



# Pneumatic Tie Rod Style Cylinders

Series MA / MAN NFPA Industrial Air Cylinders

aerospace  
climate control  
electromechanical  
filtration  
fluid & gas handling  
hydraulics  
pneumatics  
process control  
sealing & shielding



ENGINEERING YOUR SUCCESS.

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## Series MA / MAN Pneumatic Tie Rod Cylinders

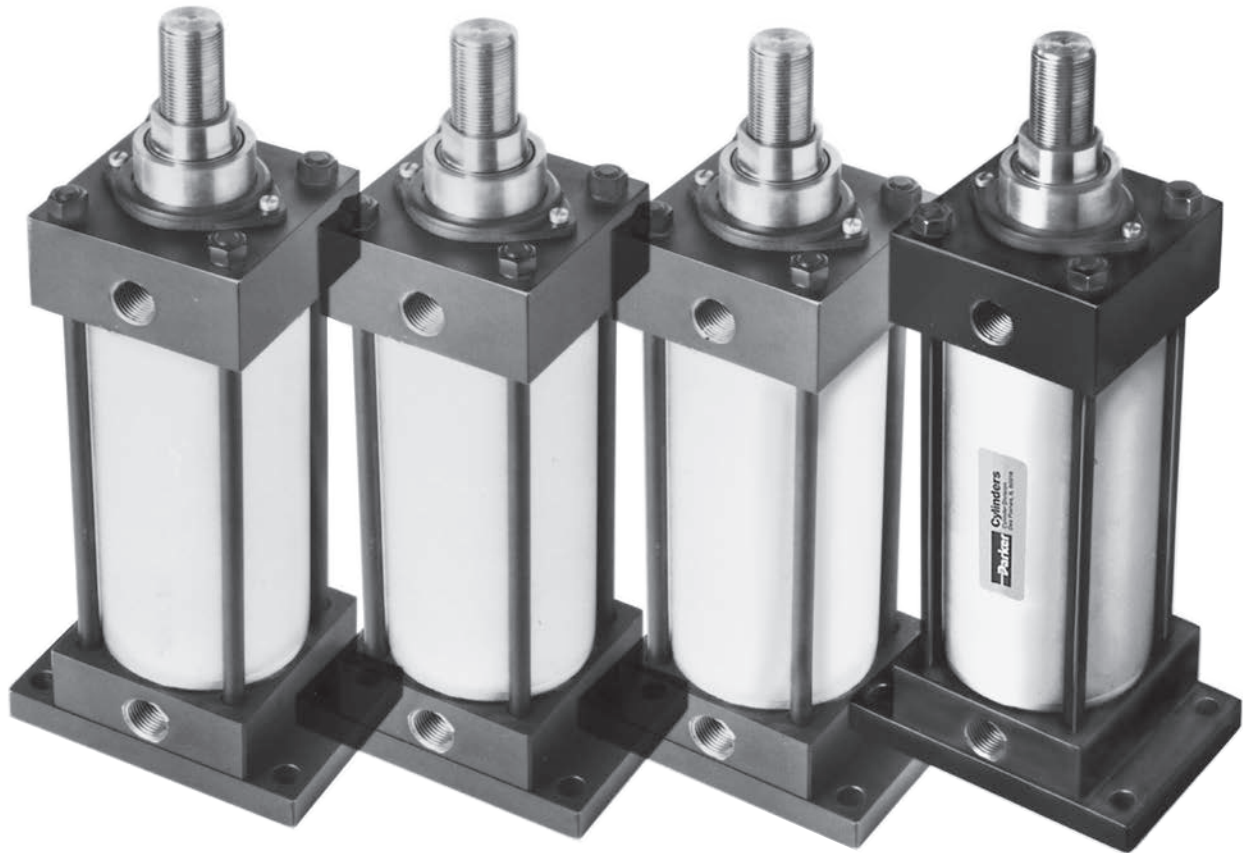
The No-Compromise Design  
NFPA Air Cylinder from Parker

Proven Parker reliability at a cost that makes  
it right for your air cylinder application.

**Series MA** for filtered and lubricated compressed air

**Series MAN** for filtered and dry compressed air

- 200 psi nominal air pressure
- Standard bore sizes: 1½", 2", 2½", 3¼", 4", 5" and 6"
- 11 Standard mounting styles



**Exclusive with the New Parker  
Check Seal Cushions:**

- Faster Cycle Time
- Easy Precision Adjustment
- Minimum Wear
- Low Pressure Drop

# Parker Series MA / MAN NFPA Industrial Air Cylinders

Parker Series MA / MAN air cylinders meet or exceed NFPA Pneumatic Standards and except for Tie Rod Mount Styles conform to ANSI/(NFPA) T3.6.7R3 - 2009 for mounting dimensions of Square Head Industrial Fluid Power Cylinders.

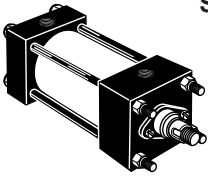
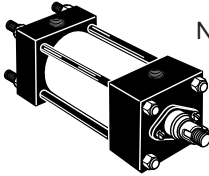
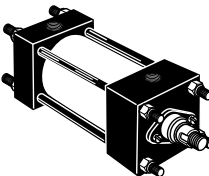
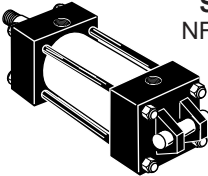
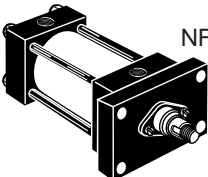
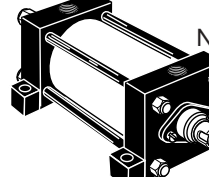
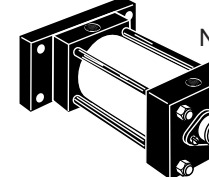
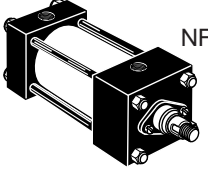
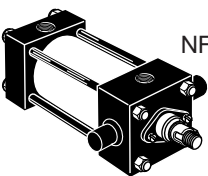
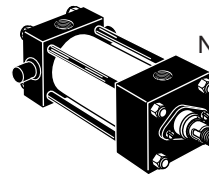
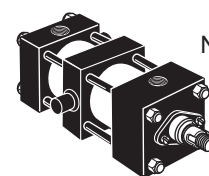
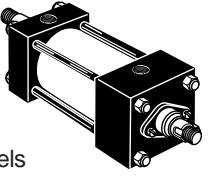
For heavy-duty applications see the Parker Series 2A HY08-0910 Catalog.

## Standard Specifications

- Seven bore sizes – 1½" through 6"
- Three rod diameters – 5/8", 1" and 1³/8"
- Eleven mounting styles
- Choice of three rod end styles
- Cushions at head, cap or both ends
- Double rod models in six mounting styles
- JIC interchangeable
- Standard Temperature – -10°F to +165°F with standard seals; -10°F to +250°F with fluorocarbon seals.

For complete ordering information see the How to Order and Model Number pages.

## Available Mountings

Tie Rods Extended Head End <b>Style TB</b> 	Tie Rods Extended Cap End <b>Style TC</b> NFPA MX2 	Tie Rods Extended Both Ends <b>Style TD</b> 	Cap Fixed Clevis <b>Style BB</b> NFPA MP1 
Head Rectangular Flange <b>Style J</b> NFPA MF1 	Side Lugs <b>Style C</b> NFPA MS2 	Cap Rectangular Flange <b>Style H</b> NFPA MF2 	Side Tapped <b>Style F</b> NFPA MS4 
Head Trunnion <b>Style D</b> NFPA MT1 	Cap Trunnion <b>Style DB</b> NFPA MT2 	Intermediate Trunnion <b>Style DD</b> NFPA MT4 	
Double Rod Cylinders 			
See Double Rod Models page for styles available.			

## Parker Series MA / MAN

### The inside story on the no-compromise design

Here's an inside look at the solid design and construction that makes Parker Series MA / MAN the high performing, longer-lasting, economical choice for your air cylinder applications.

**Hard chrome-plated and polished piston rod** of 100,000 psi yield, high tensile strength steel for reliable performance and long rod seal life, less friction.

**Rugged square steel heads and caps** resist shock and provide maximum strength within minimum space. Factory-treated to resist corrosion.

**Piston rod lipseal/wiper** combination is completely self-compensating for zero leakage at all pressures. Keeps pressure in, contamination out.

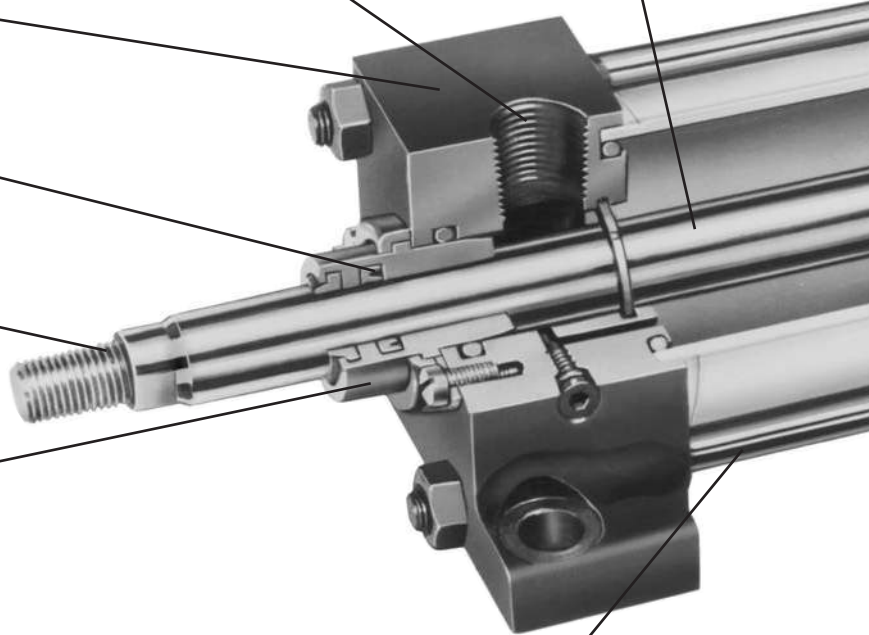
**High strength piston rod end stud** (125,000 psi minimum yield steel) with rolled threads. Choice of male or female thread at no extra cost. Anaerobic adhesive is used to permanently lock the stud to the rod.

**Bolt-on, high strength, rod gland** removes screwdriver-easy on all mounting styles and bore sizes for fast, on-the-job rod seal replacement if needed.

**Extra long inboard bearing** surface insures lubrication from within the cylinder for longer life.

**Factory prelubrication of rod and piston seal surfaces** (rod bearing and cylinder bore surfaces).

**Ports N.P.T.F. ports** are standard.



**Tie rods are 100,000 psi minimum yield steel** with rolled threads for added strength. High strength nuts provide extra margin of safety.

## Parker's New Exclusive Check Seal Cushions

### For Increased Productivity and Maximum Performance

The Parker check seal cushion is new and different from ordinary cushion designs. It combines the sealing capabilities of a lipseal for efficient capture of air for effective cushioning with check valve action for quick stroke reversal.

The lipseal design also provides "floating cushions" to assure cushion repeatability and long life. At the start of the stroke in each direction, the check valve design allows full fluid flow to piston face with a minimum pressure drop for maximum power stroke.

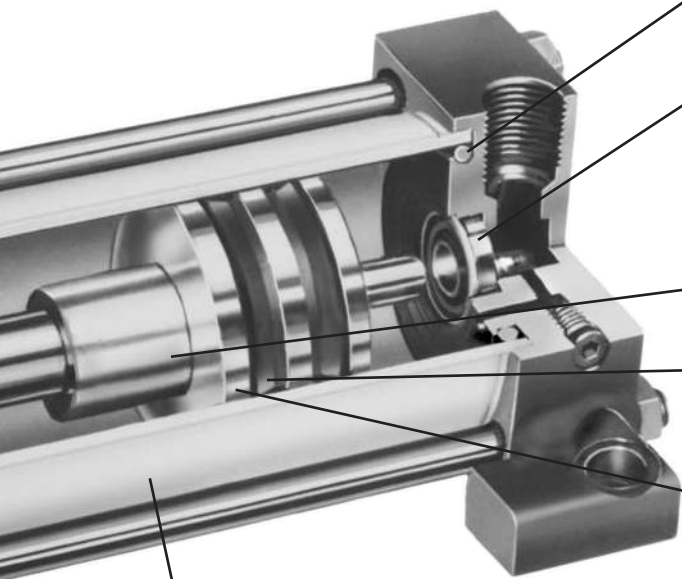
Additional benefits of the new check seal cushions are increased productivity and top performance for faster cycle time, minimum wear, easy adjustment and low pressure drop.

The basic cushion design is optional and available on either the head end, cap end or both ends without change in envelope or mounting dimensions. A cushion adjusting needle is supplied for easy, precise adjustment on all bore sizes.

At the **head end** of the cylinder, the check seal is assembled into a groove in the central bore of the head, with the groove being slightly wider and larger in diameter than the check seal, so that it floats laterally and radially within predetermined limits. The check seal has four grooves molded into the face to provide flow passages; the assembly is put together with the lip of the seal facing toward the inside of the cylinder.

A cushion sleeve is mounted on the piston rod, so that as the rod extends, air ahead of the piston flows freely out the head-end port. When the end of the cushion sleeve reaches the lip of the check seal, it seals on the wall of the groove, trapping air for cushioning.

As pressure is applied to the head-end port on retraction, the air forces the seal towards the inside of the cylinder.



**Cylinder body O-ring seals** are pressure-actuated for positive sealing. Commercially available and easily replaced, if necessary.

**Unique “check seal” cushions** with molded flow passages combine the benefits of floating cushions with check valve action, provides effective cushioning and quick stroke reversal for more cycles per hour and higher production rates. Cushion needle valves make precise adjustment quick and easy.

**Longest standard cushions in the industry** for maximum cushioning capability.

**Fully dynamic, self-compensating Lipseal™ piston seals** designed for no-leak service at all operating pressures; easily replaced, if needed, without removing piston from rod.

**One-piece, nodular iron piston**, positively locked to rod – retains lubrication and provides a wide bearing surface. An anaerobic adhesive is used to permanently lock and seal the piston to the rod.

**Piston-to-rod thread diameter** increases with rod diameter for added strength and is equal to outer end Style 4 thread on all rod sizes.

**Aluminum Alloy** cylinder body with corrosion resistant smooth hard coated bore on 1½" and 2" bores.

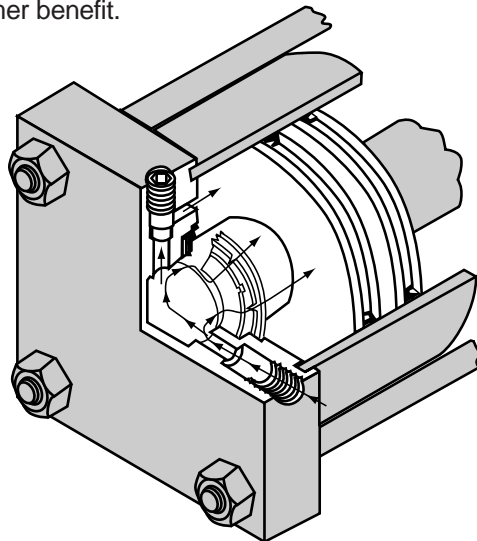
**Chrome Plated Steel Tubing** honed to a 15 micro inch finish on 2½", 3¼", 4", 5" and 6" bores (cylinders supplied with reed switches are equipped with aluminum barrels).

The air then flows around the OD of the seal and through the flutes of the seal washer. Full-flow, quick starts with little or no pressure drop is just one of the major benefits of the design.

At the **cap end** of the cylinder, the check seal is assembled into a cavity in the face of the cap with four beads molded on the OD to provide a flow passage. A fluted washer and retaining ring, rather than a groove, and a cushion spear which extends from the rear face of the piston complete the cap end assembly. When the rounded, tapered portion of the cushion spear reaches the lip of the seal, the seal seats against the rear wall of the cavity, trapping air for cushioning.

The configuration of the check-seal lip, and the controlled shape of the cushion sleeve together prevent the lip from rolling over or extruding. A check seal used at both ends provides the benefits of floating cushions with check valve action for maximum cushion effectiveness and quick stroke reversal. This new check-seal design has been tested in millions of cycles, in the lab and in the field.

Series MA / MAN cushions are the longest in the industry and are designed for maximum customer benefit.



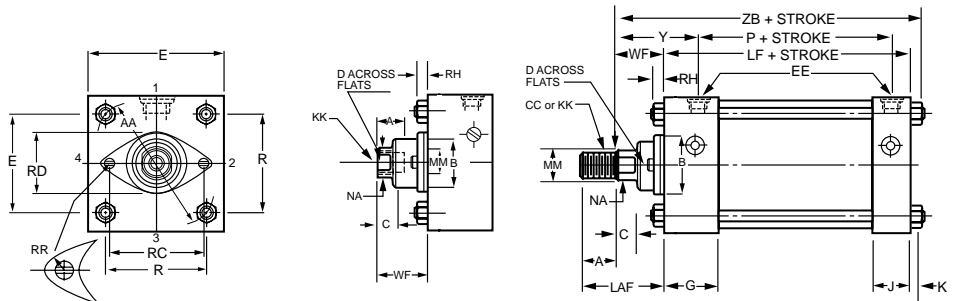
**Tie Rod Mountings Single Rod 1 1/2" - 5" Bore Series MA / MAN**

**Basic Cylinder Style T (NFPA Style MX0)**

Rod end Style 4 is standard per dimension KK. Styles 8 or 9 are optional at no extra charge. A high strength rod end stud is standard on Style 4 for all rod sizes.

For special rod ends such as nonstandard threads, rod extensions, blanks, etc., specify Style 3 and furnish desired dimensions for KK, A and W or WF.

If rod end is not specified, Style 4 will be supplied.



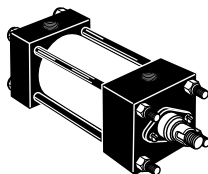
**Style 9 Rod End**  
NFPA SF

**Style 4 & 8 Rod End**  
NFPA SM & IM

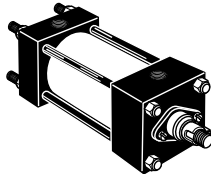
Rod End Dimensions – Styles 9 (NFPA SF), 4 (NFPA SM) and 8 (NFPA IM)																			Basic Envelope and Mounting Dimensions								
Bore	Rod No.	Rod Dia. MM	Thread		A	+0.000 -0.002 B	C	D	LA	LAF	NA	RC	RD	RH	RR	V	W	WF	Y	Add Stroke							
			Style 8 CC	Style 4 & 9 KK																AA	E	(NPTF) EE	G	J	K	LF	P
1 1/2	1	5/8	1/2-20	7/16-20	3/4	.999	3/8	1/2	1 3/8	1 3/4	9/16	1 11/16	1 5/16	3/16	1 1/4	5/8	1	1 15/16	2.02	2	3/8	1 1/2	1	1/4	3 5/8	2 1/4	4 7/8
2	1	5/8	1/2-20	7/16-20	3/4	.999	3/8	1/2	1 3/8	1 3/4	9/16	1 11/16	1 5/16	3/16	1 1/4	5/8	1	1 15/16	2.6	2 1/2	3/8	1 1/2	1	5/16	3 5/8	2 1/4	4 15/16
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	2 1/2	1 5/16	2 3/16	1 13/16	3/16	1 1/4	1	1 3/8	2 5/16	2.6	2 1/2	3/8	1 1/2	1	5/16	3 5/8	2 1/4	5 5/16
2 1/2	1	5/8	1/2-20	7/16-20	3/4	.999	3/8	1/2	1 3/8	1 3/4	9/16	1 11/16	1 5/16	3/16	1 1/4	5/8	1	1 15/16	3.1	3	3/8	1 1/2	1	5/16	3 3/4	2 3/8	5 1/16
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	2 1/2	1 5/16	2 3/16	1 13/16	3/16	1 1/4	1	1 3/8	2 5/16	3.1	3	3/8	1 1/2	1	5/16	3 3/4	2 3/8	5 7/16
3 1/4	1	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	2 1/2	1 5/16	2 3/16	1 13/16	3/16	1 1/4	3/4	1 3/8	2 7/16	3.9	3 3/4	1/2	1 3/4	1 1/4	3/8	4 1/4	2 5/8	6
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.874	5/8	1 1/8	2 5/8	3 1/4	1 5/16	2 11/16	2 15/64	7/32	1 1/8	1 5/8	2 11/16	3.9	3 3/4	1/2	1 3/4	1 1/4	3/8	4 1/4	2 5/8	6 1/4	
4	1	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	2 1/2	1 5/16	2 3/16	1 13/16	3/16	1 1/4	3/4	1 3/8	2 7/16	4.7	4 1/2	1/2	1 3/4	1 1/4	3/8	4 1/4	2 5/8	6
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.874	5/8	1 1/8	2 5/8	3 1/4	1 5/16	2 11/16	2 15/64	7/32	1 1/8	1 5/8	2 11/16	4.7	4 1/2	1/2	1 3/4	1 1/4	3/8	4 1/4	2 5/8	6 1/4	
5	1	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	2 1/2	1 5/16	2 3/16	1 13/16	3/16	1 1/4	3/4	1 3/8	2 7/16	5.8	5 1/2	1/2	1 3/4	1 1/4	7/16	4 1/2	2 7/8	6 5/16
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.874	5/8	1 1/8	2 5/8	3 1/4	1 5/16	2 11/16	2 15/64	7/32	1 1/8	1 5/8	2 11/16	5.8	5 1/2	1/2	1 3/4	1 1/4	7/16	4 1/2	2 7/8	6 9/16	

**Tie Rod Mounted Styles TB, TC, TD**

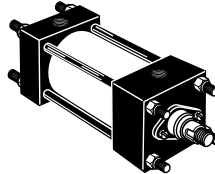
**Style TB**



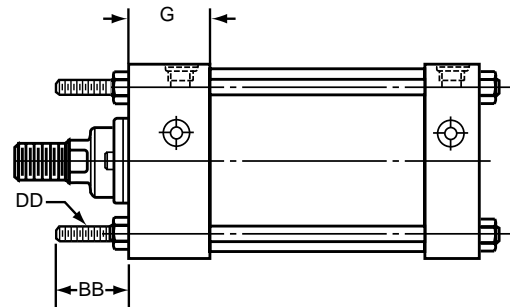
**Style TC**  
NFPA  
(MX2)



**Style TD**



Style TB, Tie Rods Extended, is illustrated at right. Style TC, Cap Tie Rods Extended, and Style TD, Both Ends Tie Rods Extended, can be dimensioned from Style TB drawing.



**Dimensions for Specific Series MA / MAN Mounting Styles H, J, C, F and BB**

Bore	Rod No.	Rod Dia. MM	BB	CB	+0.000 -0.002 CD	CW	DD	F	FB	L	LR	M	MR	ND	NT	R	SB*
1 1/2	1	5/8	1	3/4	.501	1/2	1/4-28	3/8	5/16	3/4	3/4	1/2	5/8	5/16	1/4-20	1.43	7/16
2	1	5/8	1 1/8	3/4	.501	1/2	5/16-24	3/8	3/8	3/4	3/4	1/2	5/8	11/32	5/16-18	1.84	7/16
	3	1	1 1/8	3/4	.501	1/2	5/16-24	3/8	3/8	3/4	3/4	1/2	5/8	7/16	3/8-16	2.19	7/16
2 1/2	1	5/8	1 1/8	3/4	.501	1/2	5/16-24	3/8	3/8	3/4	3/4	1/2	5/8	7/16	3/8-16	2.19	7/16
	3	1	1 1/8	3/4	.501	1/2	5/16-24	3/8	3/8	3/4	3/4	1/2	5/8	7/16	3/8-16	2.19	7/16
3 1/4	1	1	1 3/8	1 1/4	.751	5/8	3/8-24	5/8	7/16	1 1/4	1	3/4	1 5/16	1/2	1/2-13	2.76	9/16
	3	1 3/8	1 3/8	1 1/4	.751	5/8	3/8-24	5/8	7/16	1 1/4	1	3/4	1 5/16	5/8	1/2-13	3.32	9/16
4	1	1	1 3/8	1 1/4	.751	5/8	3/8-24	5/8	7/16	1 1/4	1	3/4	1 5/16	5/8	1/2-13	3.32	9/16
	3	1 3/8	1 3/8	1 1/4	.751	5/8	3/8-24	5/8	7/16	1 1/4	1	3/4	1 5/16	5/8	1/2-13	3.32	9/16
5	1	1	1 13/16	1 1/4	.751	5/8	1/2-20	5/8	9/16	1 1/4	1	3/4	1 5/16	3/4	5/8-11	4.10	13/16
	3	1 3/8	1 13/16	1 1/4	.751	5/8	1/2-20	5/8	9/16	1 1/4	1	3/4	1 5/16	3/4	5/8-11	4.10	13/16

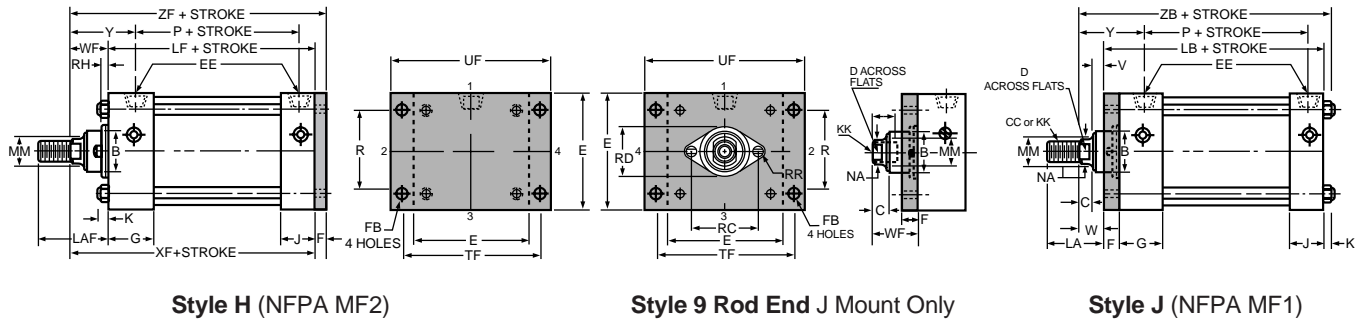
\*Upper surface spotfaced for socket head screws.





**Tie Rod Mountings Single Rod 1 1/2" - 5" Bore Series MA / MAN**

**Flange Mountings Styles H, J**

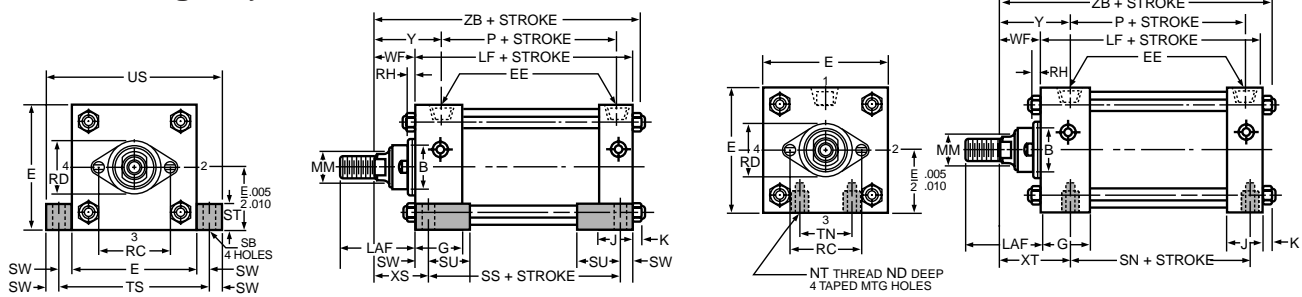


Style H (NFPA MF2)

Style 9 Rod End J Mount Only

Style J (NFPA MF1)

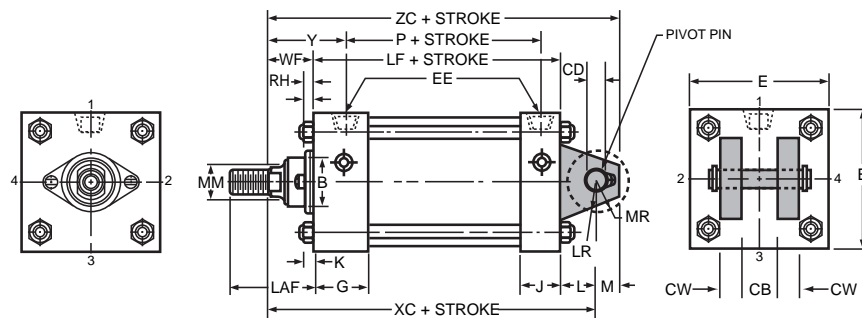
**Side Mountings Styles C, F**



Style C (NFPA MS2)

Style F (NFPA MS4)

**Pivot Mountings Style BB**

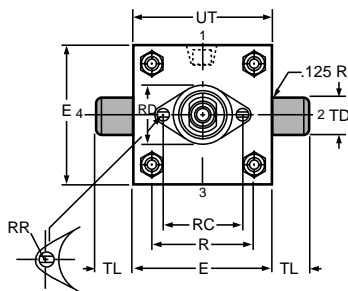


Style BB (NFPA MP1)

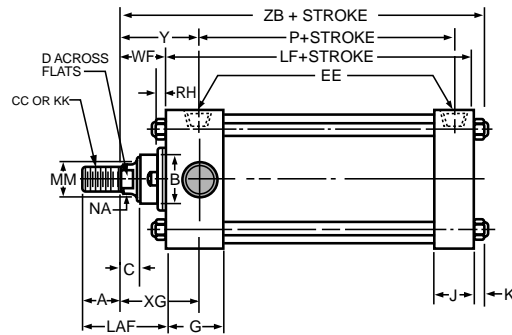
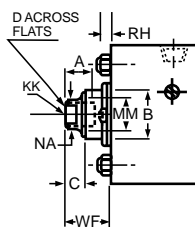
Tie Rods thread into Cap on 1 1/2", 2", 2 1/2" & 3 1/4" bore sizes as shown. Larger sizes have Tie Rod Nuts at ZB ends.

ST	SU	SW	TF	TN	TS	UF	US	LB	Add Stroke							
									SN	SS	XC	XF	XS	XT	ZC	ZF
1/2	15/16	3/8	2 3/4	5/8	2 3/4	3 3/8	3 1/2	4	2 1/4	2 7/8	5 3/8	4 5/8	1 3/8	1 15/16	5 7/8	5
1/2	15/16	3/8	3 3/8	7/8	3 1/4	4 1/8	4	4	2 1/4	2 7/8	5 3/8	4 5/8	1 3/8	1 15/16	5 7/8	5 3/8
1/2	15/16	3/8	3 7/8	1 1/4	3 3/4	4 5/8	4 1/2	4 1/8	2 3/8	3	5 1/2	4 3/4	1 3/8	1 15/16	6	5 1/8
3/4	1 1/4	1/2	4 11/16	1 1/2	4 3/4	5 1/2	5 3/4	4 7/8	2 5/8	3 1/4	6 7/8	5 5/8	1 7/8	2 7/16	7 5/8	6 1/4
3/4	1 1/4	1/2	5 7/16	2 1/16	5 1/2	6 1/4	6 1/2	4 7/8	2 5/8	3 1/4	7 1/8	5 7/8	2 1/8	2 11/16	7 7/8	6 1/2
1	1 9/16	11/16	6 5/8	2 11/16	6 7/8	7 5/8	8 1/4	5 1/8	2 7/8	3 1/8	7 1/8	5 7/8	2 1/16	2 7/16	7 7/8	6 1/2

**Head Trunnion Mounting Style D (NFPA Style MT1)**

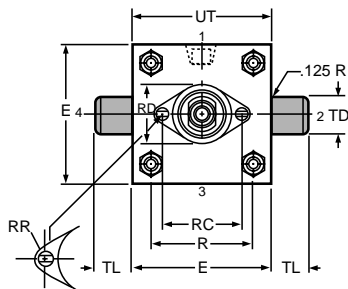


**Style 9 Rod End**  
(NFPA SF)

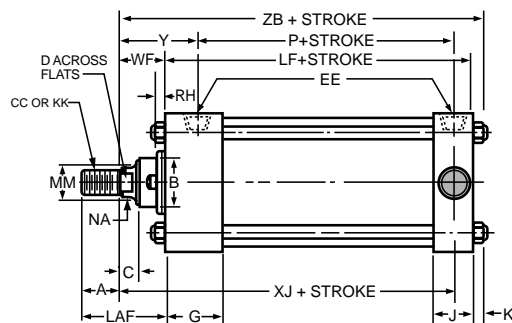
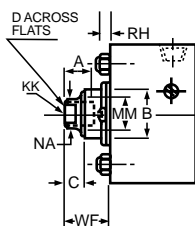


**Style 4 & 8 Rod End**  
(NFPA SM & IM)

**Cap Trunnion Mounting Style DB (NFPA Style MT2)**



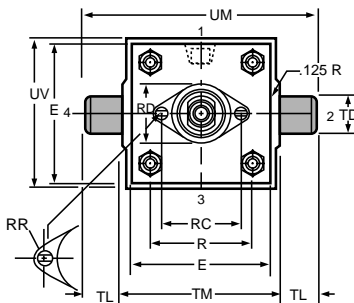
**Style 9 Rod End**  
(NFPA SF)



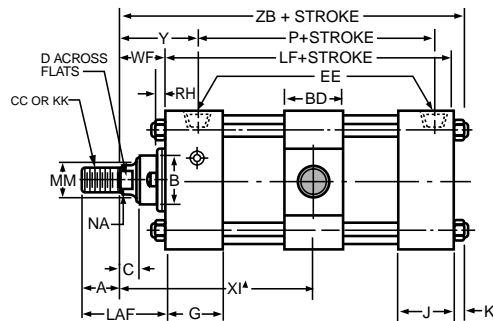
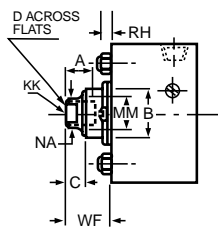
**Style 4 & 8 Rod End**  
(NFPA SM & IM)

**Intermediate Fixed Trunnion Mounting**

**Style DD (NFPA Style MT4)**



**Style 9 Rod End**  
(NFPA SF)



**Style 4 & 8 Rod End**  
(NFPA SM & IM)

Note: For Rod End Dimensions see page 6.

Bore	Rod No.	Rod Dia. MM	Thread		Basic Envelope and Mounting Dimensions														Add Stroke			
			Style 8 CC	Style 4 & 9 KK	BD	E	(NPTF) EE	G	J	K	+0.000 TD -0.001	TL	TM	UM	UT	UV	XG	Min. XI▲	LF	P	XJ	ZB
1 1/2	1	5/8	1/2-20	7/16-20	1 1/4	2	3/8	1 1/2	1	1/4	1.000	1	2 1/2	4 1/2	4	2 1/2	1 3/4	3 3/16	3 5/8	2 1/4	4 1/8	4 7/8
2	1 3	5/8 1	1/2-20 7/8-14	7/16-20 3/4-16	1 1/2	2 1/2	3/8	1 1/2	1	5/16	1.000	1	3	5	4 1/2	3	1 3/4 2 1/8	3 5/16 3 11/16	3 5/8	2 1/4	4 1/8 4 1/2	4 15/16 5 5/16
2 1/2	1 3	5/8 1	1/2-20 7/8-14	7/16-20 3/4-16	1 1/2	3	3/8	1 1/2	1	5/16	1.000	1	3 1/2	5 1/2	5	3 1/2	1 3/4 2 1/8	3 5/16 3 11/16	3 3/4	2 3/8	4 1/4 4 5/8	5 1/16 5 7/8
3 1/4	1 3	1 1 3/8	7/8-14 1 1/4-12	3/4-16 1-14	2	3 3/4	1/2	1 3/4	1 1/4	3/8	1.000	1	4 1/2	6 1/2	5 3/4	4 1/4	2 1/4 2 1/2	4 3/16 4 7/16	4 1/4	2 5/8	5 5 1/4	6 6 1/4
4	1 3	1 1 3/8	7/8-14 1 1/4-12	3/4-16 1-14	2	4 1/2	1/2	1 3/4	1 1/4	3/8	1.000	1	5 1/4	7 1/4	6 1/2	5	2 1/4 2 1/2	4 3/16 4 7/16	4 1/4	2 5/8	5 5 1/4	6 6 1/4
5	1 3	1 1 3/8	7/8-14 1 1/4-12	3/4-16 1-14	2	5 1/2	1/2	1 3/4	1 1/4	7/16	1.000	1	6 1/4	8 1/4	7 1/2	6	2 1/4 2 1/2	4 3/16 4 7/16	4 1/2	2 7/8	5 1/4 5 1/2	6 5/16 6 9/16

▲ Dimension XI to be specified by customer

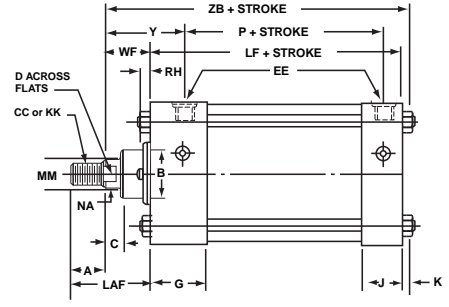
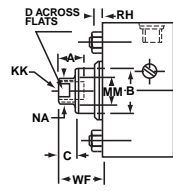
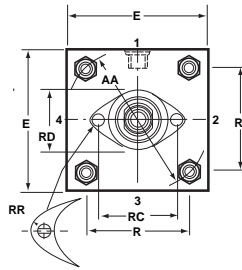
**Basic Cylinder Style T (NFPA Style MX0)**

Rod end Style 4 is standard per dimension KK. Styles 8 or 9 are optional at no extra charge. A high strength rod end stud is standard on Style 4 for all rod sizes.

For special rod ends such as non-standard threads, rod extensions, blanks, etc., specify Style 3 and furnish desired dimensions for KK, A and W or WF.

If rod end is not specified, Style 4 will be supplied.

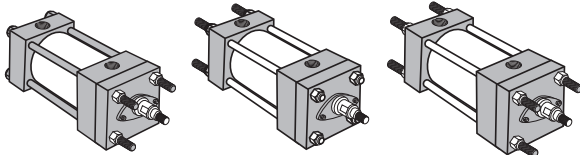
See table on next page for 6" bore rod end dimensions.



**Style 9 Rod End (NFPA SF)**

**Style 4 & 8 Rod End (NFPA SM & IM)**

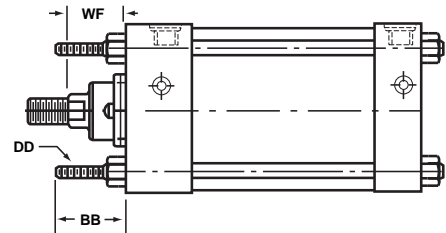
**Tie Rod Mounted Styles TB, TC, TD**



**Style TB**

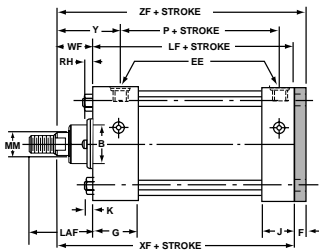
**Style TC  
NFPA (MX2)**

**Style TD**

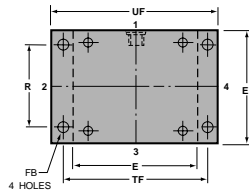


Style TB, Tie Rods Extended, is illustrated at right. Style TC, Cap Tie Rods Extended, and Style TD, Both Ends Tie Rods Extended, can be dimensioned from Style TB drawing.

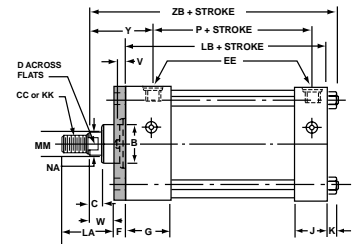
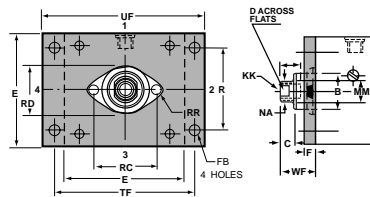
**Flange Mountings Styles H, J**



**Style H (NFPA MF2)**

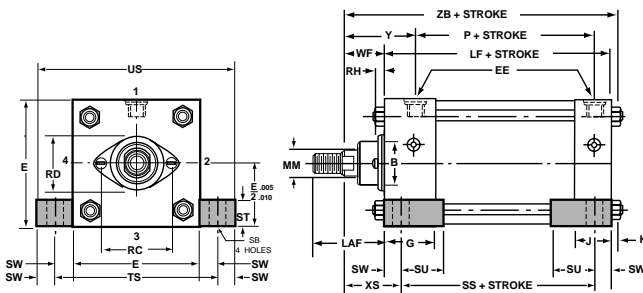


**Style 9 Rod End (NFPA SF)**

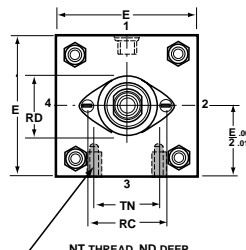


**Style J (NFPA MF1)**

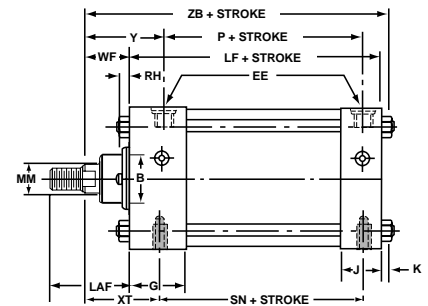
**Side Mountings Styles C, F**



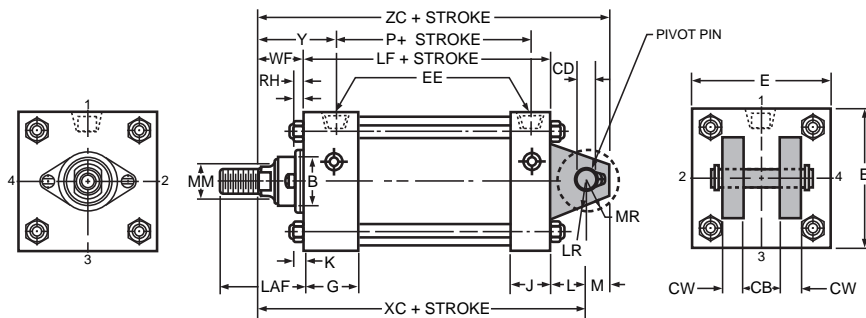
**Style C (NFPA MS2)**



**Style F (NFPA MS4)**

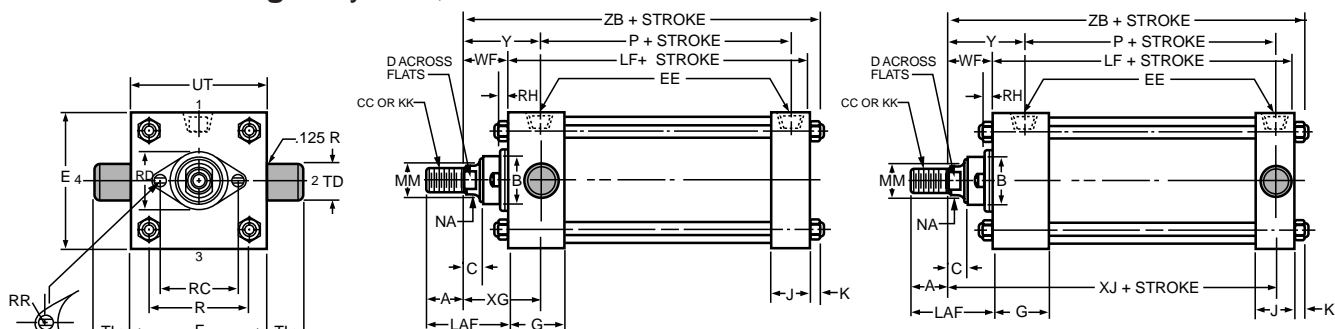


Pivot Mounting Style BB



Style BB (NFFA MP1)

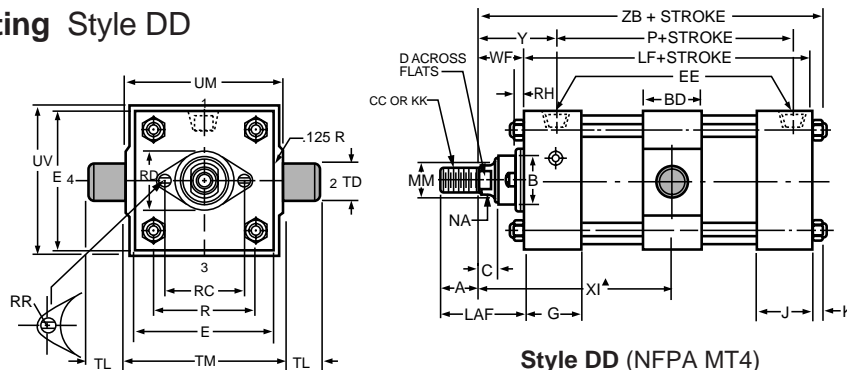
Trunnion Mountings Styles D, DB



Style D (NFFA MT1)

Style DB (NFFA MT2)

Trunnion Mounting Style DD



Style DD (NFFA MT4)

Rod End Dimensions—Styles 9 (NFFA SF), 4 (NFFA SM) and 8 (NFFA IM)

Bore	Rod No.	Rod Dia. MM	Thread		A	+.000 -.002 B	MIN. C	D	LA	LAF	NA	RC	RD	RH	RR	V	W	WF	Y
			Style 8 CC	Style 4 & 9 KK															
6	1	1 3/8	1 1/4-12	1-14	1 5/8	1.874	5/8	1 1/8	2 1/2	3 1/4	1 5/16	2 11/16	2 15/64	7/32	13/64	1/4	7/8	1 5/8	2 13/16

Basic Envelope and Mounting Dimensions

Bore	Rod No.	Rod Dia. MM	AA	BB	BD	CB	+.000 -.002 CD	CW	DD	E	(NPTF) EE	F	FB	G	J	K	L	LR	M	MR	ND	NT	R	SB	ST	SU	SW

Basic Envelope and Mounting Dimensions (cont.)

Bore	Rod No.	Rod Dia. MM	+.000 -.002 TD	ADD STROKE																								
				TF	TL	TM	TN	TS	UF	UM	US	UT	UV	XG	MIN. XI ▲	LB	LF	P	SN	SS	XC	XF	XJ	XS	XT	ZB	ZC	ZF
6	1	1 3/8	1.375	7 5/8	1 3/8	7 5/8	3 1/4	7 7/8	8 5/8	10 3/8	9 1/4	9 1/4	7	2 5/8	4 15/16	5 3/4	5	3 1/8	3 1/8	3 5/8	8 1/8	6 5/8	5 7/8	2 5/16	2 13/16	7 1/16	9 1/8	7 3/8

• Upper surface spotfaced for socket head screws. ▲ Dimension XI to be specified by customer.



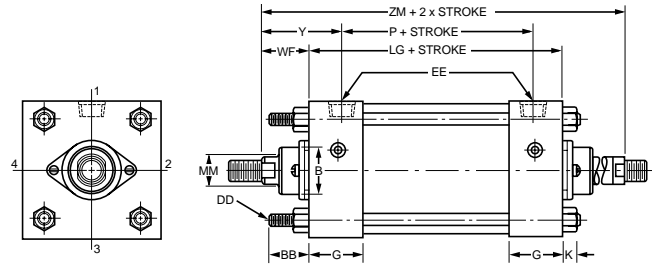
To dimension double rod cylinders, select the desired mounting style and refer to corresponding single rod model on pages 6-10. After obtaining necessary

dimensions from that drawing, supplement those with the drawings and tables below.

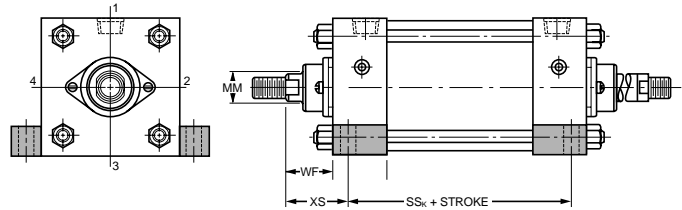
**Tie Rods Extended  
Parker Style KT**

Tie Rods Extended Head End, Style **KTB**.

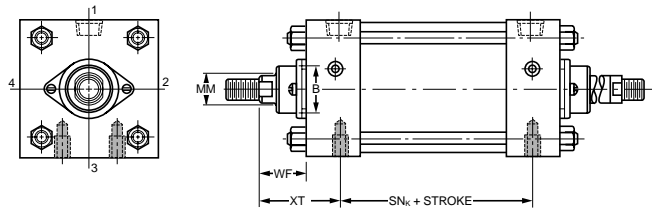
Tie Rods Extended Both Ends, Style **KTD**.



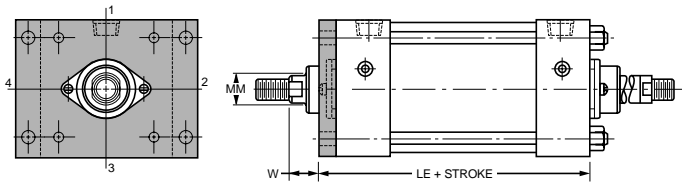
**Side Lug Mounting  
Parker Style KC**



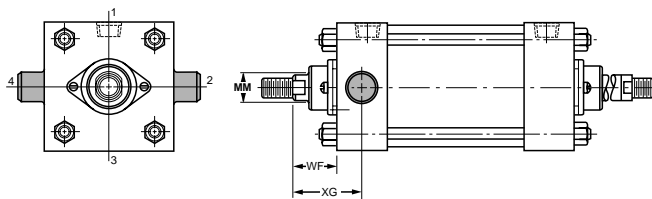
**Side Tapped Mounting  
Parker Style KF**



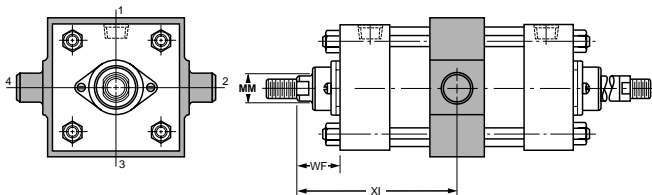
**Rectangular Flange Mounting  
Parker Style KJ**



**Head Trunnion Mounting  
Parker Style KD**



**Intermediate Fixed Trunnion Mounting  
Parker Style KDD**



**Double Rod Cylinder Dimensions**

Bore	Rod Dia.	Rod No.	Add Stroke				Add 2x Stroke ZM
			LG	LE	SS <sub>K</sub>	SN <sub>K</sub>	
1 1/2	5/8	1	4 1/8	4 1/2	3 3/8	2 1/4	6 1/8
2	5/8	1	4 1/8	4 1/2	3 3/8	2 1/4	6 1/8
		3					6 7/8
2 1/2	5/8	1	4 1/4	4 5/8	3 1/2	2 3/8	6 1/4
		3					7
3 1/4	1	1	4 3/4	5 3/8	3 3/4	2 5/8	7 1/2
		3					8
4	1	1	4 3/4	5 3/8	3 3/4	2 5/8	7 1/2
		3					8
5	1	1	5	5 5/8	3 5/8	2 7/8	7 3/4
		3					8 1/4
6	1 3/8	1	5 1/2	6 1/4	4 1/8	3 1/8	8 3/4
REPLACES DIMENSION			LF	LB	SS	SN	-
ON SINGLE ROD MOUNTING STYLES			T, TB, TC, C, F, D & DD	J	C	F	ALL

On a double rod cylinder where the two rod ends will be different, be sure to state very clearly which rod end is to go at which end of the cylinder.

NOTE: For Rod End Dimensions, see pages 6-10.

## Theoretical Push and Pull Forces for Pneumatic Cylinders

### Push Force and Displacement

Cyl. Bore Size (Inches)	Piston Area (Sq. In.)	Cylinder Push Stroke Force In Pounds At Various Pressures						Cu. Ft. Free Air At 80 Lbs. Pressure, Required To Move Max. Load 1 Inch
		25	50	65	80	100	200	
1½	1.767	44	88	115	142	177	353	.00659
2	3.14	79	157	204	251	314	628	.01171
2½	4.91	123	245	319	393	491	982	.01830
3¼	8.30	208	415	540	664	830	1660	.03093
4	12.57	314	628	817	1006	1257	2514	.04685
5	19.64	491	982	1277	1571	1964	3928	.07320
6	28.27	707	1414	1838	2262	2827	5654	.10541

### Deductions for Pull Force and Displacement

Piston Rod Dia. (Inches)	Piston Area (Sq. In.)	Piston Rod Diameter Force In Pounds At Various Pressures						Cu. Ft. Free Air At 80 Lbs. Pressure, Required To Move Max. Load 1 Inch
		To determine Cylinder Pull Force or Displacement, deduct the following Force or Displacement corresponding to Rod Size, from selected Push Stroke Force or Displacement corresponding to Bore Size in table above.						
		25	50	65	80	100	200	
5/8	.307	8	15	20	25	31	61	.00659
1	.785	20	39	51	65	79	157	.01171
1³/8	1.49	37	75	97	119	149	298	.01830

### General Formula

The cylinder output forces are derived from the formula:

$$F = P \times A$$

Where F = Force in pounds.  
 P = Pressure at the cylinder in pounds per square inch, gauge.  
 A = Effective area of cylinder piston in square inches.

Free Air refers to normal atmospheric conditions of the air at sea level (14.7 psi). Use above cu. ft. free air required data to compute CFM required from a compressor at 80 psi. Cu. ft. of free air required at other pressures can be calculated using formula below.

$$V_1 = \frac{(P_2 + 14.7) V_2}{14.7}$$

Where V<sub>1</sub> = Free air consumption per inch of stroke (cubic feet).

V<sub>2</sub> = Cubic feet displaced per inch of stroke.

P<sub>2</sub> = Gauge pressure required to move maximum load.

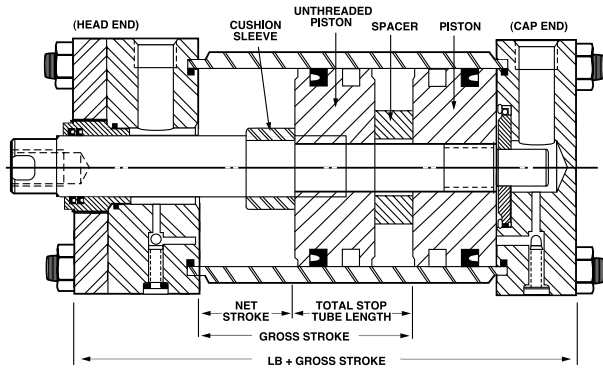
**Stop Tubing**

Stop tube is recommended to lengthen the distance between the gland and piston to reduce bearing loads when the cylinder is fully extended. This is especially true of horizontally mounted and long stroke cylinders. Long stroke cylinders achieve additional stability through the use of a stop tube.

When specifying cylinders with long stroke and stop tube, be sure to call out the net stroke and the length of the stop tube. Machine design can be continued without delay by laying in a cylinder equivalent in length to the **NET STROKE PLUS STOP TUBE LENGTH**, which is referred to as **GROSS STROKE**.

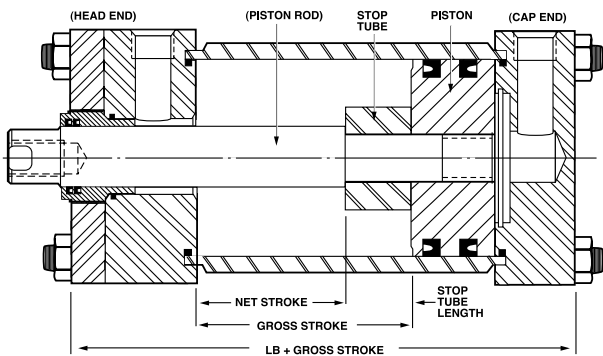
Refer to piston rod/stroke selection chart to determine stop tube length.

**Drawing A**



Double piston design is supplied on air cylinders with cushion head end or both ends.

**Drawing B**



This design is supplied on all non cushion cylinders.

**Mounting Classes**

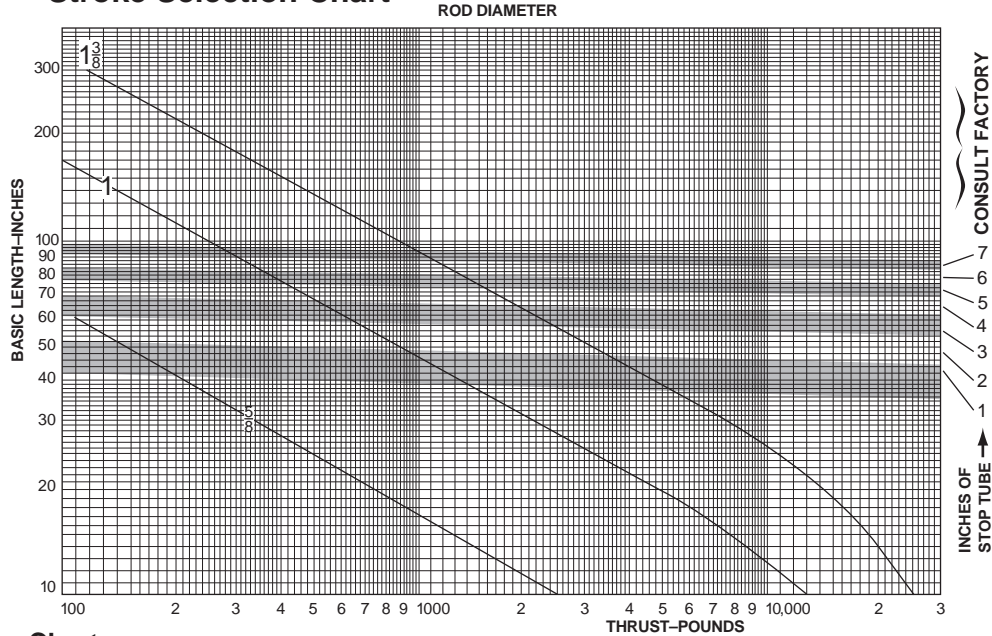
Standard mountings for fluid power cylinders fall into three basic groups. The groups can be summarized as follows:

- Group 1 – Straight Line Force Transfer with fixed mounts which absorb force on cylinder centerline.
- Group 2 – Pivot Force Transfer. Pivot mountings permit a cylinder to change its alignment in one plane.
- Group 3 – Straight Line Force Transfer with fixed mounts which do not absorb force on cylinder centerline.

Because a cylinder's mounting directly affects the maximum pressure at which the cylinder can be used, the chart below should be helpful in selection of the proper mounting combination for your application. Stroke length, piston rod connection to load, extra piston rod length over standard, etc., should be considered for thrust loads. Alloy steel mounting bolts are recommended for all mounting styles, and thrust keys are recommended for Group 3.

<b>Group 1 FIXED MOUNTS</b> which absorb force on cylinder centerline.	
<b>Heavy-Duty Service</b> For Thrust Loads For Tension Loads	Mtg. Style TC Mtg. Style JB
<b>Medium-Duty Service</b> For Thrust Loads For Tension Loads	Mtg. Style H Mtg. Style J
<b>Light-Duty Service</b> For Thrust Loads For Tension Loads	Mtg. Style J Mtg. Style H
<b>Group 2 PIVOT MOUNTS</b> which absorb force on cylinder centerline.	
<b>Heavy-Duty Service</b> For Thrust Loads For Tension Loads	Mtg. Styles DD, D Mtg. Styles BB, DD, D, DB
<b>Medium-Duty Service</b> For Thrust Loads For Tension Loads	Mtg. Style BB Mtg. Style BB
<b>Light-Duty Service</b> For Thrust Loads For Tension Loads	-----
<b>Group 3 FIXED MOUNTS</b> which do not absorb force on the centerline.	
<b>Heavy-Duty Service</b> For Thrust Loads For Tension Loads	Mtg. Style C Mtg. Style C
<b>Medium-Duty Service</b> For Thrust Loads For Tension Loads	Mtg. Style F Mtg. Style F

**Piston Rod — Stroke Selection Chart**



**How to Use the Chart**

The selection of a piston rod for thrust (push) conditions requires the following steps:

1. Determine the type of cylinder mounting style and rod end connection to be used. Then consult the chart below and find the "stroke factor" that corresponds to the conditions used.
2. Using this stroke factor, determine the "basic length" from the equation:

$$\text{Basic Length} = \frac{\text{Actual Stroke}}{\text{Stroke Factor}}$$

The graph is prepared for standard rod extensions beyond the face of the gland retainers. For rod extensions greater than standard, add the increase to the stroke in arriving at the "basic length."

3. Find the load imposed for the thrust application by multiplying the full bore area of the cylinder by the system pressure.
4. Enter the graph along the values of "basic length" and "thrust" as found above and note the point of intersection:
  - A) The correct piston rod size is read from the diagonally curved line labeled "Rod Diameter" next above the point of intersection.
  - B) The required length of stop tube is read from the right of the graph by following the shaded band in which the point of intersection lies.

- C) If required length of stop tube is in the region labeled "consult factory," submit the following information for an individual analysis:

- 1) Cylinder mounting style.
- 2) Rod end connection and method of guiding load.
- 3) Bore, required stroke, length of rod extension (Dim. "W or WF") if greater than standard, and series of cylinder used.
- 4) Mounting position of cylinder. (Note: If at an angle or vertical, specify direction of piston rod.)
- 5) Operating pressure of cylinder if limited to less than standard pressure for cylinder selected.

**Warning** ⚠

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod end to fail. If these types of additional loads are expected to be imposed on the piston rods, their magnitude should be made known to our Engineering Department so they may be properly addressed. Additionally, cylinder users should always make sure that the piston rod is securely attached to the machine member.

Recommended Mounting Styles for Maximum Stroke and Thrust Loads	Rod End Connection	Case	Stroke Factor
<b>Groups 1 or 3</b> Long stroke cylinders for thrust loads should be mounted using a heavy-duty mounting style at one end, firmly fixed and aligned to take the principal force. Additional mounting should be specified at the opposite end, which should be used for alignment and support. An intermediate support may also be desirable for long stroke cylinders mounted horizontally. See catalog page No. 80 under "Tie Rod Supports Rigidity of Envelope" for a guide. Machine mounting pads can be adjustable for support mountings to achieve proper alignment.	Fixed and Rigidly Guided	I	.50
	Pivoted and Rigidly Guided	II	.70
	Supported but not Rigidly Guided	III	2.00
<b>Group 2</b> Style D — Trunnion on Head	Pivoted and Rigidly Guided	IV	1.00
Style DD — Intermediate Trunnion	Pivoted and Rigidly Guided	V	1.50
Style DB — Trunnion on Cap or Style BB — Clevis on Cap	Pivoted and Rigidly Guided	VI	2.00



**Cylinder Accessories**

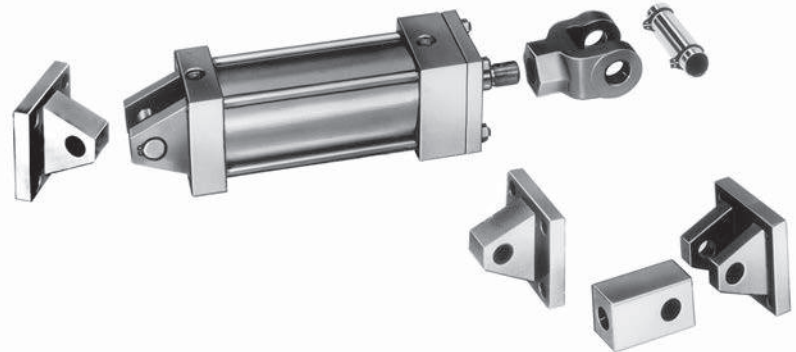
Parker offers a range of heavy-duty cylinder accessories for convenient mounting of pivot mount cylinders or for use at rod end of fixed mount types. All are load capacity rated for use at 4:1 design factor in tension or compression (pivot pin is rated in shear) when used

on bore sizes recommended in tables below. Select rod clevises or knuckles by bore and thread size along with mating parts shown. Pivot pin must be ordered as separate item, if needed.

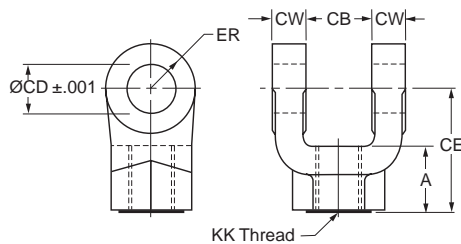
**Mounting Plate**

Mounting plates for Style BB (clevis mounted) cylinders are offered. To select proper part number for your application, refer to Chart below.

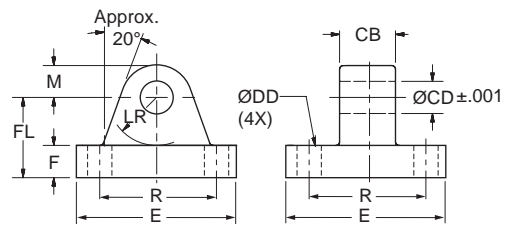
Mounting Plate	Series MA / MAN
Part No.	Bore Size
0959810050	1 1/2", 2", 2 1/2"
0959810075	3 1/4", 4", 5"
0959810100	6"



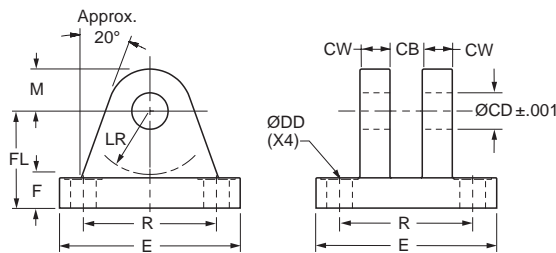
**Female Rod Clevis**



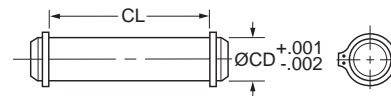
**Mounting Plate or Eye Bracket**



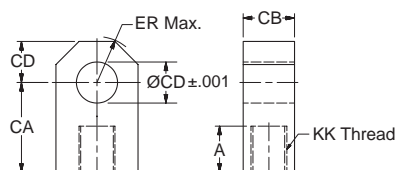
**Clevis Bracket for Knuckle**



**Pivot Pin Dimensions**



**Rod Knuckle**



For part numbers and dimensions see the Parker Accessory Catalog HY08-1300.

## How to Order Series MA / MAN Cylinders

When ordering Series MA / MAN cylinders, please review the following:

**Note:** Duplicate cylinders can be ordered by giving the SERIAL NUMBER from the nameplate of the original cylinder. Factory records supply a quick positive identification.

**Piston Rods:** Specify rod code number based on diameter. Give thread style number for a standard thread or specify dimensions. See "Style 3 Rod End" below.

**Cushions:** If cushions are required specify according to the model number on the next page. If the cylinder is to have a double rod and only one cushion is required, be sure to specify clearly which end of the cylinder is to be cushioned.

**Special Modifications:** Additional information is required on orders for cylinders with special modifications. This is best handled with descriptive notes. For further information, consult factory.

**Fluid Medium:** Series MA pneumatic cylinders are equipped with seals for use with lubricated air. Series MAN pneumatic cylinders are equipped for use with filtered dry air.

### Class 1 Seals

Class 1 seals are the seals provided as standard in a cylinder assembly unless otherwise specified. For further information on temperature compatibility or operating limitations of all components, see standard specifications on page 3.

For the MA series cylinders the following make-up Class 1 Seals:  
Primary Piston Rod Seal – Nitrile with PTFE back-up washers  
Piston Rod Wiper – Nitrile  
Piston Seals – Nitrile with polymyte back-up washers  
O-Rings – Nitrile

### Combination Mountings

**Single Rod End** The first mounting is the one called out on the head end of the cylinder. The second or subsequent mountings are called out as they appear in the assembly moving away from the rod end. Exception: When tie rod mountings are part of a combination, the model number should contain an "S" (Special) in the model code and a note in the body of the order clarifying the mounting arrangement. The "P" is used to define a thrust key and is not considered to be a mounting. However, it is located at the primary end.

Example: 4.00 CCBMALUS14AC x 10.000

Combination "C" mounting head only. "BB" mounting cap end  
This cylinder is also cushioned at both ends.

**Double Rod End** In general, the model number is read left to right corresponding to the cylinder as viewed from left to right with the primary end at rod end #1. See Double Rod

Models information page in this section. For this option the piston rod number, piston rod end, and piston rod threads are to be specified for both ends. The simplest are for symmetric cylinders such as: TD, C and F mounts. All other mounting styles, the description of the first rod end will be at the mounting end. In the case of multiple mounts, the description of the first rod end will be at the primary mounting end. For "DD" mounts, the description of the first rod end will be the same location as the "XI" dimension.

Example: 4.00 KDDMALU24A/18A x 10.000 XI=8

This is a center trunnion mounting cylinder with the XI dimension measured from the code 2 rod side of the cylinder which has the style 4 thread. The opposite end code 1 rod with the style 8 thread.

### Style 3 Rod End

A style 3 rod end indicates a special rod end configuration. All special piston rod dimensions must have **all three**: KK, A and W or WF specified with the rod fully retracted. A sketch or drawing should be submitted for rod ends requiring special machining such as snap ring grooves, keyways, tapers, multiple diameters, etc. It is good design practice to have this

machining done on a diameter at least 0.065 inches smaller than the piston rod diameter. This allows the piston rod to have a chamfer preventing rod seal damage during assembly or maintenance.

### Service Policy

On cylinders returned to the factory for repairs, it is standard policy for the Cylinder Division to make such part replacements as will put the cylinder in as good as new condition. Should the condition of the returned cylinder be such that expenses for repair would exceed the costs of a new one, you will be notified.

Address all correspondence and make shipments to, Service Department at your nearest regional plant listed in the pages of this catalog.

### Certified Dimensions

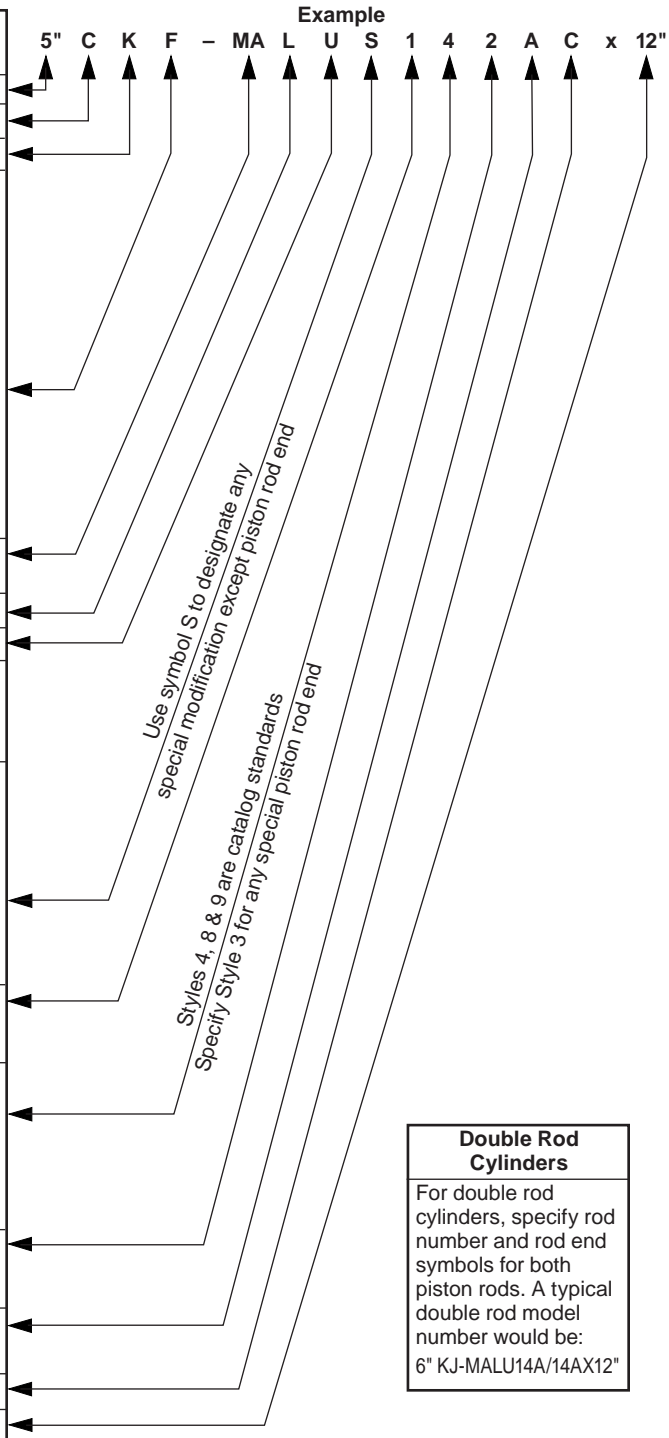
Parker Cylinder Division guarantees that all cylinders ordered from this catalog will be built to dimensions shown. All dimensions are certified to be correct, and thus it is not necessary to request certified drawings.

## Series MA / MAN Model Numbers – How to Develop and “Decode” Them

Parker Series MA / MAN cylinders can be completely and accurately described by a model number consisting of coded symbols. To develop a model number, select only those

symbols that represent the cylinder required, and place them in the sequence indicated below.

Feature	Description	Symbol	
<b>Bore</b>	Specify in inches	—	5"
<b>Cushion Head</b>	Used <b>only</b> if cushion head is required	C	C
<b>Double Rod</b>	Used <b>only</b> if double rod cylinder is required	K	K
<b>Mounting Style</b>	Head Tie Rods Extended	TB	
	Cap Tie Rods Extended	TC	
	Both End Tie Rods Extended	TD	
	Head Rectangular Flange	J	
	Cap Rectangular Flange	H	
	Side Lug	C	
	Side Tapped	F	
	Cap Fixed Clevis	BB	
	Head Trunnion	D	
	Cap Trunnion	DB	
	Intermediate Fixed Trunnion	DD	
	<b>Series</b>	Required in all MA Model Numbers	MA
MAN			MAN
<b>Piston</b>	Lipseal™ Piston standard.	L	L
<b>Ports</b>	NPTF (Dry Seal) Ports are standard.	U	U
<b>Seals</b>	Standard Seals (Class 1)	—	
	Fluorocarbon Seals (Class 5)	V	
	Fluorocarbon Rod Seals only	E	
<b>Special Modifications</b>	Used <b>only</b> if special modifications are required:	S	
	Oversize Ports		
	Port Position Change		
	Stop Tube*		
	Stroke Adjuster		
<b>Piston Rod Number</b>	For Single Rod Cylinders, Select only one. Check Cylinder Stroke page for minimum piston rod diameter chart.	1	1
		3	3
	<b>Piston Rod End</b>	Select:	
		Style 4 Small Male	4
Style 8 Intermediate Male		8	8
	Style 9 Short Female	9	9
	Style 3 Special (Specify)	3	3
<b>Piston Rod Alternate Threads</b>	Used <b>only</b> for two times longer than standard.	2	2
<b>Piston Rod Threads</b>	UNF Standard	A	A
	Metric	M	M
<b>Cushion Cap</b>	Used <b>only</b> if cushion cap is required	C	C
<b>Stroke*</b>	Specify in inches	—	12"



**Double Rod Cylinders**  
 For double rod cylinders, specify rod number and rod end symbols for both piston rods. A typical double rod model number would be: 6" KJ-MALU14A/14AX12"

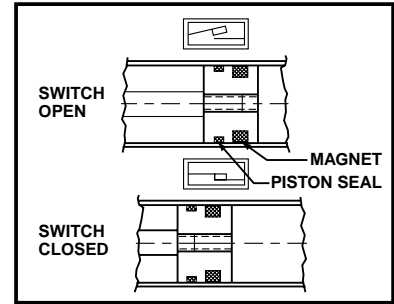
\* Required for Basic Cylinder Model Number  
 • In case of stop tube, call out gross stroke length.  
**Dark Arrows Indicate Basic Minimum Model Number.**

Cylinder serial numbers are factory production record numbers and are assigned to each cylinder, in addition to the model number.

## Magnetically Actuated Switches

The MA / MAN adjustable switch has been designed for use on Series MA / MAN Pneumatic Cylinders. It is a normally open switch. The compact design of the switch causes a minimum interference with cylinder envelope dimensions. The MA / MAN switch will sense the magnetic piston through a non-ferrous cylinder barrel. Several MA / MAN switches may be mounted on a single cylinder to control or sequence several functions.

The MA / MAN switch is mounted on a single tie rod with an aluminum extrusion for easy adjustment. Its rugged construction will provide millions of trouble free cycles. It is ideally suited as an input to programmable controllers or to activate an industrial relay.



## Switch Specifications

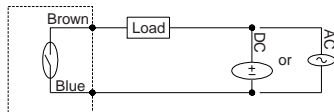
	Reed Switch Assembly MAR-2 L074480000	Solid State Switch Assembly MAS-3 PNP Sourcing L074490000 MAS-4 NPN Sinking L074500000	Reed Switch Assembly MAR-2 L074480000	Solid State Switch Assembly MAS-3 PNP Sourcing L074490000 MAS-4 NPN Sinking L074500000
Switching Logic	Normally Open, SPST	NPN or PNP	IEC IP 67	IEC IP 67
Supply Voltage Range	5 to 125 V AC/DC	5 TO 30 VDC	Operating Temperature	14° to 140°F (-10° to 60°C)      14° to 158°F (-10° to 70°C)
Max. Switching Power	10 Watts (Resistive) 5 Watts (Inductive)	6 Watts	Storage Temperature	-4° to 158°F (-20° to 70°C)      -4° to 176°F (-20° to 80°C)
Max. Switching Current	300 mA (Resistive) 150 mA (Inductive)	200 mA at 24 VDC	LED Indicator	Red, Target Present When On      Red, Target Present When On
Circuit Current Consumption	—	Max 14 mA at 24 VDC	Minimum Current To Light LED	18 mA      1 mA
Short Circuit Interruption Current	—	370 mA	Lead Wire Lengths	39 Inches, 1 Meter      39 Inches, 1 Meter
Leakage Current	—	10 µA Maximum	*Polarity is restricted to DC operation: (+) to Brown (-) to Blue If these connections are reversed the contacts will close, but the LED will not light.	
Residual Voltage	Maximum 3 V	1.5 V Maximum		
"On" State Voltage Drop	1.7V Maximum	See Below		
Response	1000 Hz Maximum	1000 Hz Maximum		
Shock Resistance	30G Non-Repeated Shock	30G Non-Repeated Shock		

## Circuits

### Reed Switch (MAS-2)

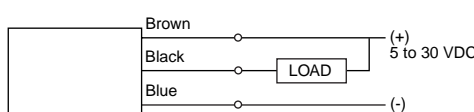
Part No. ....L074480000

NOTE: Polarity must be observed for DC operation only.



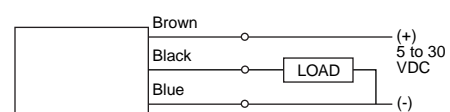
### NPN Sinking Output (MAS-4)

Part No. ....L074500000  
Color of Cable ..... Black  
"On" State Voltage Drop ..... 0.7V Maximum



### PNP Sourcing Output (MAS-3)

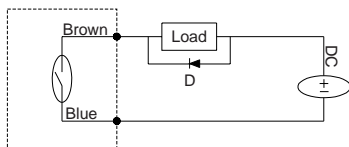
Part No. ....L074490000  
Color of Cable ..... Gray  
"On" State Voltage Drop ..... 0.2V Maximum



## Circuit for Switching Contact Protection (Inductive Loads)

(Required for proper operation 24V DC)

Put Diode parallel to loads following polarity as shown below.



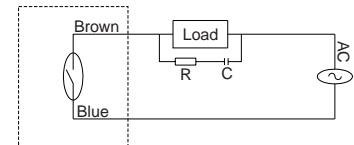
D: Diode: select a Diode with the breakdown voltage and current rating according to the load.

**Typical Example**—100 Volt, 1 Amp Diode  
Load: Relay coil (under 0.5W coil rating)  
(Recommended for longer life 125 VAC)

Put a resistor and capacitor in parallel with the load. Select the resistor and capacitor according to the load.

### Typical Example:

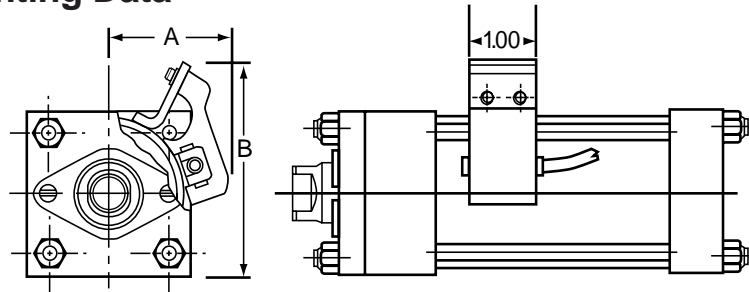
Load: Relay coil (under 2W coil rating)  
R: Resistor 1 KΩ - 5 KΩ, 1/4 W  
C: Capacitor 0.1 µF, 600 V



## Caution

- Use an ampmeter to test reed switch current. Testing devices such as incandescent light bulbs may subject the reed switch to high in-rush loads.
- **NOTE:** When checking an unpowered reed switch for continuity with a digital ohmmeter the resistance reading will change from infinity to a very large resistance (2 M ohm) when the switch is activated. This is due to the presence of a diode in the reed switch.
- Anti-magnetic shielding is recommended for reed switches exposed to high external RF or magnetic fields.
- The magnetic field strength of the piston magnet is designed to operate with our switches. Other manufacturers' switches or sensors may not operate correctly in conjunction with these magnets.
- Current capabilities are relative to operational temperatures.
- Use relay coils for reed switch contact protection.
- The operation of some 120 VAC PLC's (especially some older Allen-Bradley PLC's) can overload the reed switch. The switch may fail to release after the piston magnet has passed. This problem may be corrected by the placement of a 700 to 1K OHM resistor between the switch and the PLC input terminal. Consult the manufacturer of the PLC for appropriate circuit.
- Switches with long wire leads (greater than 15 feet) can cause capacitance build-up and sticking will result. Attach a resistor in series with the reed switch (the resistor should be installed as close as possible to the switch). The resistor should be selected such that  $R \text{ (ohms)} > E/0.3$ .

MA / MAN Switch Mounting Data



Bore	A	B	PISTON TRAVEL AT MIDSTROKE (SWITCH ON) (±.01)	MINIMUM ACTIVATION DISTANCE FROM END OF STROKE	
				Head	Cap
1 1/2	1.90	2.71	.37	.20	.20
2	2.10	3.25	.37	.20	.20
2 1/2*	2.20	3.60	.37	.13	.13
3 1/4*	2.70	4.25	.37	.13	.13
4*	2.90	4.90	.37	.13	.13
5*†	3.20	5.85	.37	0	0
6*†	3.82	6.70	.37	0	0

NOTE:

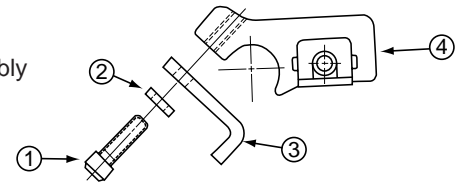
\* To maintain minimum activation distance switch can only be mounted with "LED" against end plate because of cable interference on 'End of Stroke' applications.

† On 5.0" and 6.0" bore cylinders, end of stroke activation will occur without the switch physically touching the head or cap.

Standard MA / MAN Switch Assembly

Consists of:

- |                                       |                                      |
|---------------------------------------|--------------------------------------|
| 1. 0106280032 (2) #8-32 Sh. Cap Screw | 4. (1) Switch & Bracket Sub-Assembly |
| 2. 0108850008 (2) Lockwasher          | MAR-2 – 0862580000                   |
| 3. 0854530000 (1) Bracket Clamp       | MAS-3 – 0862590000                   |
|                                       | MAS-4 – 0862600000                   |



How to Order:

MA / MAN switches are not mounted to the cylinder prior to shipment. When ordering a cylinder to accommodate an MA / MAN switch:

1. Derive a proper model number.
2. Place an "S" in the special features column.

3. Underneath the model number specify:  
1) Cylinder prepared for MA / MAN switch.
4. As a separate item specify the number of switch assemblies required.

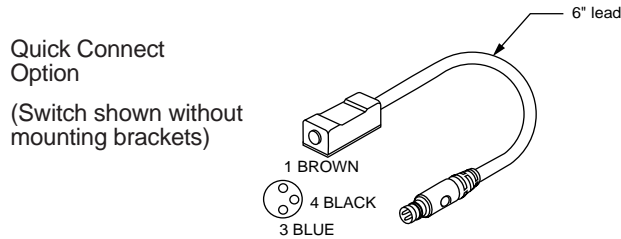
**Example:** To order a 2 1/2" x 10" MA / MAN cylinder with MA / MAN switches to sense the end of stroke at both the head and cap end specify:

Item	Qty.	Description	
A	(1)	2.50 C J MALUS 14A C x 10.000 (1) Cylinder prepared for MA / MAN Switch	* #L074480000 – MAR-2 #L074490000 – MAS-3 #L074500000 – MAS-4
B	(2)	(*) Switch Assemblies	

**Magnet Actuated Switches with Quick Connect**

Magnet Actuated Switches are available for Series MA / MAN cylinders. Refer to the appropriate Catalog information for electrical specifications on each switch. The standard lead wire length is 39" (1 meter).

Switches for the above cylinders are also offered with a 6 (six) inch lead with a male quick connect option.



**Switches with 6" Lead and Quick Connect Male End**

Series	Reed	NPN Sinking	PNP Sourcing
MA / MAN	L07448000C	L07450000C	L07449000C

Switches are supplied with the bracket to mount the switch to the cylinder. Refer to the switch information for each series for bracket dimensions.

**Cordset with Female Quick Connect (Order Separately)**

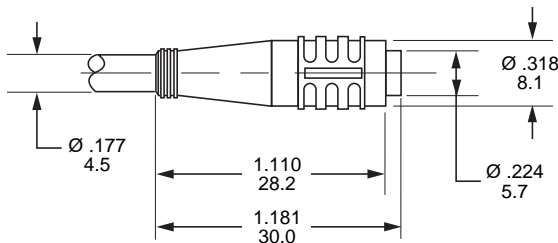
A female connector is available for all switches with the male quick connect option. The male plug will accept a snap-on or threaded connector. Cylinder Division cordset part numbers and other manufacturer's part numbers are listed below:

Manufacturer	Snap-On Version	Threaded Version
Parker	086620S005	086620T005

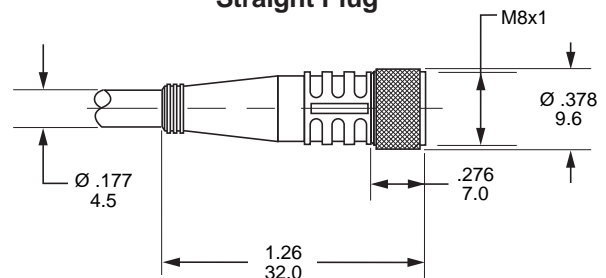
**Cordset Specification:**

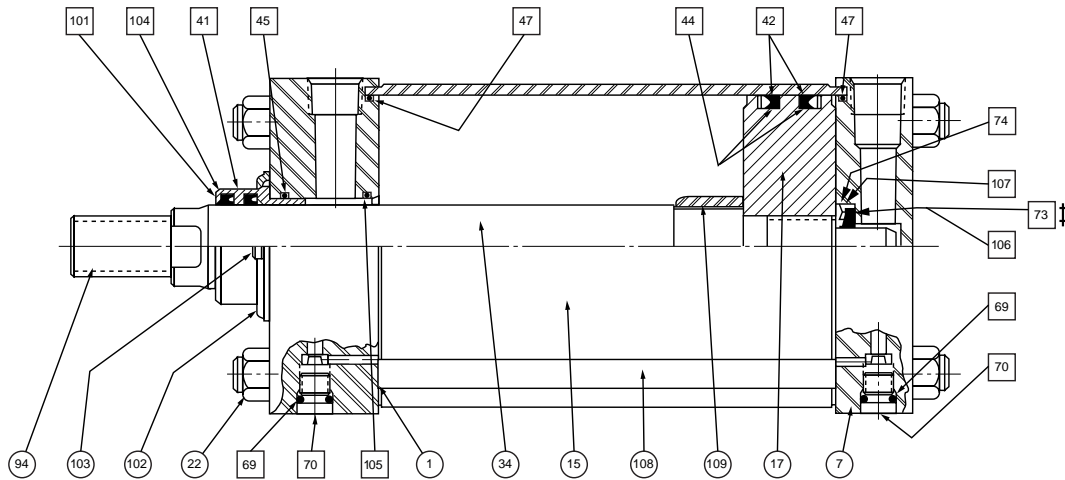
- Connector: Oil resistant polyurethane body material, PA 6 (Nylon) contact carrier, spacings to VDE 0110 Group C, (150 VAC / DC)
- Contacts: Gold plated beryllium copper, machined from solid stock
- Coupling Method: Snap-Lock or chrome plated brass nut
- Cord Construction: Oil resistant black PUR jacket, non-wicking, non-hygroscopic, 300V. Cable end is stripped and tinned.
- Conductors: Extra high flex stranding, PVC insulation
- Temperature: -40° to 185°F (-40° to 85°C)
- Protection: NEMA 1, 3, 4, 6P and IEC IP67
- Cable Length: 6.56 ft (2m) or 16.4 ft (5m)

**Snap-On Straight Plug**



**Threaded Straight Plug**





**Seal Kits**

Seals for Series MA / MAN cylinders are available in kit form and are stocked in principal industrial locations in the United States. For prompt delivery and complete information, contact the nearest Cylinder Division regional plant, or your local Parker Cylinder distributor.

Seal kits contain seals of nitrile (Buna-N) elastomers, the same as original seals installed in Series MA / MAN cylinders. They are recommended when air is the operating medium. Normal operating temperature range is -10°F. to +165°F.

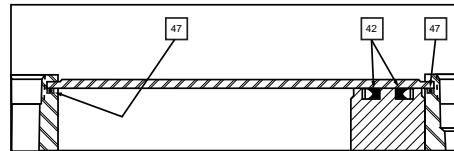
†on 6" Bore only Sym. 73 is used in place of Sym. 106 and 107.

Gland and rod seal replacement parts are identified as Symbol RG – Rod Gland Cartridge Kit. A complete seal kit for noncushion cylinder is identified as Symbol SK – Seal Kit. Cushion kits are available for head or cap end and should be ordered as required.

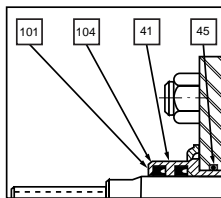
Replacement parts can be identified from list below. To order specify bore, stroke, model number and serial number shown on cylinder name plate. Order seal kits from table on the following page.

**Basic Cylinder Parts Identification**

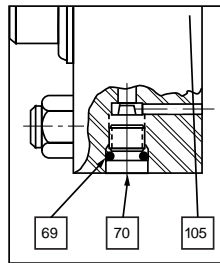
Sym.	Part Name
1	Head
7	Cap
15	Cylinder Body
17	Piston
22	Tie Rod Nut
34	Piston Rod
41	Lipseal Rod Gland
42	Lipseal, Piston
44	Back-up washer, Piston
45	O-Ring, Gland to Head
47	O-ring, End Seal
69	O-Ring, Cush. Adj.
70	Needle, Cush. Adj.
73	Bushing, Cushion
74	Retaining Ring
94	Stud, Rod End
101	Gland
102	Retainer
103	Screw, Retainer
104	Wiper, Rod
105	Check Seal, Rod End
106	Check Seal, Cap End
107	Washer, Seal
108	Tie Rod
109	Cushion Sleeve



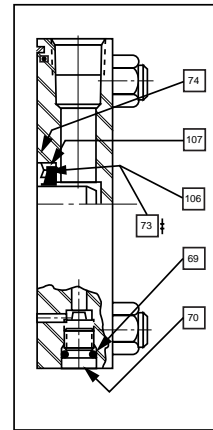
Seal Kit (Sym. SK)



Rod Gland Cartridge Kit (Sym. RG)



Head End Cushion Kit (Sym. CH)



Cap End Cushion Kit (Sym. CC)

Bore Size	Tie Rod Nut Torque* Series MA / MAN Cylinders			
	Steel Tube Tie Rod Nut Torque		Aluminum Tube Tie Rod Nut Torque	
1 1/2	60 in.-lbs.	69 cm-kg	20 in.-lbs.	23 cm-kg
2	11 ft.-lbs.	15 N.m	72 in.-lbs.	83 cm-kg
2 1/2	11 ft.-lbs.	15 N.m	72 in.-lbs.	83 cm-kg
3 1/4	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
4	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
5	60 ft.-lbs.	81 N.m	37 ft.-lbs.	50 N.m
6	60 ft.-lbs.	81 N.m	37 ft.-lbs.	50 N.m

\* (-0%, +5% tolerance) When assembling the cylinder, be sure to torque the tie rods evenly.

**Service Kits & Replacement Parts for Series MA / MAN Cylinders**

**Seal Kits**

Bore Size	Rod Dia.	Rod No.	SKL Seal Kits		SK Magnetic Seal Kits			
			Series MA	Series MAN	Series MA	Series MAN		
			Consisting of: 1 ea. Symbol # 41, 45, 104, & 2 ea. Symbol # 42 & 47		Consisting of: 1 ea. Symbol # 41, 45, 104, & 2 ea. Symbol # 42, 47, 129 & 130		Consisting of: 1 ea. Symbol # 41, 43, 45, 104, 121 & 2 ea. Symbol # 42, & 47; plus 1 ea. Quad Seal for old design.	
			Part Number	Part Number	Part Number	Part Number		
1 1/2"	5/8"	1	SKL7000MA*	SKL7000MAN	SKM7000MA1	SKM7000MAN		
2"	5/8"	1	SKL7001MA*	SKL7001MAN	SKM7001MA1	SKM7001MAN		
	1"	3	SKL7002MA*	SKL7002MAN	SKM7002MA1	SKM7002MAN		
2 1/2"	5/8"	1	SKL7003MA*	SKL7003MAN	SKM7003MA1	SKM7003MAN		
	1"	3	SKL7004MA*	SKL7004MAN	SKM7004MA1	SKM7004MAN		
3 1/4"	1"	1	SKL7005MA*	SKL7005MAN	SKM7005MA1	SKM7005MAN		
	1 3/8"	3	SKL7006MA*	SKL7006MAN	SKM7006MA1	SKM7006MAN		
4"	1"	1	SKL7007MA*	SKL7007MAN	SKM7007MA1	SKM7007MAN		
	1 3/8"	3	SKL7008MA*	SKL7008MAN	SKM7008MA1	SKM7008MAN		
5"	1"	1	SKL7009MA*	SKL7009MAN	SKM7009MA1	SKM7009MAN		
	1 3/8"	3	SKL7010MA*	SKL7010MAN	SKM7010MA1	SKM7010MAN		
6"	1 3/8"	1	SKL7098MA*	SKL7098MAN	SKM7098MA1	SKM7098MAN		

\* Ten (10) full digits are required to complete these part numbers. Replace asterisk ( \* ) with Service Class #1 or #5 as required for series MA non-magnetic cylinders. Service class 1 only for Series MAN and magnetic piston cylinders.

**Rod Gland Seal Kits & Cushion Kits**

Bore Size	Rod Dia.	Rod No.	Rod Gland Cartridge Kits		Cushion Kits			
			Series MA	Series MAN	Series MA & MAN			
			Consisting of: 1 each Symbol # 41, 45, 101 & 104		Consisting of: 1 ea. Sym. # 41, 45, 101, 104, 131 & 132		Contains: 1 each Symbol # 69, 70 & 105	Contains: 1 each Symbol # 69, 70, 74, 106 & 107
			Part Number	Part Number	Head End (CH)	Cap End (CC) ***		
1 1/2"	5/8"	1	RGL6948MA*	L070850040	CHL7011MA1	CCL7016MA1		
2"	5/8"	1			CHL7012MA1			
	1"	3	RGL6949MA*	L070850100	CHL7013MA1			
2 1/2"	5/8"	1	RGL6948MA*	L070850040	CHL7012MA1			
	1"	3	RGL6949MA*	L070850100	CHL7013MA1			
3 1/4"	1"	1	RGL6950MA*	L070850124	CHL7014MA1		CCL7017MA1	
	1 3/8"	3			CHL7015MA1			
4"	1"	1	RGL6949MA*	L070850100	CHL7014MA1			
	1 3/8"	3	RGL6950MA*	L070850124	CHL7015MA1			
5"	1"	1	RGL6949MA*	L070850100	CHL7014MA1			
	1 3/8"	3	RGL6950MA*	L070850124	CHL7015MA1			
6"	1 3/8"	1	RGL6950MA*	L070850124	CHL7170MA1	CCL7171MA1		

\* Ten (10) full digits are required to complete these part numbers. Replace asterisk ( \* ) with Service Class #1 or #5 as required.

\*\* For Class 5 consult factory.

\*\*\* 6" bore cap end cushion (CC) kit contains 1 each symbol # 69, 70, 73 & 74.





## ***Manufacturing Locations***

### **Regional Plants**

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#### ***California***

221 Helicopter Circle  
Corona, CA 92880  
Tel.: (951) 280-3800  
Fax: (951) 280-3808  
Fax: (800) 869-9886

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#### ***Georgia***

1300 Six Flags Road  
Lithia Springs, GA 30122  
Tel.: (770) 819-3400  
Fax: (800) 437-3498

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#### ***Indiana***

Goodland Plant  
715 South Iroquois Street  
Goodland, IN 47948  
Tel.: (219) 297-3182  
Fax: (800) 328-8120

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#### ***Michigan***

900 Plymouth Road  
Plymouth, MI 48170  
Tel.: (734) 455-1700  
Fax: (734) 455-1007

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#### ***Oregon***

29289 Airport Road  
Eugene, OR 97402-0079  
Tel.: (541) 689-9111  
Fax: (541) 688-6771  
Fax: (800) 624-7996

## Safety Guide for Selecting and Using Hydraulic, Pneumatic Cylinders and Their Accessories

**WARNING:** ⚠ FAILURE OF THE CYLINDER, ITS PARTS, ITS MOUNTING, ITS CONNECTIONS TO OTHER OBJECTS, OR ITS CONTROLS CAN RESULT IN:

- Unanticipated or uncontrolled movement of the cylinder or objects connected to it.
- Falling of the cylinder or objects held up by it.
- Fluid escaping from the cylinder, potentially at high velocity.

**THESE EVENTS COULD CAUSE DEATH OR PERSONAL INJURY BY, FOR EXAMPLE, PERSONS FALLING FROM HIGH LOCATIONS, BEING CRUSHED OR STRUCK BY HEAVY OR FAST MOVING OBJECTS, BEING PUSHED INTO DANGEROUS EQUIPMENT OR SITUATIONS, OR SLIPPING ON ESCAPED FLUID.**

Before selecting or using Parker Hannifin Corporation (the Company) cylinders or related accessories, it is important that you read, understand and follow the following safety information. Training is advised before selecting and using the Company's products.

### 1.0 General Instructions

**1.1 Scope** – This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) cylinder products. This safety guide is a supplement to and is to be used with the specific Company publications for the specific cylinder products that are being considered for use.

**1.2 Fail Safe** – Cylinder products can and do fail without warning for many reasons. All systems and equipment should be designed in a fail-safe mode so that if the failure of a cylinder product occurs people and property won't be endangered.

**1.3 Distribution** – Provide a free copy of this safety guide to each person responsible for selecting or using cylinder products. Do not select or use the Company's cylinders without thoroughly reading and understanding this safety guide as well as the specific Company publications for the products considered or selected.

**1.4 User Responsibility** – Due to very wide variety of cylinder applications and cylinder operating conditions, the Company does not warrant that any particular cylinder is suitable for any specific application. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The hydraulic and pneumatic cylinders outlined in this catalog are designed to the Company's design guidelines and do not necessarily meet the design guideline of other agencies such as American Bureau of Shipping, ASME Pressure Vessel Code etc. The user, through its own analysis and testing, is solely responsible for:

- Making the final selection of the cylinders and related accessories.
- Determining if the cylinders are required to meet specific design requirements as required by the Agency(s) or industry standards covering the design of the user's equipment.
- Assuring that the user's requirements are met, OSHA requirements are met, and safety guidelines from the applicable agencies such as but not limited to ANSI are followed and that the use presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the cylinders are used.

**1.5 Additional Questions** – Call the appropriate Company technical service department if you have any questions or require any additional information. See the Company publication for the product being considered or used, or call 1-847-298-2400, or go to [www.parker.com](http://www.parker.com), for telephone numbers of the appropriate technical service department.

### 2.0 Cylinder and Accessories Selection

**2.1 Seals** – Part of the process of selecting a cylinder is the selection of seal compounds. Before making this selection, consult the "seal information page(s)" of the publication for the series of cylinders of interest.

The application of cylinders may allow fluids such as cutting fluids, wash down fluids etc. to come in contact with the external area of the cylinder. These fluids may attack the piston rod wiper and or the primary seal and must be taken into account when selecting and specifying seal compounds.

Dynamic seals will wear. The rate of wear will depend on many operating factors. Wear can be rapid if a cylinder is mis-aligned or if the cylinder has been improperly serviced. The user must take seal wear into consideration in the application of cylinders.

**2.2 Piston Rods** – Possible consequences of piston rod failure or separation of the piston rod from the piston include, but are not limited to are:

- Piston rod and or attached load thrown off at high speed.
- High velocity fluid discharge.
- Piston rod extending when pressure is applied in the piston retract mode.

Piston rods or machine members attached to the piston rod may move suddenly and without warning as a consequence of other conditions occurring to the machine such as, but not limited to:

- Unexpected detachment of the machine member from the piston rod.

- Failure of the pressurized fluid delivery system (hoses, fittings, valves, pumps, compressors) which maintain cylinder position.
- Catastrophic cylinder seal failure leading to sudden loss of pressurized fluid.
- Failure of the machine control system.

Follow the recommendations of the "Piston Rod Selection Chart and Data" in the publication for the series of cylinders of interest. The suggested piston rod diameter in these charts must be followed in order to avoid piston rod buckling.

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod to fail. If these types of additional loads are expected to be imposed on the piston rod, their magnitude should be made known to our engineering department.

The cylinder user should always make sure that the piston rod is securely attached to the machine member.

On occasion cylinders are ordered with double rods (a piston rod extended from both ends of the cylinder). In some cases a stop is threaded on to one of the piston rods and used as an external stroke adjuster. On occasions spacers are attached to the machine member connected to the piston rod and also used as a stroke adjuster. In both cases the stops will create a pinch point and the user should consider appropriate use of guards. If these external stops are not perpendicular to the mating contact surface, or if debris is trapped between the contact surfaces, a bending moment will be placed on the piston rod, which can lead to piston rod failure. An external stop will also negate the effect of cushioning and will subject the piston rod to impact loading. Those two (2) conditions can cause piston rod failure. Internal stroke adjusters are available with and without cushions. The use of external stroke adjusters should be reviewed with our engineering department.

The piston rod to piston and the stud to piston rod threaded connections are secured with an anaerobic adhesive. The strength of the adhesive decreases with increasing temperature. Cylinders which can be exposed to temperatures above +250°F (+121°C) are to be ordered with a non studded piston rod and a pinned piston rod joint.

**2.3 Cushions** – Cushions should be considered for cylinder applications when the piston velocity is expected to be over 4 inches/second.

Cylinder cushions are normally designed to absorb the energy of a linear applied load. A rotating mass has considerably more energy than the same mass moving in a linear mode. Cushioning for a rotating mass application should be reviewed by our engineering department.

**2.4 Cylinder Mountings** – Some cylinder mounting configurations may have certain limitations such as but not limited to minimum stroke for side or foot mounting cylinders or pressure de-ratings for certain mounts. Carefully review the catalog for these types of restrictions.

Always mount cylinders using the largest possible high tensile alloy steel socket head cap screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

**2.5 Port Fittings** – Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at piston rod end.

The rod end pressure is approximately equal to:

$$\frac{\text{operating pressure} \times \text{effective cap end area}}{\text{effective rod end piston area}}$$

Contact your connector supplier for the pressure rating of individual connectors.

### 3.0 Cylinder and Accessories Installation and Mounting

#### 3.1 Installation

**3.1.1** – Cleanliness is an important consideration, and cylinders are shipped with the ports plugged to protect them from contaminants entering the ports. These plugs should not be removed until the piping is to be installed. Before making the connection to the cylinder ports, piping should be thoroughly cleaned to remove all chips or burrs which might have resulted from threading or flaring operations.

**3.1.2** – Cylinders operating in an environment where air drying materials are present such as fast-drying chemicals, paint, or weld splatter, or other hazardous conditions such as excessive heat, should have shields installed to prevent damage to the piston rod and piston rod seals.

**3.1.3** – Proper alignment of the cylinder piston rod and its mating component on the machine should be checked in both the extended and retracted positions. Improper alignment will result in excessive rod gland and/or cylinder bore wear. On fixed mounting cylinders attaching the piston rod while the rod is retracted will help in achieving proper alignment.

**3.1.4** – Sometimes it may be necessary to rotate the piston rod in order to thread the piston rod into the machine member. This operation must always be done with zero pressure being applied to either side of the piston. Failure to follow this procedure may result in loosening the piston to rod-threaded connection. In some rare cases the turning of the piston rod may rotate a threaded piston rod gland and loosen it from the cylinder head. Confirm that this condition is not occurring. If it does, re-tighten the piston rod gland firmly against the cylinder head.

For double rod cylinders it is also important that when attaching or detaching the piston rod from the machine member that the torque be applied to the piston rod end of the cylinder that is directly attaching to the machine member with the opposite end unrestrained. If the design of the machine is such that only the rod end of the cylinder opposite to where the rod attaches to the machine member can be rotated, consult the factory for further instructions.

## 3.2 Mounting Recommendations

**3.2.1** – Always mount cylinders using the largest possible high tensile alloy steel socket head screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

**3.2.2** – Side-Mounted Cylinders – In addition to the mounting bolts, cylinders of this type should be equipped with thrust keys or dowel pins located so as to resist the major load.

**3.2.3** – Tie Rod Mounting – Cylinders with tie rod mountings are recommended for applications where mounting space is limited. The standard tie rod extension is shown as BB in dimension tables. Longer or shorter extensions can be supplied. Nuts used for this mounting style should be torqued to the same value as the tie rods for that bore size.

**3.2.4** – Flange Mount Cylinders – The controlled diameter of the rod gland extension on head end flange mount cylinders can be used as a pilot to locate the cylinders in relation to the machine. After alignment has been obtained, the flanges may be drilled for pins or dowels to prevent shifting.

**3.2.5** – Trunnion Mountings – Cylinders require lubricated bearing blocks with minimum bearing clearances. Bearing blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to axis of the trunnion pins.

**3.2.6** – Clevis Mountings – Cylinders should be pivoted at both ends with centerline of pins parallel to each other. After cylinder is mounted, be sure to check to assure that the cylinder is free to swing through its working arc without interference from other machine parts.

## 4.0 Cylinder and Accessories Maintenance, Troubleshooting and Replacement

**4.1 Storage** – At times cylinders are delivered before a customer is ready to install them and must be stored for a period of time. When storage is required the following procedures are recommended.

**4.1.1** – Store the cylinders in an indoor area which has a dry, clean and noncorrosive atmosphere. Take care to protect the cylinder from both internal corrosion and external damage.

**4.1.2** – Whenever possible cylinders should be stored in a vertical position (piston rod up). This will minimize corrosion due to possible condensation which could occur inside the cylinder. This will also minimize seal damage.

**4.1.3** – Port protector plugs should be left in the cylinder until the time of installation.

**4.1.4** – If a cylinder is stored full of hydraulic fluid, expansion of the fluid due to temperature changes must be considered. Installing a check valve with free flow out of the cylinder is one method.

**4.1.5** – When cylinders are mounted on equipment that is stored outside for extended periods, exposed unpainted surfaces, e.g. piston rod, must be coated with a rust-inhibiting compound to prevent corrosion.

### 4.2 Cylinder Trouble Shooting

#### 4.2.1 – External Leakage

**4.2.1.1** – Rod seal leakage can generally be traced to worn or damaged seals. Examine the piston rod for dents, gouges or score marks, and replace piston rod if surface is rough.

Rod seal leakage could also be traced to gland wear. If clearance is excessive, replace rod bushing and seal. Rod seal leakage can also be traced to seal deterioration. If seals are soft or gummy or brittle, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with seal material, which is compatible with these fluids. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165°F. (+74°C). Shield the cylinder from the heat source to limit temperature to 350°F. (+177°C.) and replace with fluorocarbon seals.

**4.2.1.2** – Cylinder body seal leak can generally be traced to loose tie rods. Torque the tie rods to manufacturer's recommendation for that bore size.

Excessive pressure can also result in cylinder body seal leak. Determine maximum pressure to rated limits. Replace seals and retorquer tie rods as in paragraph above. Excessive pressure can also result in cylinder body seal leak. Determine if the pressure rating of the cylinder has been exceeded. If so, bring the operating pressure down to the rating of the cylinder and have the tie rods replaced.

Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and retorquer as in paragraph above.

Cylinder body seal leakage due to loss of radial squeeze which shows up in the form of flat spots or due to wear on the O.D. or I.D. – Either of these are symptoms of normal wear due to high cycle rate or length of service. Replace seals as per paragraph above.

#### 4.2.2 – Internal Leakage

**4.2.2.1** – Piston seal leak (by-pass) 1 to 3 cubic inches per minute leakage is considered normal for piston ring construction. Virtually no static leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.

**4.2.2.2** – With lipseal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal wear. Contamination in a hydraulic system can result in a scored cylinder bore, resulting in rapid seal wear. In either case, replace piston seals as required.

**4.2.2.3** – What appears to be piston seal leak, evidenced by the fact that the cylinder drifts, is not always traceable to the piston. To make sure, it is suggested that one side of the cylinder piston be pressurized and the fluid line at the opposite port be disconnected. Observe leakage. If none is evident, seek the cause of cylinder drift in other component parts in the circuit.

#### 4.2.3 – Cylinder Fails to Move the Load

**4.2.3.1** – Pneumatic or hydraulic pressure is too low. Check the pressure at the cylinder to make sure it is to circuit requirements.

**4.2.3.2** – Piston Seal Leak – Operate the valve to cycle the cylinder and observe fluid flow at valve exhaust ports at end of cylinder stroke. Replace piston seals if flow is excessive.

**4.2.3.3** – Cylinder is undersized for the load – Replace cylinder with one of a larger bore size.

#### 4.3 Erratic or Chatter Operation

**4.3.1** – Excessive friction at rod gland or piston bearing due to load misalignment – Correct cylinder-to-load alignment.

**4.3.2** – Cylinder sized too close to load requirements – Reduce load or install larger cylinder.

**4.3.3** – Erratic operation could be traced to the difference between static and kinetic friction. Install speed control valves to provide a back pressure to control the stroke.

#### 4.4 Cylinder Modifications, Repairs, or Failed Component

Cylinders as shipped from the factory are not to be disassembled and or modified. If cylinders require modifications, these modifications must be done at company locations or by the Company's certified facilities. The Cylinder Division Engineering Department must be notified in the event of a mechanical fracture or permanent deformation of any cylinder component (excluding seals). This includes a broken piston rod, tie rod, mounting accessory or any other cylinder component. The notification should include all operation and application details. This information will be used to provide an engineered repair that will prevent recurrence of the failure.

It is allowed to disassemble cylinders for the purpose of replacing seals or seal assemblies. However, this work must be done by strictly following all the instructions provided with the seal kits.

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods, services or work described will be referred to as "Products".

**1. Terms.** All sales of Products by Seller are expressly conditioned upon, and will be governed by the acceptance of 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. No modification to these Terms will be binding on Seller unless agreed to in writing and signed by an authorized representative of Seller.

**2. 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 at any time to adjust for any raw material price fluctuations. 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). 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.

**3. Shipment; Delivery; Title and Risk of Loss.** All delivery dates are approximate, and Seller is not responsible for damages resulting from any delay. 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 repack any Products without the prior written authorization from Seller, and any return shall be at the sole cost and expense of Buyer.

**4. Warranty.** The warranty for the Products is as follows: (i) Goods are warranted against defects in material or workmanship for a period of eighteen (18) 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, NON-INFRINGEMENT, 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".**

**5. 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.

**6. LIMITATION OF LIABILITY.** IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE THE NON-CONFORMING PRODUCT, 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.**

**7. Confidential Information.** Buyer acknowledges and agrees that any technical, commercial, or other confidential 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 ("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.

**8. Loss to Buyer's Property.** Any tools, patterns, materials, equipment or information furnished by Buyer or which are or become 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. Furthermore, Seller shall not be responsible for any loss or damage to Buyer's Property while it is in Seller's possession or control.

**9. Special Tooling.** "Special Tooling" includes but is not limited to tools, jigs, fixtures and associated manufacturing equipment acquired or necessary to manufacture Goods. Seller may impose a tooling charge for any Special Tooling. Such Special Tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. 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 discretion at any time.

**10. 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.

**11. 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.

**12. Use of Products, Indemnity by Buyer.** Buyer shall comply with all instructions, guides and specifications provided by Seller with the Quote or the Products. Unauthorized Uses. 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 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 patterns, tools, equipment, plans, drawings, designs, specifications or other information or things furnished by Buyer; (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. Seller shall not indemnify Buyer under any circumstance except as otherwise provided in these Terms.

**13. 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.

**14. Limitation on Assignment.** Buyer may not assign its rights or obligations without the prior written consent of Seller.

**15. Force Majeure.** Seller is not liable for delay or failure to perform any of its obligations by reason of 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, delays or failures in delivery from carriers or suppliers, shortages of materials, war (whether declared or not) or the serious threat of same, riots, rebellions, acts of terrorism, 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 force majeure shall be tolled for the duration of such force majeure and rescheduled for mutually agreed dates as soon as practicable after the force majeure condition ceases to exist. Force majeure shall not include financial distress, insolvency, bankruptcy, or other similar conditions affecting one of the parties, affiliates and/or sub-contractors.

**16. 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.

**17. Termination.** Seller may 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.

**18. Ownership of Software.** Seller retains ownership of all Software supplied to Buyer hereunder. In no event shall Buyer obtain any greater right in and to the Software than a right in the nature of a license limited to the use thereof and subject to compliance with any other terms provided with the Software.

**19. Indemnity for Infringement of Intellectual Property Rights.** Seller is not liable for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights ("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 sold hereunder 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 sold hereunder 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 so as 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; or (ii) directed to any Products provided hereunder 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 provided hereunder. 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.

**20. Governing Law.** These Terms 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.

**21. Entire Agreement.** These Terms, along with the terms set forth in the main body of any 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 main body of a Quote and these Terms, the terms set forth in the main body of the Quote shall prevail. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter shall have no effect. These Terms may not be modified unless in writing and signed by an authorized representative of Seller.

**22. 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 and Drug Administration ("FDA"), 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 acknowledges that it is familiar with all applicable provisions of the FCPA, the Anti-Kickback Act, Export Laws, the FDA 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 Laws. 08/2020



# Parker's Motion & Control Technologies

At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further info call 1 800 C-Parker (1 800 272 7537)



## 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



## Climate Control 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<sub>2</sub> 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



## Electromechanical Key Markets

- Aerospace
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Paper machinery
- Plastics machinery & converting
- Primary metals
- Semiconductor & electronics
- Textile
- Wire & cable

## Key Products

- AC/DC drives & systems
- Electric actuators, gantry robots & slides
- Electrohydraulic actuation systems
- Electromechanical actuation systems
- Human machine interface
- Linear motors
- Stepper motors, servo motors, drives & controls
- Structural extrusions



## 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



## Fluid & Gas Handling

### 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



## Pneumatics

### Key Markets

- Aerospace
- Conveyor & material handling
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Transportation & automotive

### Key Products

- Air preparation
- Brass fittings & valves
- Manifolds
- Pneumatic accessories
- Pneumatic actuators & grippers
- Pneumatic valves & controls
- Quick disconnects
- Rotary actuators
- Rubber & thermoplastic hose & couplings
- Structural extrusions
- Thermoplastic tubing & fittings
- Vacuum generators, cups & sensors



## Process Control

### 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
- Permanent no-weld tube fittings
- Precision industrial regulators & flow controllers
- Process control double block & bleeds
- Process control fittings, valves, regulators & manifold valves



## Sealing & Shielding

### 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

ENGINEERING YOUR SUCCESS.



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