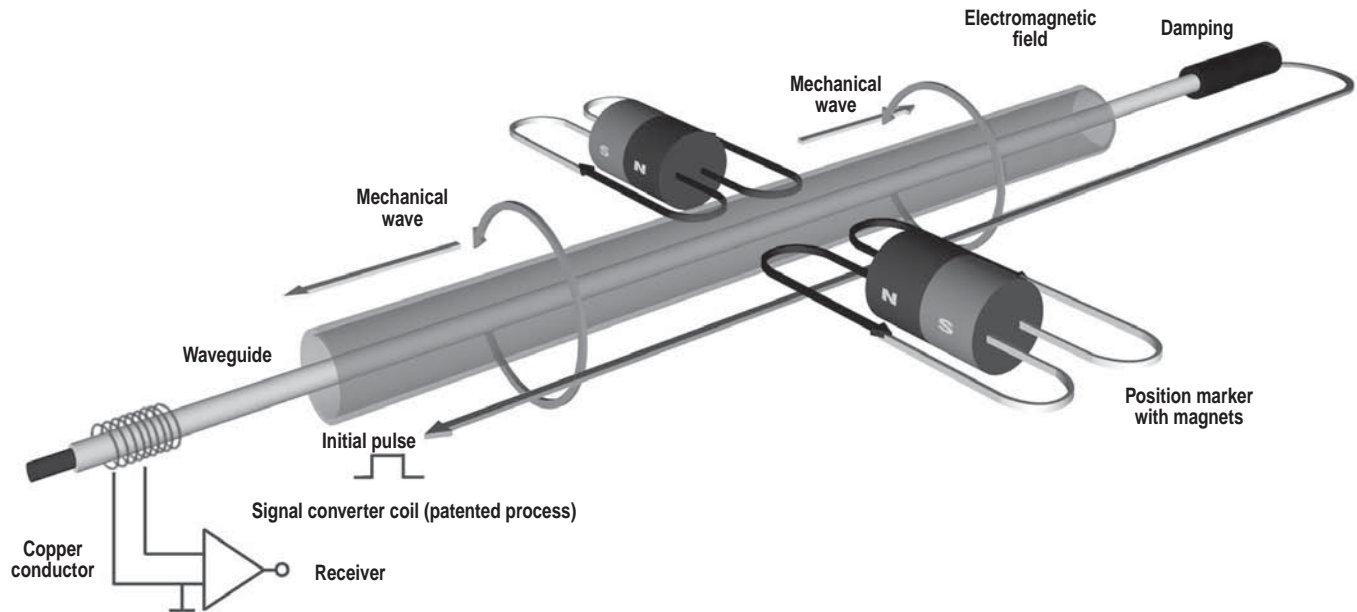
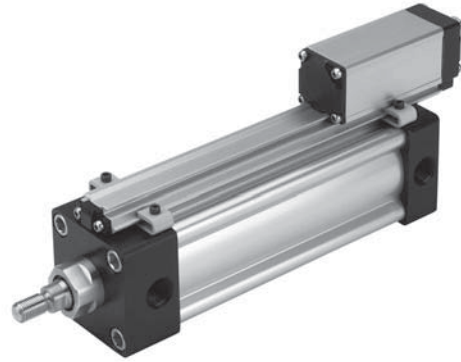
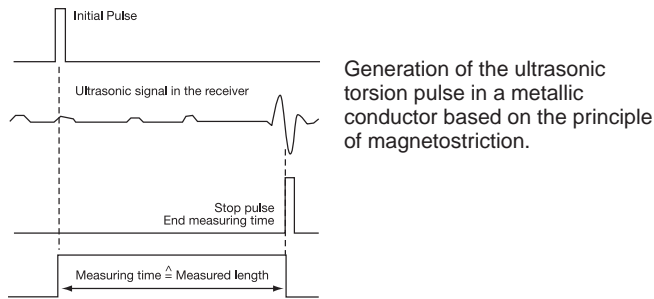


**Linear Position Sensor for Continuous
 Position Feedback**

B



Principles of Operation

The measuring element (“waveguide”), consists of a special nickel-alloy tube.

A copper conductor is introduced through the length of this tube. The start of measurement is initiated by a short current pulse.

This current generates a circular magnetic field which rotates around the waveguide. A permanent magnet at the point of measurement is used as the marker element, whose lines of field run at right angles to the electromagnetic field. In the area on the waveguide where the two fields intersect, a magneto-strictive effect causes an elastic deformation of the waveguide, which propagates along the wave guide in both directions in the form of a mechanical wave.

The propagation velocity of this wave in the waveguide is 2830 m/s, and is nearly insensitive to environmental effects (e.g., temperature, shock, contamination).

The component of the wave which reaches the far end of the waveguide is damped there, whereas the component which arrives at the signal converter is changed into an electrical

signal by reversing the magnetostrictive effect. The wave travel time from its point of origin to the signal converter is directly proportional to the distance between the permanent magnet and the signal converter. A time measurement then allows the distance to be determined with extremely high accuracy.

Design

The transducers are made to the same safety and reliability standards for use in the harshest conditions:

- The electronics unit is compactly designed using SMD technology. The boards are protected in a space-saving, rugged aluminum extruded housing.
- The waveguide is protected in the extruded aluminum housing.

Quality

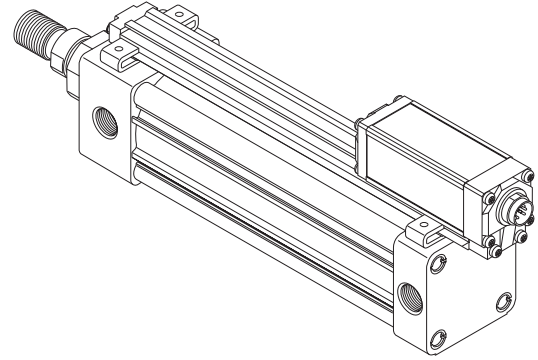
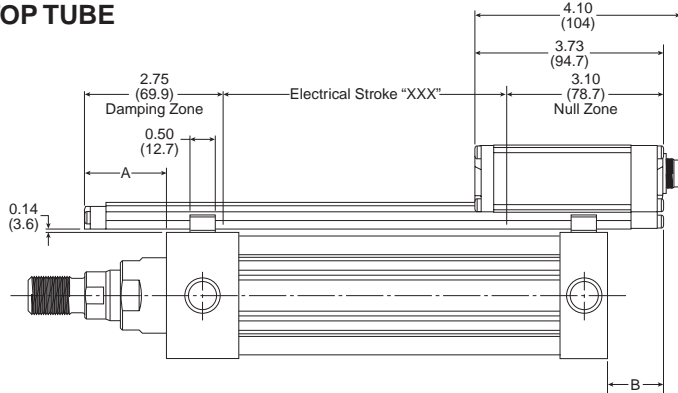
Each and every transducer undergoes a specially designed, computer-controlled testing procedure which includes 100% checking of all specified data.

The drawings below show that the Linear Position Sensor is longer than the cylinder of the same stroke length. The sensor overhang on the head end of the cylinder, as indicated by dimension A, may be eliminated by adding stop tubing, which effectively increases the gross stroke of the cylinder. The recommended stop tube lengths are provided in the

table below for each bore size. The examples show that the electrical stroke of the sensor will always match the **net** stroke of the cylinder.

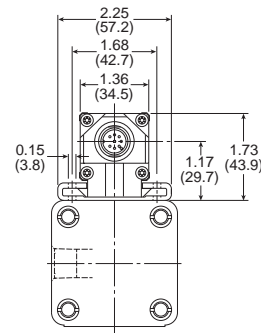
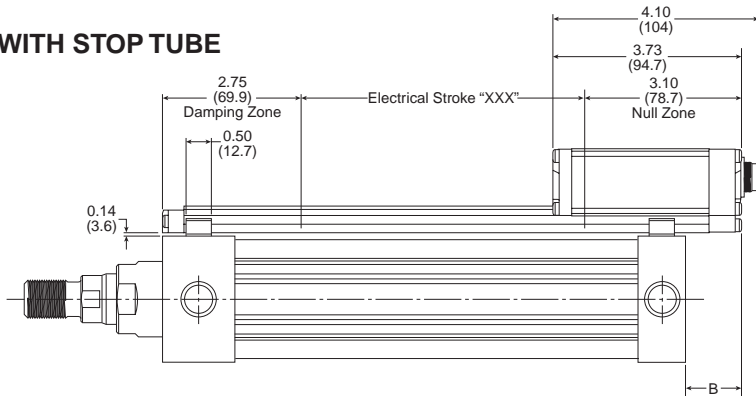
As a result of the limited sensing range of the sensor, it will overhang at the cap end of the cylinder by the amount of dimension B.

NO STOP TUBE



Example A: 12" Stroke cylinder without stop tube equals 12" Electrical Stroke for the Sensor.

WITH STOP TUBE



Example B: To eliminate sensor overhang on the head end of a 2.0" bore cylinder, add 1.0" of recommended stop tube length. The cylinder gross stroke becomes 13" and the net stroke remains 12". Specify a sensor with an electrical stroke of 12". Note that the electrical stroke equals cylinder **net** stroke length.

Example C: To eliminate sensor overhang on the head end of a 5.0" bore cylinder, add 0.625" of recommended stop tube length. The cylinder gross stroke becomes 12.625" and the net stroke remains 12". Specify a sensor with an electrical stroke of 12". Note that the electrical stroke equals cylinder **net** stroke length.

Bore	Rod Code	Rod Diameter	No Stop Tube		With Stop Tube		
			A	B	Stop Tube Length	A ₁	B
2	1	5/8	0.95	1.3	1.0	0	1.3
	3	1					
2-1/2	1	5/8	0.90	1.25	1.0	0	1.25
	3	1					
3-1/4	1	1	0.64	1.0	0.75	0	1.0
	3	1-3/8					
4	1	1	0.63	0.99	0.75	0	0.99
	3	1-3/8					
5	1	1	0.55	0.79	0.625	0	0.79
	3	1-3/8					
6	1	1-3/8	0.47	0.46	0.50	0	0.45
	3	1-3/4					
8	1	1-3/8	0.28	0.44	0.375	0	0.44
	3	1-3/4					



B

3MAJ/4MA

3MAJ/4MAJ

ACVB Option

LPSO Option

4MNR

S

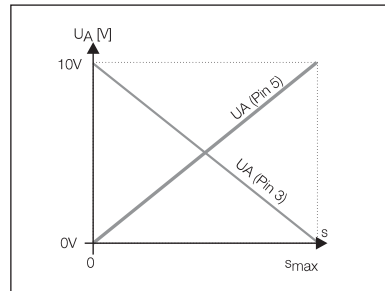
C

B

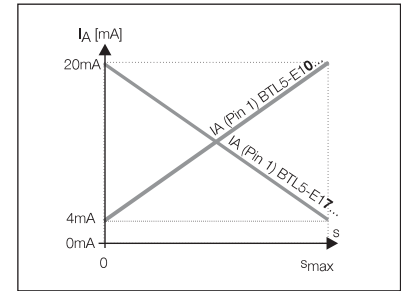
Output signal
 Transducer interface
 Input interface

analog
A
 analog

analog
E
 analog



BTL5-A11-M _ _ _ _ -RSU022S32



BTL5-E1 _M _ _ _ _ -RSU022S32

Ordering code

Output voltage
 Output current
 Load current
 max. ripple.
 Load resistance
 System resolution

0...10 V
 max. 10 mA
 ≤ 5 mV
 ≤ **0.1 mV**

4...20 mA
 ≤ 500 Ohm
 ≤ **0.2 μA**

Hysteresis
 Repeatability
 Output update rate
 max. non-linearity

≤ 4 μm
 6 μm (hysteresis + resolution)
 STANDARD = 1 ms ^{≤1400 mm}
 ±100 μm to 500 mm stroke
 ±0.02 % 501...3606 mm stroke

Temperature coefficient Voltage output
 Current output

[150 μV/°C + (5 ppm/°C x PxU/L)] x D T
 [0.6 μA/°C + (10 ppm/°C x PxI/L)] x D T

Shock loading

100 g/11 ms per IEC 68-2-27

Vibration

12 g, 10...2000 Hz per IEC 68-2-6

Traverse velocity of magnet

any

Operating voltage

24 V DC ± 20%

Current draw

≤ 150 mA

Polarity reversal protected

yes

Overvoltage protection

Transzorb protection diodes

Dielectric constant

500 V (Ground to housing)

Operating temperature

-40...185 °F (-40...85°C)

Storage temperature

-40...212 °F (-40...100°C)

S32 Pin assignments	Pin	Color
Output signals	1	YE
	2	GY
	3	PK
	5	GN
Supply voltage	6	BU
	7	BN
	8	WH

BTL5-A11...
not used
signal GND
10...0 V
0...10 V
GND
+24 V DC (GND)

BTL5-E1...BTL5-E7...
4...20 mA 20...4 mA
0 V output
10...0 V
0...10 V
GND
+24 V DC (GND)

Connect shield to housing.

Specifications subject to change.

Please enter code for output signal and nominal stroke in ordering code.

BTL transducers with analog outputs are available in the ranges of 0...10V, 4...20mA with rising or falling signal.

Ordering Sample:

BTL5-A11-M _ _ _ _ -R-SU 022S32

Output signal
 1 increasing and decreasing (for A)
 0 increasing
 7 decreasing (for E)

Standard stroke lengths (mm)

M Interface

Differential **START/STOP** control-specific interface.

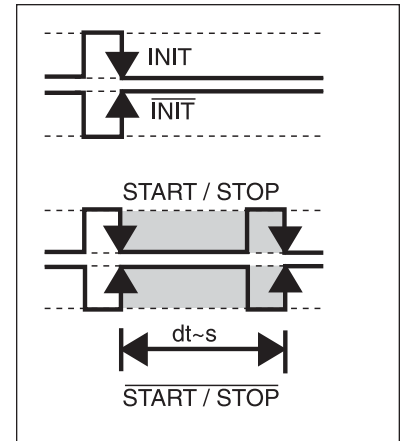
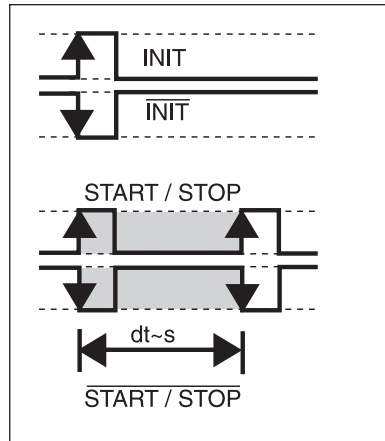
P Interface

Compatible with BTA processors and various OEM controls. Reliable signal transmission, even over cable lengths up to 500 m (1640ft.) between BTA and BTL, is assured by the especially noise-immune RS485 differential drivers and receivers. Noise signals are effectively suppressed.

Series
Transducer interface
User interface

BTL5 Low Profile
pulse M
pulse M

BTL5 Low Profile
pulse P
pulse P



Ordering code
System resolution
Repeatability
Resolution
Hysteresis
Standard sampling rate
max. non-linearity
Temperature coefficient of overall system
Traverse velocity of magnet
Operating voltage
Current draw
Operating temperature
Storage temperature

BTL5-M1-M__-RSU022S32

BTL5-P1-M__-RSU022S32

Process-dependent/control dependent
Hysteresis + Resolution
≤ 2 μm
≤ 4 μm
STANDARD = 1 kHz ≤1400 mm
±100 μm to 500 mm nominal stroke
±0.02 % 501...3750 mm nominal stroke
(6 μm + 5 ppm x L)/°C
any
24 V DC ±20 % or ±15V DC ±2% (optional)
≤ 100 mA
-40...185 °F (-40...85°C)
-40...212 °F (-40...100°C)

S32 Pin assignments	Pin	Color
Input/output signals	Input	1 YE
	Output	2 GY
	Input	3 PK
	Output	5 GN
Supply voltage	6	BU
	7	BN
	8	WH

BTL5-M1-M...
INIT
START/STOP
INIT
START/STOP
GND
+24 V DC
(GND)

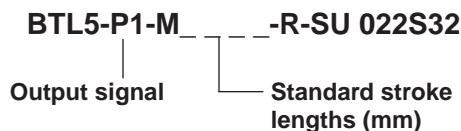
BTL5-P1-M...
INIT
START/STOP
INIT
START/STOP
GND
+24 V DC
(GND)

Shield connected to housing

Specifications subject to change.

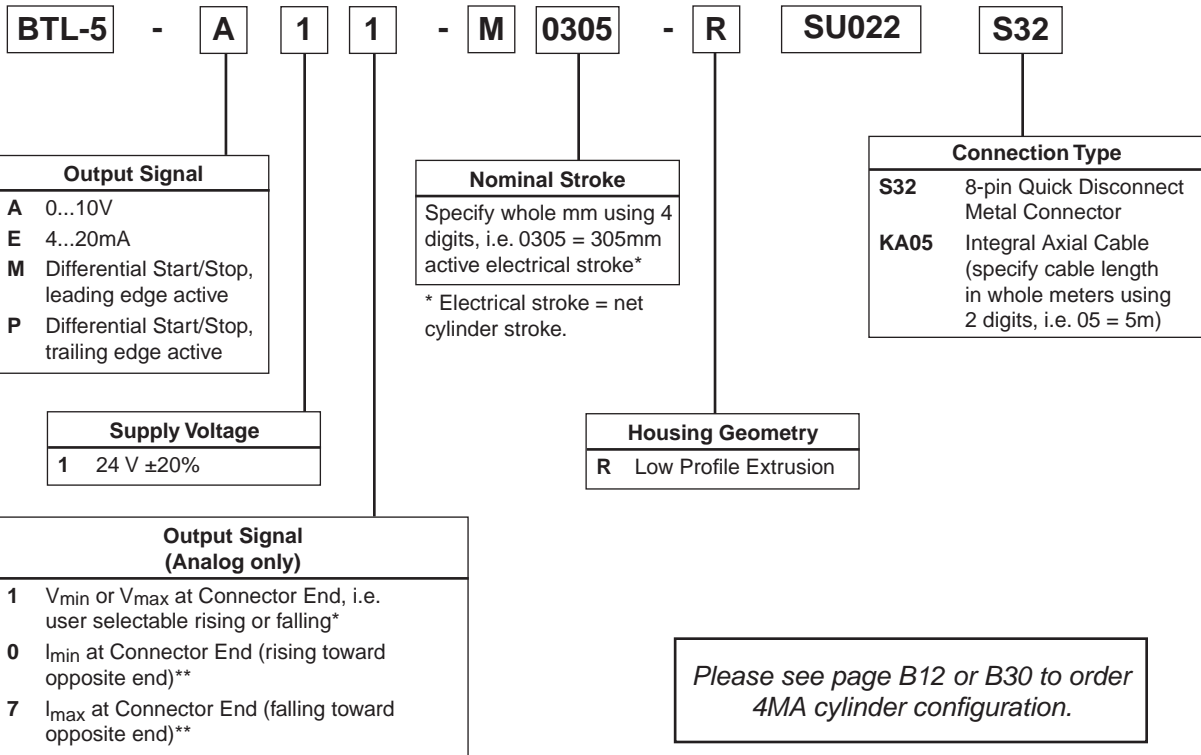
Please enter code for nominal stroke in ordering code.

Ordering Sample:



Sensor Ordering Code

B



* Available only with 0...10V output signal (A).
 **Available only with 4...20mA output signal (E).

Standard Lengths

Electrical Stroke					
inches	mm	inches	mm	inches	mm
2	0051	15	0381	42	1067
3	0077	16	0407	48	1220
4	0102	18	0457	50	1270
5	0127	20	0508	60	1524
6	0152	22	0560	70	1778
7	0178	24	0610	80	2032
8	0203	26	0661	90	2286
9	0230	28	0711	100	2540
10	0254	30	0762	110	2794
11	0280	32	0813	120	3048
12	0305	36	0914		
13	0330	40	1016		

Parker “Style 55” Piston Rod End

Rod end flange coupling for Parker 3MA, 4MA, 4ML, 3MAJ and 4MAJ Series cylinders:

- Simplifies alignment
- Reduces assembly time
- Allows full rated pneumatic pressure in push and pull directions
- Available in 5/8" through 1-3/4" piston rod diameters

How To Order

Complete Model Number and place a “55” in the Piston Rod End designator position.

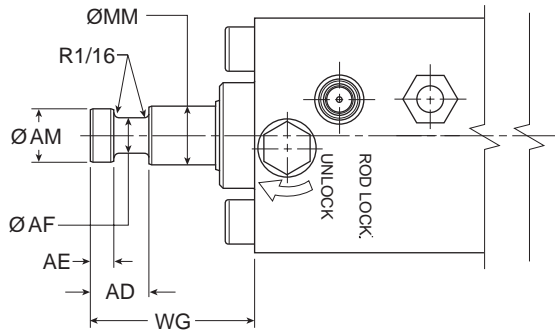
Example: 2.00 CJ4MAJU155C 6.000

Consult factory for availability of mounting accessories and hardware.

Style 55 Rod End Dimensions

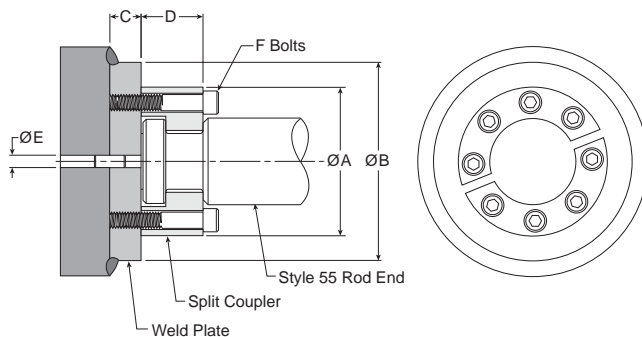
MM Rod Dia.	AD	AE	AF	AM	WG
5/8	5/8	1/4	3/8	.57	1-3/4
1	1-5/16	3/8	11/16	.95	2-3/8
1-3/8	1-1/16	3/8	7/8	1.32	2-3/4
1-3/4	1-5/16	1/2	1-1/8	1.70	3-1/8

See 3MA, 4MA or 3MAJ/4MAJ Series sections for more dimensions



Example: Style 55 Rod End shown on 4MAJ Series cylinder

Split Couplers and Weld Plates



⚠ WARNING: Piston rod separation from the machine member can result in severe personal injury or even death to nearby personnel. The cylinder user must make sure the weld holding the weld plate to the machine is of sufficient quality and size to hold the intended load. The cylinder user must also make sure the bolts holding split coupler to the weld plate are of sufficient strength to hold the intended load and installed in such a way that they will not become loose during the machine's operation.

NOTE: Screws are not included with split coupler or weld plate.

Table 1 — Part Numbers and Dimensions

Rod Dia.	A	B	C	D	E	F	Bolt Size	Bolt Circle	Split Coupler Part No.	Weld Plate Part No.
0.625	1.50	2.00	0.50	0.56	0.250	4	#10-24 x .94 LG	1.125	1472340062	1481740062
1.00	2.00	2.50	0.50	0.88	0.250	6	.250-20 x 1.25 LG	1.500	1472340100	1481740100
1.375	2.50	3.00	0.63	1.00	0.250	6	.312-18 x 1.50 LG	2.000	1472340138	1481740138
1.75	3.00	4.00	0.63	1.25	0.250	8	.312-18 x 1.75 LG	2.375	1472340175	1481740175

Note: All dimensions without a tolerance are reference dimensions.



Metric Rod Threads

Standard Metric Thread Sizes for Piston Rod Thread Type M

Rod Dia. MM	Styles 4 & 9 KK	Style 8* CC
3/8	M6 x 1.0	M8 x 1.25
1/2	M8 x 1.25	M12 x 1.25
5/8	M10 x 1.5	M12 x 1.5
1	M20 x 1.5	M22 x 1.5
1-3/8	M26 x 1.5	M30 x 2.0
1-3/4	M33 x 2.0	M39 x 2.0

*Style 6 for 1-1/8" bore 3MA

Note: All other rod end dimensions are standard per catalog.

B

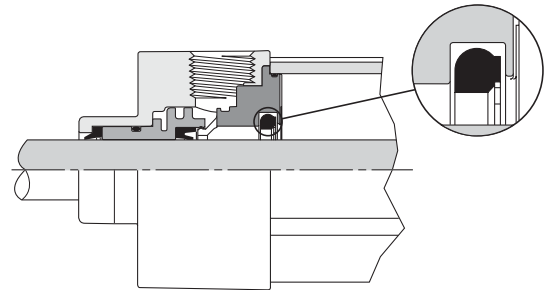
Check Seal Cushions For Increased Productivity and Maximum Performance

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

The 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 flow to piston face with a minimum pressure drop for a 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 available at both ends without change in envelope or mounting dimensions. A captive cushion adjusting needle is supplied for easy, precise adjustment on all bore sizes.

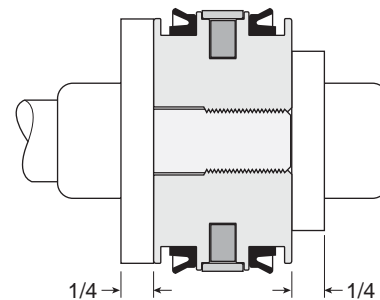


Bumpers

Impact dampening conventional bumpers can be provided on one or both sides of the piston with a 1/4" stroke loss per bumper. This style of bumper is ideal for applications subjected to high speeds where cycle time may discourage the use of cushions.

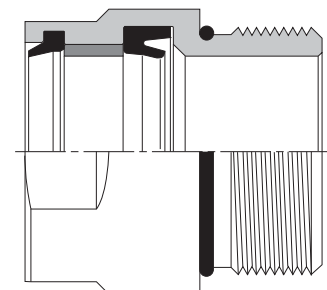
Available in 1-1/2" - 4" bore sizes for 3MA, 4MA, 4ML, 3MAJ and 4MAJ Series cylinders.

Bumper Option



HI LOAD Gland Assembly

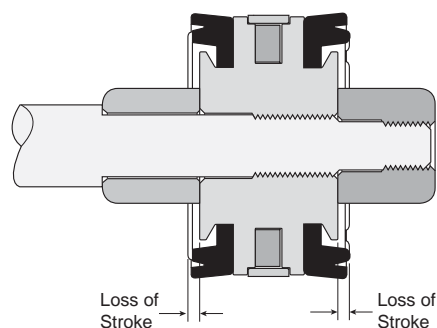
Applications with inherent side load require a slide package for maximum service life. In some cases, there may be limitations to the size or expense of these additional components. One possible solution may be the use of the optional HI LOAD gland assembly that incorporates a high strength composite bearing for radial load conditions. Extensive testing showed an approximate 50% increase in service life for general applications. Please note that each application is unique and results may vary. Includes seal options for standard, high and low temperature applications with air (4MA) or hydraulic (4ML) service.



Bumper Seal Option

Impact dampening Bumper Seals are now optional on all 3MA, 4MA, 3MAJ and 4MAJ cylinders from 1-1/8" to 5" bore. The Bumper Seal piston combines the features of low-friction, rounded lipseals and impact-dampening bumpers to provide reduced noise and smoother end-of-stroke deceleration. At pressure greater than 80 PSI, the compressible Buna Nitrile or Fluorocarbon Bumper Seal has minimal effect on stroke loss. When specified, Bumper Seals will be supplied on both ends of the piston, eliminating the need to specify head end or cap end only.

Bumper Seal Option



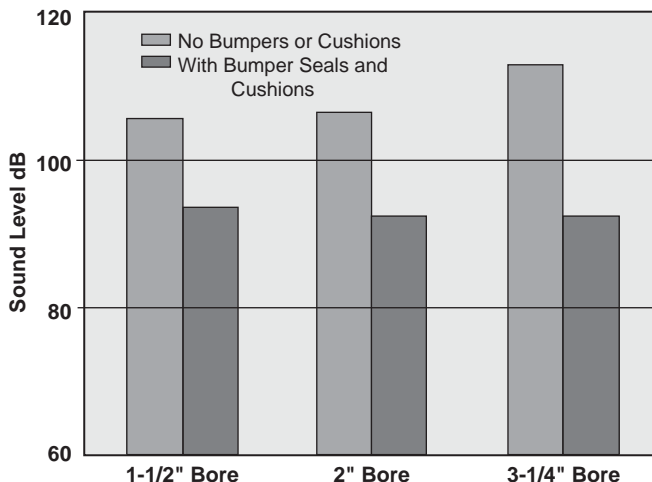
Summary of Accelerometer Test Results

Bore Size	Piston Type	Cushioning Efficiency (Maximum G's of Deceleration Force Created)	Cushioning Time (ms)
1-1/2"	Standard Piston	13.4	22
	Bumper Seal Piston	5.1	22
2"	Standard Piston	12.6	33
	Bumper Seal Piston	7.8	26
2-1/2"	Standard Piston	12.2	36
	Bumper Seal Piston	5.2	24

Bumper Seals Reduce Noise

The special profile of the Bumper Seal prevents the piston from noisily banging into the end cap at the end of stroke. Independent testing shows that the Bumper Seal, when combined with cushions, will absorb the final piston inertia and reduce the stroke noise by as much as 20 dB. The Sound Level Comparison graph illustrates the noise-reducing effects of the Bumper Seal piston when combined with cushions.

Impact noise was recorded at a distance of 3 feet from the front of the cylinder, inside a semi-anechoic chamber. Cylinders were operating at 95 PSI.



Sound Level Comparison

Bumper Seals have Minimum Effect on Stroke Length

The accompanying chart depicts typical amounts of overall stroke loss incurred at various system pressures. The amount of stroke loss may vary slightly due to design tolerances of seal size, variance in seal durometer and compression set associated with cylinder wear. To determine the stroke loss at either end of the cylinder, divide the values by two.

Pressure (PSI)	Typical Overall Loss of Stroke (inch) by Bore Size				
	1-1/2"	2"	2-1/2"	3-1/4"	4"
0	0.16	0.13	0.19	0.22	0.22
20	0.12	0.11	0.12	0.18	0.18
40	0.10	0.08	0.09	0.12	0.12
60	0.08	0.07	0.07	0.09	0.09
80	0.06	0.05	0.05	0.06	0.06
100	0.05	0.03	0.02	0.04	0.04

1-1/2" to 8" Bore Cylinder Accessories

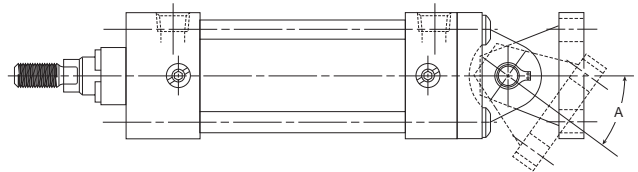
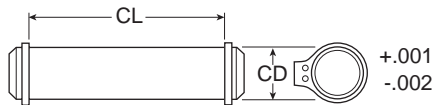
Rod end accessories can be selected by cylinder rod end thread size from Table A & B below. Mating parts for rod end accessories are listed just to the right of the knuckle or clevis selected. Mounting plates for style MP1 & MP4 cylinder mounts are selected by bore size from Table C.

B

Rod End Thread Size	TABLE A			TABLE B			TABLE C		
	Female Rod Clevis	Mating Parts		Knuckle	Mating Parts		Bore Size	Mounting Plates	
		Eye Bracket	Pivot Pin		Clevis Bracket	Pivot Pin		For Mtg. Style MP1 Cylinder	For Mtg. Style MP4 Cylinder
7/16-20	1458030044	1458060050	0856640050	1458040044	1458050050	0856640050	1-1/2	1458060050	1458050050
1/2-20	1458030050	1458060050	0856640050	1458040050	1458050050	0856640050	2	1458060050	1458050050
3/4-16	1458030075	1458060075	0856640075	1458040075	1458050075	0856640075	2-1/2	1458060050	1458050050
7/8-14	1458030088	1458060100	0856640100	1458040088	1458050100	0856640100	3-1/4	1458060075	1458050075
1-14	1458030100	1458060100	0856640100	1458040100	1458050100	0856640100	4	1458060075	1458050075
1-1/4-12	1458030125	1458060138	0856640138	1458040125	1458050138	0856640138	5	1458060075	—
1-1/2-12	1458030150	1458060175	0856640175	1458040150	1458050175	0856640175	6	1458060100	—
							8	1458060100	—

Note: For 1-1/8" bore 3MA cylinder accessories, please refer to page B59.

Pivot Pin



Symbol	0856640044	0856640050	0856640075	0856640100	0856640138	0856640175
CD	7/16	1/2	3/4	1	1-3/8	1-3/4
CL	1-5/16	1-7/8	2-5/8	3-1/8	4-1/8	5-3/16
Shear Cap. (lbs)	6600	8600	19300	34300	65000	105200

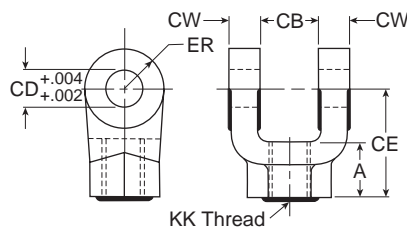
Maximum Pivot Angle for Rear Clevis Mounts (BB Mounts) and Accessories

Bore	1-1/2	2	2-1/2	3-1/4	4	5	6	8
Angle A	52	43	29	50	49	45	42	42

Note: Pivot Pin must be ordered separately for single lug pivot mounting.

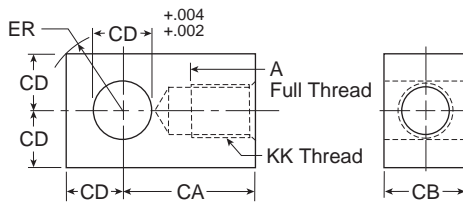
Note: All 3MA / 4MA Cylinder Mounting Kits and Assembly Instructions can be found on page B110. These kits can all be bolted onto cylinders with standard TEF mounts.

Female Rod Clevis



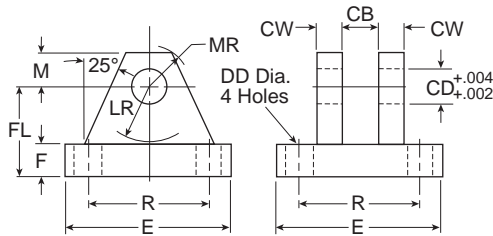
Symbol	1458030044	1458030050	1458030075	1458030088	1458030100	1458030125	1458030150
A	3/4	3/4	1-1/8	1-5/8	1-5/8	2	2-1/4
CB	3/4	3/4	1-1/4	1-1/2	1-1/2	2	2-1/2
CD	1/2	1/2	3/4	1	1	1-3/8	1-3/4
C E	1-1/2	1-1/2	2-1/8	2-15/16	2-15/16	3-3/4	4-1/2
CW	1/2	1/2	5/8	3/4	3/4	1	1-1/4
ER	1/2	1/2	3/4	1	1	1-3/8	1-3/4
KK	7/16-20	1/2-20	3/4-16	7/8-14	1-14	1-1/4-12	1-1/2-12
Load Capacity (lbs)	4250	4900	11200	18800	19500	33500	45600

Rod Eye Knuckle



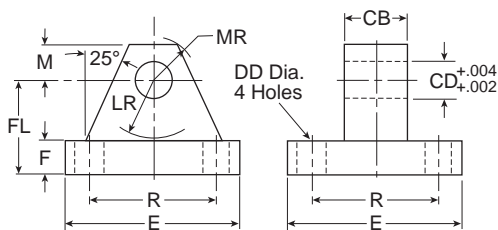
Symbol	1458040044	1458040050	1458040075	1458040088	1458040100	1458040125	1458040150
A	3/4	3/4	1-1/8	1-1/8	1-5/8	2	2-1/4
CA	1-1/2	1-1/2	2-1/16	2-3/8	2-13/16	3-7/16	4
CB	3/4	3/4	1-1/4	1-1/2	1-1/2	2	2-1/2
CD	1/2	1/2	3/4	1	1	1-3/8	1-3/4
ER	23/32	23/32	1-1/16	1-7/16	1-7/16	1-31/32	2-1/2
KK	7/16-20	1/2-20	3/4-16	7/8-14	1-14	1-1/4-12	1-1/2-12
Load Capacity (lbs)	5000	5700	12100	13000	21700	33500	45000

Clevis Bracket



Symbol	1458050044	1458050050	1458050075	1458050100	1458050138	1458050175
CB	15/32	3/4	1-1/4	1-1/2	2	2-1/2
CD	7/16	1/2	3/4	1	1-3/8	1-3/4
CW	3/8	1/2	5/8	3/4	1	1-1/4
DD	17/64	13/32	17/32	21/32	21/32	29/32
E	2-1/4	3-1/2	5	6-1/2	7-1/2	9-1/2
F	3/8	1/2	5/8	3/4	7/8	7/8
FL	1	1-1/2	1-7/8	2-1/4	3	3-5/8
LR	5/8	3/4	1-3/16	1-1/2	2	2-3/4
M	3/8	1/2	3/4	1	1-3/8	1-3/4
MR	1/2	5/8	29/32	1-1/4	1-21/32	2-7/32
R	1.75	2.55	3.82	4.95	5.73	7.50
Load Capacity (lbs)	3600	7300	14000	19200	36900	34000

Mounting Plate & Eye Bracket



Symbol	1458060031	1458060050	1458060075	1458060100	1458060138	1458060175
CB	15/16	3/4	1-1/4	1-1/2	2	2-1/2
CD	15/16	1/2	3/4	1	1-3/8	1-3/4
DD	17/64	13/32	17/32	21/32	21/32	29/32
E	2-1/4	2-1/2	3-1/2	4-1/2	5	6-1/2
F	3/8	3/8	5/8	7/8	7/8	1-1/8
FL	1	1-1/8	17/8	2-3/8	3	3-3/8
LR	5/8	3/4	1-1/4	1-1/2	2-1/8	2-1/4
M	3/8	1/2	3/4	1	1-3/8	1-3/4
MR	1/2	9/16	7/8	1-1/4	1-5/8	2-1/8
R	1.75	1.63	2.55	3.25	3.82	4.95
Load Capacity (lbs)	1700	4100	10500	20400	21200	49480



B
 3MA/4MA
 3MAJ/4MAJ
 ACVB Option
 LPSO Option
 4MNR
 S
 C

Mounting Kit Assembly

Perform the following steps when installing mounting kits onto 1-1/2" - 5" bore 3MA, 4MA and 4ML cylinders with the standard mount (TE or TEF).

- 1) Clean mating parts to remove oil, grease and dirt.
- 2) Fasteners should be clean, dry and burr free.
- 3) Brush mounting fastener threads thoroughly with anti-seize lubricant.
- 4) Follow the appropriate procedure below for the desired mounting.

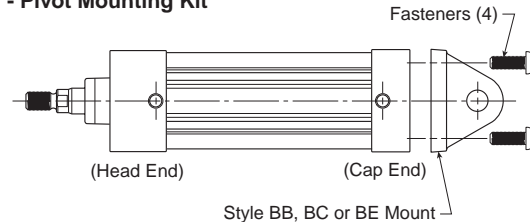
Rear Pivot Mounting Kits – Style BB, BC and BE (Fig. 1)

Place pivot mount over end cap, lining up the four fastener holes in the end cap with the pivot mounting plate. Note that the pivot mount can be rotated allowing for different cylinder port locations. Secure mounting to cylinder cap (finger tight) using the four fasteners. Torque the fasteners to the specifications in the table below.

Side Lug Mount – Style C (not shown)

Place one bracket over one cylinder endcap. Align the lower two fastener holes in the endcap with the thru holes in the bracket. Note that the bracket can be rotated allowing for different cylinder port locations. Secure the bracket to the endcap (finger tight) using two fasteners. Repeat for the other bracket and endcap. Place the assembly with the brackets down on a flat surface and torque the four fasteners on both brackets to specifications shown in the table below.

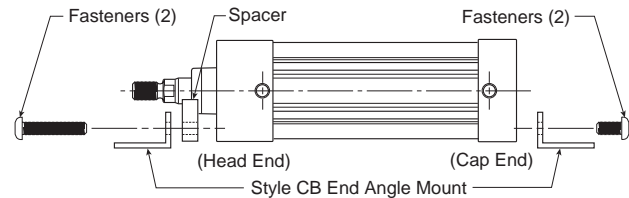
Fig. 1 - Pivot Mounting Kit



End Angle Mounting Kit – Style CB (Fig. 2)

The end angles bolt to the front and rear of the cylinder end caps. The spacer plate** provided is to be assembled at the rod end under the angle plate. Line up the two holes of the spacer plate and angle plate with the two fastener holes in the cylinder head. If 2 different length fasteners are in the kit, use the longer fasteners for the cylinder head end (rod end) mount. Secure (finger tight) using two fasteners. Repeat this assembly at the opposite end (less spacer). Place the assembly with the end angles down on a flat surface and torque the four fasteners to the specifications shown in the table below.

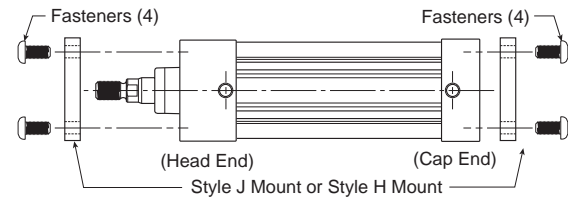
Fig. 2 - End Angle Mounting Kit



Flange Mounting Kits – Style J and H Single and Double Rod Cylinders (Fig. 3)

Place rectangular flange plate over appropriate end cap. Line up the four holes in the mounting plate with the four fastener holes in the cylinder end cap. Note that the rectangular mounting plate can be rotated to allow for different port locations. Secure the rectangular mounting plate to the end cap (finger tight) using the four fasteners. Then torque the four fasteners to the specifications shown in the table below.

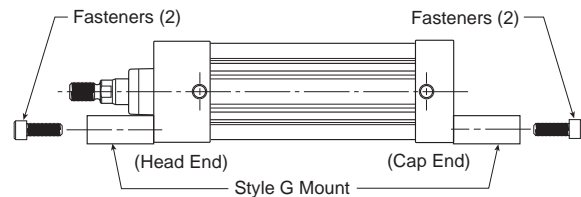
Fig. 3 - Flange Mounting Kit



Side End Lug Mounting Kits – Style G (Fig. 4)

Attach the two longer lugs with the fasteners provided in the kit to the cylinder head as shown. Attach the two shorter lugs to the cylinder cap in a similar fashion. Place the assembly with the lugs down on a flat surface and torque the four fasteners to the specifications shown in the table below.

Fig. 4 - Side End Lug Mounting Kit - Style MS7



3MA and 4MA Mounting Kits										
Bore Size	J (MF1)	H (MF2)	BB (MP1)	BC (MP2)	BE (MP4)	CB (MS1)	C (MS2)	G (MS7)	Kit Fastener Torque Units	
	Head Rectangular Flange	Cap Rectangular Flange	Cap Fixed Clevis	Cap Detachable Clevis	Cap Detachable Eye	Side End Angles	Side Lug (3MA only)	Side End Lug	USA inch-lbs	Metric N-m
	Kit Number	Kit Number	Kit Number	Kit Number	Kit Number	Kit Number	Kit Number	Kit Number		
1-1/2	L079700150	L079700150	L079710150	L079730150	L079720150	L079740150	L079830150	L079750150	32 - 36	3.6 - 4.1
2	L079700200	L079700200	L079710200	L079730200	L079720200	L079740200	L079830200	L079750200	72 - 82	8 - 9
2-1/2	L079700250	L079700250	L079710250	L079730250	L079720250	L079740250	L079830250	L079750250	72 - 82	8 - 9
3-1/4	L079700325	L079700325	L079710325	L079730325	L079720325	L079740325	L079830325	L079750325	216 - 228	24 - 25.3
4	L079700400	L079700400	L079710400	L079730400	L079720400	L079740400	L079830400	L079750400	216 - 228	24 - 25.3
5	L079700500	L079700500	L079710500	L079730500	N/A	L079740500	L079830500	N/A	360 - 372	41 - 42

** Spacer plate not used for 4" bore or double rod cylinders

1-1/8" Bore 3MA/3ML Individual and Complete Cylinder Kits

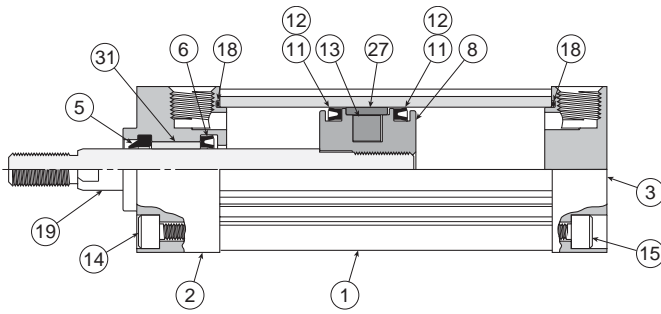
3MA kits – pneumatic service only
3ML kits – hydraulic service

Temperatures:

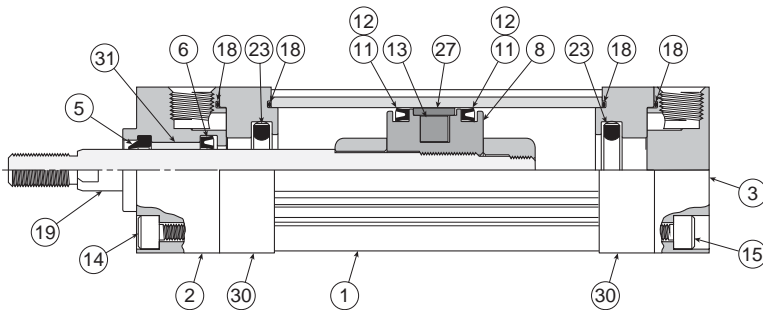
- Nitrile -10°F to +165°F (-23°C to +74°C)
- Fluorocarbon -10°F to +250°F (-23°C to +121°C)



Non-cushioned (3MA or 3ML)



Cushioned (3MA only)



Symbol Legend

Symbol	Description
1	Cylinder body
2	Head
3	Cap
5	Rod wiper
6	Rod seal
8	Piston
11	Piston seal (lipseal)
12	Piston seal (bumper seal option)
13	Magnetic ring
14	Head fastener
15	Cap fastener
18	O-ring - cylinder body to head & cap
19	Piston rod
23	Cushion check seal
24	Tie rod nut (Some mounts)
27	Wear band
28	Tie rod (Some mounts)
30	Cushion spacer
31	Rod bearing (1-1/2" bore)

Servicing the complete cylinder

The SK kit offers all parts to service an entire 3MA or 3ML cylinder with standard piston lipseals. Kits are available with Nitrile or Fluorocarbon seals. This kit is a combination of the rod wiper, rod seal, rod bearing and standard Piston Seal Kit.

1 tube of Lube-A-Cyl is also included with each kit.

3MA Kits

Rod Dia.	Rod No.	PK - Piston Seal Kit, Standard Lipseals Includes (2) each of symbol 11 & 18, and (1) of symbol 27		BK - Piston Seal Kit, Bumper Seals Includes (2) each of symbol 12 & 18, and (1) of symbol 27		Magnetic Ring Symbol 13 Only with Nitrile Seals	Endcap Fastener or Tie Rod Torque Units	
		Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	Part Number	USA inch-lbs	Metric N-m
3/8	1	PK11003MA1	PK11003MA5	BK01123MA1	BK01123MA5	086513S112	32-36	3.6-4.1
1/2	3							

Rod Dia.	Rod No.	CH - Cushion Kit for either end Includes 1 each of symbol 18, 23 and cushion needle valve assembly (no symbol)		SK - Complete Cylinder Kit Includes 1 each of symbol 5, 6, 31 and Standard Piston Seal Kit		Endcap Fastener or Tie Rod Torque Units	
		Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	USA inch-lbs	Metric N-m
3/8	1	CH11003MA1	CH11003MA5	SK11103MA1	SK11103MA5	32-36	3.6-4.1
1/2	3	CH11003MA1	CH11003MA5	SK111303MA1	SK111303MA5		

3ML Kits

Rod Dia.	Rod No.	PK - Piston Seal Kit, Standard Lipseals Includes (2) each of symbol 11 & 18, and (1) of symbol 27		Magnetic Ring Symbol 13 Only with Nitrile Seals	SK - Complete Cylinder Kit Includes 1 each of symbol 5, 6, 31 and Standard Piston Seal Kit	Endcap Fastener or Tie Rod Torque Units		
		Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	Part Number	Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	USA inch-lbs	Metric N-m
3/8	1	PK1123ML01	PK1123ML05	086513S112	SK11103ML1	SK11103ML5	32-36	3.6-4.1
1/2	3	PK1123ML01	PK1123ML05	086513S112	SK111303ML1	SK111303ML5		

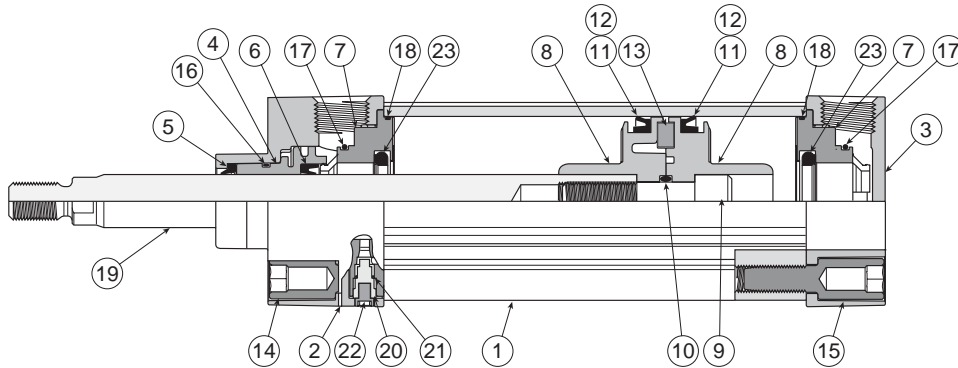
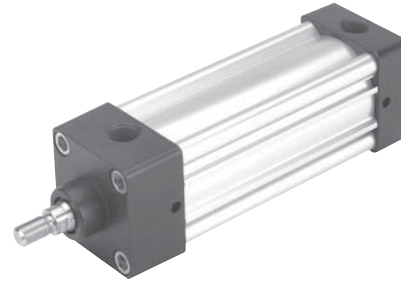


**1-1/2" - 5" Bore 3MA Piston Seal Kits
(Piston and cylinder body seals)**

Pneumatic service only

Temperatures:

- Nitrile -10°F to +165°F (-23°C to +74°C)



Composite piston assembly shown above.
Aluminum piston options available.
The same piston lipseals fit both piston types.

Servicing the piston seals – see next page

Every standard piston seal kit (PK) contains 2 of the following:

Symbol	Description
11	Piston seal (lipseal)
18	O-ring - cylinder body to head & cap

Every bumper piston seal kit (BK) contains 2 of the following:

Symbol	Description
12	Piston seal (bumper seat cushion)
18	O-ring - cylinder body to head & cap

1 tube of Lube-A-Cyl is also included with each PK or BK kit.

Warning ⚠ The piston rod (or fastener) to piston threaded connection is secured with an anaerobic adhesive that is temperature sensitive. Cylinders are assembled with an anaerobic adhesive having a maximum operating temperature rating of +165°F (+74°C). This temperature limitation is necessary to prevent possible loosening of the threaded connections.

Note: the maximum temperature rating for the 1-1/2"-5" bore 3MA is +165°F (+74°C).

Bore Size	PK - Piston Seal Kit, Standard Lipseals Includes 2 each of symbol 11 & 18	BK - Piston Seal Kit, Bumper Seals Includes 2 each of symbol 12 & 18	Magnetic Ring (not replaceable for composite piston, only for aluminum piston)	Torque Units Endcap Fastener or Tie Rod	
	Includes wear band (#27) for aluminum pistons and 4" and 5" composite pistons			Part Number	USA inch-lbs
	Nitrile Seals Kit Number	Nitrile Seals Kit Number			
1-1/2	PK1503MA01	BK01503MA1	0865130151	32 - 36	3.6 - 4.1
2	PK2003MA01	BK02003MA1	0865130200	72 - 82	8 - 9
2-1/2	PK2503MA01	BK02503MA1	0865130250	72 - 82	8 - 9
3-1/4	PK3253MA01	BK03253MA1	0865130325	216 - 228	24 - 25.3
4	PK4003MA01	BK04003MA1	0865130400	216 - 228	24 - 25.3
5	PK5003MA01	BK05003MA1	0865130500	360 - 372	41 - 42



Parker Lube-A-Cyl...

Is recommended for use in air cylinders during normal operation, and particularly when servicing and reassembling cylinders. It is a multi-purpose lubricant in grease form that provides lubrication without deteriorating effects on synthetic seals. It produces a thin film which will not blow out with exhaust air. It provides piston, rod and seal lubrication, and has excellent resistance to water and mechanical breakdown with temperature range of -10°F (-23°C) to +350°F (+177°C). Lube-A-Cyl is packaged in 1.5 oz. tubes, a sufficient quantity for average size air cylinder. One application should last for a period of 6 to 18 months depending upon service. Order by part number 0761630000.

Servicing the Piston Seals

Disassemble the cylinder completely, remove the old seals and clean all the parts. The cylinder bore and piston should then be examined for evidence of scoring. (The light scratch marks usually present on both cylinder bore and piston will generally have no detrimental effects on the performance of the cylinder.)

Apply Parker "Lube-A-Cyl" to O.D. of piston and all grooves. Install one piston Lipseal (sym. # 11 or 12) in the groove nearest the rod. The two "lips" of this seal should face toward the rod end of the piston. **Aluminum and 4" & 5" composite pistons only** – If required, install magnetic ring (sym. #13) in the bottom of the middle groove and then install wear band (sym. #27) in the top of the middle groove.

Coat the inside of the cylinder body with Parker "Lube-A-Cyl" and insert the piston – cap end first – into the cylinder body as shown in detail "2" below.

Next, turn the cylinder body on its side and push the piston and rod assembly through the barrel just far enough to expose the groove for the second Lipseal. (See detail "3" below.) For aluminum pistons, be careful not to move the piston too far so as to expose the wear strip (sym. #27). If the piston should move too far, push the piston and rod assembly completely through the cylinder body and again start the piston from the original end. Now install the second Lipseal (sym. # 11 or 12) in the exposed groove with the two "lips" facing away from the rod and pull the piston into the cylinder body.

The piston and rod are securely locked together with anaerobic adhesive. This threaded connection should only be disassembled or reassembled by factory trained personnel.

NOTE: An extreme pressure lubricant (such as molybdenum disulphate) should be used on the tie rod threads and bearing faces to reduce friction and tie rod twist.

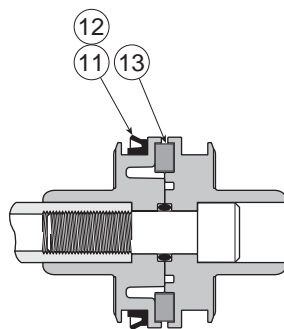
Assemble both cap and head, complete with cylinder body O-Rings (sym. # 18), to each end of the cylinder body. Install end cap fasteners and tighten to appropriate torque, using opposite corner to corner torquing sequence.

In case of a "DD" – center trunnion – mounted cylinder, care must be taken to prevent binding the cylinder body when repositioning the trunnion collar. The proper method of assembling this type of cylinder is as follows:

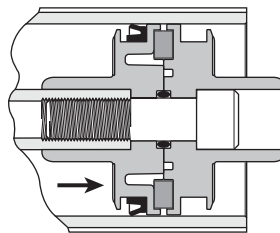
After all the piston seals have been installed on the piston and the piston is in the cylinder body, fit the cap with its O-ring (sym. # 18) in position onto the cylinder body. Then "stud" into the trunnion collar the four tie rods that connect the cap to the trunnion collar. Hand tighten the four tie rod nuts at the cap. Distances from the inner face of the cap to the finished face of the trunnion collar should be made equal at all four tie rods when all four tie rod nuts are in contact with the cap.

When the assembly is ready for final torquing, it may be necessary to adjust the tie rods at the cap when torquing the tie rods at the head in order to position the trunnion collar in its final position.

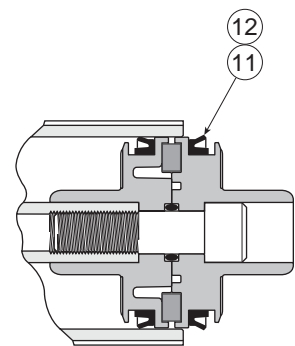
As a check, to be certain the trunnion mount will not interfere with cylinder operation, move the piston and rod assembly by hand to determine whether there is any tendency for the piston to bind at the spot where the trunnion collar is located. If any binding is noticeable, readjust the tie rods.



Detail "1"



Detail "2"



Detail "3"

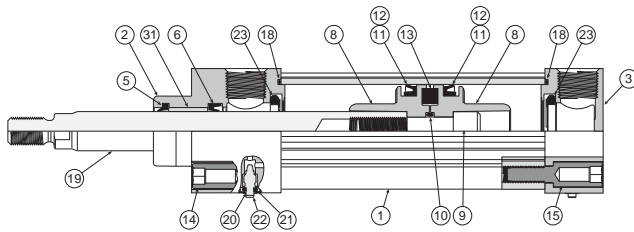
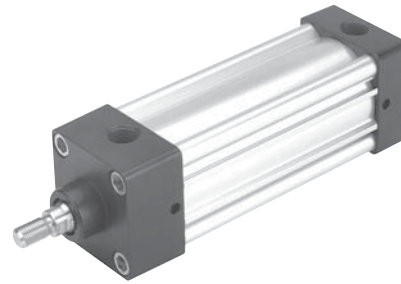
D
3MA/4MA
3MAJ/4MAJ
ACVB Option
LPSO Option
4MNR
S
C

**1-1/2"- 5" Bore 3MA Complete Cylinder Kits
(All parts to service entire cylinder)**

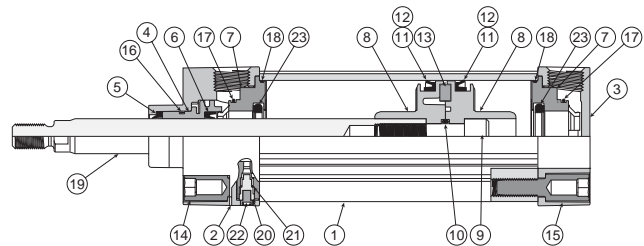
Pneumatic service only

Temperatures:

- Nitrile -10°F to +165°F (-23°C to +74°C)
- Fluorocarbon rod seals only (all other Nitrile)
-10°F to +165°F (-23°C to +74°C)



1-1/2" Bore



2"-5" Bores

Servicing the complete cylinder

The SK kit offers all parts to service an entire 3MA cylinder with the standard piston lipseals. Kits are available with Nitrile seals or Fluorocarbon rod seals only (all other Nitrile).

This kit a combination of the rod wiper, rod seal, rod bearing, Standard Piston Seal Kit, two Cushion Kits and any other necessary seals. These kits can service cylinders with either the composite or aluminum piston (lipseal). Depending on cylinder configuration, some parts may not be used. Please refer to the pages or bulletins of these individual kits for service instructions.

Bore Size	Rod Dia.	Rod No.	SK - Complete Cylinder Kit Includes (1) each of symbol 5, 6, 31 (or 4); (1 Standard Piston Seal Kit and (2) Cushion Kits		Endcap Fastener or Tie Rod Torque Units	
			Nitrile Seals Kit Number	Fluorocarbon Rod Seals Only (all other Nitrile) Kit Number	USA inch-lbs	Metric N-m
1-1/2	5/8	1	SK15003MA1	SK15003MA5	32 - 36	3.6 - 4.1
2	5/8	1	SK20003MA1	SK20003MA5	72 - 82	8 - 9
2-1/2	5/8	1	SK25003MA1	SK25003MA5	72 - 82	8 - 9
3-1/4	1	1	SK32003MA1	SK32003MA5	216 - 228	24 - 25.3
4	1	1	SK40003MA1	SK40003MA5	216 - 228	24 - 25.3
5	1	1	SK50003MA1	SK50003MA5	360 - 372	41 - 42

Cushion Kits

Bore Size	Rod Dia.	Rod No.	CH - Cushion Kit for either end Includes 1 each of symbol 7, 17, 18, 20, 21, 22 & 23		Endcap Fastener or Tie Rod Torque Units	
			Nitrile Seals Kit Number		USA inch-lbs	Metric N-m
1-1/2	5/8	1	CH15003MA1		32 - 36	3.6 - 4.1
2	5/8	1	CH20003MA1		72 - 82	8 - 9
2-1/2	5/8	1	CH25003MA1		72 - 82	8 - 9
3-1/4	1	1	CH32003MA1		216 - 228	24 - 25.3
4	1	1	CH40003MA1		216 - 228	24 - 25.3
5	1	1	CH50003MA1		360 - 372	41 - 42

Symbol Legend

Symbol	Description
1	Cylinder body
2	Head
3	Cap
4	Rod bearing insert (2"-5" bores)
5	Rod wiper
6	Rod seal
7	Needle valve insert
8	Piston (composite or aluminum)
9	Piston fastener (only for composite piston)
10	O-ring - piston fastener to piston
11	Piston seal (lipseal)
12	Piston seal (bumper seal option)
13	Magnetic ring
14	Head fastener
15	Cap fastener
16	O-ring - rod bearing insert
17	O-ring - needle valve insert
18	O-ring - cylinder body to head & cap
19	Piston rod
20	Cushion needle valve
21	O-ring - cushion needle valve
22	Cushion knob
23	Cushion check seal
24	Tie rod nut (Style DD mounts)
27	Wear band (aluminum and 4" & 5" composite pistons)
28	Tie rod (Style DD mounts)
31	Rod bearing (1-1/2" bore)

1 tube of Lube-A-Cyl is also included with each SK or CH kit.

B



**4MA Gland Kits
 (Gland cartridges and rod seals)**

Pneumatic service only

Temperatures:

- Nitrile -10°F to +165°F (-23°C to +74°C)
- Fluorocarbon -10°F to +250°F (-23°C to +121°C)

Servicing the rod gland (Cylinder disassembly is not required)

Air leakage around the piston rod at the gland area will normally indicate a need to replace the gland cartridge.

The Parker 4MA gland is a unique cartridge design. It is threaded into the cylinder head and all sizes are removable without disturbing the endcap fasteners.

To remove the old gland cartridge from the cylinder:

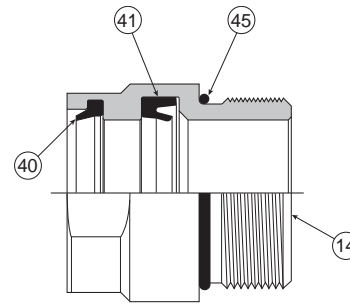
1. Inspect the piston rod to be sure it is free of burrs or other foreign material that would prevent sliding the gland off the rod.
2. Disconnect any attachments to the piston rod end thread.
3. Lubricate the rod with Lube-A-Cyl (included in kit).
4. Unscrew the gland cartridge from the head using the appropriate wrench (see D1 dimension in catalog).
5. Slide the gland cartridge off the piston rod.
6. Verify that the gland-to-head o-ring (#45) is also removed from the head.

To install the new gland cartridge onto the cylinder:

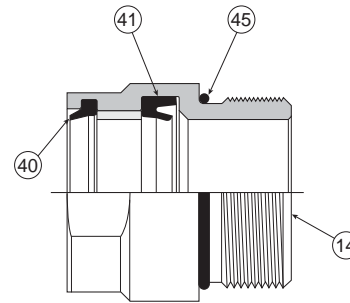
1. Re-inspect the surface of the piston rod for scratches, dents and other surface damage, and repair if necessary.
2. Clean and lubricate the surface of the piston rod with Lube-A-Cyl (included in kit).
3. Lubricate the rod wiper (#40), rod seal (#41), o-ring (#45) and the inside surfaces of the gland cartridge with Lube-A-Cyl.
4. Slide the gland cartridge onto the piston rod, align it with the threads in the head, and tighten (clockwise) until seated firmly against the head.
5. Torque the gland cartridge to the specifications shown below. Tools are available to assist this process (see below).

Note: Make sure the gland cartridge is sufficiently tight. Failure to do so may result in loosening during operation.

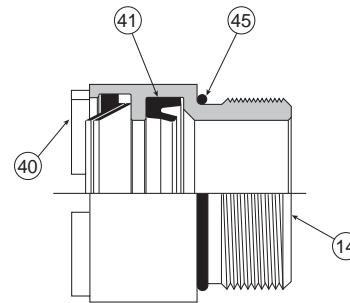
Rod Dia.	Standard & HI LOAD Gland	Metallic Rod Wiper Gland	
	Gland Wrench	Gland Wrench	Spanner Wrench
5/8	0695800000	0695900000	0116760000
1	0695810000	0695910000	0116760000
1-3/8	0695820000	0695920000	0117030000
1-3/4	0695830000	0695930000	0116770000



Standard Rod Gland



HI LOAD Rod Gland
 (includes composite bearing)



Metallic Rod Wiper Gland

Every gland cartridge kit contains 1 each of the following:

Symbol	Description
14	Gland
40	Rod Wiper
41	Rod Seal
45	O-ring - Gland to head

Bore Size	Rod Dia.	Rod No.	Standard Rod Gland Cartridge Kit Includes 1 each of symbol 14, 40, 41 & 45		HI LOAD Rod Gland Cartridge Kit Includes 1 each of symbol 14, 40, 41 & 45		Metallic Rod Wiper Gland Cartridge Kit Includes 1 each of symbol 14, 40, 41 & 45		Gland to Head Torque Units	
			Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	Nitrile & PUR Seals Kit Number	Fluorocarbon Seals Kit Number	USA Ft-Lbs	Metric N-m
1-1/2	5/8	1	RG04MA0061	RG04MA0065	RG04MAH061	RG04MAH065	RG04MAM061	RG04MAM065	40 - 45	54 - 61
	1	2	RG04MA0101	RG04MA0105	RG04MAH101	RG04MAH105	RG04MAM101	RG04MAM105	45 - 50	61 - 68
2	5/8	1	RG04MA0061	RG04MA0065	RG04MAH061	RG04MAH065	RG04MAM061	RG04MAM065	40 - 45	54 - 61
	1	3	RG04MA0101	RG04MA0105	RG04MAH101	RG04MAH105	RG04MAM101	RG04MAM105	45 - 50	61 - 68
2-1/2	5/8	1	RG04MA0061	RG04MA0065	RG04MAH061	RG04MAH065	RG04MAM061	RG04MAM065	40 - 45	54 - 61
	1	3	RG04MA0101	RG04MA0105	RG04MAH101	RG04MAH105	RG04MAM101	RG04MAM105	45 - 50	61 - 68
3-1/4	1	1	RG04MA0101	RG04MA0105	RG04MAH101	RG04MAH105	RG04MAM101	RG04MAM105	45 - 50	61 - 68
	1-3/8	3	RG04MA0131	RG04MA0135	RG04MAH131	RG04MAH135	RG04MAM131	RG04MAM135	75 - 80	102 - 108
4	1	1	RG04MA0101	RG04MA0105	RG04MAH101	RG04MAH105	RG04MAM101	RG04MAM105	45 - 50	61 - 68
	1-3/8	3	RG04MA0131	RG04MA0135	RG04MAH131	RG04MAH135	RG04MAM131	RG04MAM135	75 - 80	102 - 108
5	1	1	RG04MA0101	RG04MA0105	RG04MAH101	RG04MAH105	RG04MAM101	RG04MAM105	45 - 50	61 - 68
	1-3/8	3	RG04MA0131	RG04MA0135	RG04MAH131	RG04MAH135	RG04MAM131	RG04MAM135	75 - 80	102 - 108
6	1-3/8	1	RG04MA0131	RG04MA0135	RG04MAH131	RG04MAH135	RG04MAM131	RG04MAM135	75 - 80	102 - 108
	1-3/4	3	RG04MA0171	RG04MA0175	RG04MAH171	RG04MAH175	RG04MAM171	RG04MAM175	90 - 95	122 - 129
8	1-3/8	1	RG04MA0131	RG04MA0135	RG04MAH131	RG04MAH135	RG04MAM131	RG04MAM135	75 - 80	102 - 108
	1-3/4	3	RG04MA0171	RG04MA0175	RG04MAH171	RG04MAH175	RG04MAM171	RG04MAM175	90 - 95	122 - 129

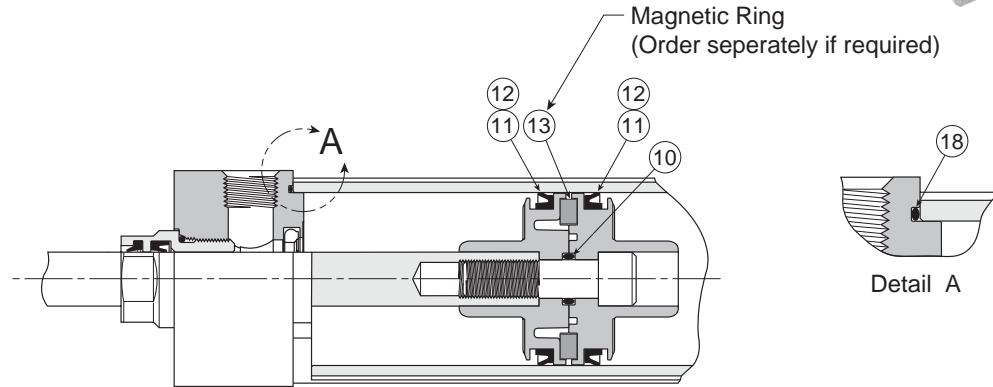
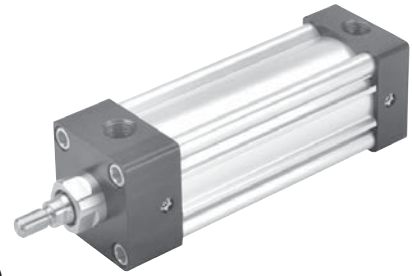


**4MA Piston Seal Kits
 (Piston and cylinder body seals)**

Pneumatic service only

Temperatures:

- Nitrile -10°F to +165°F (-23°C to +74°C)
- Fluorocarbon -10°F to +250°F (-23°C to +121°C)



Composite piston assembly shown above.
 Aluminum piston options available.
 The same piston lipseals fit both piston types.

Servicing the piston seals – see next page

Warning – The piston rod (or fastener) to piston threaded connection is secured with an anaerobic adhesive that is temperature sensitive. Cylinders specified with all fluorocarbon seals are assembled with an anaerobic adhesive having a maximum operating temperature rating of +250°F (+121°C). Cylinders specified with other seal compounds are assembled with an anaerobic adhesive having a maximum operating temperature rating of +165°F (+74°C). These temperature limitations are necessary to prevent possible loosening of the threaded connections. Cylinders originally manufactured with Class 1 seals (Nitrile) that will be exposed to ambient temperatures above +165°F (+74°C) must be modified for higher temperature service. Contact the Wadsworth, OH facility immediately and arrange for the piston to rod connection to be properly re-assembled to withstand the higher temperature service and other cylinder changes.

Note: the maximum temperature rating for the composite piston is +165°F (+74°C).

Every standard piston seal kit (PK) contains 2 of the following:

Symbol	Description
11	Piston seal (lipseal)
18	O-ring - cylinder body to head & cap

Every bumper piston seal kit (BK) contains 2 of the following:

Symbol	Description
12	Piston seal (bumper seat cushion)
18	O-ring - cylinder body to head & cap

1 tube of Lube-A-Cyl is also included with each PK or BK kit.

Bore Size	PK - Piston Seal Kit, Standard Lipseals Includes 2 each of symbol 11 & 18		BK - Piston Seal Kit, Bumper Seals Includes 2 each of symbol 12 & 18		Magnetic Ring (not replaceable for composite piston)	Torque Units Endcap Fastener or Tie Rod	
	Includes wear band (#27) for aluminum pistons and 4" and 5" composite pistons					Only with Nitrile Seals Part Number	USA inch-lbs
	Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number			
1-1/2	PK1504MA01	PK1504MA05	BK01504MA1	BK01504MA5	0865130151	32 - 36	3.6 - 4.1
2	PK2004MA01	PK2004MA05	BK02004MA1	BK02004MA5	0865130200	72 - 82	8 - 9
2-1/2	PK2504MA01	PK2504MA05	BK02504MA1	BK02504MA5	0865130250	72 - 82	8 - 9
3-1/4	PK3254MA01	PK3254MA05	BK03254MA1	BK03254MA5	0865130325	216 - 228	24 - 25.3
4	PK4004MA01	PK4004MA05	BK04004MA1	BK04004MA5	0865130400	216 - 228	24 - 25.3
5	PK5004MA01	PK5004MA05	BK05004MA1	BK05004MA5	0865130500	360 - 372	41 - 42
6	PK6004MA01	PK6004MA05	N/A	N/A	0865130600	420 - 432	48 - 49
8	PK8004MA01	PK8004MA05	N/A	N/A	0865130800	960 - 972	109 - 115



Parker Lube-A-Cyl...

Is recommended for use in air cylinders during normal operation, and particularly when servicing and reassembling cylinders. It is a multi-purpose lubricant in grease form that provides lubrication without deteriorating effects on synthetic seals. It produces a thin film which will not blow out with exhaust air. It provides piston, rod and seal lubrication, and has excellent resistance to water and mechanical breakdown with temperature range of -10°F (-23°C) to +350°F (+177°C). Lube-A-Cyl is packaged in 1.5 oz. tubes, a sufficient quantity for average size air cylinder. One application should last for a period of 6 to 18 months depending upon service. Order by part number 0761630000.

Servicing the Piston Seals

Disassemble the cylinder completely, remove the old seals and clean all the parts. The cylinder bore and piston should then be examined for evidence of scoring. (The light scratch marks usually present on both cylinder bore and piston will generally have no detrimental effects on the performance of the cylinder.)

Apply Parker "Lube-A-Cyl" to O.D. of piston and all grooves. Install one piston Lipseal (sym. # 11 or 12) in the groove nearest the rod. The two "lips" of this seal should face toward the rod end of the piston. **Aluminum and 4" & 5" composite pistons only** – If required, install magnetic ring (sym. #13) in the bottom of the middle groove and then install wear band (sym. #27) in the top of the middle groove.

Coat the inside of the cylinder body with Parker "Lube-A-Cyl" and insert the piston – cap end first – into the cylinder body as shown in detail "2" below.

Next, turn the cylinder body on its side and push the piston and rod assembly through the barrel just far enough to expose the groove for the second Lipseal. (See detail "3" below.) For aluminum pistons, be careful not to move the piston too far so as to expose the wear strip (sym. #27). If the piston should move too far, push the piston and rod assembly completely through the cylinder body and again start the piston from the original end. Now install the second Lipseal (sym. # 11 or 12) in the exposed groove with the two "lips" facing away from the rod and pull the piston into the cylinder body.

The piston and rod are securely locked together with anaerobic adhesive. This threaded connection should only be disassembled or reassembled by factory trained personnel.

NOTE: An extreme pressure lubricant (such as molybdenum disulphate) should be used on the tie rod threads and bearing faces to reduce friction and tie rod twist.

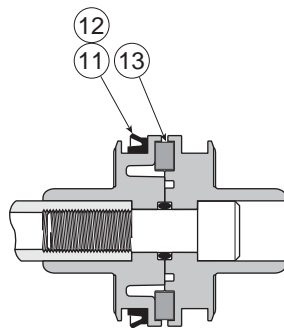
Assemble both cap and head, complete with cylinder body O-Rings (sym. # 18), to each end of the cylinder body. Install end cap fasteners and tighten to appropriate torque, using opposite corner to corner torquing sequence.

In case of a "DD" – center trunnion – mounted cylinder, care must be taken to prevent binding the cylinder body when repositioning the trunnion collar. The proper method of assembling this type of cylinder is as follows:

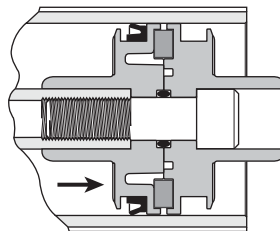
After all the piston seals have been installed on the piston and the piston is in the cylinder body, fit the cap with its O-ring (sym. # 18) in position onto the cylinder body. Then "stud" into the trunnion collar the four tie rods that connect the cap to the trunnion collar. Hand tighten the four tie rod nuts at the cap. Distances from the inner face of the cap to the finished face of the trunnion collar should be made equal at all four tie rods when all four tie rod nuts are in contact with the cap.

When the assembly is ready for final torquing, it may be necessary to adjust the tie rods at the cap when torquing the tie rods at the head in order to position the trunnion collar in its final position.

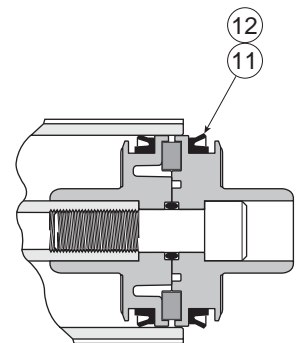
As a check, to be certain the trunnion mount will not interfere with cylinder operation, move the piston and rod assembly by hand to determine whether there is any tendency for the piston to bind at the spot where the trunnion collar is located. If any binding is noticeable, readjust the tie rods.



Detail "1"



Detail "2"



Detail "3"

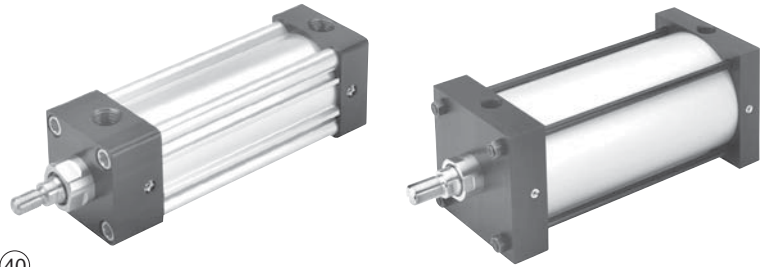
B
3MA/4MA
3MAJ/4MAJ
ACVB Option
LPSO Option
4MNR
S
C

4MA Complete Cylinder Kits
(All parts to service entire cylinder)

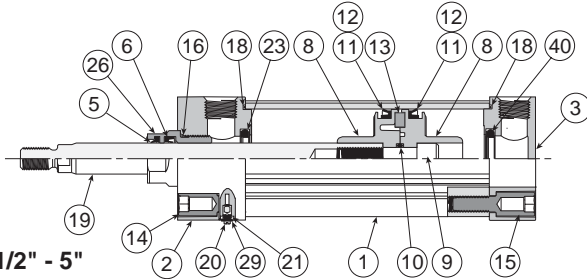
Pneumatic service only

Temperatures:

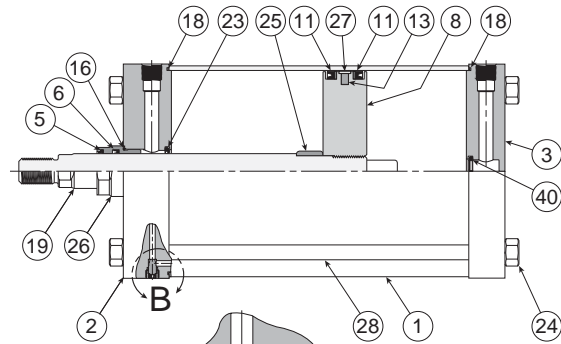
- Nitrile -10°F to +165°F (-23°C to +74°C)
- Fluorocarbon -10°F to +250°F (-23°C to +121°C)



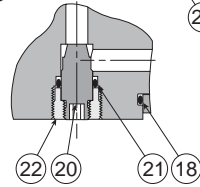
B



**1-1/2" - 5"
 Bores**



**6" - 8"
 Bores**



Detail B

Symbol Legen

Symbol	Description
1	Cylinder body
2	Head
3	Cap
5	Rod wiper
6	Rod seal
8	Piston (composite or aluminum)
9	Piston fastener (only for composite piston)
10	O-ring - piston fastener to piston
11	Piston seal (lipseal)
12	Piston seal (Bumper seal option)
13	Magnetic ring
14	Head fastener
15	Cap fastener
16	O-ring - gland to head
18	O-ring - cylinder body to head & cap
19	Piston rod
20	Cushion needle valve
21	O-ring - cushion needle valve
22	Cushion needle valve retainer (6" & 8")
23	Cushion check seal - head
24	Tie rod nut (6" & 8" bore or Style DD mounts)
25	Head cushion sleeve
26	Gland
27	Wear band (aluminum and 4" & 5" composite pistons)
28	Tie rod (6" & 8" bore or Style DD mounts)
29	Retaining washer
40	Cushion check seal - cap

Servicing the complete cylinder

This kit offers all parts to service an entire 4MA cylinder with the standard rod gland and standard piston lipseals. Kits are available with Nitrile or Fluorocarbon seals.

This kit is a combination of the Standard Gland Kit, Standard Piston Seal Kit, Head Cushion Kit and Cap Cushion Kit. The kits can service cylinders with either the composite or aluminum piston (lipseal). Depending on cylinder configuration, some parts may not be used. Please refer to the pages or bulletins of these individual kits for service instructions.

1 tube of Lube-A-Cyl is also included with each SK kit.

Bore Size	Rod Dia.	Rod No.	SK - Complete Cylinder Kit Includes 1 each of Standard Rod Gland Kit, Standard Piston Seal Kit, Head Cushion Kit and Cap Cushion Kit		Gland to Head Torque Units		Endcap Fastener or Tie Rod Torque Units	
			Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number	USA Ft-Lbs	Metric N-m	USA inch-lbs	Metric N-m
			1-1/2	5/8	1	SK15104MA1	SK15104MA5	40 - 45
	1	2	SK15304MA1*	SK15304MA5*	45 - 50	61 - 68		
2	5/8	1	SK20104MA1	SK20104MA5	40 - 45	54 - 61	72 - 82	8 - 9
	1	3	SK20304MA1	SK20304MA5	45 - 50	61 - 68		
2-1/2	5/8	1	SK25104MA1	SK25104MA5	40 - 45	54 - 61	72 - 82	8 - 9
	1	3	SK25304MA1	SK25304MA5	45 - 50	61 - 68		
3-1/4	1	1	SK32104MA1	SK32104MA5	45 - 50	61 - 68	216 - 228	24 - 25.3
	1-3/8	3	SK32304MA1	SK32304MA5	75 - 80	102 - 108		
4	1	1	SK40104MA1	SK40104MA5	45 - 50	61 - 68	216 - 228	24 - 25.3
	1-3/8	3	SK40304MA1	SK40304MA5	75 - 80	102 - 108		
5	1	1	SK50104MA1	SK50104MA5	45 - 50	61 - 68	360 - 372	41 - 42
	1-3/8	3	SK50304MA1	SK50304MA5	75 - 80	102 - 108		
6	1-3/8	1	SK60104MA1	SK60104MA5	75 - 80	102 - 108	420 - 432	48 - 49
	1-3/4	3	SK60304MA1	SK60304MA5	90 - 95	122 - 129		
8	1-3/8	1	SK80104MA1	SK80104MA5	75 - 80	102 - 108	960 - 972	109 - 115
	1-3/4	3	SK80304MA1	SK80304MA5	90 - 95	122 - 129		

*Does not include Head Cushion Kit (not available)



4ML Gland Kits (Gland cartridges and rod seals)

Hydraulic service (includes TS-2000 rod seal)

Temperatures:

- Nitrile/Polyurethane (PUR) -10°F to +165°F (-23°C to +74°C)
- Fluorocarbon -10°F to +250°F (-23°C to +121°C)

Servicing the rod gland (Cylinder disassembly is not required)

Fluid leakage around the piston rod at the gland area will normally indicate a need to replace the gland cartridge.

The Parker 4ML gland is a unique cartridge design. It is threaded into the cylinder head and all sizes are removable without disturbing the endcap fasteners.

To remove the old gland cartridge from the cylinder:

To remove the old gland cartridge from the cylinder:

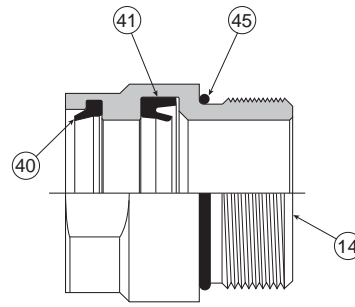
1. Inspect the piston rod to be sure it is free of burrs or other foreign material that would prevent sliding the gland off the rod.
2. Disconnect any attachments to the piston rod end thread.
3. Lubricate the rod with clean light oil.
4. Unscrew the gland cartridge from the head using the appropriate wrench (see D1 dimension in catalog).
5. Slide the gland cartridge off the piston rod.
6. Verify that the gland-to-head o-ring (#45) is also removed from the head.

To install the new gland cartridge onto the cylinder:

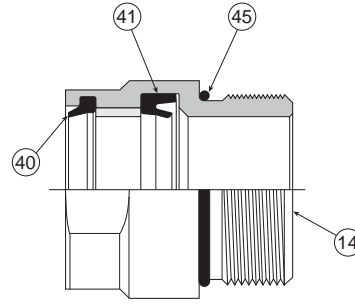
1. Re-inspect the surface of the piston rod for scratches, dents and other surface damage, and repair if necessary.
2. Clean and lubricate the surface of the piston rod with clean light oil.
3. Lubricate the rod wiper (#40), rod seal (#41), o-ring (#45) and the inside surfaces of the gland cartridge with clean light oil.
4. Slide the gland cartridge onto the piston rod, align it with the threads in the head, and tighten (clockwise) until seated firmly against the head.
5. Torque the gland cartridge to the specifications shown below.

Tools are available to assist this process (see below).

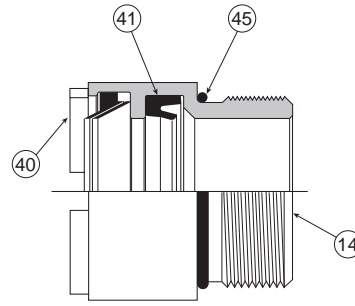
Note: Make sure the gland cartridge is sufficiently tight. Failure to do so may result in loosening during operation.



Standard Rod Gland



HI LOAD Rod Gland
(includes composite bearing)



Metallic Rod Wiper Gland

Rod Dia.	Standard & HI LOAD Gland	Metallic Rod Wiper Gland	
	Gland Wrench	Gland Wrench	Spanner Wrench
5/8	0695800000	0695900000	0116760000
1	0695810000	0695910000	0116760000
1-3/8	0695820000	0695920000	0117030000
1-3/4	0695830000	0695930000	0116770000

Every gland cartridge kit contains 1 each of the following:

Symbol	Description
14	Gland
40	Rod Wiper
41	Rod Seal
45	O-ring - Gland to head

Bore Size	Rod Dia.	Rod No.	Standard Rod Gland Cartridge Kit Includes 1 each of symbol 14, 40, 41 & 45		HI LOAD Rod Gland Cartridge Kit Includes 1 each of symbol 14, 40, 41 & 45		Metallic Rod Wiper Gland Cartridge Kit Includes 1 each of symbol 14, 40, 41 & 45		Gland to Head Torque Units	
			Nitrile & PUR Seals Kit Number	Fluorocarbon Seals Kit Number	Nitrile & PUR Seals Kit Number	Fluorocarbon Seals Kit Number	Nitrile & PUR Seals Kit Number	Fluorocarbon Seals Kit Number	USA Ft-Lbs	Metric N-m
1-1/2	5/8	1	RG04ML0061	RG04ML0065	RG04MLH061	RG04MLH065	RG04MLM061	RG04MLM065	40 - 45	54 - 61
	1	2	RG04ML0101	RG04ML0105	RG04MLH101	RG04MLH105	RG04MLM101	RG04MLM105	45 - 50	61 - 68
2	5/8	1	RG04ML0061	RG04ML0065	RG04MLH061	RG04MLH065	RG04MLM061	RG04MLM065	40 - 45	54 - 61
	1	3	RG04ML0101	RG04ML0105	RG04MLH101	RG04MLH105	RG04MLM101	RG04MLM105	45 - 50	61 - 68
2-1/2	5/8	1	RG04ML0061	RG04ML0065	RG04MLH061	RG04MLH065	RG04MLM061	RG04MLM065	40 - 45	54 - 61
	1	3	RG04ML0101	RG04ML0105	RG04MLH101	RG04MLH105	RG04MLM101	RG04MLM105	45 - 50	61 - 68
3-1/4	1	1	RG04ML0101	RG04ML0105	RG04MLH101	RG04MLH105	RG04MLM101	RG04MLM105	45 - 50	61 - 68
	1-3/8	3	RG04ML0131	RG04ML0135	RG04MLH131	RG04MLH135	RG04MLM131	RG04MLM135	75 - 80	102 - 108
4	1	1	RG04ML0101	RG04ML0105	RG04MLH101	RG04MLH105	RG04MLM101	RG04MLM105	45 - 50	61 - 68
	1-3/8	3	RG04ML0131	RG04ML0135	RG04MLH131	RG04MLH135	RG04MLM131	RG04MLM135	75 - 80	102 - 108
5	1	1	RG04ML0101	RG04ML0105	RG04MLH101	RG04MLH105	RG04MLM101	RG04MLM105	45 - 50	61 - 68
	1-3/8	3	RG04ML0131	RG04ML0135	RG04MLH131	RG04MLH135	RG04MLM131	RG04MLM135	75 - 80	102 - 108
6	1-3/8	1	RG04ML0131	RG04ML0135	RG04MLH131	RG04MLH135	RG04MLM131	RG04MLM135	75 - 80	102 - 108
	1-3/4	3	RG04ML0171	RG04ML0175	RG04MLH171	RG04MLH175	RG04MLM171	RG04MLM175	90 - 95	122 - 129
8	1-3/8	1	RG04ML0131	RG04ML0135	RG04MLH131	RG04MLH135	RG04MLM131	RG04MLM135	75 - 80	102 - 108
	1-3/4	3	RG04ML0171	RG04ML0175	RG04MLH171	RG04MLH175	RG04MLM171	RG04MLM175	90 - 95	122 - 129



B
 3MAJ/4MAJ
 ACVB Option
 LPSO Option
 4MNR
 S
 C

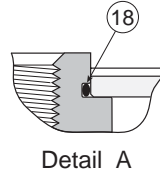
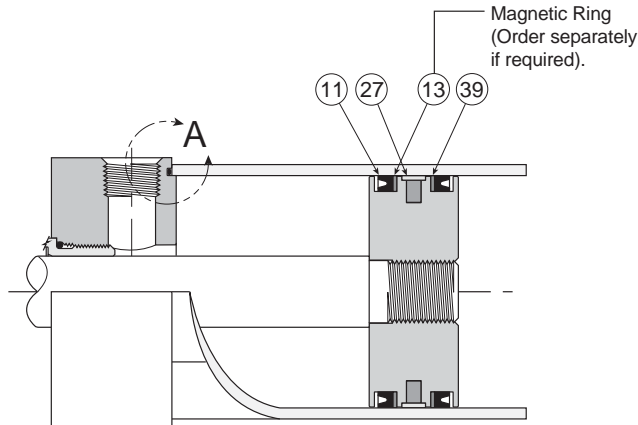
4ML Piston Seal Kits
(Piston and cylinder body seals)

Hydraulic service

Temperatures:

- Nitrile -10°F to +165°F (-23°C to +74°C)
- Fluorocarbon -10°F to +250°F (-23°C to +121°C)

B



Servicing the piston seals – see next page

Warning – The piston rod (or fastener) to piston threaded connection is secured with an anaerobic adhesive that is temperature sensitive. Cylinders specified with all fluorocarbon seals are assembled with an anaerobic adhesive having a maximum operating temperature rating of +250°F (+121°C). Cylinders specified with other seal compounds are assembled with an anaerobic adhesive having a maximum operating temperature rating of +165°F (+74°C). These temperature limitations are necessary to prevent possible loosening of the threaded connections. Cylinders originally manufactured with Class 1 seals (Nitrile) that will be exposed to ambient temperatures above +165°F (+74°C) must be modified for higher temperature service. Contact the Wadsworth, OH facility immediately and arrange for the piston to rod connection to be properly re-assembled to withstand the higher temperature service and other cylinder changes.

Every piston seal kit (PK) contains (2) of symbols 11, 18 and 39, and (1) of symbol 27

Symbol	Description
11	Piston seal (lipseal)
18	O-ring - cylinder body to head & cap
27	Wear band
39	Piston seal backup washer

Bore Size	PK - Piston Seal Kit, Standard Lipseals		Magnetic Ring Symbol 13 Only with Nitrile Seals	Endcap Fastener or Tie Rod Torque Units	
	Includes 2 each of symbol 11, 39 & 18			Part Number	USA inch-lbs
	Wear band (#27) for aluminum piston included				
	Nitrile Seals Kit Number	Fluorocarbon Seals Kit Number			
1-1/2	PK1504ML01	PK1504ML05	0865130151	32 - 36	3.6 - 4.1
2	PK2004ML01	PK2004ML05	0865130200	72 - 82	8 - 9
2-1/2	PK2504ML01	PK2504ML05	0865130250	72 - 82	8 - 9
3-1/4	PK3254ML01	PK3254ML05	0865130325	216 - 228	24 - 25.3
4	PK4004ML01	PK4004ML05	0865130400	216 - 228	24 - 25.3
5	PK5004ML01	PK5004ML05	0865130500	360 - 372	41 - 42
6	PK6004ML01	PK6004ML05	0865130600	420 - 432	48 - 49
8	PK8004ML01	PK8004ML05	0865130800	960 - 972	109 - 115



Servicing the Piston Seals

Disassemble the cylinder completely, remove the old seals and clean all the parts. The cylinder bore and piston should then be examined for evidence of scoring. (The light scratch marks usually present on both cylinder bore and piston will generally have no detrimental effects on the performance of the cylinder.)

Apply clean light oil to O.D. of piston and all grooves. Install one piston Lipseal (sym. # 11) & one Back-Up Washer (sym. #39) in the groove nearest the rod. The two “lips” of the Lipseal (sym. #11) should face toward the rod end of the piston and the Back-Up Washer (sym. #39) should be installed in the same piston groove as shown. If required, install the magnetic ring (sym. # 13) in the bottom of the middle groove. (See detail “1” below) Next, install the wear strip (sym. # 27) in the top of the middle groove – (See detail “2” below).

Coat the inside of the cylinder body with clean light oil and insert the piston – cap end first – into the cylinder body as shown in detail “3” below.

Next, turn the cylinder body on its side and push the piston and rod assembly through the barrel just far enough to expose the piston groove for the second Lipseal. (See detail “4” below.) Be careful not to move the piston too far so as to expose the wear strip (sym. # 27). If the piston should move too far, push the piston and rod assembly completely through the cylinder body and again start the piston from the original end. Now install the second Lipseal (sym. # 11) & Back-Up Washer (sym. #39) in the exposed groove with the two “lips” of the Lipseal (sym. #11) facing away from the rod and the Back-Up Washer (sym. #39) positioned as shown. Then pull the piston into the cylinder body.

The piston and rod are securely locked together with anaerobic adhesive. This threaded connection should only be disassembled or reassembled by factory trained personnel.

NOTE: An extreme pressure lubricant (such as molybdenum disulphate) should be used on the tie rod threads and bearing faces to reduce friction and tie rod twist.

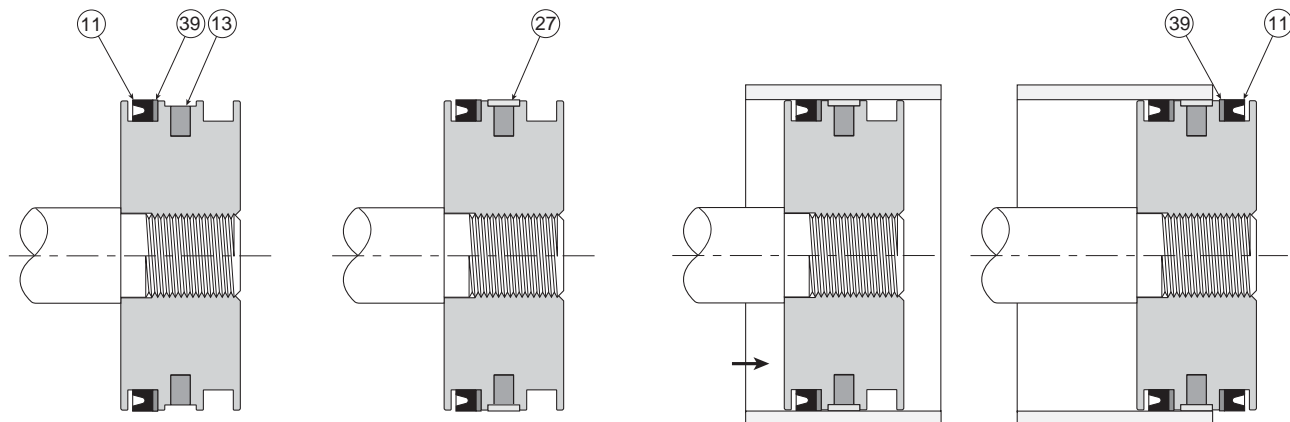
Assemble both cap and head, complete with cylinder body O-Rings (sym. # 18), to each end of the cylinder body. Install end cap fasteners and tighten to appropriate torque, using opposite corner to corner torquing sequence. After screws are torqued, firmly torque the rod gland against the head.

In case of a “DD” – center trunnion – mounted cylinder, care must be taken to prevent binding the cylinder body when repositioning the trunnion collar. The proper method of assembling this type of cylinder is as follows:

After all the piston seals have been installed on the piston and the piston is in the cylinder body, fit the cap with its O-ring (sym. # 18) in position onto the cylinder body. Then “stud” into the trunnion collar the four tie rods that connect the cap to the trunnion collar. Hand tighten the four tie rod nuts at the cap. Distances from the inner face of the cap to the finished face of the trunnion collar should be made equal at all four tie rods when all four tie rod nuts are in contact with the cap.

When the assembly is ready for final torquing, it may be necessary to adjust the tie rods at the cap when torquing the tie rods at the head in order to position the trunnion collar in its final position.

As a check, to be certain the trunnion mount will not interfere with cylinder operation, move the piston and rod assembly by hand to determine whether there is any tendency for the piston to bind at the spot where the trunnion collar is located. If any binding is noticeable, readjust the tie rods.



Detail “1”

Detail “2”

Detail “3”

Detail “4”

B
3MAJ/4MA
3MAJ/4MAJ
ACVB Option
LPSO Option
4MNR
S
C

**4ML Complete Cylinder Kits
(All parts to service entire cylinder)**

Hydraulic service

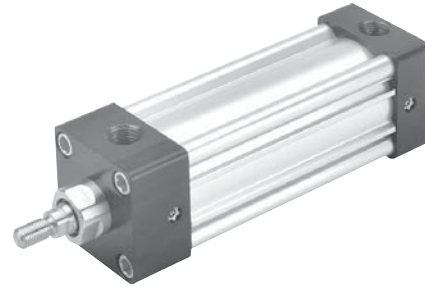
Temperatures:

- Nitrile/Polyurethane (PUR) -10°F to +165°F (-23°C to +74°C)
- Fluorocarbon -10°F to +250°F (-23°C to +121°C)

Servicing the complete cylinder

This kit offers all parts to service an entire 4ML cylinder with the standard rod gland and standard piston lipseals. Kits are available with Nitrile/Polyurethane or Fluorocarbon seals.

This kit is a combination of the Standard Gland Kit and Standard Piston Seal Kit. Please refer to the pages or bulletins of these individual kits for service instructions.



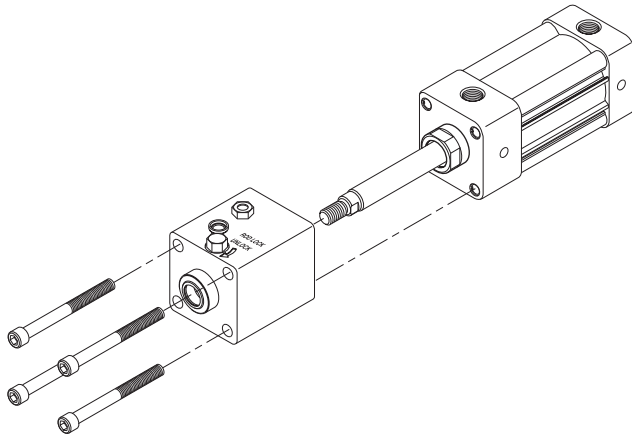
B

Bore Size	Rod Dia.	Rod No.	SK - Complete Cylinder Kit Includes 1 each of Standard Rod Gland Kit and Piston Seal Kit		Gland to Head Torque Units		Endcap Fastener or Tie Rod Torque Units	
			Nitrile & PUR Seals Kit Number	Fluorocarbon Seals Kit Number	USA Ft-Lbs	Metric N-m	USA inch-lbs	Metric N-m
1-1/2	5/8	1	SK15104ML1	SK15104ML5	40 - 45	54 - 61	32 - 36	3.6 - 4.1
	1	2	SK15304ML1	SK15304ML5	45 - 50	61 - 68		
2	5/8	1	SK20104ML1	SK20104ML5	40 - 45	54 - 61	72 - 82	8 - 9
	1	3	SK20304ML1	SK20304ML5	45 - 50	61 - 68		
2-1/2	5/8	1	SK25104ML1	SK25104ML5	40 - 45	54 - 61	72 - 82	8 - 9
	1	3	SK25304ML1	SK25304ML5	45 - 50	61 - 68		
3-1/4	1	1	SK32104ML1	SK32104ML5	45 - 50	61 - 68	216 - 228	24 - 25.3
	1-3/8	3	SK32304ML1	SK32304ML5	75 - 80	102 - 108		
4	1	1	SK40104ML1	SK40104ML5	45 - 50	61 - 68	216 - 228	24 - 25.3
	1-3/8	3	SK40304ML1	SK40304ML5	75 - 80	102 - 108		
5	1	1	SK50104ML1	SK50104ML5	45 - 50	61 - 68	360 - 372	41 - 42
	1-3/8	3	SK50304ML1	SK50304ML5	75 - 80	102 - 108		
6	1-3/8	1	SK60104ML1	SK60104ML5	75 - 80	102 - 108	420 - 432	48 - 49
	1-3/4	3	SK60304ML1	SK60304ML5	90 - 95	122 - 129		
8	1-3/8	1	SK80104ML1	SK80104ML5	75 - 80	102 - 108	960 - 972	109 - 115
	1-3/4	3	SK80304ML1	SK80304ML5	90 - 95	122 - 129		

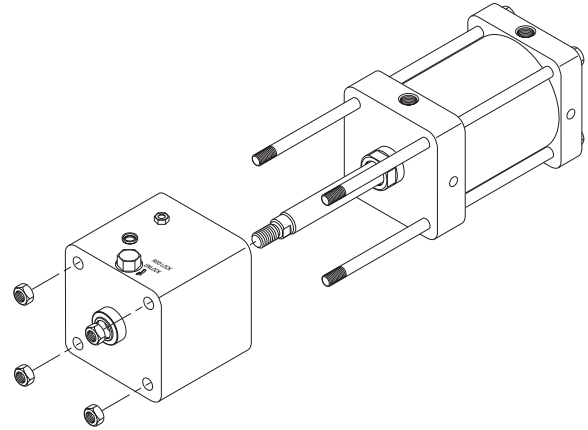


Rod Lock Removal and Re-assembly

1-1/2" to 5" Bores



6" to 8" Bores and
all Style DD Mounts (NFPA MT4)



To remove the rod lock from the 3MAJ/4MAJ cylinder in order to service the base 3MAJ/4MAJ cylinder, please perform the following steps:

1. Remove the 3MAJ/4MAJ cylinder from the application to a serviceable area.
2. Using a corner-to-corner sequence, loosen the four SHCS fasteners (1-1/2" to 5" bores) or tie rod nuts (6" to 8" bores and all Style DD mounts (NFPA MT4)) at the rod lock face and remove them from the rod lock. Please note that the tie rod nuts for 6" to 8" bores and all Style DD mounts are also used to assemble the base cylinder.
3. Apply a minimum of 60 PSI air pressure to the rod lock port, or apply the appropriate amount of torque to the manual override shaft, in order to release the rod lock from the piston rod.
4. Carefully slide the rod lock off the piston rod and away from the base cylinder. The rod lock is piloted and sealed to the gland OD, so some force may be required.
5. Particularly at larger bores, the rod lock can be heavy. Please remove the rod lock from the piston rod and follow all necessary safety precautions.

To re-assemble the rod lock to the base 3MAJ/4MAJ cylinder, please perform the following steps:

1. Remove all dirt and debris from the mating features of the rod lock, base cylinder, fasteners (or nuts) and threads.
2. Apply a minimum of 60 PSI air pressure to the rod lock port, or apply the appropriate amount of torque to the manual override shaft, in order to open the rod lock.
3. Carefully slide the rod lock onto the piston rod and toward the base cylinder. The rod lock is piloted and sealed to the gland OD, so some force may be required. Press the rod lock to the head face as close as possible, avoiding damage to the rod lock o-ring that seals the gland OD.
4. Using a corner-to-corner sequence, install and tighten, to approximately 75% of final torque specifications, the SHCS fasteners (1-1/2" to 5" bores) or tie rod nuts (6" to 8" bores and all Style DD mounts (NFPA MT4)) at the rod lock face. See torque specification table below.
5. Using a calibrated torque wrench, tighten the fasteners or nuts to the final torque specification using the same corner-to-corner sequence.
6. Remove the air pressure from the rod lock port or remove the torque from the manual override shaft to return the rod lock to the locked state.

The rod lock units are not field-repairable and must be returned to the Pneumatic Division for any repairs. Please contact the Wadsworth, Ohio facility for any assistance.

3MAJ/4MAJ Bore Size	SHCS Fastener Torque or Tie Rod Torque	
	inch-lbs	Nm
1-1/2	32-36	3.6-4.1
2	72-82	8-9
2-1/2	72-82	8-9
3-1/4	216-228	24-25.3
4	216-228	24-25.3
5	360-372	41-42
6	420-432	48-49
8	960-972	109-115



DD

3MAJ/4MA

3MAJ/4MAJ

ACVB Option

LPSO Option

4MNR

S

C

B