Test Point Connector, Pin	PSR	Progressive Ring (new)
VKA3/	Test Point Connector, M16x2	R	Tube
90° Elbows		ROV	Plug
BFW	Square Flange Connector	VH	Insert
DG103/	Rotary Union	VKA	Cap
DG104/	Rotary Connector	VSTI	Hollow Hex Plug
DG108/	Rotary Bulkhead Union	**Valves**	
DVWE	Plain Bearing Rotary	RHD	Union Check
EW	Swivel Nut	RHV	Connector Check
SWVE	Banjo	RHZ	Connector Check
W	Union	RHDI	Female Check
WAS	Weld Connector	RVP	Cartridge Check
WE	Male Connector	KH	2-way Ball Valve
WEE	Adjustable	KH3/2-	3-way Ball Valve
WFS__/	Flange Connector	WV	Alternating Union Tee
WH	High Pressure Banjo		
WSV	Bulkhead Union		
Double 90° Elbows			
DG105/	Rotary Union		
DG106/	Rotary Connector		
45° Elbows			
EV	Swivel Nut		
VEE	Adjustable		

Box 2 — Tube Size (mm.)
04
05
06
08
10
12
14
15
16
18
20
22
25
28
30
35
38
42

Box 3 — EO-2 Designator	
Z	EO-2 Assy.

Box 4 — Pressure Series	
LL	Very Light
L	Light
S	Heavy

Box 5 — Port Size/ Designator (optional)	
Metric	
M_	Metric Parallel
M_X_	Metric Parallel (Jump Size)
M_X_keg	Metric Taper
NPT — Inch	
1/8NPT	NPT Thread
1/4NPT	NPT Thread
3/8NPT	NPT Thread
1/2NPT	NPT Thread
3/4NPT	NPT Thread
1NPT	NPT Thread
1 1/3NPT	NPT Thread
1 1/2NPT	NPT Thread
SAE-ORB	
7/16UNF	Inch Parallel Thread
9/16UNF	Inch Parallel Thread
3/4UNF	Inch Parallel Thread
3/4UNF	Inch Parallel Thread
7/8UNF	Inch Parallel Thread
11/16UNF	Inch Parallel Thread
15/16UNF	Inch Parallel Thread
1 5/8UNF	Inch Parallel Thread
1 7/8UNF	
BSPP/BSPT	
R_	BSPP
R_/_keg	BSPT

Box 6 — Port Sealing Method Modifier (optional)	
ED	EOlastic Seal
OR	ISO 6149 O-ring

Box 7 — Modifier 1 (optional)	
OMD	Without Nut and Sleeve
VIT	FPM (omitted for Stainless)
NBR	Nitrile Seals (omitted for Steel and Brass)
_ _ B	Special Cracking Pressure (check valve)

Box 8 — Material	
CF	Chromium 6 Free
MS	Brass
71	Stainless Steel
VZ	Zinc Plated (tube only)

Box 9 — Modifier 2 (optional)	
X	Unassembled

Dimensions and pressures for reference only, subject to change.

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T APPENDIX

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Applicable Standards For TFD Products
by Standard Number

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ASTM A269	Seamless and welded type 316 Stainless Steel tubing
ASTM B633	Zinc plating
ASTM F1387	Mechanically attached fittings — Triple-Lok, Ferulok and Seal-Lok
DIN 2353	24° cone compression (bite-type) fitting range (configurations)
DIN 3852-1	Metric parallel thread port (ISO 9974-1)
DIN 3852-2	BSPP parallel thread port (ISO 1179-1)
DIN 3852-3	Metric O-ring port (ISO 6149-1)
DIN 3861	24° cone machining and sleeve for compression (bite-type) fittings
DIN 3865	24° cone nipple with O-ring
DIN 3859	Technical delivery conditions for compression fittings
DIN 1630	Seamless steel tube
DIN 2391	Seamless precision steel tubes
DIN 17458	Stainless steel tubes
ISO 1179	BSPP, flat face port and stud ends – same as DIN 3852 - Part 2
ISO 3304	Seamless precision steel tubes
ISO 3305	Welded precision steel tubes
ISO 6149	Metric straight thread O-ring port and stud ends – same as SAE J2244 and DIN 3852, Part 3
ISO 6162	Four bolt split flange connections – inch and metric bolts (inch bolt, Part II – same as SAE J518)
ISO 8434-1	24° cone bite type fittings (EO fittings)
ISO 8434-2	Metric 37° flare fittings (Metric Triple-Lok)
ISO 8434-3	Metric face seal fitting with ISO 6149 port end – (Metric Seal-Lok)
ISO 8434-4	24° cone bite type fittings with weld nipple (EO Fittings)
ISO 19879	Test methods for threaded fluid connectors
ISO 8434-6	60° cone connectors with BSPP threads
ISO 9974	Metric flat face port and stud ends – same as DIN 3852 - Part 1
JIS B8363	60° cone (male and female) hose adapters
MIL-16142	UN/UNF straight thread O-ring port – same as SAE J1926-1
MIL-F-18866	37° flare and flareless tube fittings – Triple-Lok and Ferulok (dimensionally similar to SAE J514)
MIL-33649	Straight thread O-ring port – **different from SAE J1926-1**
NFPA T3.8.3[2)]	Test methods for steel separable tube fittings
SAE J343	Tests and procedures for hose and hose assemblies (impulse test applies to fittings)
SAE J356	Welded and flash controlled low carbon steel tubing
SAE J512	Automotive tube fittings - 45° flare type - Inverted flare type - Tapered sleeve compression type
SAE J514	Hydraulic tube fittings - 37° flare (Triple-Lok) - Flareless – 24° bite type (Ferulok) - O-ring plugs - Pipe fittings - Adapter unions (pipe swivel – “07” adapters)
SAE J515	Hydraulic O-rings (SAE straight thread, face seal, four-bolt split flange, and metric O-ring port)
SAE J518	Code 61 and 62 four-bolt split flange connections – (same as ISO 6162 Type II flange connection)
SAE J524	Seamless low carbon steel tubing
SAE J525	Welded and cold drawn low carbon steel tubing
SAE J527	Brazed double wall steel tubing
SAE J528	Seamless copper tube
SAE J531	Automotive pipe, filler and drain plugs (HP and HHP plugs)
SAE J533	Flares for tubing – 37° and 45° single and double flares
SAE J846	Coding system for identification of fluid connectors
SAE J1065	Pressure ratings for hydraulic tubing
SAE J1231	Beaded tube hose fittings
SAE J1453	O-ring face seal fitting with SAE port end – (Seal-Lok)
SAE J1644	Test methods for fluid connectors
SAE J1926	SAE straight thread O-ring port and stud ends – same as ISO 11926
SAE J2244	Metric straight thread O-ring port and stud ends – same as ISO 6149
SAE J2435	Welded and flash controlled C-1021 tubing
SAE J2467	Welded and cold drawn, C-1021 tubing
SAE J2613	Welded and flash controlled high strength low alloy (HSLA) tubing
SAE J2614	Welded and cold drawn HSLA tubing

Table T1 — Applicable Standards by Standard Number

Dimensions and pressures for reference only, subject to change.

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Thread Designations and Standards for Threads Used in Fluid Connectors

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Abbreviation	Description	Applicable Std.
Straight Pipe		
NPSC	American Standard Straight Pipe Threads in Pipe Couplings Couplings	ANSI B1.20.1 FED-STD-H28/7
NPSF	Dryseal American Standard Fuel Internal Straight Pipe Threads (generally used in soft or ductile materials to mate with NPTF external taper threads)	SAEJ476 ANSI B1.20.3 FED-STD-H28/8
NPSI	Dryseal American Intermediate Internal Straight Pipe Threads (for brittle or hard materials; intended to mate with PTF-SAE short external taper threads)	SAE J476 ANSI B1.20.3 FED-STD-H28/8
NPSM	American Standard Straight Pipe Threads for Free-Fitting Mechanical Joints for Fixtures (these threads fit freely over NPTF threads. They are used in swivel nuts of 07 adapters)	ANSI B1.20.1 FED-STD-H28/7
Taper Pipe		
ANPT	Aeronautical National Taper Pipe Threads (similar to NPT with various additional requirements in gaging)	MIL-P-7105
NPT	American Standard Taper Pipe Threads for General Use	ANSI B1.20.1 FED-STD-H28/7
NPTF	Dryseal American Standard Taper Pipe Threads (used in all of our steel and brass fittings)	SAE J476 ANSI B1.20.3 FED-STD-H28/8
PTF — SAE Short	Dryseal SAE Short Taper Pipe Threads (mainly used in low pressure pneumatic and fuel applications)	SAE J476 ANSI B1.20.3 FED-STD-H28/8
PTF — SPL Short[1)]	Dryseal Special Short Taper Pipe Threads	ANSI B1.20.3
PTF — SPL Extra Short[1)]	Dryseal Special Extra Short Taper Pipe Threads	ANSI B1.20.3
Unified Threads		
UN	Unified Constant Pitch Threads (standard series: 4, 6, 8, 12, 16, 20, 28, 32)	ANSI B1.1 FED-STD-H28/2
UNC	Unified Coarse Threads	ANSI B1.1 FED-STD-H28/2
UNEF	Unifed Extra Fine Threads	ANSI B1.1 FED-STD-H28/2
UNF	Unified Fine Threads	ANSI B1.1 FED-STD-H28/2
UNS	Unified Special Pitch Threads	ANSI B1.1 FED-STD-H28/3
UNJ	Unified Controlled Root Radius Threads	ANSI B1.15 FED-STD-H28/4

Table T2— Thread Designations and Standards for Threads Used in Fluid Connectors **(continued on the next page)**

1) Used in some pneumatic components where shortened thread depth is required because of lack of enough material due to component size limitations.

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Thread Designations and Standards for Threads Used in Fluid Connectors (Continued)

Abbreviation	Description	Applicable Std.
Metric Threads		
M	Metric Screw Threads — M profile	ISO 261 ANSI B1.13M FED-STD-H28/21
M — Keg	Metric Taper Threads (mainly used in Germany)	DIN 158
British Standard Pipe Threads		
R (BSPT)	British Standard Taper Pipe Threads, External	BS 21 ISO 7/1
Rc (BSPT)	British Standard Taper Pipe Threads, Internal	BS 21 ISO 7/1
Rp or G (BSPP)	British Standard Pipe (Parallel) Threads	BS 2779 ISO 228/1
Japanese Standard Pipe Threads		
PF[1)]	JIS Parallel Pipe Threads	JIS B202 ISO 228/1
PT[1)]	JIS Taper Pipe Threads	JIS B203 ISO 7/1
PS	JIS Parallel Internal Pipe Threads (to mate with PT threads)	JIS B203

Table T2 (Cont'd) — Thread Designations and Standards for Threads Used in Fluid Connectors

1) PF and PT threads are functionally interchangeable with BSPP and BSPT threads, respectively.
These are old designations. They are being replaced with G (for PF) and R and Rc (for PT) as documents are revised.

Document Sources for Connector Specifications

ANSI American National Standards Institute
11 West 42nd Street, 13th Floor
New York, New York 10036-8002
Phone: 212-642-4900
Fax: 212-398-0023
www.ansi.org/public/std_info.html

BSI British Standards Institution
389 Chiswick High Road
London, W4 4AL
United Kingdom
Phone: 44-181-996-9000
Fax: 44-181-996-7400
www.bsi.org.uk/bsis/index.htm

British Standards are also available from ANSI

DIN Deutsches Institut Fur Normung
(German Institute for Standards)
Burggrafenstrasse 6
Postfach 1107
D - 1000 Berlin 30, Germany
www.beuth.de/beuth.htm/?datenbanken

English translations of some German Standards can be obtained from:

ANSI

— or —

Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112-9660
Phone: 1-800-854-7179

FED-STD Federal Standard
Department of Defense Single Stock Point
Commanding Officer
Naval Publications and Forms Center
5801 Taber Avenue
Philadelphia, PA 19120-5099

ISO International Organization for Standardization
Case Postale 56
I, Rue de Varembe
CH - 1211 Geneve 20
Switzerland
www.iso.ch/infoe/catinfo.html

ISO Documents are also available from ANSI

JIS Japanese Industrial Standards
Published by Japanese Standards Association
1-24 Akasaka 4
Minto-ku, Tokyo 107-8440
Japan
Phone: 81-3-3583-8000
Fax: 81-3-3586-2014

English translations of some Japanese Standards can be obtained from ANSI

SAE SAE International
400 Commonwealth Drive
Warrendale, PA 15096-0001
Phone: 412-776-4841
Fax: 412-776-0002
www.sae.org/prodserv/stds/stdsinfo/standard.html

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SI Prefixes		
Prefix	SI Symbol	Multiplication Factor
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
hecto	h	10^{2}
deka	da	10^{1}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	m	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}
atto	a	10^{-18}

Table T3 — SI Prefixes

Derived Units			
Quantity	Unit	SI Symbol	Formula
Acceleration	Meter per Second Squared	—	m/s^2
Angular Velocity	Radian per Second	—	rad/s
Area	Square Meter	—	m^2
Density	Kilogram per Cubic Meter	—	kg/m^3
Electric Resistance	Ohm	W	V/A
Energy & Work	Joule	J	N.m
Force	Newton	N	$kg.m/s^2$
Frequency	Hertz	Hz	cycles/s
Power	Watt	W	J/s
Pressure & Stress	Pascal	Pa	N/m^2
Quantity of Heat	Joule	J	N.m
Specific Heat	Joule per Kilogram-Kelvin	—	J/kg.K
Thermal Conductivity	Watt per Meter-Kelvin	—	W/m.K
Velocity	Meter per second	—	m/s
Viscosity, Dynamic	Pascal Second	—	Pa.s
Viscosity, Kinematic	Square Meter per Second	—	m^2/s
Voltage	Volt	V	W/A
Volume	Cubic Meter	—	m^3

Table T4 — Derived Units

Basic Units		
Quantity	Unit	SI Symbol
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Electric Current	Ampere	A
Thermodynamic Temperature	Kelvin	K
Amount of Substance	Mole	mol
Luminous Intensity	Candela	cd

Table T5 — Basic Units

Supplementary Units		
Quantity	Unit	SI Symbol
Plane Angle	Radian	rad
Solid Angle	Sterodian	sr

Table T6 — Supplementary Units

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	English to Metric			Metric to English		
	To Convert From	To	Multiply By	To Convert From	To	Multiply By
Area	sq. in. (in^2)	sq. mm (mm^2)	645.16	square millimeters	square inches	0.00155
	sq. in. (in^2)	sq. cm (cm^2)	6.4516	(mm^2)	(in^2)	
	sq. ft. (ft^2)	sq. meters (m^2)	0.0929			
Density	pounds/cubic ft (lb/ft^3)	Kilograms/cubic meter (kg/m^3)	16.02	kilograms/cubic meter (kg/m^3)	pounds/cubic ft (lb/ft^3)	0.0624
Energy	British thermal units (Btu) (1 J = Ws = 0.2388 cal)	joules (J)	1055	joules (J)	British thermal units (Btu)	0.000947
Force	pounds - force (lbf) (1N = 0.102 kgf)	newtons (N)	4.448	newtons (N)	pounds - force (lbf)	0.2248
Length	inches (in)	millimeters (mm)	25.4	millimeters (mm)	inches (in)	0.03937
	feet (ft)	meters (m)	0.3048	meters (m)	feet (ft)	3.281
	miles (mi)	kilometers (km)	1.609	kilometers (km)	miles (mi)	0.621
Mass (Weight)	ounces (oz)	grams (g)	28.35	grams (g)	ounces (oz)	0.035
	pounds-mass (lb)	kilograms (kg)	0.4536	kilograms (kg)	pounds-mass (lb)	2.205
	short tons (2000 lb) (tn)	metric tons (1000 kg) (t)	0.9072	metric tons (1000 kg) (t)	short tons (2000 lb) (tn)	1.102
Power	horsepower (550 ft. lb/s) (hp)	kilowatts (kW)	0.7457	kolowatts (kW)	horsepower (550 ft. lb/s) (hp)	1.341
Pressure	pounds/square inch (psi)	kilograms (f)/square cm (kg (f)/cm^2)	0.0703	kilograms (f)/square cm (kg (f)/cm^2)	pounds/square inch (psi)	14.22
	pounds/square inch (psi)	kilopascals (kPa)	6.8948	kolopascals (kPa)	pounds/square inch (psi)	0.145
	pounds/square inch (psi)	bars (100 kPa)	0.06895	bars (100 kPa)	pounds/square inch (psi)	14.503
Stress	pounds/square inch (psi) (1 N/mm^2 = 1 MPa)	megapascals (MPa)	0.006895	megapascals (MPa) (1 N/mm^2 = 1 MPa)	pounds/square inch (psi)	145.039
Temperature	degrees fahrenheit (°F)	degrees celsius (°C)	5/9 (after subtracting 32)	degrees celsius (°C)	degrees fahrenheit (°F)	9/5 (then add 32)
Torque or Bending Moment	pounds-force-foot (lb-ft)	Newtons-meter (Nm)	1.3567	Newtons-meter (Nm)	pounds-force-foot (lb-ft)	0.737
	pounds-force-inch (lb-in)	Newtons-meter (Nm)	0.113	Newtons-meter (Nm)	pounds-force-inch (lb-in)	8.85
Velocity	feet/second (ft/s)	meters/second (m/s)	0.3048	meters/second (m/s)	feet/second (ft/s)	3.2808
Viscosity	dynamic (centipoise)	pascal-second (Pas)	0.001	pascal-second)Pas)	dynamic (centipoise)	1000
	kenematic-$foot^2$/sec (ft^2/s)	meter^2/sec (m^2/s)	0.0929	meter^2/sec (m^2/s)	$foot^2$/sec (ft^2/s)	10.7643
Volume	cubic inch (in^3)	cubic centimeter (cm^3) (milliliter)	16.3871	cubic centimeter (cm^3) (milliliter)	cubic inch (in^3)	0.061
	quarts (qt)	liters (1000 cm^3)	0.9464	liters (1000 cm^3)	quarts (qt)	1.057
	gallons (gal)	liters	3.7854	liters	gallons (gal)	0.2642

Table T7 — English to Metric and Metric to English Conversions

Dimensions and pressures for reference only, subject to change.

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Glossary of Key Tube Fittings, Fluid Power and Other Engineering Terms

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Alloy: A substance having metallic properties and composed of two or more chemical elements of which at least one is a metal.

Annealing: Heat treating process used primarily to soften metals or to stabilize their structures.

Boss: A relatively short protrusion or projection from the surface of a forging or casting, often cylindrical in shape.

Brass: An alloy consisting mainly of copper (over 50%) and zinc, to which smaller amounts of other elements may be added.

Braze 505: Braze 505 is a trademark of the Handy & Harman Company.

Brazing: The joining of metals through the use of heat and capillary flow of a filler metal. The filler metal having a melting temperature above 840 degrees Fahrenheit, but below the melting point of the metals being joined.

Bright Annealing: Annealing in a protective atmosphere to prevent discoloration of the bright surface.

Brinell Hardness Test: A test for determining the hardness of a material by forcing a hard steel or carbide ball of specified diameter into it under a specified load.

Brittle Fracture: A fracture which is accompanied by little or no plastic deformation.

Brittleness: The quality of a material that leads to crack propagation without appreciable plastic deformation.

Bulk Modulus: The measure of resistance to compressibility of a fluid. It is the reciprocal of the compressibility.

Burnishing: Smoothing surfaces of a work piece through frictional contact between it and some hardened tooling.

Carbonitriding: A case hardening process of suitable ferrous material that is effected by the simultaneous absorption of nitrogen and carbon into the surface of the work piece, by heating above the lower transformation temperature in a suitable gaseous atmosphere.

Cavitation: A localized gaseous condition within a liquid stream which occurs when the pressure is reduced to the vapor pressure. Generally occurs in pumps and suction lines where fluid velocity is too high due to poorly sized (too small) line size.

Chatter: The undesirable wavy surface on a machined surface, produced by vibration of the tool, grinding wheel or work piece itself during machining or grinding.

Chromate Treatment: A treatment of metal in a solution of a hexavalent chromium compound to produce a conversion coating of chromium compounds on the surface of the metal, thus improving the resistance to corrosion.

Cold Heading: Working metal at room temperature in such a manner that the cross-sectional area of a portion or all of the stock is increased.

Cold Working (Cold Forming): Permanently deforming metal, usually at room temperature, by the application of an external force in order to produce a near net shape component.

Compressibility: The change in volume of a unit volume of a fluid when subjected to a unit change in pressure.

Corrosion: The deterioration of a metal by chemical or electrochemical reaction with its environment.

Creep: Time dependent strain occuring under stress. This phenomenon may result in relaxation i.e.the relief of pre-load/ pre-stress in assembled components.

Crimping: A swaging and squeezing operation usually used to secure components, such as, nuts and shells to their mating parts.

Deburring: Removing burrs, sharp edges or fins from metal parts usually by filing, grinding or tumbling the work in a barrel containing suitable liquid medium and abrasives.

Density: Ratio of the mass of an object (including fluids) to its volume.

Diamond Pyramid Hardness Test (DPH): An indentation hardness test employing a 136° diamond pyramid indenter and variable loads.

Ductility: The ability of a metal to deform plastically (permanently) without fracturing.

Dynamic Pressure Rating: See PRESSURE, RATED DYNAMIC.

Easy Flo 45: Easy Flo 45 is a trademark of the Handy & Harman Company.

Elastic Deformation: Change of dimensions accompanying stress in the elastic range, original dimensions being restored upon release of stress.

Elastomer: Often referred to as rubber, is a high polymer that can be, or has been modified to a state exhibiting little plastic flow and quick recovery from an extending force.

Erosion: Destruction of metals or other materials by the abrasive action of moving fluids, or particles.

Extrusion: Conversion of an ingot slug or billet into lengths of uniform cross section by plastically forcing the metal through a die orifice having the desired cross sectional profile.

Fatigue/Endurance Limit: The maximum stress below which a material can presumably endure an infinite number of stress cycles.

Fatigue Fracture: The initiation of minute cracks, propagating into ultimate fracture under the application of repeated or fluctuating stresses having a maximum value less than the tensile strength of the material.

Ferrous Metal: A metal in which the major constituent is iron.

Fire Point: The temperature to which a fluid must be heated to *ignite* and *burn* for at least five seconds in the presence of air when a small flame is applied.

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Fitting: A connector or closure for fluid power lines and passages.

Flare Test: A test applied to tubing, involving a tapered expansion over a cone, in order to verify tube ductility and resistance to cracking during flaring operation.

Flaring: Forming an outward acute-angle flange on a tubular part.

Flash Point: The temperature to which a liquid must be heated to form a mixture with air that can be ignited *momentarily* by a flame.

Flow: Movement of fluid generated by pressure differences.

Flow, Laminar: A flow situation in which fluid moves in parallel lamina or streamlined layers.

Flow Lines: A fiber pattern, frequently observed in wrought metal, which indicates the manner in which the metal flowed during forming.

Flow Rate: The volume, mass or weight of a fluid passing through any conductor per unit of time.

Flow, Turbulent: A flow situation in which the fluid particles move in a random fluctuation manner. This is generally caused by too high fluid velocity.

Fluid Friction: Friction due to the viscosity of the fluid.

Fluid Power System: A system that transmits and controls power through the use of a pressurized fluid within an enclosed circuit.

Fluorocarbon Rubber: An elastomeric material which is extensively used for O-ring. Fluorocarbon (Viton) is recommended for higher temperatures than nitrile (Buna N) material.

Flux: In brazing, cutting, soldering or welding, material used to dissolve or facilitate the removal of oxides and other undesirable substances.

Folds: Defects in metals, usually on or near the surface caused by continued fabrication of overlapping surfaces.

Forgeabiltiy: Term used to describe the relative ability of materials to deform without rupture.

Forging: Plastically deforming metal, usually hot, into desired shapes with compressive force, with or without dies.

Forging Die: A forging whose shape is determined by impressions in specially prepared dies.

Free Machining: Denotes the machining characteristics of an alloy to which one or more ingredients have been introduced to produce small broken chips, lower power consumption, better surface finish and longer tool life.

Galling: Localized welding on mating surfaces of metal parts caused from excessive friction developed during the rubbing action that occurs during assembly.

Galvanic Corrosion: Corrosion resulting from the placing of two dissimilar metals in direct contact with each other then exposing them to an incompatible fluid or atmosphere.

Hammer, Liquid: Pressure and depression waves created by relatively rapid flow changes and transmitted through the system.

Handy Flux: Handy Flux is a trademark of the Handy & Harman Company.

Hardening: Increasing the hardness of a material by suitable treatment, usually involving heating and rapid cooling.

Hardness: Resistance of a material to scratching, abrasion, cutting or deformation.

Head, Pressure: The pressure due to the height of a column or body of fluid.

Heading: See COLD HEADING.

Hot Finishing/Hot Forming: A deformation operation performed at elevated temperature, usually above the recrystallization temperature of the metal.

Hydraulic Power: Power derived from flow rate and pressure differential of the fluid.

Hydraulics: Engineering science pertaining to liquid pressure and flow.

Hydrogen Embrittlement: A condition of low ductility in metals resulting from the absorption of hydrogen.

Hydropneumatics: Engineering science pertaining to the combination of hydraulic and pneumatic fluid power.

Impact Test: A single blow to determine the behavior of materials when subjected to high rates of loading, usually sudden and in the bending, tension or torsion mode. Charpy or Izod tests are typically used to measure materials' impact energy characteristics.

Inclusions: Nonmetallic materials in solid metallic matrix.

Intergranular Corrosion: A preferential corrosive attack at the grain boundaries of a metal.

LB2000: Registered Trademark of ITW.

Lubricant: Any substance used to reduce friction between two surfaces which are in contact.

MPG 2: Registered Trademark of Dubois Chemical Inc.

Machinability: The relative ease of machining a metal.

Machining: Removing material, in the form of chips, from work, usually through the use of a machine.

Malleability: The characteristic of metals that permits plastic deformation in compression without rupture.

Mandrel: (1) A metal bar around which other metal may be cast bent, formed, or shaped. (2) A rod used to retain the cavity in hollow metal products during working.

Mechanical Properties: The properties of a material that reveal its elastic and inelastic behavior under the application of force, thus indicating the material's suitability for mechanical applications. Examples of such properties are: tensile strength, elongation, modulus of elasticity, yield strength, reduction in area and fatigue limit.

Microhardness: The hardness of microscopic areas or of the individual microconstituents in a metal.

Microstructure: The structure of polished and etched metals as revealed by a microscope at a magnification greater than ten diameters.

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Flaring: Forming an outward acute-angle flange on a tubular part.

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Mechanical Properties: The properties of a material that reveal its elastic and inelastic behavior under the application of force, thus indicating the material's suitability for mechanical applications. Examples of such properties are: tensile strength, elongation, modulus of elasticity, yield strength, reduction in area and fatigue limit.

Microhardness: The hardness of microscopic areas or of the individual microconstituents in a metal.

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Microstructure: The structure of polished and etched metals as revealed by a microscope at a magnification greater than ten diameters.

Mild Steel: Carbon steel with a maximum of .25 percent carbon.

Nitriding: A case hardening process conducted by the introduction of nitrogen into the surface of a solid ferrous alloy.

Nitrile (Buna N): A copolymer of butadienne and acrylonitrile. It is the elastomer most widely used to manufacture O-rings.

Nondestructive: Inspection or test by methods that do not destroy the part.

O-ring: A torus, or doughnut shaped object, generally made from elastomer and is used primarily for sealing.

Passivation: A process used to improve corrosive behavior of a metal by changing its chemically active surface to a much less reactive state.

Pipe: (l) The defect in wrought or cast products resulting from the central cavity formed by contraction in metal, especially ingots, during solidification. (2) A tubular metal product that includes iron pipe size (I.P.S.) and schedule number in its classification.

Pipe Thread, Dry Seal: Tapered pipe threads in which sealing is a function of root and crest interference.

Pitting: Forming small sharp cavities in a metal surface by corrosion, mechanical action or nonuniform electrodeposition.

Plastic Deformation: Deformation that does or will remain permanent in an element after removal of the stress that caused it.

Pneumatics: Engineering science pertaining to gaseous pressure and flow.

Port: A terminus of a passage in a component to which conductors can be connected.

Port, Pipe: A port which conforms to pipe thread standards.

Port, Straight Thread: A port which conforms to straight thread standards. It typically employs an O-ring compressed in a wedge-shaped cavity.

Power Supply, Fluid: Energy source which generates and maintains a flow of fluid under pressure.

Precipitation Hardening: Hardening caused by the precipitation of a constituent from a supersaturated solid solution.

Pressure: Force per unit area, usually expressed in pounds per square inch (psi).

Pressure, Absolute: The pressure above absolute zero, i.e., the sum of atmospheric pressure plus gage pressure.

Pressure, Atmospheric: Pressure exerted by the atmosphere at any specific location. [Sea level atmospheric pressure is approximately 14.7 pounds per square inch (about 1 bar)]

Pressure, Burst: The pressure which causes failure of, and consequential loss of fluid through the product envelope.

Pressure, Cyclic Test: A pressure range applied in cyclic endurance tests that are performed to help determine recommended working pressure.

Pressure, Differential (Pressure Drop): The difference in pressure between any two points of a system or a component.

Pressure, Gage: Pressure differential above or below ambient atmospheric pressure.

Pressure, Nominal: A pressure value assigned to a component or system for the purpose of convenient designation.

Pressure, Operating: See WORKING PRESSURE.

Pressure, Proof: The non-destructive test pressure, in excess of the maximum rated operating pressure, which causes no permanent deformation, external leakage, or other resulting malfunction.

Pressure, Rated Dynamic: The maximum fluctuating pressure load that a pressure containing envelope is capable of sustaining for a minimum of 1 million operating cycles without failure.

Pressure, Rated Static: The maximum pressure that a pressure containing envelope is capable of sustaining in an application not exceeding 30,000 operating cycles in a system free of pressure surges, shocks, vibration, temperature excursions, etc.

Pressure, Relief: The pressure at which the relief valve is set for actuation. This pressure is generally slightly higher than the system working pressure.

Pressure Shock: A pressure wave front which moves at a sonic velocity, due to sudden stoppage of fluid flow.

Pressure, Static: The pressure in a fluid at rest.

Pressure, Surge: The pressure increases resulting from pressure fluctuations in a hydraulic system.

Pressure, Working: The pressure at which the apparatus is being operated in a given application.

Pressure, Working Rated: The qualified operating pressure which is recommended for a system or a component by the manufacturer.

Proof Load: A pre-determined load, generally some multiple of the service load, to which a specimen or structure is submitted before acceptance for use.

Quenching: Rapid cooling method used in heat treating process.

Residual Stress: Stress existing in a body that is free of external forces or thermal gradients.

Rockwell Hardness Test: A test for determining the hardness of a material based upon the depth of penetration of a specified penetrator into the specimen.

Roughness: Relatively finely-spaced surface irregularities, the height, width and direction of which establish the predominant surface pattern.

STP: Distributed by First Brand Corp. Danbury, CT.

Scaling: (1) Forming a thick layer of oxidation products on metals at high temperatures. (2) Depositing water-insoluble constituents on a metal surface, as in cooling tubes and water boilers.

Seam: A fold or lap on the surface of a metal appearing as a crack, usually resulting from a defect obtained in casting or in working.

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Segregation: Concentration of alloying elements in specific regions in a metallic object.

Shear Strength: The load divided by the original cross-sectional area of a section separated by a shear force.

Sour Environment: Fluids containing water as a liquid and hydrogen sulfide, and may cause sulfide stress cracking (SSC) of susceptible materials.

Specific Gravity, Liquid: The ratio of the weight of a given volume of liquid to an equal volume of water.

Spot Facing: Machining in the mating component, a flat seat for a bolt head, nut, locknut or other similar element.

Springback: (1) The elastic recovery of metal after stressing. (2) The degree to which metal tends to return to its original shape or contour after undergoing a forming operation.

Stainless Steel: Basically, low carbon alloy steels containing at least 11.5% chromium. These steels are characterized by their high resistance to corrosion.

Static Pressure Rating: See pressure, rated static

Steel: An iron-based alloy, containing: manganese, usually carbon, and often other alloying elements.

Strain: A measure of the relative change in size or shape of a body. Example, linear strain is computed as the ratio of change in length to the original length.

Stress: The result of a force acting on a given surface area. Computed as the ratio of the applied force to the affected area.

Stress Corrosion Cracking (SCC): Fracture in a material resulting from the combined action of applied stress and corrosive environment.

Stress Raisers/Concentration: Changes in contour or discontinuities in structure that cause local increases in stress.

Stringer: In wrought materials, an elongated configuration of microconstituents or foreign material aligned in the direction of working.

Sulfide Stress: Brittle failure by cracking under the combined action of tensile stress and corrosion in the presence of water Cracking (SSC) and hydrogen sulfide.

Surge: A transient rise of pressure or flow.

Swaging: Forming a taper or a reduction on metal products such as rod and tubing by forging, squeezing or hammering.

Temperature, Ambient: The temperature of the environment in which the apparatus is working.

Tensile Strength: In tensile testing, the ratio of maximum load to original cross-sectional area.

Tensile Strength, Ultimate: The maximum stress that a material can withstand.

Torque: Turning effort (moment) applied to a component for fastening, tightening or assembling.

Torsion: A twisting action resulting in shear stresses and strain.

Toughness: Ability of a metal to absorb energy and deform without fracturing.

Tube: Hollow, cylindrical products having outside diameters that are not standardized for threading. Tubes are dimensionally classified in terms of their outside diameters and wall thicknesses.

Upsetting: See COLD HEADING.

Vacuum: Pressure less than ambient atmospheric pressure.

Vibra-Seal: Vibra-Seal is a registered trademark of Loctite Corporation.

Viscosity: A measure of the internal friction or the resistance of a fluid to flow.

Viton: Viton is a registered trademark of E.I. Du Pont de Nemours and Company.

Welding: Joining two or more pieces of metal by applying heat, pressure or both with or without filler metal, to produce a localized union through fusion or recrystallization across the interface.

Work Hardening: An increase in hardness and strength caused by plastic deformation at temperatures lower than the recrystallization range. (Same as Strain Hardening. See also, Cold Working.)

Working Pressure, Dynamic: See PRESSURE, RATED DYNAMIC.

Working Pressure, Static: See PRESSURE, RATED STATIC.

Yield Strength: The maximum stress that can be applied to a material, which upon removal, the material will return to approximately its original shape.

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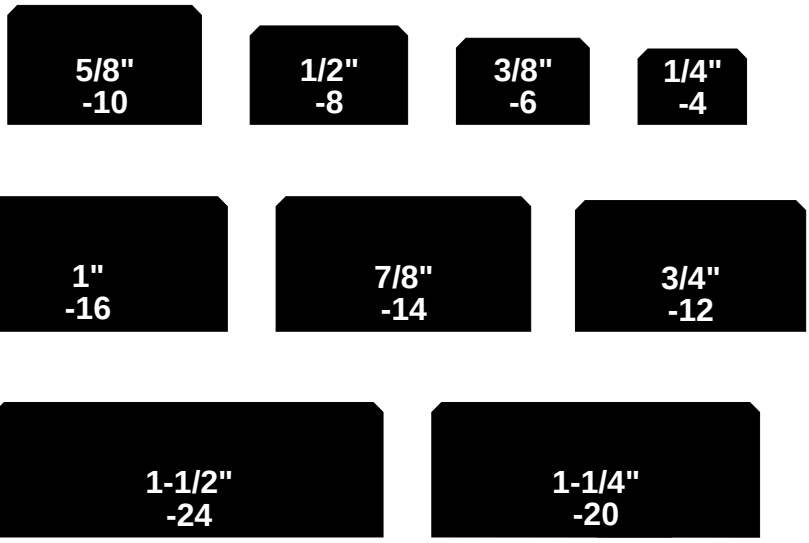

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FITTING END SIZE CHART

SAE (JIC) 37° Flare Nose Cone Sizes

SAE 45° Flare Nose Cone Sizes

Parker Safety Guide for Selecting and Using Hose, Tubing, Fittings, Connectors, Conductors, Valves and Related Accessories

Parker Publication No. 4400-B.1

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WARNING: Failure or improper selection or improper use of hose, tubing, fittings, assemblies, valves, connectors, conductors or related accessories ("Products") can cause death, personal injury and property damage. Possible consequences of failure or improper selection or improper use of these Products include but are not limited to:

- Fittings thrown off at high speed.
- High velocity fluid discharge.
- Explosion or burning of the conveyed fluid.
- Electrocution from high voltage electric powerlines.
- Contact with suddenly moving or falling objects that are controlled by the conveyed fluid.
- Injections by high-pressure fluid discharge.
- Dangerously whipping Hose.
- Tube or pipe burst.
- Weld joint fracture.
- Contact with conveyed fluids that may be hot, cold, toxic or otherwise injurious.
- Sparking or explosion caused by static electricity buildup or other sources of electricity.
- Sparking or explosion while spraying paint or flammable liquids.
- Injuries resulting from inhalation, ingestion or exposure to fluids.

Before selecting or using any of these Products, it is important that you read and follow the instructions below. No product from any division in Parker Fluid Connectors Group is approved for in-flight aerospace applications. For hoses and fittings used in in-flight aerospace applications, please contact Parker Aerospace Group.

1.0 GENERAL INSTRUCTIONS

1.1 Scope: This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) these Products. For convenience, all rubber and/or thermoplastic products commonly called "hose" or "tubing" are called "Hose" in this safety guide. Metallic tube or pipe are called "tube". All assemblies made with Hose are called "Hose Assemblies". All assemblies made with Tube are called "Tube Assemblies". All products commonly called "fittings", "couplings" or "adapters" are called "Fittings". Valves are fluid system components that control the passage of fluid. Related accessories are ancillary devices that enhance or monitor performance including crimping, flaring, flanging, presetting, bending, cutting, deburring, swaging machines, sensors, tags, lockout handles, spring guards and associated tooling. This safety guide is a supplement to and is to be used with the specific Parker publications for the specific Hose, Fittings and Related Accessories that are being considered for use. Parker publications are available at www.parker.com. SAE J1273 (www.sae.org) and ISO 17165-2 (www.ansi.org) also provide recommended practices for hydraulic Hose Assemblies, and should be followed.

1.2 Fail-Safe: Hose, Hose Assemblies, Tube, Tube Assemblies and Fittings can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of the Hose, Hose Assembly, Tube, Tube Assembly or Fitting will not endanger persons or property.

1.3 Distribution: Provide a copy of this safety guide to each person responsible for selecting or using Hose, Tube and Fitting products. Do not select or use Parker Hose, Tube or Fittings without thoroughly reading and understanding this safety guide as well as the specific Parker publications for the Products.

1.4 User Responsibility: Due to the wide variety of operating conditions and applications for Hose, Tube and Fittings. Parker does not represent or warrant that any particular Hose, Tube or Fitting is suitable for any specific end use system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing, is solely responsible for:

- Making the final selection of the Products.
- Assuring that the user's requirements are met and that the application presents no health or safety hazards.
- Following the safety guide for Related Accessories and being trained to operate Related Accessories.
- Providing all appropriate health and safety warnings on the equipment on which the Products are used.
- Assuring compliance with all applicable government and industry standards.

1.5 Additional Questions: Call the appropriate Parker technical service department if you have any questions or require any additional information. See the Parker publication for the Products being considered or used, or call 1-800-CPARKER, or go to www.parker.com, for telephone numbers of the appropriate technical service department.

2.0 HOSE, TUBE AND FITTINGS SELECTION INSTRUCTIONS

2.1 Electrical Conductivity: Certain applications require that the Hose be nonconductive to prevent electrical current flow. Other applications require the Hose and the Fittings and the Hose/Fitting interface to be sufficiently conductive to drain off static electricity. Extreme care must be exercised when selecting Hose, Tube and Fittings for these or any other applications in which electrical conductivity or nonconductivity is a factor.

The electrical conductivity or nonconductivity of Hose, Tube and Fittings is dependent upon many factors and may be susceptible to change. These factors include but are not limited to the various materials used to make the Hose and the Fittings, Fitting finish (some Fitting finishes are electrically conductive while others are nonconductive), manufacturing methods (including moisture control), how the Fittings contact the Hose, age and amount of deterioration or damage or other changes, moisture content of the Hose at any particular time, and other factors.

The following are considerations for electrically nonconductive and conductive Hose. For other applications consult the individual catalog pages and the appropriate industry or regulatory standards for proper selection.

2.1.1 Electrically Nonconductive Hose: Certain applications require that the Hose be nonconductive to prevent electrical current flow or to maintain electrical isolation. For applications that require Hose to be electrically nonconductive, including but not limited to applications near high voltage electric lines, only special nonconductive Hose can be used. The manufacturer of the equipment in which the nonconductive Hose is to be used must be consulted to be certain that the Hose, Tube and Fittings that are selected are proper for the application. Do not use any Parker Hose or Fittings for any such application requiring nonconductive Hose, including but not limited to applications near high voltage electric lines or dense magnetic fields, unless (i) the application is expressly approved in the Parker technical publication for the product, (ii) the Hose is marked "nonconductive", and (iii) the manufacturer of the equipment on which the Hose is to be used specifically approves the particular Parker Hose, Tube and Fittings for such use.

2.1.2 Electrically Conductive Hose: Parker manufactures special Hose for certain applications that require electrically conductive Hose. Parker manufactures special Hose for conveying paint in airless paint spraying applications. This Hose is labeled "Electrically Conductive Airless Paint Spray Hose" on its layline and packaging. This Hose must be properly connected to the appropriate Parker Fittings and properly grounded in order to dissipate dangerous static charge buildup, which occurs in all airless paint spraying applications. Do not use any other Hose for airless paint spraying, even if electrically conductive. Use of any other Hose or failure to properly connect the Hose can cause a fire or an explosion resulting in death, personal injury, and property damage. All hoses that convey fuels must be grounded.

Parker manufactures a special Hose for certain compressed natural gas ("CNG") applications where static electricity buildup may occur. Parker CNG Hose assemblies comply with the requirements of ANSI/IAS NGV 4.2; CSA 12.52, "Hoses for Natural Gas Vehicles and Dispensing Systems" (www.ansi.org). This Hose is labeled "Electrically Conductive for CNG Use" on its layline and packaging. This Hose must be properly connected to the appropriate Parker Fittings and properly grounded in order to dissipate dangerous static charge buildup, which occurs in, for example, high velocity CNG dispensing or transfer. Do not use any other Hose for CNG applications where static charge buildup may occur, even if electrically conductive. Use of other Hoses in CNG applications or failure to properly connect or ground this Hose can cause a fire or an explosion resulting in death, personal injury, and property damage. Care must also be taken to protect against CNG permeation through the Hose wall. See section 2.6, Permeation, for more information. Parker CNG Hose is intended for dispenser and vehicle use

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within the specified temperature range. Parker CNG Hose should not be used in confined spaces or unventilated areas or areas exceeding the specified temperature range. Final assemblies must be tested for leaks. CNG Hose Assemblies should be tested on a monthly basis for conductivity per ANSI/IAS NGV 4.2; CSA 12.52.

Parker manufactures special Hose for aerospace in-flight applications. Aerospace in-flight applications employing Hose to transmit fuel, lubricating fluids and hydraulic fluids require a special Hose with a conductive inner tube. This Hose for in-flight applications is available only from Parker's Stratoflex Products Division. Do not use any other Parker Hose for in-flight applications, even if electrically conductive. Use of other Hoses for in-flight applications or failure to properly connect or ground this Hose can cause a fire or an explosion resulting in death, personal injury and property damage. These Hose assemblies for in-flight applications must meet all applicable aerospace industry, aircraft engine and aircraft requirements.

2.2 **Pressure:** Hose, Tube and Fitting selection must be made so that the published maximum working pressure of the Hose, Tube and Fittings are equal to or greater than the maximum system pressure. The maximum working pressure of a Hose, or Tube Assembly is the lower of the respective published maximum working pressures of the Hose, Tube and the Fittings used. Surge pressures or peak transient pressures in the system must be below the published maximum working pressure for the Hose, Tube and Fitting. Surge pressures and peak pressures can usually only be determined by sensitive electrical instrumentation that measures and indicates pressures at millisecond intervals. Mechanical pressure gauges indicate only average pressures and cannot be used to determine surge pressures or peak transient pressures. Published burst pressure ratings for Hose is for manufacturing test purposes only and is no indication that the Product can be used in applications at the burst pressure or otherwise above the published maximum recommended working pressure.

2.3 **Suction:** Hoses used for suction applications must be selected to insure that the Hose will withstand the vacuum and pressure of the system. Improperly selected Hose may collapse in suction application.

2.4 **Temperature:** Be certain that fluid and ambient temperatures, both steady and transient, do not exceed the limitations of the Hose, Tube, Fitting and Seals. Temperatures below and above the recommended limit can degrade Hose, Tube, Fittings and Seals to a point where a failure may occur and release fluid. Tube and Fittings performances are normally degraded at elevated temperature. Material compatibility can also change at temperatures outside of the rated range. Properly insulate and protect the Hose Assembly when routing near hot objects (e.g. manifolds). Do not use any Hose in any application where failure of the Hose could result in the conveyed fluids (or vapors or mist from the conveyed fluids) contacting any open flame, molten metal, or other potential fire ignition source that could cause burning or explosion of the conveyed fluids or vapors.

2.5 **Fluid Compatibility:** Hose, and Tube Assembly selection must assure compatibility of the Hose tube, cover, reinforcement, Tube, Plating and Seals with the fluid media used. See the fluid compatibility chart in the Parker publication for the product being considered or used. This information is offered only as a guide. Actual service life can only be determined by the end user by testing under all extreme conditions and other analysis.

Hose, and Tube that is chemically compatible with a particular fluid must be assembled using Fittings and adapters containing likewise compatible seals. Flange or flare processes can change Tube material properties that may not be compatible with certain requirements such as NACE

2.6 **Permeation:** Permeation (that is, seepage through the Hose or Seal) will occur from inside the Hose or Fitting to outside when Hose or Fitting is used with gases, liquid and gas fuels, and refrigerants (including but not limited to such materials as helium, diesel fuel, gasoline, natural gas, or LPG). This permeation may result in high concentrations of vapors which are potentially flammable, explosive, or toxic, and in loss of fluid. Dangerous explosions, fires, and other hazards can result when using the wrong Hose for such applications. The system designer must take into account the fact that this permeation will take place and must not use Hose or Fitting if this permeation could be hazardous. The system designer must take into account all legal, government, insurance, or any other special regulations which govern the use of fuels and refrigerants. Never use a Hose or Fitting even though the fluid compatibility is acceptable without considering the potential hazardous effects that can result from permeation through the Hose or Tube Assembly.

Permeation of moisture from outside the Hose or Fitting to inside the Hose or Fitting will also occur in Hose or Tube assemblies, regardless of internal pressure. If this moisture permeation would have detrimental effects (particularly, but not limited to refrigeration and air conditioning systems), incorporation of sufficient drying capacity in the system or other appropriate system safeguards should be selected and used. The sudden pressure release of highly pressurized gas could also result in Explosive Decompression failure of permeated Seals and Hoses.

2.7 **Size:** Transmission of power by means of pressurized fluid varies with pressure and rate of flow. The size of the components must be adequate to keep pressure losses to a minimum and avoid damage due to heat generation or excessive fluid velocity.

2.8 **Routing:** Attention must be given to optimum routing to minimize inherent problems (kinking or flow restriction due to Hose collapse, twisting of the Hose, proximity to hot objects or heat sources). For additional routing recommendations see SAE J1273 and ISO 17165-2. Hose Assemblies have a finite life and should be installed in a manner that allows for ease of inspection and future replacement. Hose because of its relative short life, should not be used in residential and commercial buildings inside of inaccessible walls or floors, unless specifically allowed in the product literature. Always review all product literature for proper installation and routing instructions.

2.9 **Environment:** Care must be taken to insure that the Hose, Tube and Fittings are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals and air pollutants can cause degradation and premature failure.

2.10 **Mechanical Loads:** External forces can significantly reduce Hose, Tube and Fitting life or cause failure. Mechanical loads which must be considered include excessive flexing, twist, kinking, tensile or side loads, bend radius, and vibration. Use of swivel type Fittings or adapters may be required to insure no twist is put into the Hose. Use of proper Hose or Tube clamps may also be required to reduce external mechanical loads. Unusual applications may require special testing prior to Hose selection.

2.11 **Physical Damage:** Care must be taken to protect Hose from wear, snagging, kinking, bending smaller that minimum bend radius and cutting, any of which can cause premature Hose failure. Any Hose that has been kinked or bent to a radius smaller than the minimum bend radius, and any Hose that has been cut or is cracked or is otherwise damaged should be removed and discarded. Fittings with damages such as scratches on sealing surfaces and deformation should be replaced.

2.12 **Proper End Fitting:** See instructions 3.2 through 3.5. These recommendations may be substantiated by testing to industry standards such as SAE J517 for hydraulic applications, or MIL-A-5070, AS1339, or AS3517 for Hoses from Parker's Stratoflex Products Division for aerospace applications.

2.13 **Length:** When determining the proper Hose or Tube length of an assembly, be aware of Hose length change due to pressure, Tube length change due to thermal expansion or contraction, and Hose or Tube and machine tolerances and movement must be considered. When routing short hose assemblies, it is recommended that the minimum free hose length is always used. Consult the hose manufacturer for their minimum free hose length recommendations. Hose assemblies should be installed in such a way that any motion or flexing occurs within the same plane.

2.14 **Specifications and Standards:** When selecting Hose, Tube and Fittings, government, industry, and Parker specifications and recommendations must be reviewed and followed as applicable.

2.15 **Hose Cleanliness:** Hose and Tube components may vary in cleanliness levels. Care must be taken to insure that the Hose and Tube Assembly selected has an adequate level of cleanliness for the application.

2.16 **Fire Resistant Fluids:** Some fire resistant fluids that are to be conveyed by Hose or Tube require use of the same type of Hose or Tube as used with petroleum base fluids. Some such fluids require a special Hose, Tube, Fitting and Seal, while a few fluids will not work with any Hose at all. See instructions 2.5 and 1.5. The wrong Hose, Tube, Fitting or Seal may fail after a very short service. In addition, all liquids but pure water may burn fiercely under certain conditions, and even pure water leakage may be hazardous.

2.17 **Radiant Heat:** Hose and Seals can be heated to destruction without contact by such nearby items as hot manifolds or molten metal. The same heat source may then initiate a fire. This can occur despite the presence of cool air around the Hose or Seal. Performance of Tube and Fitting subjected to the heat could be degraded.

2.18 **Welding or Brazing:** When using a torch or arc welder in close proximity to hydraulic lines, the hydraulic lines should be removed or shielded with appropriate fire resistant materials. Flame or weld spatter could burn through the Hose or Seal and possibly ignite escaping fluid resulting in a catastrophic failure. Heating of plated parts, including Hose Fittings and adapters, above 450°F (232°C) such as during welding, brazing or soldering may emit deadly gases. Any elastomer seal on fittings shall be removed prior to welding or brazing, any metallic surfaces shall be protected after brazing or welding when necessary. Welding and brazing filler

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material shall be compatible with the Tube and Fitting that are joined.

2.19 **Atomic Radiation:** Atomic radiation affects all materials used in Hose and Tube assemblies. Since the long-term effects may be unknown, do not expose Hose or Tube assemblies to atomic radiation. Nuclear applications may require special Tube and Fittings.

2.20 **Aerospace Applications:** The only Hose, Tube and Fittings that may be used for in-flight aerospace applications are those available from Parker's Stratoflex Products Division. Do not use any other Hose or Fittings for in-flight applications. Do not use any Hose or Fittings from Parker's Stratoflex Products Division with any other Hose or Fittings, unless expressly approved in writing by the engineering manager or chief engineer of Stratoflex Products Division and verified by the user's own testing and inspection to aerospace industry standards.

2.21 **Unlocking Couplings:** Ball locking couplings or other Fittings with quick disconnect ability can unintentionally disconnect if they are dragged over obstructions, or if the sleeve or other disconnect member, is bumped or moved enough to cause disconnect. Threaded Fittings should be considered where there is a potential for accidental uncoupling.

3.0 HOSE AND FITTINGS ASSEMBLY AND INSTALLATION INSTRUCTIONS

3.1 **Component Inspection:** Prior to assembly, a careful examination of the Hose and Fittings must be performed. All components must be checked for correct style, size, catalog number, and length. The Hose must be examined for cleanliness, obstructions, blisters, cover looseness, kinks, cracks, cuts or any other visible defects. Inspect the Fitting and sealing surfaces for burrs, nicks, corrosion or other imperfections. Do NOT use any component that displays any signs of nonconformance.

3.2 **Hose and Fitting Assembly:** Do not assemble a Parker Fitting on a Parker Hose that is not specifically listed by Parker for that Fitting, unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division. Do not assemble a Parker Fitting on another manufacturer's Hose or a Parker Hose on another manufacturer's Fitting unless (i) the engineering manager or chief engineer of the appropriate Parker division approves the Assembly in writing or that combination is expressly approved in the appropriate Parker literature for the specific Parker product, and (ii) the user verifies the Assembly and the application through analysis and testing. For Parker Hose that does not specify a Parker Fitting, the user is solely responsible for the selection of the proper Fitting and Hose Assembly procedures. See instruction 1.4.

To prevent the possibility of problems such as leakage at the Fitting or system contamination, it is important to completely remove all debris from the cutting operation before installation of the Fittings. The Parker published instructions must be followed for assembling the Fittings on the Hose. These instructions are provided in the Parker Fitting catalog for the specific Parker Fitting being used, or by calling 1-800-CPARKER, or at www.parker.com.

3.3 **Related Accessories:** Do not crimp or swage any Parker Hose or Fitting with anything but the listed swage or crimp machine and dies in accordance with Parker published instructions. Do not crimp or swage another manufacturer's Fitting with a Parker crimp or swage die unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division.

3.4 **Parts:** Do not use any Parker Fitting part (including but not limited to socket, shell, nipple, or insert) except with the correct Parker mating parts, in accordance with Parker published instructions, unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division.

3.5 **Field Attachable/Permanent:** Do not reuse any field attachable Hose Fitting that has blown or pulled off a Hose. Do not reuse a Parker permanent Hose Fitting (crimped or swaged) or any part thereof. Complete Hose Assemblies may only be reused after proper inspection under section 4.0. Do not assemble Fittings to any previously used hydraulic Hose that was in service, for use in a fluid power application.

3.6 **Pre-Installation Inspection:** Prior to installation, a careful examination of the Hose Assembly must be performed. Inspect the Hose Assembly for any damage or defects. DO NOT use any Hose Assembly that displays any signs of nonconformance.

3.7 **Minimum Bend Radius:** Installation of a Hose at less than the minimum listed bend radius may significantly reduce the Hose life. Particular attention must be given to preclude sharp bending at the Hose to Fitting juncture. Any bending during installation at less than the minimum bend radius must be avoided. If any Hose is kinked during installation, the Hose must be discarded.

3.8 **Twist Angle and Orientation:** Hose Assembly installation must be such that relative motion of machine components does not produce twisting.

3.9 **Securement:** In many applications, it may be necessary to restrain, protect, or guide the Hose to protect it from damage by unnecessary flexing, pressure surges, and contact with other mechanical components. Care must be taken to insure such restraints do not introduce additional stress or wear points.

3.10 **Proper Connection of Ports:** Proper physical installation of the Hose Assembly requires a correctly installed port connection insuring that no twist or torque is transferred to the Hose when the Fittings are being tightened or otherwise during use.

3.11 **External Damage:** Proper installation is not complete without insuring that tensile loads, side loads, kinking, flattening, potential abrasion, thread damage or damage to sealing surfaces are corrected or eliminated. See instruction 2.10.

3.12 **System Checkout:** All air entrapment must be eliminated and the system pressurized to the maximum system pressure (at or below the Hose maximum working pressure) and checked for proper function and freedom from leaks. Personnel must stay out of potential hazardous areas while testing and using.

3.13 **Routing:** The Hose Assembly should be routed in such a manner so if a failure does occur, the escaping media will not cause personal injury or property damage. In addition, if fluid media comes in contact with hot surfaces, open flame or sparks, a fire or explosion may occur. See section 2.4.

3.14 **Ground Fault Equipment Protection Devices (GFEPDs): WARNING! Fire and Shock Hazard.** To minimize the danger of fire if the heating cable of a Multitube bundle is damaged or improperly installed, use a Ground Fault Equipment Protection Device. Electrical fault currents may be insufficient to trip a conventional circuit breaker.

For ground fault protection, the IEEE 515: (www.ansi.org) standard for heating cables recommends the use of GFEPDs with a nominal 30 milliampere trip level for "piping systems in classified areas, those areas requiring a high degree of maintenance, or which may be exposed to physical abuse or corrosive atmospheres".

4.0 TUBE AND FITTINGS ASSEMBLY AND INSTALLATION INSTRUCTIONS

4.1 **Component Inspection:** Prior to assembly, a careful examination of the Tube and Fittings must be performed. All components must be checked for correct style, size, material, seal, and length. Inspect the Fitting and sealing surfaces for burrs, nicks, corrosion, missing seal or other imperfections. Do NOT use any component that displays any signs of nonconformance.

4.2 **Tube and Fitting Assembly:** Do not assemble a Parker Fitting with a Tube that is not specifically listed by Parker for that Fitting, unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division. The Tube must meet the requirements specified to the Fitting.

The Parker published instructions must be followed for assembling the Fittings to a Tube. These instructions are provided in the Parker Fitting catalog for the specific Parker Fitting being used, or by calling 1-800-CPARKER, or at www.parker.com.

4.3 **Related Accessories:** Do not preset or flange Parker Fitting components using another manufacturer's equipment or procedures unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division. Tube, Fitting component and tooling must be check for correct style, size and material. Operation and maintenance of Related Accessories must be in accordance with the operation manual for the designated Accessory.

4.4 **Securement:** In many applications, it may be necessary to restrain, protect, or guide the Tube to protect it from damage by unnecessary flexing, pressure surges, vibration, and contact with other mechanical components. Care must be taken to insure such restraints do not introduce additional stress or wear points.

4.5 **Proper Connection of Ports:** Proper physical installation of the Tube Assembly requires a correctly installed port connection insuring that no torque is transferred to the Tube when the Fittings are being tightened or otherwise during use.

4.6 **External Damage:** Proper installation is not complete without insuring that tensile loads, side loads, flattening, potential abrasion, thread damage or damage to sealing surfaces are corrected or eliminated. See instruction 2.10.

4.7 **System Checkout:** All air entrapment must be eliminated and the system pressurized to the maximum system pressure (at or below the Tube Assembly maximum working pressure) and checked for proper function and freedom from leaks. Personnel must stay out of potential hazardous areas while testing and using.

4.8 **Routing:** The Tube Assembly should be routed in such a manner so if a failure does occur, the escaping media will not cause personal injury or property damage. In addition, if fluid media comes in contact with hot surfaces, open flame or sparks, a fire or explosion may occur. See section 2.4.

5.0 HOSE AND FITTING MAINTENANCE AND REPLACEMENT INSTRUCTIONS

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5.1 Even with proper selection and installation, Hose life may be significantly reduced without a continuing maintenance program. The severity of the application, risk potential from a possible Hose failure, and experience with any Hose failures in the application or in similar applications should determine the frequency of the inspection and the replacement for the Products so that Products are replaced before any failure occurs. Certain products require maintenance and inspection per industry requirements. Failure to adhere to these requirements may lead to premature failure. A maintenance program must be established and followed by the user and, at minimum, must include instructions 5.2 through 5.7

5.2 **Visual Inspection Hose/Fitting:** Any of the following conditions require immediate shut down and replacement of the Hose Assembly:
- Fitting slippage on Hose;
- Damaged, cracked, cut or abraded cover (any reinforcement exposed);
- Hard, stiff, heat cracked, or charred Hose;
- Cracked, damaged, or badly corroded Fittings;
- Leaks at Fitting or in Hose;
- Kinked, crushed, flattened or twisted Hose; and
- Blistered, soft, degraded, or loose cover.

5.3 **Visual Inspection All Other:** The following items must be tightened, repaired, corrected or replaced as required:
- Leaking port conditions;
- Excess dirt buildup;/
- Worn clamps, guards or shields; and
- System fluid level, fluid type, and any air entrapment.

5.4 **Functional Test:** Operate the system at maximum operating pressure and check for possible malfunctions and leaks. Personnel must avoid potential hazardous areas while testing and using the system. See section 2.2.

5.5 **Replacement Intervals:** Hose assemblies and elastomeric seals used on Hose Fittings and adapters will eventually age, harden, wear and deteriorate under thermal cycling and compression set. Hose Assemblies and elastomeric seals should be inspected and replaced at specific replacement intervals, based on previous service life, government or industry recommendations, or when failures could result in unacceptable downtime, damage, or injury risk. See section 1.2. Hose and Fittings may be subjected to internal mechanical and/or chemical wear from the conveying fluid and may fail without warning. The user must determine the product life under such circumstances by testing. Also see section 2.5.

5.6 **Hose Inspection and Failure:** Hydraulic power is accomplished by utilizing high pressure fluids to transfer energy and do work. Hoses, Fittings and Hose Assemblies all contribute to this by transmitting fluids at high pressures. Fluids under pressure can be dangerous and potentially lethal and, therefore, extreme caution must be exercised when working with fluids under pressure and handling the Hoses transporting the fluids. From time to time, Hose Assemblies will fail if they are not replaced at proper time intervals. Usually these failures are the result of some form of misapplication, abuse, wear or failure to perform proper maintenance. When Hoses fail, generally the high pressure fluids inside escape in a stream which may or may not be visible to the user. Under no circumstances should the user attempt to locate the leak by “feeling” with their hands or any other part of their body. High pressure fluids can and will penetrate the skin and cause severe tissue damage and possibly loss of limb. Even seemingly minor hydraulic fluid injection injuries must be treated immediately by a physician with knowledge of the tissue damaging properties of hydraulic fluid.

If a Hose failure occurs, immediately shut down the equipment and leave the area until pressure has been completely released from the Hose Assembly. Simply shutting down the hydraulic pump may or may not eliminate the pressure in the Hose Assembly. Many times check valves, etc., are employed in a system and can cause pressure to remain in a Hose Assembly even when pumps or equipment are not operating. Tiny holes in the Hose, commonly known as pinholes, can eject small, dangerously powerful but hard to see streams of hydraulic fluid. It may take several minutes or even hours for the pressure to be relieved so that the Hose Assembly may be examined safely.

Once the pressure has been reduced to zero, the Hose Assembly may be taken off the equipment and examined. It must always be replaced if a failure has occurred. Never attempt to patch or repair a Hose Assembly that has failed. Consult the nearest Parker distributor or the appropriate Parker division for Hose Assembly replacement information.

Never touch or examine a failed Hose Assembly unless it is obvious that the Hose no longer contains fluid under pressure. The high pressure fluid is extremely dangerous and can cause serious and potentially fatal injury.

5.7 **Elastomeric seals:** Elastomeric seals will eventually age, harden, wear and deteriorate under thermal cycling and compression set. Elastomeric seals should be inspected and replaced.

5.8 **Refrigerant gases:** Special care should be taken when working with refrigeration systems. Sudden escape of refrigerant gases can cause blindness if the escaping gases contact the eye and can cause freezing or other severe injuries if it contacts any other portion of the body.

5.9 **Compressed natural gas (CNG):** Parker CNG Hose Assemblies should be tested after installation and before use, and at least on a monthly basis per instructions provided on the Hose Assembly tag. The recommended procedure is to pressurize the Hose and check for leaks and to visually inspect the Hose for damage and to perform an electrical resistance test.

Caution: Matches, candles, open flame or other sources of ignition shall not be used for Hose inspection. Leak check solutions should be rinsed off after use.

6.0 HOSE STORAGE

6.1 **Age Control:** Hose and Hose Assemblies must be stored in a manner that facilitates age control and first-in and first-out usage based on manufacturing date of the Hose and Hose Assemblies. Unless otherwise specified by the manufacturer or defined by local laws and regulations:

6.1.1 The shelf life of rubber hose in bulk form or hose made from two or more materials is 28 quarters (7 years) from the date of manufacture, with an extension of 12 quarters (3 years), if stored in accordance with ISO 2230;

6.1.2 The shelf life of thermoplastic and polytetrafluoroethylene hose is considered to be unlimited;

6.1.3 Hose assemblies that pass visual inspection and proof test shall not be stored for longer than 2 years.

6.1.4 **Storage:** Stored Hose and Hose Assemblies must not be subjected to damage that could reduce their expected service life and must be placed in a cool, dark and dry area with the ends capped. Stored Hose and Hose Assemblies must not be exposed to temperature extremes, ozone, oils, corrosive liquids or fumes, solvents, high humidity, rodents, insects, ultraviolet light, electromagnetic fields or radioactive materials.

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Offer of Sale

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1. Definitions. As used herein, the following terms have the meanings indicated.

Buyer:	means any customer receiving a Quote for Products.
Buyer's Property:	means any tools, patterns, plans, drawings, designs, specifications materials, equipment, or information furnished by Buyer, or which are or become Buyer's property.
Confidential Information:	means any technical, commercial, or other proprietary information of Seller, including, without limitation, pricing, technical drawings or prints and/or part lists, which has been or will be disclosed, delivered, or made available, whether directly or indirectly, to Buyer.
Goods:	means any tangible part, system or component to be supplied by Seller.
Intellectual Property Rights:	means any patents, trademarks, copyrights, trade dress, trade secrets or similar rights.
Products:	means the Goods, Services and/or Software as described in a Quote.
Quote:	means the offer or proposal made by Seller to Buyer for the supply of Products.
Seller:	means Parker-Hannifin Corporation, including all divisions, subsidiaries and businesses selling Products under these Terms.
Seller's IP:	means patents, trademarks, copyrights, or other intellectual property rights relating to the Products, including without limitation, names, designs, images, drawings, models, software, templates, information, any improvements or creations or other intellectual property developed prior to or during the relationship contemplated herein.
Services:	means any services to be provided by Seller.
Software:	means any software related to the Goods, whether embedded or separately downloaded.
Special Tooling:	means equipment acquired by Seller or otherwise owned by Seller necessary to manufacture Goods, including but not limited to tools, jigs, and fixtures.
Terms:	means the terms and conditions of this Offer of Sale.

2. Terms. All sales of Products by Seller will be governed by, and are expressly conditioned upon Buyer's assent to, these Terms. These Terms are incorporated into any Quote provided by Seller to Buyer. Buyer's order for any Products whether communicated to Seller verbally, in writing, by electronic data interface or other electronic commerce, shall constitute acceptance of these Terms. Seller objects to any contrary or additional terms or conditions of Buyer. Reference in Seller's order acknowledgement to Buyer's purchase order or purchase order number shall in no way constitute an acceptance of any of Buyer's terms or conditions of purchase. Any Quote made by Seller to Buyer shall be considered a firm and definite offer and shall not be deemed to be otherwise despite any language on the face of the Quote. Seller reserves all rights to accept or reject any purported acceptance by Buyer to Seller's Quote if such purported acceptance attempts to vary the terms of the Quote. If Seller ships Products after Buyer issues an acceptance to the Quote, any additional or different terms proposed by Buyer will not become part of the parties' business relationship unless agreed to in a writing that is signed by an authorized representative of Seller, excluding email correspondence. If the transaction proceeds without such agreement on the part of Seller, the business relationship will be governed solely by these Terms and the specific terms in Seller's Quote.

3. Price; Payment. The Products set forth in the Quote are offered for sale at the prices indicated in the Quote. Unless otherwise specifically stated in the Quote, prices are valid for thirty (30) days and do not include any sales, use, or other taxes or duties. Seller reserves the right to modify prices for any reason and at any time by giving ten (10) days prior written notice. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2020). All sales are contingent upon credit approval and full payment for all purchases is due thirty (30) days from the date of invoice (or such date as may be specified in the Quote). Under any circumstances, Buyer may not withhold or suspend payment of any amounts due and payable as a deduction, set-off or recoupment of any amount, claim or dispute with Seller. Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law. Seller reserves the right to require advance payment or provision of securities for first and subsequent deliveries if there is any doubt, in Seller's sole determination, regarding the Buyer's creditworthiness or for other business reasons. If the requested advance payment or securities are not provided to Seller's satisfaction, Seller reserves the right to suspend performance or reject the purchase order, in whole or in part, without prejudice to Seller's other rights or remedies, including the right to full compensation. Seller may revoke or shorten any payment periods previously granted in Seller's sole determination. The rights and remedies herein reserved to Seller are cumulative and in addition to any other or further rights and remedies available at law or in equity. No waiver by Seller of any breach by Buyer of any provision of these terms will constitute a waiver by Seller of any other breach of such provision.

4. Shipment; Delivery; Title and Risk of Loss. All delivery dates are approximate, and Seller is not responsible for damages or additional costs resulting from any delay. All deliveries are subject to our ability to procure materials from our suppliers. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the carrier at Seller's facility. Unless otherwise agreed prior to shipment and for domestic delivery locations only, Seller will select and arrange, at Buyer's sole expense, the carrier and means of delivery. When Seller selects and arranges the carrier and means of delivery, freight and insurance costs for shipment to the designated delivery location will be prepaid by Seller and added as a separate line item to the invoice. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions. Buyer shall not return or repackage any Products without the prior written authorization from Seller, and any return shall be at the sole cost and expense of Buyer.

5. Warranty. The warranty for the Products is as follows:
(i) Goods are warranted against defects in material or workmanship for a period of twelve (12) months from the date of delivery or 2,000 hours of use, whichever occurs first; (ii) Services shall be performed in accordance with generally accepted practices and using the degree of care and skill that is ordinarily exercised and customary in the field to which the Services pertain and are warranted for a period of six (6) months from the date of completion of the Services; and (iii) Software is only warranted to perform in accordance with applicable specifications provided by Seller to Buyer for ninety (90) days from the date of delivery or, when downloaded by a Buyer or end-user, from the date of the initial download. All prices are based upon the exclusive limited warranty stated above, and upon the following disclaimer: EXEMPTION CLAUSE; DISCLAIMER OF WARRANTY, CONDITIONS, REPRESENTATIONS: THIS WARRANTY IS THE SOLE AND ENTIRE WARRANTY, CONDITION, AND REPRESENTATION, PERTAINING TO PRODUCTS. SELLER DISCLAIMS ALL OTHER WARRANTIES, CONDITIONS, AND REPRESENTATIONS, WHETHER STATUTORY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THOSE RELATING TO DESIGN, NONINFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. SELLER DOES NOT WARRANT THAT THE SOFTWARE IS ERROR-FREE OR FAULT-TOLERANT, OR THAT BUYER'S USE THEREOF WILL BE SECURE OR UNINTERRUPTED, UNLESS OTHERWISE AUTHORIZED IN WRITING BY SELLER, THE SOFTWARE SHALL NOT BE USED IN CONNECTION WITH HAZARDOUS OR HIGH-RISK ACTIVITIES OR ENVIRONMENTS. EXCEPT AS EXPRESSLY STATED HEREIN, ALL PRODUCTS ARE PROVIDED "AS IS".

6. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to Seller within ten (10) days of delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the non-conformance is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

7. LIMITATION OF LIABILITY. IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE THE NON-CONFORMING PRODUCTS, RE-PERFORM THE SERVICES, OR REFUND THE PURCHASE PRICE PAID WITHIN A REASONABLE PERIOD OF TIME. IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING ANY LOSS OF REVENUE OR PROFITS, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE PAID FOR THE PRODUCTS.

8. Confidential Information. Buyer acknowledges and agrees that Confidential Information has been and will be received in confidence and will remain the property of Seller. Buyer further agrees that it will not use Seller's Confidential Information for any purpose other than for the benefit of Seller and shall return all such Confidential Information to Seller within thirty (30) days upon request.

9. Loss to Buyer's Property. Buyer's Property will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the Products manufactured using Buyer's Property. Also, Seller shall not be responsible for any loss or damage to Buyer's Property while it is in Seller's possession or control.

10. Special Tooling. Seller may impose a tooling charge for any Special Tooling. Special Tooling shall be and remain Seller's property. In no event will Buyer acquire any interest in the Special Tooling, even if such Special Tooling has been specially converted or adapted for manufacture of Goods for Buyer and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any Special Tooling or other property owned by Seller in its sole determination at any time.

11. Security Interest. To secure payment of all sums due from Buyer, Seller retains a security interest in all Products delivered to Buyer and, Buyer's acceptance of these Terms is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect Seller's security interest.

12. User Responsibility. Buyer, through its own analysis and testing, is solely responsible for making the final selection of the Products and assuring that all performance, endurance, maintenance, safety and warning requirements of the application of the Products are met. Buyer must analyze all aspects of the application and follow applicable industry standards, specifications, and any technical information provided with the Quote or the Products, such as Seller's instructions, guides and specifications. If Seller provides options of or for Products based upon data or specifications provided by Buyer, Buyer is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products. In the event Buyer is not the end-user of the Products, Buyer will ensure such end-user complies with this paragraph.

13. Use of Products, Indemnity by Buyer. Use of Products, Indemnity by Buyer. Buyer shall comply with all instructions, guides and specifications provided by Seller with the Quote or the Products. If Buyer uses or resells the Products in any way prohibited by Seller's instructions, guides or specifications, or Buyer otherwise fails to comply with Seller's instructions, guides and specifications, Buyer acknowledges that any such use, resale, or non-compliance is at Buyer's sole risk. Further, Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense

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costs), whether for personal injury, property damage, intellectual property infringement or any other claim, arising out of or in connection with: (a) improper selection, design, specification, application, or any misuse of Products; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of Buyer's Property; (d) damage to the Products from an external cause, repair or attempted repair by anyone other than Seller, failure to follow instructions, guides and specifications provided by Seller, use with goods not provided by Seller, or opening, modifying, deconstructing, tampering with or repackaging the Products; or (e) Buyer's failure to comply with these Terms, including any legal or administrative proceedings, collection efforts, or other actions arising from or relating to such failure to comply. Seller shall not indemnify Buyer under any circumstance except as otherwise provided in these Terms.

14. Cancellations and Changes. Buyer may not cancel or modify, including but not limited to movement of delivery dates for the Products, any order for any reason except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage and any additional expense. Seller, at any time, may change features, specifications, designs and availability of Products.

15. Assignment. Buyer may not assign its rights or obligations without the prior written consent of Seller.

16. Force Majeure. Seller is not liable for delay or failure to perform any of its obligations by reason of any events or circumstances beyond its reasonable control. Such circumstances include without limitation: accidents, labor disputes or stoppages, government acts or orders, acts of nature, pandemics, epidemics, other widespread illness, or public health emergency, cyber related disruptions, cyber-attacks, ransomware sabotage, delays or failures in delivery from carriers or suppliers, shortages of materials, sudden increases in the price of raw material or components, shutdowns or slowdowns affecting the supply of raw materials or components, or the transportation thereof, oil shortages or oil price increases, energy crisis, energy or fuel interruption, war (whether declared or not) or the serious threat of same, riots, rebellions, acts of terrorism, embargoes, fire or any reason whether similar to the foregoing or otherwise. Seller will resume performance as soon as practicable after the event of force majeure has been removed. All delivery dates affected by an event of force majeure shall be tolled for the duration of such event of force majeure and rescheduled for mutually agreed dates as soon as practicable after the event of force majeure ceases to exist. The right to allocate capacity is in the Seller's sole discretion. An event of force majeure shall not include financial distress, insolvency, bankruptcy, or other similar conditions affecting one of the parties, affiliates and/or subcontractors. An event of force majeure in the meaning of these Terms means any circumstances beyond Seller's control that permanently or temporarily hinders performance, even where that circumstance was already foreseen. Buyer shall not be entitled to cancel any orders following its claim of an event of force majeure.

17. Waiver and Severability. Failure to enforce any provision of these Terms will not invalidate that provision; nor will any such failure prejudice either party's right to enforce that provision in the future. Invalidation of any provision of these Terms shall not invalidate any other provision herein and, the remaining provisions will remain in full force and effect.

18. Duration. Unless otherwise stated in the Quote, any agreement governed by or arising from these Terms shall: (a) be for an initial duration of one (1) year; and (b) shall automatically renew for successive one-year terms unless terminated by Buyer with at least 180-days written notice to Seller or if Seller terminates the agreement pursuant to Section 19 of these Terms.

19. Termination. Seller may, without liability to Buyer, terminate any agreement governed by or arising from these Terms for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate, in writing, if Buyer: (a) breaches any provision of these Terms, (b) becomes or is deemed insolvent, (c) appoints or has appointed a trustee, receiver or custodian for all or any part of Buyer's property,(d) files a petition for relief in bankruptcy on its own behalf, or one is filed against Buyer by a third party, (e) makes an assignment for the benefit of creditors; or (f) dissolves its business or liquidates all or a majority of its assets.

20. Ownership of Rights. Buyer agrees that (a) Seller (and/or its affiliates) owns or is the valid licensee of Seller's IP and (b) the furnishing of information, related documents or other materials by Seller to Buyer does not grant or transfer any ownership interest or license in or to Seller's IP to Buyer, unless expressly agreed in writing. Without limiting the foregoing, Seller retains ownership of all Software supplied to Buyer. In no event shall Buyer obtain any greater right in and to the Software than a right in a license limited to the use thereof and subject to compliance with any other terms provided with the Software. Buyer further agrees that it will not, directly or through intermediaries, reverse engineer, decompile, or disassemble any Software (including firmware) comprising or contained within a Product, except and only to the extent that such activity may be expressly permitted, either by applicable law or, in the case of open source software, the applicable open source license.

21. Indemnity for Infringement of Intellectual Property Rights. Seller is not liable for infringement of any Intellectual Property Rights except as provided in this Section. Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on a third-party claim that one or more of the Products infringes the Intellectual Property Rights of a third party in the country of delivery of the Products by Seller to Buyer. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of any such claim, and Seller having sole control over the defense of the claim including all negotiations for settlement or compromise. If one or more Products is subject to such a claim, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Products, replace or modify the Products to render them non-infringing, or offer to accept return of the Products and refund the purchase price less a reasonable allowance for depreciation. Seller has no obligation or liability for any claim of infringement: (i) arising from information provided by Buyer (including Seller's use of Buyer's Property); or (ii) directed to any Products for which the designs are specified in whole or part by Buyer; or (iii) resulting from the modification, combination or use in a system of any Products. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for claims of infringement of Intellectual Property Rights.

22. Governing Law. These Terms, the terms of any Quote, and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to the sale and delivery of the Products.

23. Entire Agreement. These Terms, along with the terms set forth in the Quote, forms the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale and purchase. In the event of a conflict between any term set forth in the Quote and these Terms, the terms set forth in the Quote shall prevail. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter shall have no effect. No modification to these Terms will be binding on Seller unless agreed to in a writing that is signed by an authorized representative of Seller, excluding email correspondence, 'clickwrap' or other purported electronic assent to different or additional terms. Sections 2-25 of these Terms shall survive termination or cancellation of any agreement governed by or arising from these Terms.

24. No 'Wrap' Agreements/No Authority to Bind. Seller's clicking any buttons or any similar action, such as clicking "I Agree" or "Confirm," to utilize Buyer's software or webpage for the placement of orders, is NOT an agreement to Buyer's Terms and Conditions. NO EMPLOYEE, AGENT OR REPRESENTATIVE OF SELLER HAS THE AUTHORITY TO BIND SELLER BY THE ACT OF CLICKING ANY BUTTON OR SIMILAR ACTION ON BUYER'S WEBSITE OR PORTAL.

25. Compliance with Laws. Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards, including those of the United States of America, and the country or countries in which Buyer may operate, including without limitation the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act"), U.S. and E.U. export control and sanctions laws ("Export Laws"), the U.S. Food Drug and Cosmetic Act ("FDCA"), and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), each as currently amended. Buyer agrees to indemnify, defend, and hold harmless Seller from the consequences of any violation of such laws, regulations and standards by Buyer, its employees or agents. Buyer represents that it is familiar with all applicable provisions of the FCPA, the Anti-Kickback Act, Export Laws, the FDCA and the FDA and certifies that Buyer will adhere to the requirements thereof and not take any action that would make Seller violate such requirements. Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly, to any governmental official, foreign political party or official thereof, candidate for foreign political office, or commercial entity or person, for any improper purpose, including the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller. Buyer further represents and agrees that it will not receive, use, service, transfer or ship any Products from Seller in a manner or for a purpose that violates Export Laws or would cause Seller to be in violation of Export Laws. Buyer agrees to promptly and reliably provide Seller all requested information or documents, including end-user statements and other written assurances, concerning Buyer's ongoing compliance with Export Law.

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Aerospace

Key Markets

Aftermarket services
Commercial transports
Engines
General & business aviation
Helicopters
Launch vehicles
Military aircraft
Missiles
Power generation
Regional transports
Unmanned aerial vehicles

Key Products

Control systems & actuation products
Engine systems & components
Fluid conveyance systems & components
Fluid metering, delivery & atomization devices
Fuel systems & components
Fuel tank inerting systems
Hydraulic systems & components
Thermal management
Wheels & brakes

Automation

Key Markets

Alternative energy
Conveyor & material handling
Factory automation
Food & beverage
Life sciences & medical
Machine tools
Packaging machinery
Paper machinery
Plastics machinery
Primary metals
Safety & security
Semiconductor & electronics
Transportation & automotive

Key Products

AC/DC drives & systems
Air preparation
Electric actuators, gantry robots & slides
Human machine interfaces
Inverters
Manifolds
Miniature fluidics
Pneumatic actuators & grippers
Pneumatic valves & controls
Rotary actuators
Stepper motors, servo motors, drives & controls
Structural extrusions
Vacuum generators, cups & sensors

Climate & Industrial Controls

Key Markets

Agriculture
Air conditioning
Construction Machinery
Food & beverage
Industrial machinery
Life sciences
Oil & gas
Precision cooling
Process
Refrigeration
Transportation

Key Products

Accumulators
Advanced actuators
CO_2 controls
Electronic controllers
Filter driers
Hand shut-off valves
Heat exchangers
Hose & fittings
Pressure regulating valves
Refrigerant distributors
Safety relief valves
Smart pumps
Solenoid valves
Thermostatic expansion valves

Filtration

Key Markets

Aerospace
Food & beverage
Industrial plant & equipment
Life sciences
Marine
Mobile equipment
Oil & gas
Power generation & renewable energy
Process
Transportation
Water Purification

Key Products

Analytical gas generators
Compressed air filters & dryers
Engine air, coolant, fuel & oil filtration systems
Fluid condition monitoring systems
Hydraulic & lubrication filters
Hydrogen, nitrogen & zero air generators
Instrumentation filters
Membrane & fiber filters
Microfiltration
Sterile air filtration
Water desalination & purification filters & systems

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Fluid Connectors

Key Markets

Aerial lift
Agriculture
Bulk chemical handling
Construction machinery
Food & beverage
Fuel & gas delivery
Industrial machinery
Life sciences
Marine
Mining
Mobile
Oil & gas
Renewable energy
Transportation

Key Products

Check valves
Connectors for low pressure fluid conveyance
Deep sea umbilicals
Diagnostic equipment
Hose couplings
Industrial hose
Mooring systems & power cables
PTFE hose & tubing
Quick couplings
Rubber & thermoplastic hose
Tube fittings & adapters
Tubing & plastic fittings

Hydraulics

Key Markets

Aerial lift
Agriculture
Alternative energy
Construction machinery
Forestry
Industrial machinery
Machine tools
Marine
Material handling
Mining
Oil & gas
Power generation
Refuse vehicles
Renewable energy
Truck hydraulics
Turf equipment

Key Products

Accumulators
Cartridge valves
Electrohydraulic actuators
Human machine interfaces
Hybrid drives
Hydraulic cylinders
Hydraulic motors & pumps
Hydraulic systems
Hydraulic valves & controls
Hydrostatic steering
Integrated hydraulic circuits
Power take-offs
Power units
Rotary actuators
Sensors

Instrumentation

Key Markets

Alternative fuels
Biopharmaceuticals
Chemical & refining
Food & beverage
Marine & shipbuilding
Medical & dental
Microelectronics
Nuclear Power
Offshore oil exploration
Oil & gas
Pharmaceuticals
Power generation
Pulp & paper
Steel
Water/wastewater

Key Products

Analytical Instruments
Analytical sample conditioning products & systems
Chemical injection fittings & valves
Fluoropolymer chemical delivery fittings, valves & pumps
High purity gas delivery fittings, valves, regulators & digital flow controllers
Industrial mass flow meters/ controllers
Process control double block & bleeds
Process control fittings, valves, regulators & manifold valves
Permanent no-weld tube fittings
Precision industrial regulators & flow controllers

Seal

Key Markets

Aerospace
Chemical processing
Consumer
Fluid power
General industrial
Information technology
Life sciences
Microelectronics
Military
Oil & gas
Power generation
Renewable energy
Telecommunications
Transportation

Key Products

Dynamic seals
Elastomeric o-rings
Electro-medical instrument design & assembly
EMI shielding
Extruded & precision-cut, fabricated elastomeric seals
High temperature metal seals
Homogeneous & inserted elastomeric shapes
Medical device fabrication & assembly
Metal & plastic retained composite seals
Shielded optical windows
Silicone tubing & extrusions
Thermal management
Vibration dampening

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Parker Fluid Connectors Group
North American Divisions & Distribution Service Centers

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Available in inch and metric sizes covering SAE, BSP, DIN, GAZ, JIS and ISO thread configurations, manufactured from steel, stainless steel, brass, aluminum, nylon and thermoplastic.

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Available in a wide variety of sizes and materials including rubber, wire-reinforced, thermoplastic, hybrid and custom compounds.

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Quick Coupling Division
Minneapolis, MN
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fax 419 878 7001
fax 419 878 7420
(FCG Kit Operations)

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fax 905 876 1958
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