

Section C – Hydraulic and Pneumatic Cylinders

Schrader Bellows offers you the widest range of Hydraulic and Pneumatic Cylinder Modifications and Options...all available to meet your particular cylinder design requirements of today...and tomorrow. We have a section that lets you “customize” cylinders to fit your

application and help reduce your operating costs. At Schrader Bellows we’re ready to give you any and all the technical assistance you need to provide you with the modified standard cylinder design you need to meet your requirements.

Custom Modifications and Innovations

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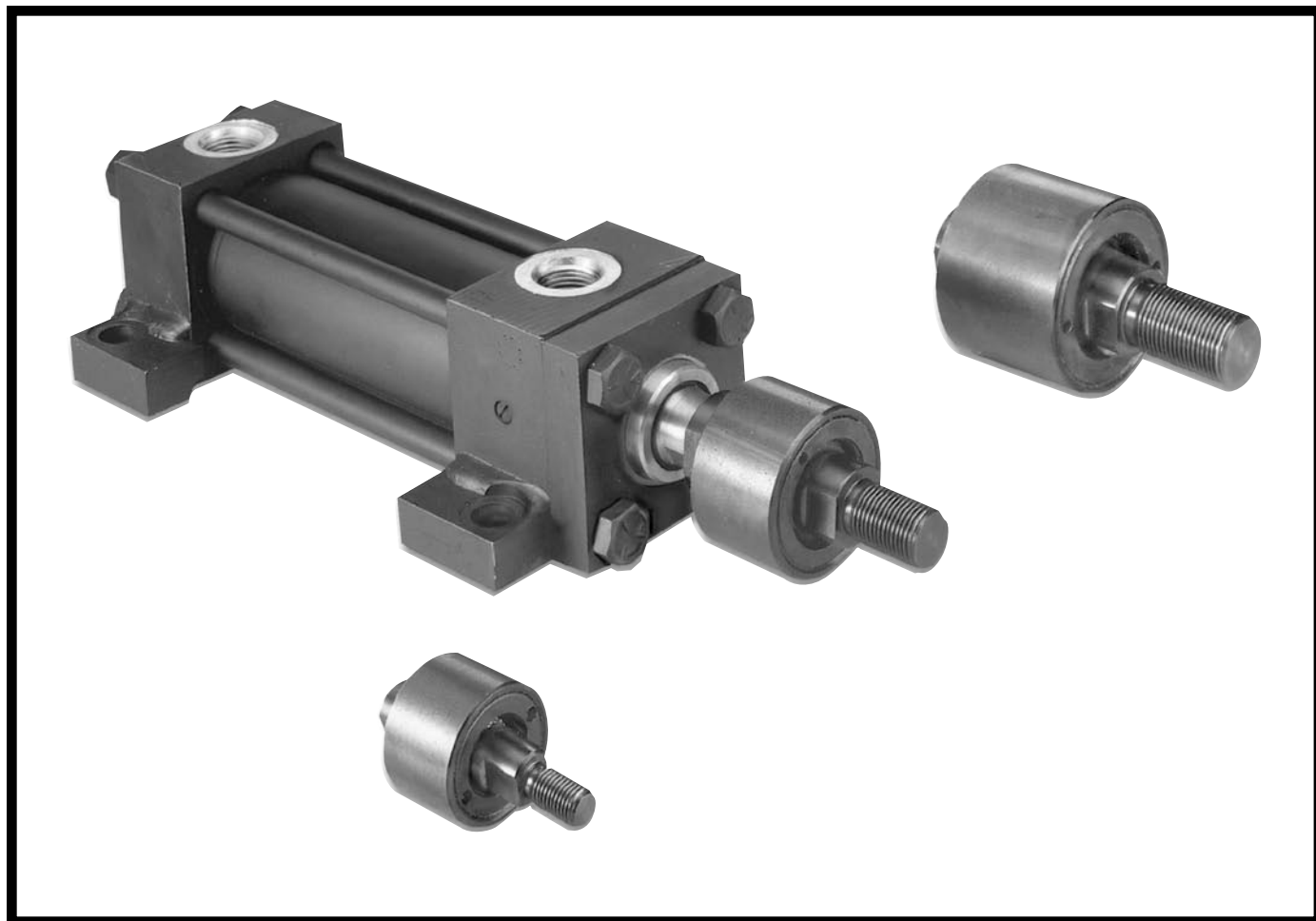


Feature	Hydraulic Series						Pneumatic Series	
	PL-2	PH-2	PH-3	CHE	SH/SHG	SHM	PA-2	NC9
Non-Lube (N)* (1)							●	●
High Water Content Fluids	●	●	●		●	●		
Special Piston Rod Ends (1)	●	●	●	●	●	●	●	●
Rod End Threads 2 X Std. Length (1)	●	●	●	●	●	●	●	●
Port Relocation (2)	●	●	●		●	●	●	●
Extra Ports (2)	●	●	●		●	●	●	●
SAE "O" Ring Ports (2)	●	●	●	●	●	●	●	●
Oversize Port (2)	●	●	●		●	●	●	●
Mounting Combinations (2)	●	●	●	●	●	●	●	●
Stroke Adjusters (2)	●	●	●		●	●	●	
Spring Return (2)	●	●	●		●	●	●	●
Spring Extend (1)	●	●	●		●	●	●	
Water Service (2)	●	●	●		●	●	●	●
Hi-Load Piston (1)		●	●		●	●		
Fluorocarbon Seals (2)	●	●	●	●	●	●	●	●
Rod End Boots (2)	●	●	●		●	●	●	
Manifold Ports (2)	●	●	●			●	●	
Metallic Rod Wiper (2)	●	●	●		●	●	●	
Gland Drain (2)	●	●	●			●		
Air Bleeds (2)	●	●	●		●	●		
Thrust Key (2)	●	●	●	●	●	●	●	●
Spherical Bearings (1)	●	●				●	●	●
EPS-5, 6 & 7 and CLS1 & 4 Proximity Switches (2)	●	●	●			●	●	●
Flange Coupling Piston Rod End (2)	●	●	●	●	●		●	●

*Modification suffix ie: PN.

(1) See Catalog Section for details.

(2) See Application Engineering Section for details.



- Simplify Cylinder Installation
- Reduce Assembly Time
- Increase Cylinder Bearing and Seal Life
- Reliable Performance in “Push”
and “Pull” Applications

Linear Alignment Couplers are available in 12 standard thread sizes...

Cost Saving Features and Benefits Include...

- Maximum reliability for trouble-free operation, long life and lower operating costs
- Increased cylinder life by reducing wear on Piston and Rod bearings
- Simplifying Cylinder installation and reducing assembly costs
- Increase Rod Bearing and Rod Seal life for lower maintenance costs

Alignment Coupler

See Table 1 for Part Numbers and Dimensions

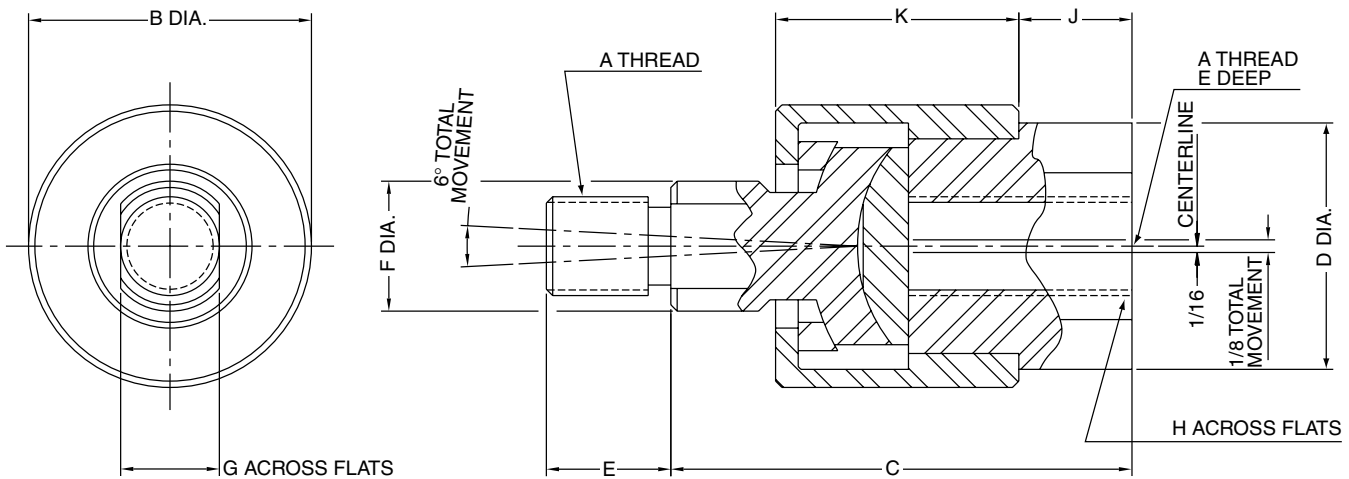


Table 1 — Part Numbers and Dimensions

Part No.	A	B	C*	D	E	F	G	H	J	K	Max. Pull Load (lbs.)	Approx. Weight (lbs.)
1347570031	$5/16$ -24	$1\frac{1}{8}$	$1\frac{3}{4}$	$15/16$	$1/2$	$1/2$	$3/8$	$3/4$	$3/8$	$15/16$	1200	.35
1347570038	$3/8$ -24	$1\frac{1}{8}$	$1\frac{3}{4}$	$15/16$	$1/2$	$1/2$	$3/8$	$3/4$	$3/8$	$15/16$	2425	.35
1347570044	$7/16$ -20	$1\frac{3}{8}$	2	$1\frac{1}{8}$	$3/4$	$5/8$	$1/2$	$7/8$	$3/8$	$1\frac{3}{32}$	3250	.55
1347570050	$1/2$ -20	$1\frac{3}{8}$	2	$1\frac{1}{8}$	$3/4$	$5/8$	$1/2$	$7/8$	$3/8$	$1\frac{3}{32}$	4450	.55
1347570063	$5/8$ -18	$1\frac{3}{8}$	2	$1\frac{1}{8}$	$3/4$	$5/8$	$1/2$	$7/8$	$3/8$	$1\frac{3}{32}$	6800	.55
1347570075	$3/4$ -16	2	$2\frac{5}{16}$	$1\frac{5}{8}$	$1\frac{1}{8}$	$15/16$	$3/4$	$1\frac{5}{16}$	$7/16$	$1\frac{9}{32}$	9050	1.4
1347570088	$7/8$ -14	2	$2\frac{5}{16}$	$1\frac{5}{8}$	$1\frac{1}{8}$	$15/16$	$3/4$	$1\frac{5}{16}$	$7/16$	$1\frac{9}{32}$	14450	1.4
1347570100	1-14	$3\frac{1}{8}$	3	$2\frac{3}{8}$	$1\frac{5}{8}$	$1\frac{7}{16}$	$1\frac{1}{4}$	$1\frac{7}{8}$	$3/4$	$1\frac{25}{32}$	19425	4.8
1347570125	$1\frac{1}{4}$ -12	$3\frac{1}{8}$	3	$2\frac{3}{8}$	$1\frac{5}{8}$	$1\frac{7}{16}$	$1\frac{1}{4}$	$1\frac{7}{8}$	$3/4$	$1\frac{25}{32}$	30500	4.8
1337390125	$1\frac{1}{4}$ -12	$3\frac{1}{2}$	4	2	2	$1\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{11}{16}$	$3/4$	$2\frac{1}{2}$	30500	6.9
1337390150	$1\frac{1}{2}$ -12	4	$4\frac{3}{8}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{15}{16}$	$7/8$	$2\frac{3}{4}$	45750	9.8
1337390175	$1\frac{3}{4}$ -12	4	$4\frac{3}{8}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{15}{16}$	$7/8$	$2\frac{3}{4}$	58350	9.8
1337390188	$1\frac{7}{8}$ -12	5	$5\frac{5}{8}$	3	3	$2\frac{1}{4}$	$1\frac{15}{16}$	$2\frac{5}{8}$	$1\frac{3}{8}$	$3\frac{3}{8}$	67550	19.8

How to Order Linear Alignment Couplers — When ordering a cylinder with a threaded male rod end, specify the coupler of equal thread size by part number as listed in Table 1, i.e.; Piston Rod "KK" or "CC" dimension is $3/4$ " - 16", specify coupler part number 1347570075.

Cylinder End-of-Stroke Proximity Sensors

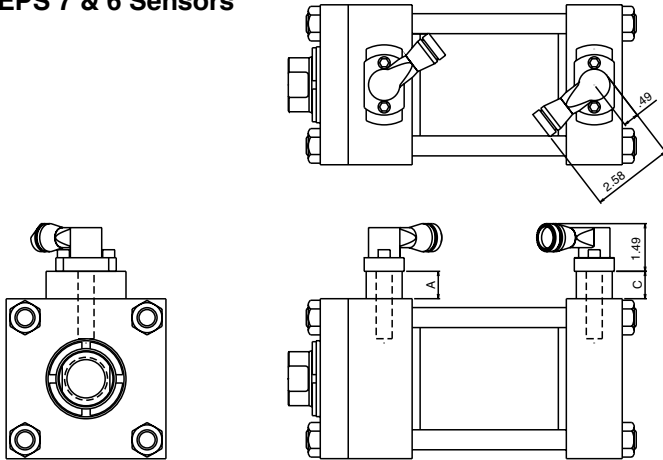
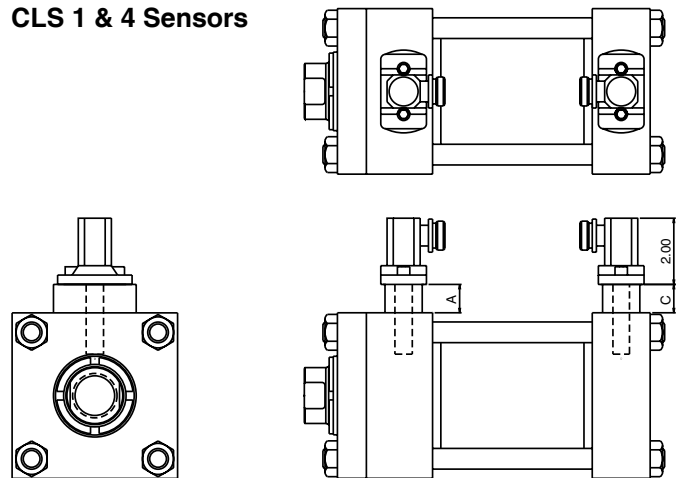
**For Series PA-2, PH-2, PL-2,
PH-3 and SHM Cylinders**



“EPS” Style Inductive Sensors
For General Industrial AC and DC Applications

“CLS” Style Magnetic Sensors
For Extreme Temperature Applications

All Sensors Are:
Non-Contacting
Water Resistant
Weld-Field Immune
Shock and Vibration Resistant
Flange-Mounted to Cylinder End Caps

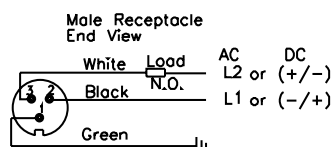
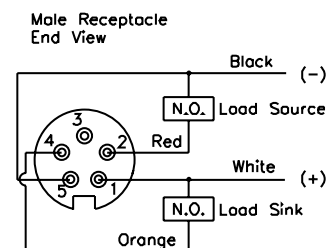
EPS 7 & 6 Sensors**CLS 1 & 4 Sensors****Series and Parallel Wiring**

When Schrader Bellows EPS-6 or 7 proximity switches are used as inputs to programmable controllers the preferred practice is to connect each switch to a separate input channel of the PC. Series or parallel operations may then be accomplished by the internal PC programming.

Schrader Bellows EPS-6 or 7 switches may be hard wired for series operation, but the voltage drop through the switches (see specifications) must not reduce the available voltage below what is needed to actuate the load.

Schrader Bellows EPS-6 or 7 switches may also be hard wired for parallel operation. However, the leakage current of each switch will pass through the load. The total of all leakage currents must not exceed the current required to actuate the load. In most cases, the use of two or more EPS-6 or 7 switches in parallel will require the use of a bypass (shunt) resistor.

Series	A max.	C max.
PH-2, PH-3 1.5"-8" bores	.86"	1.75"
PL-2	1.55"	1.05"
PA-2	1.55"	1.30"
SHM	1.19"	1.05"

Connector Pin Numbering**3-Pin Mini****5-Pin Mini**

Specifications				
Style:	EPS-7	EPS-6	CLS-1	CLS-4
Code Designator:	H	D	F	B
Description:	Economical, General Purpose, 2 wire device, primarily for AC applications, not suitable for 24 VDC applications. Also for automotive industry applications.	Economical, General Purpose, 3 wire, DC sensor, dual output: sinking and sourcing	Functional replacement for AB (Mechanical) Limit Switches in many applications, or where customer needs NC contacts, zero leakage, zero voltage drop, higher or lower load current than EPS-style.	Functional replacement for AB (Mechanical) Limit Switches in many High Temperature applications, or where customer needs NC contacts, zero leakage, zero voltage drop, higher or lower load current than EPS-style.
Supply Voltage:	20 to 250 VAC/DC	10 to 30 VDC	24 to 240 VAC/DC	24 to 240 VAC/DC
Load Current, min:	8 mA	NA	NA	NA
Load Current, max:	300 mA	200 mA	4 AMPS @ 120 VAC 3 AMPS @ 24 VDC	4 AMPS @ 120 VAC 3 AMPS @ 24 VDC
Leakage Current:	1.7 mA, max.	10 micro amps max.	-	-
Voltage Drop:	7 V, max.	2 VDC max.	NA	NA
Operating Temperature:	-14° to +158° F	-14° to +158° F	-40°F to +221° F	-40° F to +400° F
Sensor Type:	Inductive proximity	Inductive proximity	Non-contacting magnetically actuated	Non-contacting magnetically actuated
Part Number:	148897****	148896****	148275****	149109****
Part Number Suffix **** :	**** 4-digit suffix indicates probe length: 0125=1.25", 0206=2.06", 0288=2.875", 0456=4.562"			
Connection:	3 pin mini	5 pin mini	3 pin mini	144" PTFE Coated Flying Leads with 1/2" conduit hub
Enclosure Rating:	IEC IP67	IEC IP67	NEMA 1, 2, 3, 4, 4x, 5, 6, 6P, 11, 12, 12K, 13	NEMA 1, 2, 3, 4, 4x, 5
LED indication:	Yes	Yes	No	No
Short Circuit Protection:	Yes	Yes	No	No
Weld Field Immunity:	Yes	Yes	Yes	Yes
Output:	2 wire, Normally Open with leakage current	Dual output: DC Sinking and DC Sourcing, user selectable via wiring	SPDT (Single Pole Double Throw), Normally Open/Normally Closed, Form C	SPDT (Single Pole Double Throw), Normally Open/Normally Closed, Form C
Approvals/Marks:	CE, UL, CSA	CE, UL, CSA	UL or CSA†	UL or CSA†
Make/Break Location	0.125" from end of stroke, typical. Tolerance is 0/- .125"			
Wiring Instructions:	Pin 1: AC Ground (Green) Pin 2: Output (Black) Pin 3: AC Line (White)	Pin 1) +10 to 30 VDC (White) Pin 2) Sourcing Output (Red) Pin 3) Grounded (not connected or required) Pin 4) Sinking Output (Orange) Pin 5) DC Common (Black)	Pin 1: Common (Green) Pin 2: Normally Closed (Black) Pin 3: Normally Open (White)	Common: (Black) Normally Open: (Blue) Normally Closed: (Red)
Standard Cable: 6'	0853550006	0859170006	0853550006	-
Standard Cable: 12'	0853550012	0859170012	0853550012	-
Cable: 6', Right Angle	0875470006	-	0875470006	-

†CSA available upon request – consult factory

Schrader Bellows EPS proximity switches may be ordered on Series PA-2, PN, PL-2, PH-2, PH-3, and SHM cylinders as follows:

- 1) Complete the basic cylinder model number.
- 2) Place an "S" in the model number to denote switches and/or special features.

- 3) Mounting styles MT1, MT2, ME5, MF5, MF6 should be used with caution because of possible mounting interferences. See the following page.
- 4) Special modifications to cylinders other than switches must have a written description.

How to Specify EPS Switches

5) Specify letter prefix "H" for EPS-7, "D" for EPS-6, and "F" for CLS-1, or "B" for CLS-4, then fill in the four blanks specifying port location, switch orientation and actuation point for both head and cap. If only one switch is used, place "XXXX" in the unused blanks.

Example = H13CGG-XXXX denotes a switch on the head end only, EPS-7
Example = XXXX-B42BGG denotes a switch on the cap end only, CLS-4

Head End

H	1	3	A	GG
Specify: "H" = EPS-7 "D" = EPS-6 "F" = CLS-1* "B" = CLS-4* "N" = Prepared for switches only	Port Location See Figure 1.	Switch Location See Figure 1.	Switch Orientation See Figure 2 for EPS-7 and EPS-6 only.	Actuation Point GG = End of Stroke FF = Stroke to Go; See pages 10-12 for stroke remaining.

Cap End

4	2	B	GG
Port Location See Figure 1.	Switch Location See Figure 1.	Switch Orientation See Figure 2 for EPS-7 and EPS-6 only.	Actuation Point GG = End of Stroke FF = Stroke to Go; See pages 10-12 for stroke remaining.

* CLS-1 and CLS-4 switches are not available on the head end of 1 1/2" bore with 1" rod and 2" bore with 1 3/8" rod.
Note: All specified switch and port locations are as seen from rod end of cylinder.

Figure 1

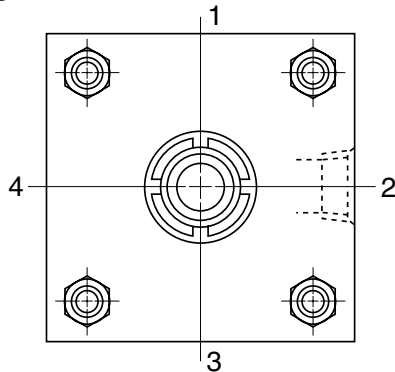
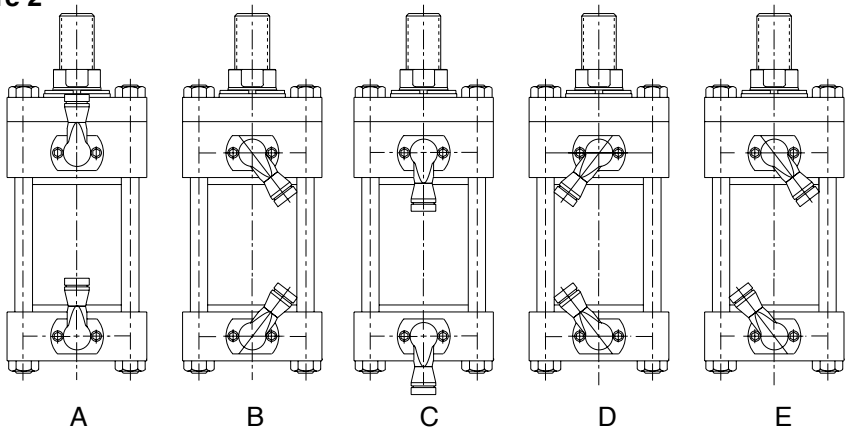


Figure 2

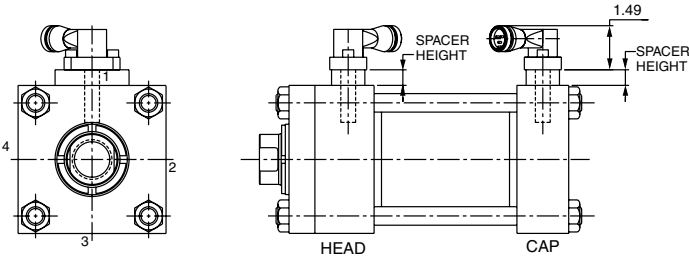


These pages contain mounting information for EPS and CLS Style Proximity Switches by bore and rod combination.

Switches, spacers and mounting bolts have each been assigned a code that can be found in Tables 2, 3 and 4.

The components of a complete switch assembly may be identified by cross referencing these codes with the part numbers in Tables 5, 6 and 7.

**EPS-6 & 7 Heavy Duty
Industrial & Automotive Applications**



**CLS-1 & 4 Switches
Extreme Temperature Applications**

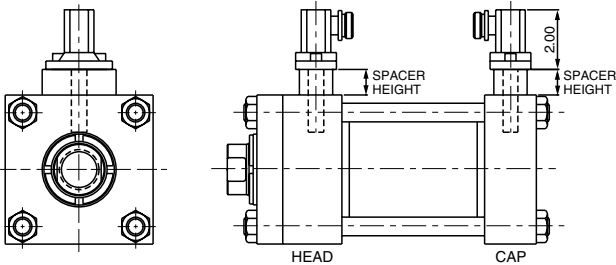


Table 1 - Available Mounting Positions for EPS- 6, 7 & CLS 1, 4

EPS 6,7 & CLS 1, 4		Switch Locations for PA-2, PN, PL-2, PH-2, PH-3, SHM Series									
MOUNTING STYLES											
Bores sizes (inches):		1.5	2	2.5	3.25	4	5	6	7	8	10
MHP bores sizes (mm):		40	50	63	80	100	125	160	—	200	—
MT4, MX0, MX1, MX2, MX3, MP1	HEAD	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
	CAP	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
MF1, ME5, MT1 (see note 3)	HEAD	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
	CAP	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
MF2, ME6, MT2	HEAD	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
	CAP	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
MS2 (see note 2)	HEAD	1	1	1	1	1	1	1,2,4	1,2,4	1,2,4	1,2,4
	CAP	1	1	1	1	1	1	1,2,4	1,2,4	1,2,4	1,2,4
MS4	HEAD	1	1	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4
	CAP	1	1	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4
MF5	HEAD	NA	NA	NA	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
	CAP	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
MF6	HEAD	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
	CAP	NA	NA	NA	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4

Note: The electrical connector orientation may be restricted in some cases. Consult the dimensions in the current catalog.

Note 2: On 6" cylinders and larger, and for 160mm and 200mm bores, switches mounted in position 2 or 4 will interfere with the installation and removal of mounting bolts.

Note 3: On 1.5 through 5" Style ME5 cylinders, switches will extend beyond mounting surface of cylinder.

Note 4: Positions 1, 2, 3 and 4 are determined by viewing cylinder from piston rod end and going clockwise.



Table 2 CODES FOR PA-2, PN, PL-2 SERIES CYLINDERS WITH EPS 6, 7 & CLS 1, 4 SWITCHES									
BORE	SERIES	ROD DIA	END-OF-STROKE PROBE LOCATION ("GG" ORDER CODE)	SPACER HEIGHT	SWITCH CODE	SPACER CODE	EPS 6,7 BOLT CODE (1)	CLS 1, 4 BOLT CODE (1)	OPTIONAL STROKE TO GO ("FF" ORDER CODE)
1.5	PA-2 PL-2	0.63	0.59	0.688	1	FK	299	F99	0.44
		1	0.59	0.876	1	1K	399	199	0.44
		CAP	0.63	0.468	1	BK	1D9	9D9	0.17
2	PA-2 PL-2	0.63	0.59	0.579	1	D2	2E9	0E9	0.44
		1.375	0.59	0.829	1	H2	399	199	0.44
		1	0.59	0.688	1	F2	299	F99	0.44
		CAP	0.63	1.048	2	EG2	499	299	0.17
		0.63	0.63	0.296	1	E	29	F9	0.48
2.5	PA-2 PL-2	1.75	0.63	0.796	1	EH	49	29	0.48
		1	0.63	0.421	1	G	39	19	0.48
		1.38	0.63	0.608	1	DF	39	29	0.48
		CAP	0.63	0.780	2	FG	49	29	0.17
		1	0.88	0.858	2	FH	49	39	0.73
3.25	PA-2 PL-2	2	0.56	0.608	1	DF	39	29	0.42
		1.375	0.88	0.249	1	D	2E	FE	0.73
		1.75	0.88	0.421	1	G	39	19	0.73
		CAP	0.75	0.546	2	J	39	29	0.34
		1	0.88	0.499	2	H	39	19	0.73
4	PA-2 PL-2	2.5	0.56	0.546	1	J	39	29	0.42
		1.375	0.88	0.671	2	DG	49	29	0.73
		1.75	0.88	0.858	2	FH	49	39	0.73
		2	0.56	0.249	0	D	2E	FE	0.42
		CAP	0.75	0.170	2	C	1D	OD	0.34
		1	0.88	0.796	3	EH	49	39	0.72
5	PA-2 PL-2	3.5	0.56	0.546	1	J	39	29	0.42
		1.38	0.88	0.170	2	C	2D	FD	0.72
		1.75	0.88	0.358	2	F	29	F9	0.72
		2	0.56	0.546	2	J	39	29	0.42
		2.5	0.56	0.858	2	FH	49	39	0.42
		3	0.56	0.296	1	E	29	F9	0.42
		CAP	0.75	0.499	3	H	39	19	0.34
		1.38	1.13	0.499	3	H	39	29	0.98
6	PA-2 PL-2	4	0.81	0.296	1	E	29	F9	0.66
		1.75	1.13	0.671	3	DG	49	29	0.98
		2	0.81	0.858	3	FH	49	39	0.66
		2.5	0.81	0.358	2	F	29	F9	0.66
		3	0.81	0.608	2	DF	39	29	0.66
		3.5	0.81	0.858	2	FH	49	39	0.66
		CAP	0.75	0.109	3	A	1D	GD	0.34
7	PA-2	1.38	1.13	0	3	NONE	1	G	0.98
		1.75	1.13	0.170	3	C	2D	FD	0.98
		2	0.81	0.358	3	F	29	F9	0.66
		CAP	0.94	1.296	4	EHH	6B	5B	0.53
8	PA-2 PL-2	1.38	1.13	1.171	4	DGH	6B	4B	0.98
		5.5	0.69	0.921	2	GH	5B	3B	0.54
		1.75	1.13	1.358	4	FHH	6B	5B	0.98
		2	0.81	1.546	4	HHJ	7C	6C	0.66
		2.5	0.81	0.170	3	C	2D	FD	0.66
		3	0.81	0.421	3	G	39	19	0.66
		3.5	0.81	0.671	3	DG	49	29	0.66
		4	0.81	0.110	2	A	1D	GD	0.66
		5	0.81	0.671	2	DG	49	29	0.66
10	PA-2	CAP	0.94	0.796	4	EH	49	39	0.63
		1.75	1.38	0.296	4	E	29	F9	1.22
		2	1.06	0.499	4	H	39	19	0.91
		2.5	1.06	0.499	4	EH	49	39	0.91
		3	1.06	1.046	4	DEH	5B	4B	0.91
		3.5	1.06	1.296	4	EHH	6B	5B	0.91
		4	1.06	0	3	NONE	1	G	0.91
		5	0.94	0.421	3	G	39	19	0.79
		5.5	0.94	0.671	3	DG	49	29	0.79
		CAP	0.94	0	4	NONE	1	G	0.53

(1) The first digit of the Bolt Code refers to screws that mount the switch to the cylinder. The second and third digits refer to screws that mount the spacers to the cylinder.

Table 4 CODES FOR SHM SERIES CYLINDERS WITH EPS 6, 7 & CLS 1, 4 SWITCHES									
BORE	SERIES	ROD DIA	END-OF-STROKE PROBE LOCATION ("GG" ORDER CODE)	SPACER HEIGHT	SWITCH CODE	SPACER CODE	EPS 6, 7 BOLT CODE (1)	CLS 1, 4 BOLT CODE (1)	OPTIONAL STROKE TO GO ("FF" ORDER CODE)
40	SHM	18	0.875	0.688	1	E3	HPP	LPP	.532
		28	0.875	0.688	1	F3	HPP	LPP	.532
		CAP	0.875	1.048	2	EG3	KPP	UPP	.656
50	SHM	22	0.875	1.188	2	FH3	KPP	UPP	.532
		36	0.875	0.626	1	E3	HPP	LPP	.532
		28	0.875	0.500	1	C3	HNP	WPP	.532
		CAP	0.875	0.829	2	H3	JPP	HPP	.656
63	SHM	28	0.875	0.249	1	D	HN	LN	.500
		45	0.875	0.546	1	J	JP	UP	.500
		36	0.875	0.358	1	F	HP	HP	.500
		CAP	0.875	0.671	2	DG	KP	UP	.656
80	SHM	36	1.125	0.671	2	DG	KP	UP	.500
		56	0.812	0.296	1	E	HN	LN	.500
		45	1.125	0.858	2	FH	KP	UP	.500
		CAP	1.000	0.296	2	E	HP	LP	.656
100	SHM	45	1.125	0.608	2	DF	JP	UP	.500
		70	0.812	0.358	1	F	HP	LP	.500
		56	0.812	0.858	2	FH	KP	JP	.500
		CAP	1.000	0.170	2	C	HN	LN	.656
125	SHM	56	0.812	0.170	2	C	HN	LN	.500
		90	0.812	0.109	1	A	LN	WN	.500
		70	0.812	0.499	2	H	JP	HP	.500
		CAP	1.000	0.421	3	G	JP	HP	.656
160	SHM	70	1.062	0.499	3	H	JP	HP	.500
		110	1.062	0.499	2	H	JP	HP	.500
		90	1.062	0.109	2	A	LN	WN	.500
		CAP	1.312	0.546	4	J	MQ	YQ	.670
200	SHM	90	1.562	0.170	3	C	HN	LN	.670
		140	1.687	0.421	2	G	JP	HP	.670
		110	1.687	0.546	3	J	JP	UP	.670
		CAP	1.937	0.671	4	DG	KP	UP	.670

(1) The first digit of the Bolt Code refers to screws that mount the switch to the cylinder. The second and third digits refer to screws that mount the spacers to the cylinder.

Table 5-EPS & CLS Switches					
Code	Probe Length (inches)	Schrader Bellows Part Number			
		EPS 6 DC	EPS 7 AC	CLS 1 AC	CLS 4 AC
1	1.250	1488960125	1488970125	1482750125	1491090125
2	2.062	1488960206	1488970206	1482750206	1491090206
3	2.875	1488960287	1488970287	1482750287	1491090287
4	4.562	1488960456	1488970456	1482750456	1491090456
Brand		Pepperl & Fuchs	Pepperl & Fuchs	Topworx	Topworx
Connection		5 Pin Mini	3 Pin Mini	3 Pin Mini	144" PTFE Coated Flying Leads with 1/2" conduit hub
Voltage		10-30 VDC	50-220 VAC/DC	24-240 VAC/DC	24 to 240 VAC/DC
Output		PNP & NPN	Normally Open	SPDT, Form C	SPDT, Form C
Leakage Current		NA	<1.7mA	—	—
Voltage Drop		<.8 VDC	<10 Volts	NA	NA

Table 3 CODES FOR PH-2 and PH-3 SERIES CYLINDERS WITH EPS 6, 7 & CLS 1, 4 SWITCHES									
BORE	SERIES	ROD DIA	END-OF-STROKE PROBE LOCATION ("GG" ORDER CODE)	SPACER HEIGHT	SWITCH CODE	SPACER CODE	EPS 6, 7 BOLT CODE (1)	CLS 1, 4 BOLT CODE (1)	OPTIONAL STROKE TO GO ("FF" ORDER CODE)
1.5	PH-2	0.63	0.880	0.439	1	A2	1D9	GD9	.422
		1	0.880	0.626	1	E2	299	F99	.422
		CAP	0.937	1.048	2	EG2	499	299	.381
2	PH-2	1	0.880	0.439	1	A2	1D9	GD9	.442
		1.375	0.880	0.579	1	D2	2E9	0E9	.442
		CAP	0.875	0.938	2	DF2	399	299	.319
2.5	PH-2	1	0.880	0.170	1	C	2D	FD	.475
		1.75	0.880	0.546	1	J	39	29	.475
		1.375	0.880	0.358	1	F	39	F9	.475
		CAP	0.875	0.671	2	DG	49	29	.319
3.25	PH-2	1.375	1.125	0.671	2	DG	49	29	.725
		2	0.812	0.249	1	D	2	FE	.417
		1.75	1.125	0.858	2	FH	49	39	.725
		CAP	1.062	0.296	2	E	29	F9	.506
4	PH-2	1.75	1.125	0.608	2	DF	39	29	.725
		2.5	0.812	0.296	1	E	29	F9	.417
		2	0.812	0	1	NONE	1	G	.417
		CAP	1.000	0.170	2	C	2D	FD	.444
5	PH-2	2	0.812	0.858	3	FH	49	39	.417
		3.5	0.812	0.858	2	FH	49	39	.417
		2.5	0.812	0.358	2	F	29	F9	.417
		3	0.812	0.608	2	DF	39	29	.417
		CAP	0.875	0.358	3	F	29	F9	.319
6	PH-2	2.5	1.062	0.671	3	DG	49	29	.663
		4	1.062	0.608	2	DF	39	29	.663
		3	1.062	0.109	2	A	1	GD	.663
		3.5	0.812	0.358	2	F	29	F9	.417
		CAP	1.250	1.749	4	DHHH	8D	6C	.683
7	PH-3	3	1.562	0.421	3	G	39	19	1.162
		5	1.437	0.671	2	DG	49	29	1.037
		3.5	1.562	0.671	3	DG	49	29	1.162
		4	1.062	0.109	2	A	1D	GD	.663
8	PH-3	CAP	1.687	1.421	4	GHH	7B	51	1.117
		3.5	1.812	0.170	3	C	2D	FD	1.412
		5.5	1.687	0.421	2	G	39	19	1.287
		4	1.062	0.421	3	G	39	19	.663
		5	1.437	0.170	2	C	2D	FD	1.037
		CAP	1.687	0.921	4	GH	5B	3B	1.183

(1) The first digit of the Bolt Code refers to screws that mount the switch to the cylinder. The second and third digits refer to screws that mount the spacers to the cylinder.

Table 6 — Spacer Blocks

Letter Code	Part #	Spacer Height (inches)	Letter Code	Part #	Spacer Height (inches)
A	0854690110	.109	EH	0854690797	.796
B	0854670000	.138	FH	0854690859	.858
C	0854690171	.170	GH	0854690922	.921
D	0854690250	.249	BGG	0854690983	.982
E	0854690297	.296	DEH	0854691047	1.046
F	0854680359	.358	DGH	0854691172	1.171
G	0854690422	.421	EHH	0854691297	1.296
H	0854690500	.499	FHH	0854691359	1.358
J	0854690547	.546	GHH	0854691422	1.421
K	0854660000	.330	HHJ	0854691547	1.546
DF	0854690609	.608	DHHH	0854691750	1.749
DG	0854690672	.671	1	0854680547	.546
EG	0854690719	.718	2	0854820000	.330
FG	0854690781	.780	3*	0875830000	.330

One O-Ring per spacer, Size# 2 - 15, Part Number 0100240003 (Fluorocarbon)

* Used on SHM only

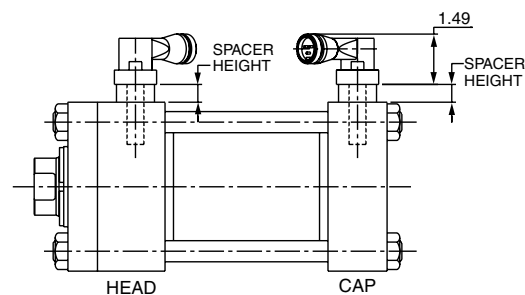
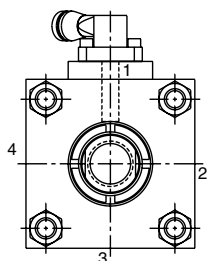
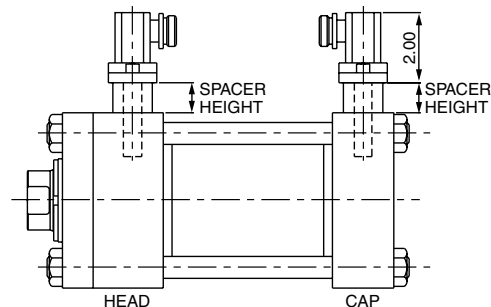
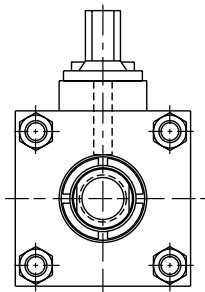
**EPS-6 & 7 Heavy Duty
Industrial & Automotive
Applications****CLS-1 & 4 Extreme
Temperature Applications**

Table 7 — Mounting Bolts

Two mounting bolts are required per switch.

Mounting Bolts for PA-2, PN, PL-2, PH-2, PH-3

Code #	Bolt Part Number	Bolt Length Inches	Bolt Thread & Type
0	0106340048	0.75	1/4-20 SHCS
1	0106340100	1.00	1/4-20 SHCS
2	0106340116	1.25	1/4-20 SHCS
3	0106340132	1.50	1/4-20 SHCS
4	0106340148	1.75	1/4-20 SHCS
5	0106340200	2.00	1/4-20 SHCS
6	0106340216	2.25	1/4-20 SHCS
7	0106340232	2.50	1/4-20 SHCS
8	0106340248	2.75	1/4-20 SHCS
9	0106280024	0.38	#8-32 SHCS
A	0106280032	0.50	#8-32 SHCS
B	0106280100	1.00	#8-32 SHCS
C	0106280132	1.50	#8-32 SHCS
D	0104530024	0.38	#8-32 PHS
E	0104530032	0.50	#8-32 PHS
F	0106340056	0.88	1/4-20 SHCS
G	0106340040	0.62	1/4-20 SHCS

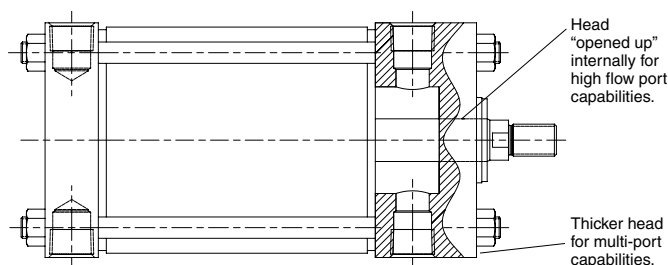
Mounting Bolts for SHM

Code #	Bolt Part Number	Bolt Length mm	Bolt Thread & Type
H	1474210030	30	M6X1.0 SHCS
J	1474210040	40	M6X1.0 SHCS
K	1474210045	45	M6X1.0 SHCS
L	1474210025	25	M6X1.0 SHCS
M	1474210065	65	M6X1.0 SHCS
N	1487220210	10	M6X1.0 SHCS
P	1487640010	10	M6X1.0 SHCS (LOW HEAD)
Q	1474190035	35	M4X0.7 SHCS
R	1487220212	12	M4X0.7 FHSS
S	1487220216	16	M4X0.7 FHSS
T	1487220220	20	M4X0.7 FHSS
U	1474210035	35	M6X1.0 SHCS
V	1487220208	8	M4X0.7 FHSS
W	1474210020	20	M6X1.0 SHCS
X	1474210055	55	M6X1.0 SHCS
Y	1474210060	60	M6X1.0 SHCS
Z	0108800016	1/4" HI COLLAR LOCK WASHER, 4 REQ'D	

FHSS=Flat Head Socket Screw

PHS=Phillip Head Screw

PA-2 Series Counter Balance Cylinder



The innovative PA-2 Series Counter Balance Cylinder is designed with special dimensioned heads and caps opened up internally to allow for the high flow port option. The heads and caps are also thicker to accommodate multi-porting capabilities.

Standard Specifications

- Square head – tie rod design.
- Bore sizes – 1½" through 14" standard.
- Nominal pressure – to 250 PSI air.
- Strokes available in any practical length.
- Porting properly sized for optimum air flow.
- Heads and caps properly sized to accommodate porting.
- Case hardened, chrome plated piston rod is standard.

An efficient counter balance system consists of cylinders working in conjunction with receiver tanks to balance a vertical load, with minimized restrictions to air flow situations. Simplified examples of a cylinder and an air tank are shown below in Figures A and B.

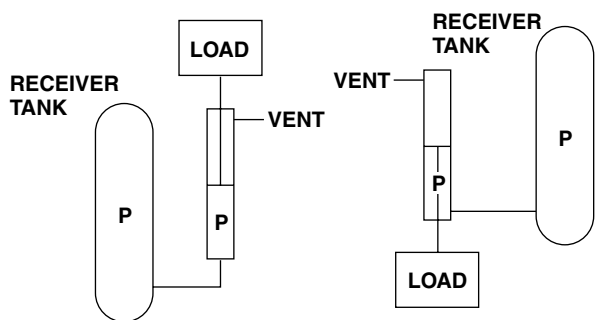


FIGURE A
CAP END PRESSURIZED

FIGURE B
ROD END PRESSURIZED

Pipe Schedule Chart

A _F for Proper Pipe			
Pipe	A _F (in. ²)	Pipe	A _F (in. ²)
½	.304	1½	2.036
¾	.533	2	3.356
1	.864	2½	4.788
1¼	1.496	3	7.392

In many vertical driven load applications, use of the Counter Balance Cylinder is very effective for load control. The machine designer must assure that the cylinder itself does not become an excessive restricting factor. Restricting factor occurs when rapidly moving air tries to pass through a cylinder port or other orifice.

Excessive restricting factor will usually show up as higher than anticipated motor current draw at the vertical drive. The higher amperage causes increased electricity costs. Also the additional mechanical load due to air flow restricting factor could cause premature failure of motor, drive or other machine components.

The PA-2 Series Special Counter Balance Cylinders are specifically designed for applications where it is desirable to reduce the restricting factor of air flow through a cylinder orifice. An excellent guideline to follow regarding restricting factor is to have standard condition air velocity through the cylinder port at or below 5,000 feet per minute.

By applying the following information, you can properly size ports for a flow rate within the 5,000 feet/minute guideline.

- Cylinder Bore (D) in.
- Cylinder Rod Size (d) in.
- Stroke Length (l) in.
- Stroke Time (t) Sec.
- Receiver Tank Pressure (P) P.S.I.

Using the above information in the following formulas, with the provided Pipe Schedule Chart, you can properly size the Counter Balance Cylinder ports at both pressurized and vented ends.

AE: Cylinder Piston Areas

AE for cylinders connected to receiver tank as shown in Fig. A, cap end pressurized

$$AE = \frac{\pi \times D^2}{4} = \text{in.}^2$$

AE for cylinders connected to receiver tank as shown in Fig. B, rod end pressurized.

$$AE = \frac{\pi \times (D^2 - d^2)}{4} = \text{in.}^2$$

CR: Compression Ratio.
At vented end, CR = 1.

$$CR = \frac{P + 14.7}{14.7} = \text{_____}$$

A_F: Minimum Orifice Area for 5,000 ft./min. velocity.

$$A_F^* = \frac{AE \times l \times CR}{1000t} = \text{in.}^2$$

*A_F can be achieved by the use of one or two ports. Once A_F is found, compare to pipe chart shown at left for required flow areas in in.². Select proper pipe schedule based upon operating pressure.

- The counterbalance version of the heavy duty PA-2 cylinder is a special and cannot be ordered directly from a standard PA-2 catalog.
- When dealing with extreme air velocities, it is critical that the PA-2 cylinder load, stroke, and speed requirements are satisfied before attempting to use the provided formulas.
- Once the flow rate guideline of 5,000 feet/minute is satisfied, provide the proper port size to accommodate the pipe size shown on the chart to the left. Apply minimum orifice area formula A_F (in.²) to match proper port size.

NOTES



- **Maximum Input Pressures:**
 - Air – 250 psi (17 BAR)
 - Oil – 1000 psi (69 BAR)
- **Maximum Output Pressures:**
 - 5/8" to 3" RAM – 5000 psi (345 BAR);
 - 3 1/2" to 5" RAM – 3000 psi (206 BAR)
- **Maximum Operating Temperatures:**
 - 10°F to +165°F (-23°C) to (+74°C)

Schrader Bellows Intensifiers

Designed to Save Energy, Time, Space and Money in a Wide Variety of Applications.

A Schrader Bellows Intensifier is an efficient way of generating high pressure hydraulic fluid. Its operation is quite simple. Pressurized fluid – either air or oil – enters the intensifier and acts on a confined piston. This in turn drives a smaller diameter ram or piston to deliver a given volume of fluid. As a result, the output pressure is intensified and is considerably higher than the input pressure.

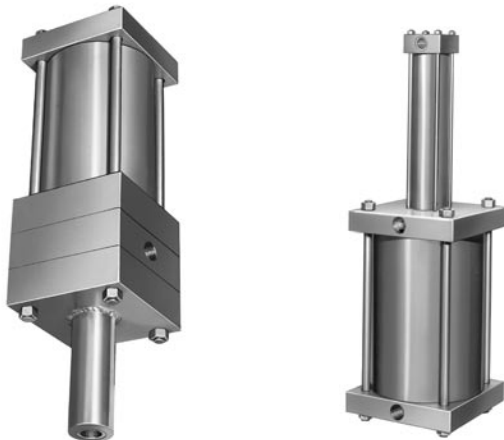
By using a Schrader Bellows Intensifier you can save in many ways. First, since it requires only low pressure input and less costly control valving, you eliminate the extra expense of high pressure pumps, valving and a large electrical power source. The simpler mountings and controls also save you valuable installation time.

In addition, since Schrader Bellows Intensifiers produce high hydraulic pressure, you can save space by using a smaller bore hydraulic cylinder in place of a larger bore air cylinder that is heavier and more costly.

Finally, because of the rugged dependability of Schrader Bellows Intensifiers and the simpler circuitry required, you eliminate the constant motion, heat generation and power consumption found in pump systems. This means that you use less energy with less downtime and maintenance.

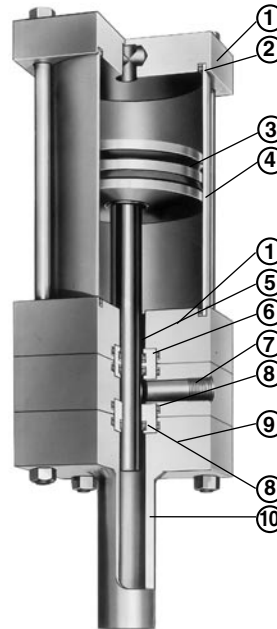
These abilities and benefits of Schrader Bellows Intensifiers make them the ideal component in many applications. You can use them for such operations as marking, forming, molding, punching, riveting, shearing, straightening, laminating, embossing, welding and testing.

What's more, the Schrader Bellows Intensifier can be mounted on or off the equipment and can even be integrally combined with the work cylinder. This flexibility makes them particularly useful hydraulic pressure sources on portable equipment.



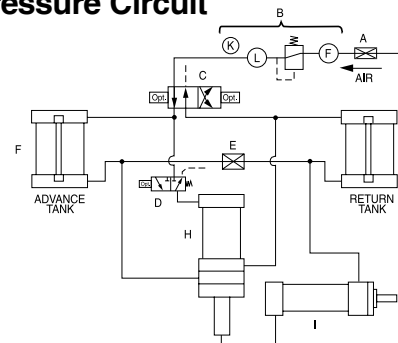
Schrader Bellows Intensifiers are available in various sizes and configurations. There are cylinder-to-ram units with capability for either single pressure or dual pressure service (left above), as well as several cylinder-to-cylinder models (above right).

Here are the features you'll find in every Schrader Bellows Intensifier:



1. Compact, high-strength steel heads, cap and tie rods meet the most demanding applications.
2. Seal by pressure O-rings serve as cylinder body-to-head seals prevent leaks. The cylinder body is also piloted on the O.D. to insure metal-to-metal contact to support the seals.
3. The rugged one-piece iron piston is threaded and Loctited to the ram. Schrader Bellows Lipseal® piston seals are used with air; piston rings with hydraulic fluid.
4. The driving cylinder body is steel tubing with chrome-plated bore for corrosion-resistance in bore sizes 3 1/4" through 14" sizes.
5. The smooth, wear-resistant surface of the chrome-plated and induction-hardened ram greatly lengthens seal life.
6. Static O-ring seals prevent leaks past the O.D. of the glands. Back-up washers prevent extrusion.
7. Intensifier operation is speeded up by the free flow of fluid in and out of the unobstructed ports. All high-pressure hydraulic ports are SAE straight thread o-ring type for leak-proof service.
8. Rod Lipseals are self-compensating and self-adjusting to provide leakproof ram seal for both high and low pressure operation.
9. For servicing the high pressure ram seals, the pressure chamber is independently secured with studs so it can be easily removed without disassembling the complete intensifier.
10. For optimum strength and safety, the pressure chamber wall is made of extra thick steel tubing that is piloted in a counterbore and pressure-welded to the head.

Dual Pressure Circuit



- | | |
|--|-----------------------------|
| A Cutoff Valve | F Advancing Tank (Air-Oil) |
| B Air Preparation Unit (Filter Regulator) | G Retracting Tank (Air-Oil) |
| C 4-Way Valve (Normally 2 Position) | H Intensifier |
| D 3-Way Valve | I Work Cylinder |
| E Cutoff Valve (For Balancing Tank Fluid Levels) | |

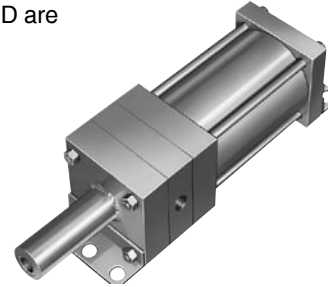
Dual Pressure Circuit (*continued*)

This basic circuit is for a dual pressure system supplying pressure to a double-acting work system. The circuit may be readily changed for other operating conditions such as single acting cylinder and single pressure delivery.

The input pressure is introduced to the system through shop air lines to the 4-way directional control valve C. When valve C is shifted to position as shown, air is directed into air-oil tank F and to valve D. Oil, acted upon by air pressure, is forced from tank through pressure chamber of retracted intensifier and into work cylinder. The cylinder advances in stroke, being driven by this incoming oil. At a predetermined point in the stroke length of the work cylinder, valve D is synchronized to shift and direct air pressure to the intensifier to drive it in its power stroke, isolating tank F and supplying high pressure to work cylinder for its high thrust stroke. The work cylinder and intensifier are retracted by

the shifting of valves C and D simultaneously to exhaust the intensifier and tank F. At the same time, air pressure is directed to tank G and to rod end side of intensifier piston. Oil from tank G retracts cylinder at low pressure.

The operators for valves C and D are optional – mechanical, manual, pilot or solenoid. The method of synchronizing valve D to stroke length position of work cylinder is also optional. This may be done by pilot control, limit switch, pressure switch, mechanically such as cams, or manually.



How to Select Schrader Bellows Intensifiers

Step 1: Determine the intensifier ratio for your application. This is the ratio of the available input fluid pressure and the output operating pressure required for the application. For cylinder-to-ram or cylinder-to-cylinder units, use the following formula:

$$\text{Intensifier ratio} = \frac{\text{Output pressure}}{\text{Input pressure}}$$

Step 2: Locate the intensifier ratio in column 5 of the appropriate chart on page 44. If the exact ratio is not shown, use the next larger ratio listed. When more than one choice is possible, usually the smallest driving cylinder bore size for a given intensifier ratio is the most economical answer.

Step 3: On same horizontal line as ratio determined in Step 2, select the driving cylinder bore size from column 1 and the ram diameter or driven cylinder bore size from column 3.

Note: For cylinder-to-ram applications, proceed with Steps 4 and 5. If a cylinder-to-cylinder unit is required, go to Step 6.

Step 4: Determine the type of cylinder-to-ram intensifier needed. Generally, a single pressure intensifier is used when the hydraulic work cylinder requires a high pressure for the entire stroke or in test vessel applications. A dual pressure intensifier is recommended if the high pressure is to be used only during the last portion of the work cylinder stroke.

Step 5: Calculate the intensifier stroke.

For single pressure intensifiers, use the formula:

$$\text{Intensifier stroke} = \frac{V + V_c}{A_r}$$

For dual pressure intensifier, use this formula:

$$\text{Intensifier stroke} = \frac{V_h + V_c + 2''^*}{A_r}$$

Where: V = work cylinder volume or test vessel fluid requirement in cubic inches.

V_h = oil volume in cubic inches required to move the work cylinder piston through its high pressure stroke.

V_c = compressibility allowance of 1% per 1000 psi of total volume in cubic inches of oil in the high pressure circuit, determined from:

V_c = total volume x .01 x high pressure/1000.

A_r = area of intensifier ram in square inches.

*This 2" is the intensifier stroke advance necessary to close the high pressure seal on dual pressure intensifiers only.

Note: If the calculated intensifier stroke results in a fraction, correct to the next larger **even** inch. The recommended maximum stroke is 20". If stroke calculation results in longer than 20" stroke, select a larger driving cylinder and ram having a similar intensifier ratio and recalculate stroke.

Step 6: For cylinder-to-cylinder intensifiers: Select the proper output cylinder. Since the output pressure is limited by the cylinder construction, the cylinder should be selected using the maximum pressure to be developed under nonshock conditions.

For Schrader Bellows PL-2 and PH-2 Series hydraulic cylinders, the maximum pressures under nonshock conditions are:

PL-2 Series: 1½" – 2500 psi; 2" – 2000 psi; 2½" – 1800 psi;
 3¼" – 2000 psi; 4" – 1350 psi; 5" – 1500 psi;
 6" – 1100 psi; 8" – 900 psi

PH-2 Series: All bore sizes – 3000 psi.

General Guidelines

- Intensifiers are generally faster operating when:
 - There is adequate input pressure.
 - The ports and piping are large enough. Consider the use of oversize ports and connecting lines, to minimize pressure drop.
 - The intensifier is pre-exhausted prior to the power stroke.
 - Size hydraulic lines so that fluid flow velocity does not exceed 7 feet per second.
- Bypass the intensifier with a pre-fill low pressure line by direct connection through a check valve to the pressure vessel.
- Regulate the driving pressure to the intensifier to achieve the required high pressure output.
- Keep all piping lengths to a minimum by having the tanks, intensifier and pressure vessel as close together as possible.
- A single pressure intensifier usually provides faster cylinder action because it does not need to change from low to high pressure but instead immediately supplies the high pressure.
- Intensifiers are generally used in circuits where limited quantities of high pressure fluid is required.

(Series PS and PD) Cylinder to Ram Intensifiers

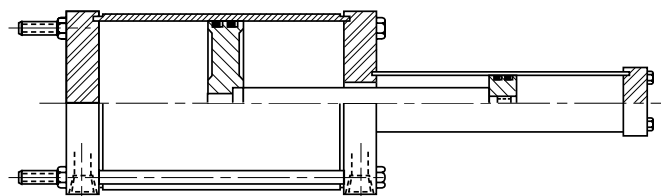
Driving Cylinder		Hydraulic Ram		Intensifier Ratio	Theoretical Intensified Hydraulic Pressure (PSI) Using An Input Pressure Of					
		Bore	Area		50	80	100	200	500	1000
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11
3 1/4	8.296	5/8	.307	27.02	1351	2161	2702			
		1	.785	10.57	529	846	1057	2114		
		1 3/8	1.485	5.59	280	447	559	1118	2795	
		1 3/4	2.405	3.45	173	276	345	690	1725	3450
		2	3.142	2.64	132	211	264	528	1320	2640
4	12.566	5/8	.307	40.93	2046	3274	4093			
		1	.785	16.00	800	1280	1600	3200		
		1 3/8	1.485	8.46	423	677	846	1692	4230	
		1 3/4	2.405	5.23	262	418	523	1046	2615	
		2	3.142	4.00	200	320	400	800	2000	4000
		2 1/2	4.909	2.56	128	205	256	512	1280	2560
5	19.635	5/8	.307	63.95	3197	5116				
		1	.785	25.01	1250	2000	2501	5002		
		1 3/8	1.485	13.22	661	1058	1322	2644		
		1 3/4	2.405	8.16	408	653	816	1632	4080	
		2	3.142	6.25	313	500	625	1250	3125	
		2 1/2	4.909	4.00	200	320	400	800	2000	4000
		3	7.069	2.78	139	222	278	556	1390	2780
		3 1/2	9.621	2.04	102	163	204	408	1020	2040
6	28.274	1	.785	36.01	1800	2880	3601			
		1 3/8	1.485	19.05	953	1524	1905	3810		
		1 3/4	2.405	11.76	588	941	1176	2352		
		2	3.142	9.00	450	720	900	1800	4500	
		2 1/2	4.909	5.76	288	461	576	1152	2880	
		3	7.069	4.00	200	320	400	800	2000	4000
		3 1/2	9.621	2.94	147	235	294	588	1470	2940
8	50.265	1	.785	64.03	3201	5122				
		1 3/8	1.485	33.85	1693	2708	3385			
		1 3/4	2.405	20.90	1045	1672	2090	4180		
		2	3.142	16.00	800	1280	1600	3200		
		2 1/2	4.909	10.24	512	819	1024	1048		
		3	7.069	7.11	356	569	711	1422	3555	
		3 1/2	9.621	5.23	262	418	523	1046	1615	
10	78.540	1 3/8	1.485	52.89	2644	4231				
		1 3/4	2.405	32.66	1633	2613	3266			
		2	3.142	25.00	1250	2000	2500	5000		
		2 1/2	4.909	16.00	800	1280	1600	3200		
		3	7.069	11.11	556	889	1111	2222		
		3 1/2	9.621	8.16	408	653	816	1632	4080	
12	113.10	1 3/8	1.485	76.16	3808					
		1 3/4	2.405	47.02	2351	3761	4702			
		2	3.142	36.00	1800	2880	3600			
		2 1/2	4.909	23.04	1152	1843	2304	4608		
		3	7.069	16.00	800	1280	1600	3200		
		3 1/2	9.621	11.75	588	940	1175	2350		
14	153.94	1 3/4	2.405	64.00	3200	5120				
		2	3.142	48.99	2449	3919	4899			
		2 1/2	4.909	31.36	1568	2509	3136			
		3	7.069	21.78	1089	1742	2178	4356		
		3 1/2	9.621	16.00	800	1280	1600	3200		

(Series PC) Cylinder to Cylinder Intensifiers

Driving Cylinder		Driving Cylinder		Intensifier Ratio	Theoretical Intensified Hydraulic Pressure (PSI) Using An Input Pressure Of					
		Bore	Area		50	80	100	200	500	1000
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11
3 1/4	8.296	1 1/2	1.767	4.69	235	375	469	938	2345	
		2	3.142	2.64	132	211	264	528	1320	2640*
4	12.566	1 1/2	1.767	7.11	356	569	711	1422	3555*	
		2	3.142	4.00	200	320	400	800	2000	4000*
		2 1/2	4.909	2.56	128	205	256	512	1280	2560*
5	19.635	1 1/2	1.767	11.11	556	889	1111	2222		
		2	3.142	6.25	313	500	625	1250	3125*	
		2 1/2	4.909	4.00	200	320	400	800	2000*	4000*
		3 1/4	8.296	2.37	119	190	237	474	1185	2370*
6	28.274	2	3.142	9.00	450	720	900	1800	4500*	
		2 1/2	4.909	5.76	288	461	576	1152	2880*	
		3 1/4	8.296	3.41	171	273	341	682	1705	3410*
		4	12.566	2.25	113	180	225	450	1125	2250*
		5	19.635	1.44	72	115	144	188	720	1440
8	50.265	2	3.142	16.00	800	1280	1600	3200*		
		2 1/2	4.909	10.24	512	819	1024	2048		
		3 1/4	8.296	6.06	303	485	606	1212	3030*	
		4	12.566	4.00	200	320	400	800	2000*	4000*
		5	19.635	2.56	128	205	256	512	1280	2560*
		6	28.274	1.78	89	143	178	356	890	1780*
10	78.540	2 1/2	4.909	16.00	800	1280	1600	3200*		
		3 1/4	8.296	9.47	474	758	947	1894	4735*	
		4	12.566	6.25	313	500	625	1250	3125*	
		5	19.635	4.00	200	320	400	800	2000*	4000*
		6	28.274	2.78	139	223	278	556	1390*	2780*
12	113.10	3 1/4	8.296	13.64	682	1091	1364	2728*		
		4	12.566	9.00	450	720	900	1800*	4500*	
		5	19.635	5.76	288	460	576	1152	2880*	
		6	28.274	4.00	200	320	400	800	2000*	4000*
		7	38.485	2.94	147*	235*	294*	588*	1470*	2940*
		8	50.265	2.25	113	180	225	450	1125*	2250*
14	153.94	4	12.566	12.25	613	980	1225	2450*		
		5	19.635	7.84	392	627	784	1568*	3920*	
		6	28.274	5.45	273	436	545	1090	1725*	
		7	38.485	4.00	200*	320*	400*	800*	2000*	4000*
		8	50.265	3.06	153	245	306	612	1530*	3060*

*Not recommended for PL-2 Series driven cylinder, use PH-2 Series.

Cylinder to Cylinder Intensifier – Series PC

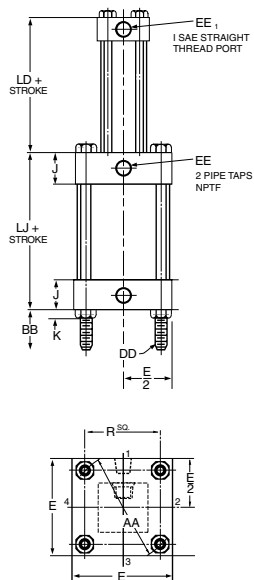


Schrader Bellows Cylinder to Cylinder Intensifiers (Series PC)

Series PC Intensifiers consist of two cylinders joined into an integral unit with one piston driving a second piston of smaller diameter. These intensifiers are not self-bleeding or self-filling, therefore, for the most effective operation, it is recommended that these tasks be done manually.

Special Note: It is recommended that Series PC cylinder-to-cylinder intensifiers be mounted vertically with the smaller cylinder up.

Bore	1 1/2	2	2 1/2	3 1/4	4	5	6	8	10	12	14
	PA-2 & PL-2 Series							PA-2 Series Only			
E	2	2 1/2	3	3 3/4	4 1/2	5 1/2	6 1/2	8 1/2	10 5/8	12 3/4	14 3/4
F	3/8	3/8	3/8	5/8	5/8	5/8	3/4	—	—	—	—
J	1	1	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	2	2	2 1/4
K	7/32	17/64	17/64	21/64	21/64	7/16	7/16	35/64	41/64	41/64	3/4
R	1.43	1.84	2.19	2.76	3.32	4.10	4.88	6.44	7.92	9.40	10.90
AA	2.02	2.6	3.1	3.9	4.7	5.8	6.9	9.1	11.2	13.3	15.4
BB	1	1 1/8	1 1/8	1 3/8	1 3/8	1 13/16	1 13/16	2 5/16	2 11/16	2 11/16	3 3/16
DD	1/4-28	5/16-24	5/16-24	3/8-24	3/8-24	1/2-20	1/2-20	5/8-18	3/4-16	3/4-16	7/8-14
EE	3/8	3/8	3/8	1/2	1/2	1/2	3/4	3/4	1	1	1 1/4
EE ₁	#6	#6	#6	#10	#10	#10	#12	#12	—	—	—
EB	—	—	—	—	—	—	—	11/16	13/16	13/16	15/16
FB	5/16	3/8	3/8	7/16	7/16	9/16	9/16	—	—	—	—
LD	2 5/8	2 5/8	2 3/4	3	3	3 1/4	3 1/2	3 5/8	4 5/8	5 1/8	5 7/8
LF	3 1/2	3 1/2	3 5/8	4 3/8	4 3/8	4 5/8	5 1/4	—	—	—	—
LJ	3 1/8	3 1/8	3 1/4	3 3/4	3 3/4	4	4 1/2	4 5/8	6 1/8	6 5/8	7 5/8
TE	—	—	—	—	—	—	—	7.57	9.40	11.10	12.87
TF	2 3/4	3 3/8	3 7/8	4 11/16	5 7/16	6 5/8	7 5/8	—	—	—	—
TT	—	—	—	—	—	—	—	10.7	13.3	15.7	18.2
UF	3 3/8	4 1/8	4 5/8	5 1/2	6 1/4	7 5/8	8 5/8	—	—	—	—



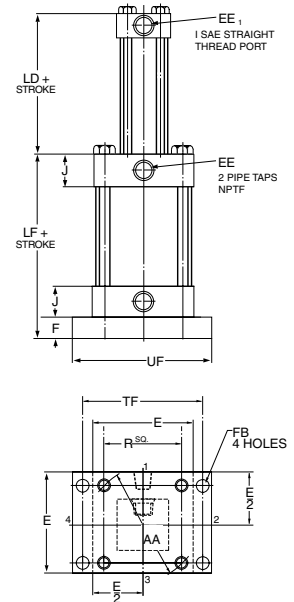
Mounting Style TC Cap Tie Rods Extended

This mounting available in driving cylinder bore sizes 3 1/4-inches through 14-inches.

MTG Styles are:
TCA Cap End – Air Input
TCL Cap End Hyd. Input

Bore	1 1/2	2	2 1/2	3 1/4	4	5	6	7	8
	PH-2 & PH-3 Series								
E	2 1/2	3	3 1/2	4 1/2	5	6 1/2	7 1/2	8 1/2	9 1/2
F	3/8	5/8	5/8	3/4	7/8	7/8	1	1	1
J	1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	2	2 1/4	2 1/2
K	21/64	7/16	7/16	35/64	35/64	3/4	55/64	31/32	1 1/16
R	1.63	2.05	2.55	3.25	3.82	4.95	5.73	6.58	7.50
AA	2.3	2.9	3.6	4.6	5.4	7.0	8.1	9.3	10.6
BB	1 3/8	1 13/16	1 13/16	2 5/16	2 5/16	3 3/16	3 5/8	4 1/8	4 1/2
DD	3/8-24	1/2-20	1/2-20	5/8-18	5/8-18	7/8-14	1-14	1 1/8-12	1 1/4-12
EE	1/2	1/2	1/2	3/4	3/4	3/4	1	1 1/4	1 1/2
EE ₁	#10	#10	#10	#16	#16	#16	#16	#20	#24
FB	7/16	9/16	9/16	1 1/16	1 1/16	1 1/16	1 3/16	1 3/16	1 5/16
LD	3 3/8	3 3/8	3 1/2	4	4 1/4	4 3/4	5 5/8	6 1/4	7
LF	4 3/4	5	5 1/8	6	6 3/8	6 7/8	8 1/8	9	10
LJ	4 3/8	4 3/8	4 1/2	5 1/4	5 1/2	6	7 1/8	8	9
TF	3 7/16	4 1/8	4 5/8	5 7/8	6 3/8	8 3/16	9 7/16	10 5/8	11 13/16
UF	4 1/8	5 1/8	5 5/8	7 1/8	7 5/8	9 3/4	11 1/4	12 5/8	14

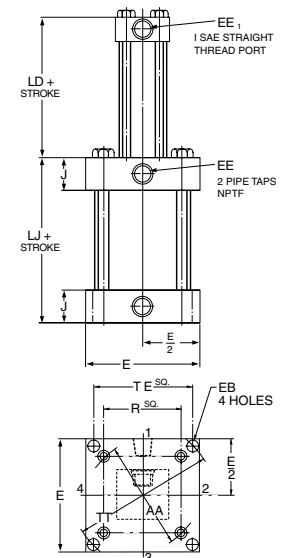
Maximum non-shock pressure rating for PL-2 and PH-2 Series can be found on page 56.



Mounting Style H Cap Rectangular Flange

This mounting available in driving cylinder bore sizes 3 1/4-inches through 6-inches.

MTG Styles are:
HA – Air Input
HL – Hyd. Input



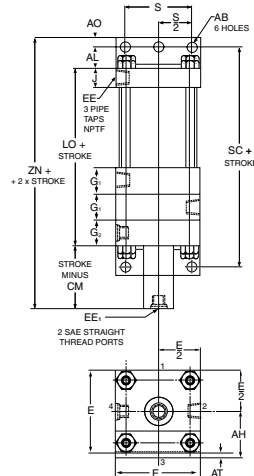
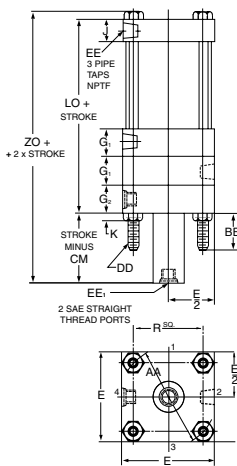
Mounting Style HB Cap Square Flange

This mounting available in driving cylinder bore sizes 8-inches through 14-inches.

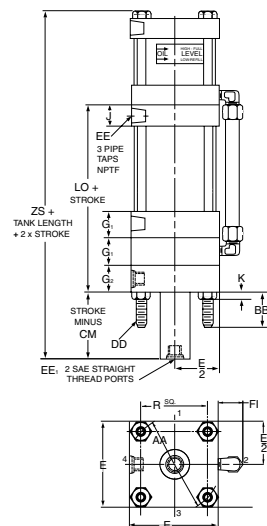
MTG Styles are:
HBA – Air Input
HBL – Hyd. Input

Schrader Bellows Cylinder to Ram Dual Pressure Intensifiers (Series PD)

Series PD Intensifiers are similar to the Series PS units except a center head has been added to retain another gland and a third ram seal. When the ram is fully retracted, it withdraws from this third seal, allowing the low pressure hydraulic fluid to flow through the port in the center head. The fluid then goes past the ram and out the pressure chamber port to prefill and advance the work cylinder. Actually, this third seal and the ram act as a check valve. As the circuit sequences, the ram advances into the seal to close this "valve" and build up high pressure. With this arrangement and the proper mounting, Series PD intensifiers are self-bleeding and self-filling. And these intensifiers may be used in either single or dual pressure circuits.

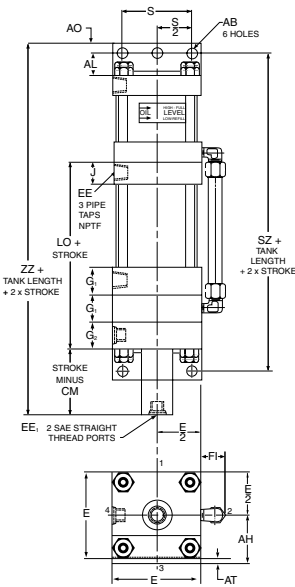


**Mounting Style TB –
Head Tie Rods Extended**
(Styles TC – Cap Tie Rods Extended
and TD – Both Ends Tie Rods
Extended are also available.
Dimensions “BB” remains the same
in all cases.)



Mounting Style TB – Head Tie Rods Extended with Integral Air-Oil Tank

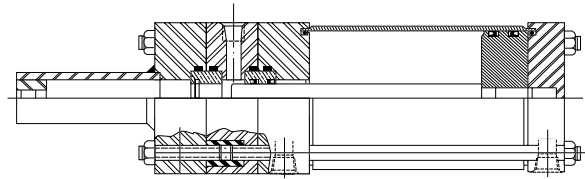
Mounting Style CB – End Angles



Mounting Style CB – End Angles with Integral Air-Oil Tanks

Special Notes:

1. When equipped with integral air-oil tanks, Series PD intensifiers have a maximum input pressure of 150 psi.
2. It is recommended that Series PD dual pressure intensifiers be mounted vertically with the pressure chamber down.



Dimensions Independent of Ram Size

Bore	3 1/4	4	5	6	8	10	12	14
	PA-2 & PL-2 Series					PA-2 Series		
E	3 3/4	4 1/2	5 1/2	6 1/2	8 1/2	10 5/8	12 3/4	14 3/4
G ₁	1 3/4	1 3/4	1 3/4	2	2	2 1/4	2 1/4	2 3/4
J	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	2	2	2 1/4
K	3/8	3/8	7/16	7/16	9/16	11/16	11/16	3/4
R	2.76	3.32	4.10	4.88	6.44	7.92	9.40	10.90
S	2 3/4	3 1/2	4 1/4	5 1/4	7 1/8	8 7/8	11	12 5/8
AA	3.9	4.7	5.8	6.9	9.1	11.2	13.3	15.4
AB	9/16	9/16	11/16	13/16	13/16	1 1/16	1 1/16	1 5/16
AH	115/16	2 1/4	2 3/4	3 1/4	4 1/4	5 5/16	6 3/8	7 3/8
AL	1 1/4	1 1/4	1 3/8	1 3/8	1 13/16	2 1/8	2 1/8	2 7/16
AO	1/2	1/2	5/8	5/8	11/16	7/8	7/8	1 1/16
AT	1/8	1/8	3/16	3/16	1/4	1/4	3/8	3/8
BB	1 3/8	1 3/8	1 13/16	1 13/16	2 5/16	2 11/16	2 11/16	3 3/16
DD	3/8-24	3/8-24	1/2-20	1/2-20	5/8-18	3/4-16	3/4-16	7/8-14
EE	1/2	1/2	1/2	3/4	3/4	1	1	1 1/4
EE ₁	#8	#8	#8	#8	#8	#12	#12	#16
FI	1 3/8	1 3/8	1 3/8	1 21/32	1 21/32	1 15/16	1 15/16	2 13/32
ST	5	5	5 1/4	5 3/4	6 5/8	8 1/4	8 1/4	9 3/8
ZI	413/64	413/64	4 3/4	5 1/4	5 55/64	7 21/64	7 21/64	8 7/16
ZK	6	6	6 1/2	7	8	10	10	11 1/2
ZN	8 3/8	8 3/8	8 7/8	9 1/2	10 1/8	12	12 1/2	14 1/2
ZO	661/64	661/64	7 5/16	7 15/16	8 11/64	9 41/64	10 9/64	11 3/4
ZS	929/64	929/64	10 5/16	10 15/16	11 11/64	13 41/64	14 9/64	16 1/4
ZZ	10 1/8	10 7/8	11 7/8	12 1/2	13 1/8	16	16 1/2	19

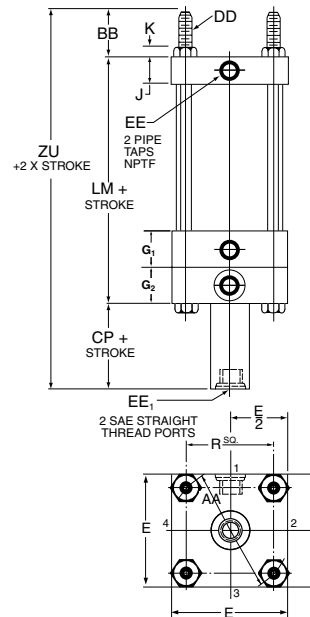
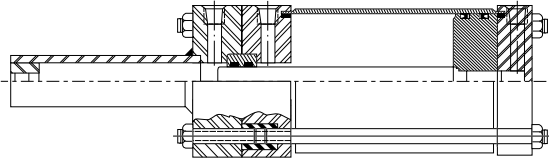
Dimensions Dependent on Ram Size

Bore	3 1/4	4	5	6	8	10	12	14
	PA-2 & PL-2 Series					PA-2 Series		
						Ram Sizes		
					1 3/8		2, 2 1/2	2 1/2, 3
					1 3/4, 2	1 3/4, 2	3, 3 1/2, 4	3 1/2, 4
G ₂	-	-	-	-	2	2	2 1/4	2 1/4
CM	-	-	-	-	1 1/2	1 5/8	1 7/8	2 1/8
LO	-	-	-	-	9 1/8	10 5/8	11 3/8	13 1/8
SC	-	-	-	-	10 3/4	12 7/8	13 3/8	15 3/4
SZ					13 3/4	16 7/8	17 3/8	20 1/4
						Ram Sizes		
					3 1/2, 5 5 1/2	3 1/2		
G ₂	1 3/4	1 3/4	1 3/4	2	2	2 1/4	2 1/4	2 3/4
CM	1 1/8	1 1/8	1 1/8	1 1/2	1 1/2	1 7/8	1 7/8	2 5/8
LO	7 3/4	7 3/4	8	9	9 1/8	10 7/8	11 3/8	13 5/8
SC	10 1/4	10 1/4	10 3/4	11 3/4	12 3/4	15 1/8	15 5/8	18 1/2
SZ	12 3/4	12 3/4	13 3/4	14 3/4	15 3/4	19 1/8	19 5/8	23

Schrader Bellows Cylinder to Ram Single Pressure Intensifiers (Series PS)

Series PS Intensifier delivers a single pressure through a double acting piston driving a ram. One seal on the ram gland works on the driving piston side; the other on the pressure chamber side. Since this intensifier is neither self-bleeding nor self-filling, for best performance it is recommended that these tasks be performed manually.

Special Note: It is recommended that Series PS single pressure intensifiers be mounted vertically with the pressure chamber up.



Dimensions Independent of Ram Size

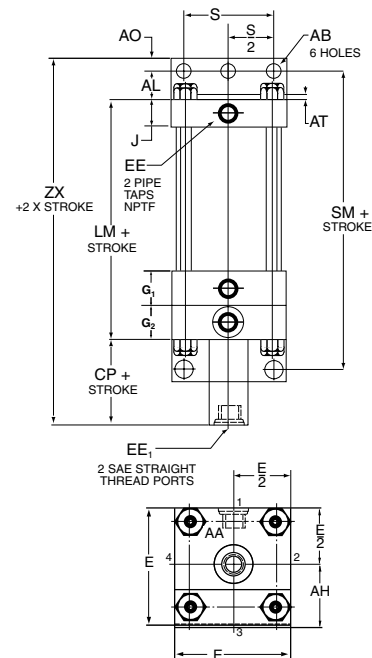
Bore	3 1/4	4	5	6	8	10	12	14
	PA-2 & PL-2 Series				PA-2 Series			
E	3 3/4	4 1/2	5 1/2	6 1/2	8 1/2	10 5/8	12 3/4	14 3/4
G ₁	1 3/4	1 3/4	1 3/4	2	2	2 1/4	2 1/4	2 3/4
J	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	2	2	2 1/4
K	3/8	3/8	7/16	7/16	9/16	11/16	11/16	3/4
R	2.76	3.32	4.10	4.88	6.44	7.92	9.40	10.90
S	2 3/4	3 1/2	4 1/4	5 1/4	7 1/8	8 7/8	11	12 5/8
AA	3.9	4.7	5.8	6.9	9.1	11.2	13.3	15.4
AB	9/16	9/16	11/16	13/16	13/16	1 1/16	1 1/16	1 5/16
AH	1 15/16	2 1/4	2 3/4	3 1/4	4 1/4	5 5/16	6 3/8	7 3/8
AL	1 1/4	1 1/4	1 3/8	1 3/8	1 13/16	2 1/8	2 1/8	2 7/16
AO	1/2	1/2	5/8	5/8	11/16	7/8	7/8	1 1/16
AT	1/8	1/8	3/16	3/16	1/4	1/4	3/8	3/8
BB	1 3/8	1 3/8	1 13/16	1 13/16	2 5/16	2 11/16	2 11/16	3 3/16
DD	3/8-24	3/8-24	1/2-20	1/2-20	5/8-18	3/4-16	3/4-16	7/8-14
EE	1/2	1/2	1/2	3/4	3/4	1	1	1 1/4
EE ₁	#8	#8	#8	#8	#8	#12	#12	#16
ZU	8 3/8	8 3/8	9 1/6	9 9/16	10 3/16	11 13/16	12 5/16	14 1/16
ZX	8 3/4	8 3/4	9 1/4	9 3/4	10 3/8	12 1/8	12 5/8	14 3/8

Dimensions Dependent on Ram Size

Bore	3 1/4	4	5	6	8	10	12	14
	PA-2 & PL-2 Series				PA-2 Series Only			
					Ram Sizes			
					1 3/8	2, 2 1/2	2 1/2, 3	
					1 3/4, 2	1 3/4, 2	3, 3 1/2, 4	3 1/2, 4
G ₂	—	—	—	—	2	2	2 1/4	2 1/4
CP	—	—	—	—	3/4	3/4	1/2	1/2
LM	—	—	—	—	7 1/8	8 3/8	9 1/8	10 3/8
SM	—	—	—	—	8 3/4	10 5/8	11 1/8	13
					Ram Sizes			
					2 1/2, 3	2 1/2, 3		
					3 1/2, 5	3 1/2,		
					5 1/2			
G ₂	1 3/4	1 3/4	1 3/4	2	2	2 1/4	2 1/4	2 3/4
CP	1	1	1	3/4	3/4	1/2	1/2	0
LM	6	6	6 1/4	7	7 1/8	8 5/8	9 1/8	10 7/8
SM	8 1/2	8 1/2	9	9 3/4	10 3/4	12 7/8	13 3/8	15 3/4

Mounting Style TC – Cap Tie Rods Extended

(Style TB – Head Rods Extended, and TD – Both Ends Tie Rods Extended, are also available. Dimension “BB” remains the same in all cases.)



Mounting Style CB – End Angles

How to Order Schrader Bellows Intensifiers

How To Order

When ordering Schrader Bellows Intensifiers, please specify:

- Quantity
- Driving Cylinder bore size
- Mounting style – specify by using style letters given beneath dimension drawings.
- Driving cylinder operating fluid medium
- Intensifier series (PS, PD or PC)

- Intensifier ram diameter (for cylinder-to-ram intensifiers) or Output cylinder bore (for cylinder-to-cylinder units)

- Driving cylinder stroke

- Input pressure, output pressure and volume

Note: Standard intensifiers are designed for use with petroleum base hydraulic oil. If other fluids will be used, please consult the factory.

Model Numbers

Each Schrader Bellows Intensifier has a model number. This, along with the driving cylinder bore size and stroke, is an accurate and coded description of the unit. The

chart here shows the elements of these model numbers. It is provided so that you can check our order acknowledgement against your order.

When Ordering Intensifiers By Model Number

Driving Cylinder Bore	Driving Cylinder Mounting Style	Driving Cylinder Operating Fluid		Intensifier Series	Driven Cylinder Series PC Only	Special Features	Intensifier Ram (or Driven Cylinder) Diameter		Driving Cylinder Stroke
3 1/4, 4, 5, 6, 8, 10, 12 or 14	CB, TB, TC, TD, H or HB	PA-2 (Air) or PL-2* (HYD.) Specify One Series Only	–	PD, PS, PC	PH-2 / PH-3 (3000 PSI Maximum) or PL-2 (900 to 2500 PSI Maximum Depending on Bore Size)	S Use Only if Intensifier Varies From Catalog	Specify From Dimension Tables	X	Specify For PD Style See Note Below

NOTE: PD style intensifiers require 2" additional stroke to seal the high pressure end. See page 43.

*PL-2 supplied with cast iron piston rings unless otherwise specified.

Specifications

Maximum Input Pressures:

Air – 250 psi (17 BAR); Oil – 1000 psi (69 BAR).

Maximum Operating Temperatures:

–10°F to +165°F (–23°C) to (+74°C).

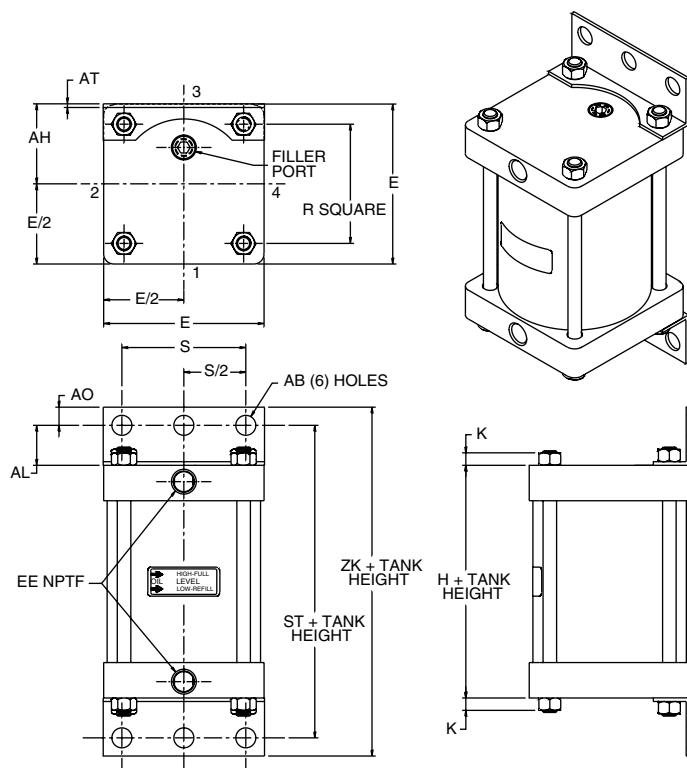
Maximum Output Pressures:

5/8" to 3" RAM – 5000 psi (345 BAR);

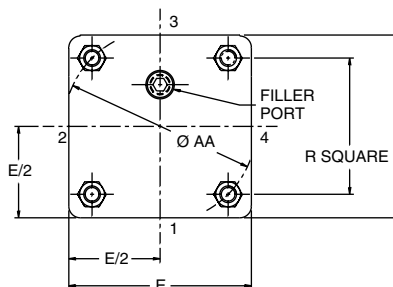
3 1/2" to 5 1/2" RAM – 3000 psi (206 BAR).



- 6 Standard Bore Sizes 2½" - 8" Bores
- Operating Pressure: Up to 250 psi
- Operating Temperature: 165°F Max.
- Lightweight Aluminum/Fiberglass Design
- Premium Quality and Economy
- Larger Bore Sizes Available

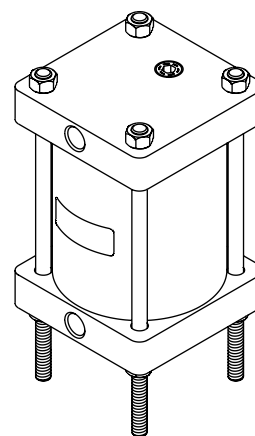
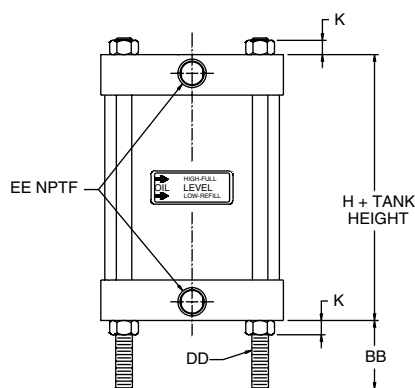


Mounting Style 01
Side end angles



Mounting Style 57
Tie rods extended – oil end

Mounting Style 61
Tie rods extended – air end



Air-Oil Tanks Dimensions

Bore Size	E	H	K	R	S	AB	AH	AL	AO	AT	BB	DD	EE	ST	ZK
2 1/2	3	2	5/32	2.19	2 1/4	7/16	1 5/8	1	3/8	1/8	1 1/8	5/16-24	3/8	4	4 3/4
3 1/4	3 3/4	2 1/2	3/16	2.76	2 3/4	9/16	1 15/16	1 1/4	1/2	1/8	1 3/8	3/8-24	1/2	5	6
4	4 1/2	2 1/2	3/16	3.32	3 1/2	9/16	2 1/4	1 1/4	1/2	1/8	1 3/8	3/8-24	1/2	5	6
5	5 1/2	3	7/16	4.10	4 1/4	1 1/16	2 3/4	1 3/8	5/8	3/16	1 13/16	1/2-20	1/2	5 3/4	7
6	6 1/2	3	7/16	4.88	5 1/4	1 3/16	3 1/4	1 3/8	5/8	3/16	1 13/16	1/2-20	3/4	5 3/4	7
8	8 1/2	3	9/16	6.44	7 1/8	1 3/16	4 1/4	1 13/16	1 1/16	1/4	2 5/16	5/8-18	3/4	6 5/8	8

In a basic air-oil circuit the advance tank is connected to the cap end port of a hydraulic cylinder and the return tank to the head end port. Shop air is applied alternately to the two tanks through a 4-way air control valve. The oil in the advance tank is forced into the cap end of the cylinder to cause the piston rod to extend. At the same time, oil from the head end port is forced into the return tank, the air side of which is open to exhaust. To return cylinder to retract position, air pressure is applied to the oil in return tank.

To limit the fluid velocity, speed controls should be applied to the air side of the tank to restrict the exhaust.

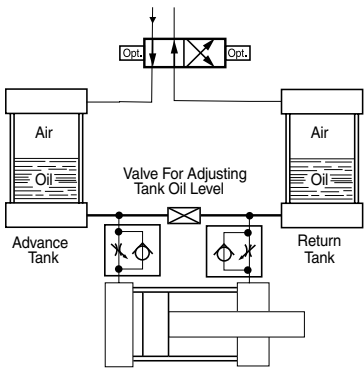


Table A Rated Capacities – Cubic Inches

USABLE TANK VOLUME (CUBIC INCHES)												
INTERNAL LENGTH OF TANK												
BORE	BORE CODE	5	6	7	8	9	10	12	14	16	18	20
2 1/2	C	12	16.6	21.6	25.5	30	34	43	52	61	70	78
3 1/4	D	19	26	34	41	49	56	74	86	101	116	131
4	E	28	40	51	62	74	85	107	129	153	175	195
5	F	39	57	75	92	110	128	163	199	234	269	305
6	G	62	86	111	137	161	186	232	284	333	386	432
8	J	109	146	195	239	280	324	414	504	592	684	774

How to Select

Step 1: Determine the volume (cu. in.) of fluid required to fill the work cylinder at full stroke by taking the bore area times the stroke length.

Step 2: Select the proper tank bore height from the chart. Since there are usually several combinations with similar capacities, select the one having a rated capacity closest to but slightly greater than your volume requirements. Generally, the most economical choice is a higher tank with a smaller bore.

Air-Oil Tanks – For Smoother Hydraulic Flow

Schrader Bellows Air-Oil tanks provide a means to convert shop air pressure into hydraulic pressure. Compressed air is applied directly to the oil in the air-oil tank to convert it into hydraulic pressure. The hydraulic pressure is at a 1-to-1 ratio, i.e. 80 psi air produces 80 psi hydraulic pressure.

All Schrader Bellows Air-Oil tanks have a fiberglass tube which shows the proper oil level. They also contain two fluid flow baffles. The top baffle disperses the incoming air over the surface of the oil in such a way to avoid agitation and aeration. The bottom baffle insures a smooth flow pattern that minimizes oil turbulence and eliminates swirling, funneling or splashing which in turn could cause oil aeration or the oil to be blown from the tank into the exhaust air.

Air-Oil tanks are used to smooth out the cylinder piston rod travel and to prevent chatter. They are mainly used in slow speed circuits. Fluid velocity in or out of the tank through standard ports should be less than 6 feet per second to prevent aeration of the oil. Since each tank is designed for a peficic port size, increasing the port size in a tank to lower the fluid velocity is not recommended. A tank with a larger port size should be selected.

How To Order

When ordering Schrader Bellows Air-Oil Tanks, please specify:

- a. Type **F02**
- b. Bore Code (see above)
- c. Rod Code **NN** (none)
- d. Mount **01** (side end angles), **57** (tie rod extended - oil end), **61** (tie rods extended - air end)
- e. Rod Style **N** (none)
- f. Seals **1** (Buna N)
- g. Tank Length

Example: F02 E NN 01 N 1 x 6.00

Notes: Standard air-oil tanks are designed for use with petroleum base hydraulic oil. If other fluids will be used, please consult the factory. For larger than 8" Bore Sizes consult factory.

NOTES

Cylinder Parts Identification and Seal Kit Data**Series CHE/CHD Cylinders**

Parts Identification, Seal Kits Pages 30-31

PA-2, PL-2, PH-2 and 7" & 8" Bore PH-3 Series Cylinders

Mountings, Parts Identification, Cushion Kits – Standard and Fluorocarbon..... Pages 32-34

PA-2, PL- 2 Series Cylinders

Standard Seal Kit, Fluorocarbon Seal Kits Pages 35-36

PN Series

Parts Identification, Seal Kits Page 37

PH-2 Series Hydraulic Cylinders

Parts Identification, Seal Kits – Standard and Fluorocarbon..... Pages 38-39

PH-3 Series and PH-3 Series Large Bore Hydraulic Cylinders

Parts Identification, Seal Kits, Maintenance, Optional Piston Seal Kits Page 40-43

PL-2 Series

Gland Seal Kits, Parts Identification Page 44

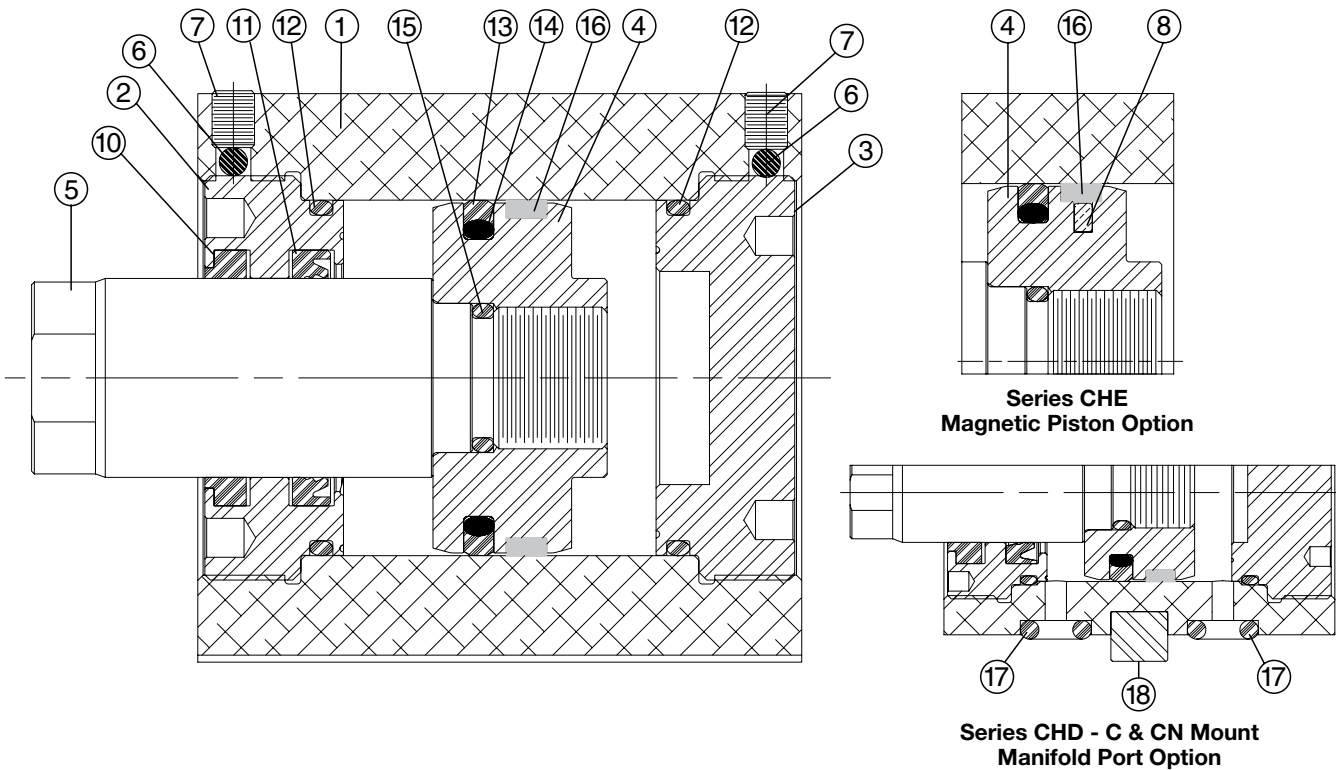
Series SHM Cylinders

Replacement Parts and Service, Parts Identification Pages 45-46

SH/SHG Series

Parts Identification, Thrust Key, Seal Kits Pages 47-48

Parts Identification Drawing – Standard Piston



Item No.	Description	Material	Item No.	Description	Material	
					Standard	Fluorocarbon
1	Cylinder Body - CHE	Aluminum Alloy (Hard Anodized)	10	Rod Wiper	PUR	Fluorocarbon
	Cylinder Body - CHD	Steel	11	Rod Seal	PUR	Fluorocarbon
2	Gland	Nodular Iron	12	End Seal	PUR	Fluorocarbon
3	Cap	Nodular Iron	13	Piston Seal	PUR	Filled PTFE
4	Piston – Standard	Nodular Iron	14	PS Energizer	NBR	Fluorocarbon
	Piston – with Magnet	Aluminum Alloy	15	Piston-to-Rod o-ring	PUR	Fluorocarbon
5	Piston Rod	Carbon Steel (Hard Chrome Plated)		Piston Wear Band	Glass-reinforced nylon	Glass-reinforced nylon
6	Ball	Nylon	16	Manifold Port Seal	PUR	Fluorocarbon
7	Set Screw	Alloy Steel		C & CN Mount Key	Steel	
8	Magnet	Sintered NdFeB ¹				

¹ Neodymium Iron Boron

Seal Kits

See Standard Specifications Page for fluid and temperature compatibility. Cylinder gland and cap are threaded into the cylinder body. To service rod seal, rod wiper, piston seal, or end seals the gland or cap must be removed. Spanner holes in the gland and cap

are available for the purpose of removing and installing these components. Be sure to torque the gland or cap to the specifications below and replace the nylon ball and set screw to further lock them in place.

Rod Gland and Rod Seal Kits

Rod Ø	Rod Gland (w/o pilot ¹) Kits		Rod Seal Kits	
	Class 1	Class 5	Class 1	Class 5
	Consists of 1 ea. of items #2, 6, 10, 11, & 12		Consists of 1 ea. of items #6, 10, 11, & 12	
12	A63430A12	A63430B12	A63430C12	A63430D12
14	A63430A14	A63430B14	A63430C14	A63430D14
18	A63430A18	A63430B18	A63430C18	A63430D18
22	A63430A22	A63430B22	A63430C22	A63430D22
28	A63430A28	A63430B28	A63430C28	A63430D28
36	A63430A36	A63430B36	A63430C36	A63430D36
45	A63430A45	A63430B45	A63430C45	A63430D45
56	A63430A56	A63430B56	A63430C56	A63430D56

¹ Pilot gland is required for AN, CA, CN, J, MN and TN mounting styles. For Gland Kit with pilot change the '0' to a 'P' before the 'A' or 'B'. For example: A6343PA12.

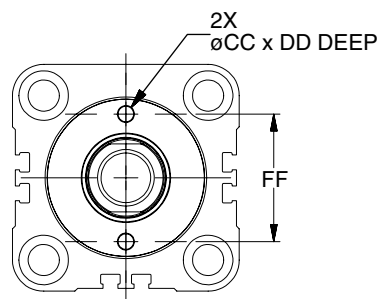
Complete Seal Kits

Bore Ø	Class 1	Class 5	Gland & Cap Torque Specifications	
	Consists of 1 ea. of items #10, 11, 13, 14, 16 & 2 ea. of items #6 & 12		N-m	ft. lbs.
20	A63440A20	A63440B20	8-11	6-8
25	A63440A25	A63440B25	12-25	9-11
32	A63440A32	A63440B32	20-24	15-18
40	A63440A40	A63440B40	41-47	30-35
50	A63440A50	A63440B50	61-67	45-50
63	A63440A63	A63440B63	108-122	80-90
80	A63440A80	A63440B80	217-230	160-170
100	A63440A00	A63440B00	434-461	320-340

Spanner Hole Dimensions

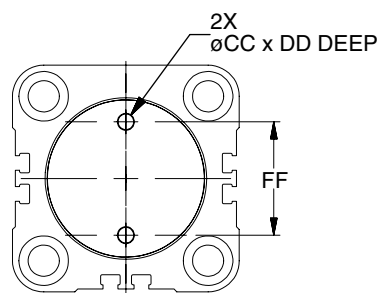
Gland Spanners

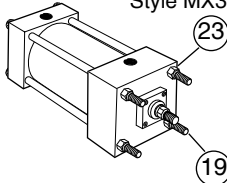
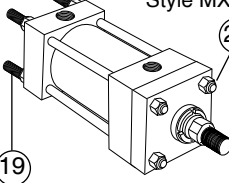
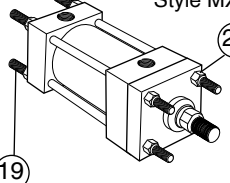
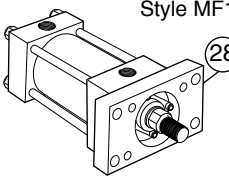
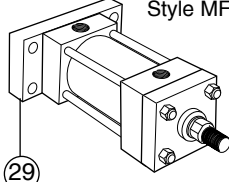
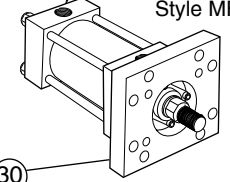
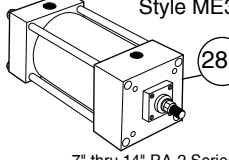
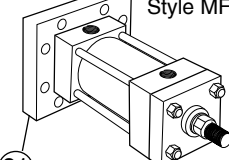
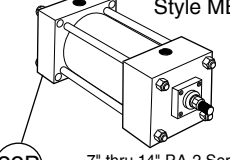
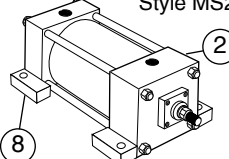
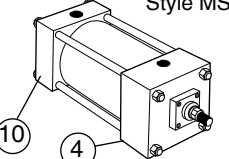
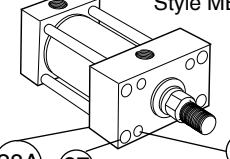
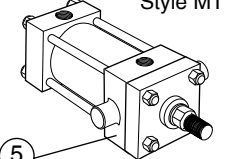
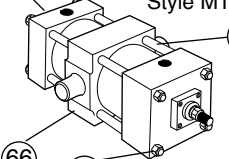
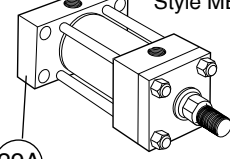

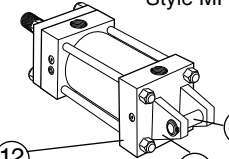
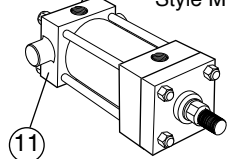
Bore Ø	CC	DD	FF
20	2.25	2.5	22
25	2.75	3	25
32	3.5	3.5	30
40	4.5	4.5	35
50	5.5	5.5	45
63	6.5	6.5	55
80	8.5	8.5	70
100	10.5	10.5	85

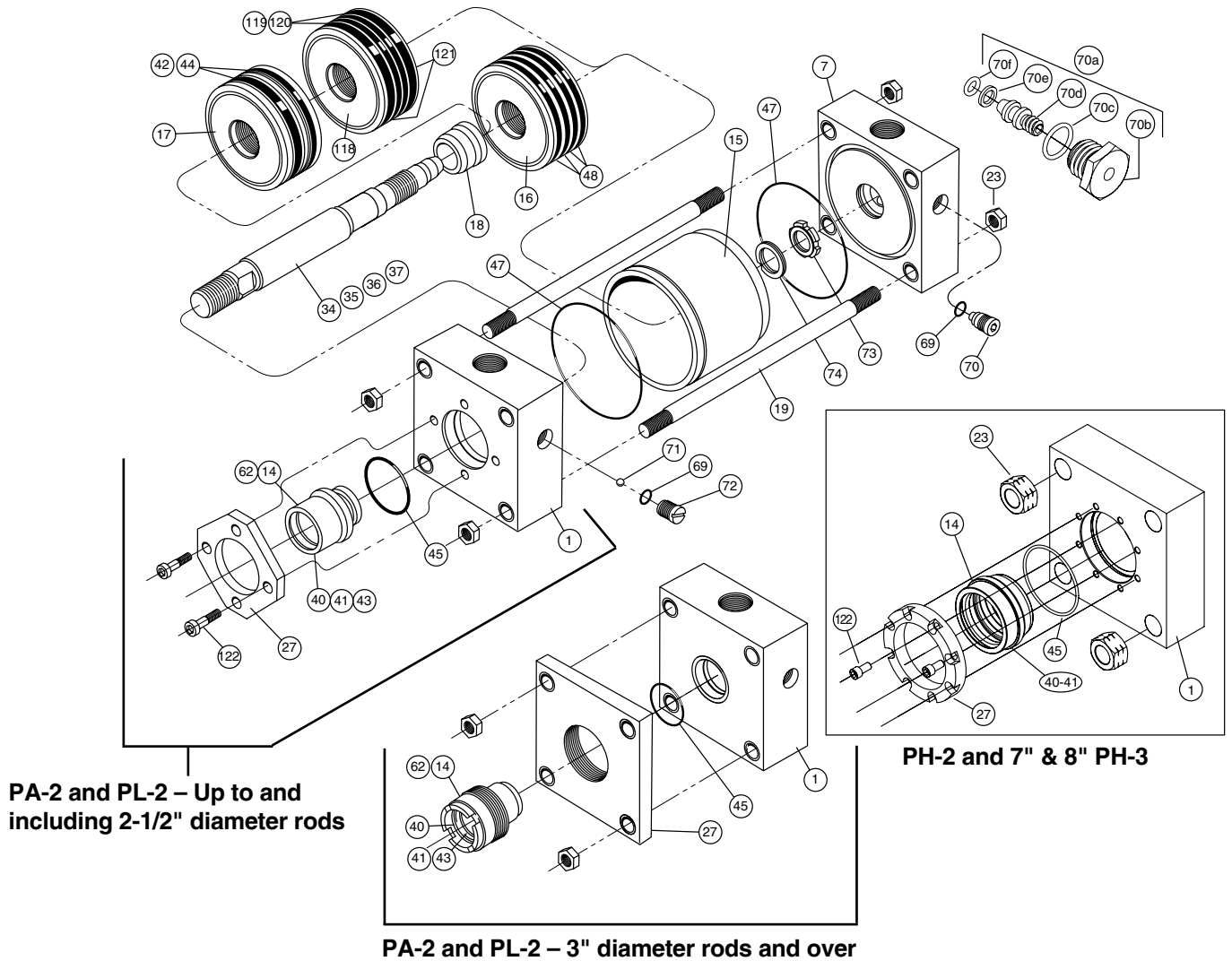


Cap Spanners

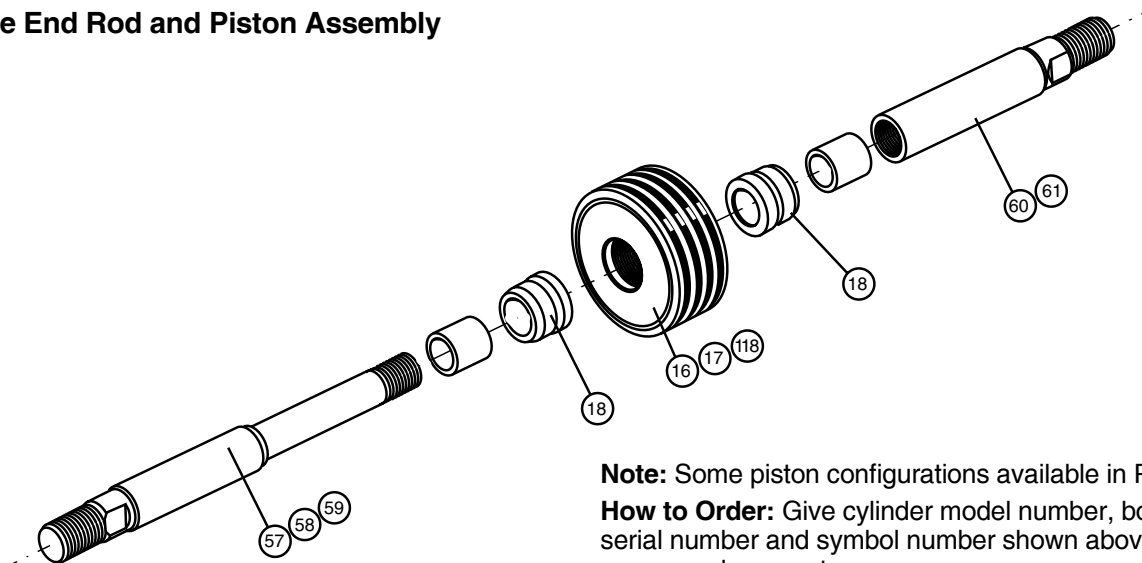
Bore Ø	CC	DD	FF
20	2.25	2.5	15
25	2.75	3	18
32	3.5	3.5	25
40	4.5	4.5	32
50	5.5	5.5	40
63	6.5	6.5	50
80	8.5	8.5	63
100	10.5	10.5	80



 <p>NFFPA Style MX3</p>	 <p>NFFPA Style MX2</p>	 <p>NFFPA Style MX1</p>	<h2>Replacement Mountings and Hardware</h2> <p>Note: For items not shown see pages 24 and 25.</p> <table><tr><th>Symbol</th><th>Description</th></tr><tr><td>2</td><td>Head, side lug mounting</td></tr><tr><td>4</td><td>Head, side tap mounting</td></tr><tr><td>5</td><td>Head, trunnion mounting</td></tr><tr><td>8</td><td>Cap, side lug mounting</td></tr><tr><td>10</td><td>Cap, side tap mounting</td></tr><tr><td>11</td><td>Cap, trunnion mounting</td></tr><tr><td>12</td><td>Cap, fixed clevis mounting</td></tr><tr><td>19</td><td>Tie rod</td></tr><tr><td>20</td><td>Tie rod, head end mounting</td></tr><tr><td>21</td><td>Tie rod, cap end mounting</td></tr><tr><td>23</td><td>Tie rod nut</td></tr><tr><td>27</td><td>Retainer</td></tr><tr><td>28</td><td>Flange, rectangular mounting</td></tr><tr><td>28A</td><td>Head, rectangular mounting</td></tr><tr><td>28B</td><td>Head, square mounting</td></tr><tr><td>29</td><td>Flange, rectangular mounting</td></tr><tr><td>29A</td><td>Cap, rectangular mounting</td></tr><tr><td>29B</td><td>Cap, square mounting</td></tr><tr><td>30</td><td>Flange, square mounting</td></tr><tr><td>31</td><td>Flange, square mounting</td></tr><tr><td>66</td><td>Intermediate trunnion</td></tr><tr><td>67</td><td>Screws, intermediate trunnion mtg</td></tr><tr><td>79</td><td>Socket head cap screws</td></tr><tr><td>86</td><td>Clevis pin mounting</td></tr><tr><td>87</td><td>Retaining ring mounting</td></tr></table>	Symbol	Description	2	Head, side lug mounting	4	Head, side tap mounting	5	Head, trunnion mounting	8	Cap, side lug mounting	10	Cap, side tap mounting	11	Cap, trunnion mounting	12	Cap, fixed clevis mounting	19	Tie rod	20	Tie rod, head end mounting	21	Tie rod, cap end mounting	23	Tie rod nut	27	Retainer	28	Flange, rectangular mounting	28A	Head, rectangular mounting	28B	Head, square mounting	29	Flange, rectangular mounting	29A	Cap, rectangular mounting	29B	Cap, square mounting	30	Flange, square mounting	31	Flange, square mounting	66	Intermediate trunnion	67	Screws, intermediate trunnion mtg	79	Socket head cap screws	86	Clevis pin mounting	87	Retaining ring mounting
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 <p>NFFPA Style MF1</p>	 <p>NFFPA Style MF2</p>	 <p>NFFPA Style MF5</p>																																																					
 <p>NFFPA Style ME3</p> <p>7" thru 14" PA-2 Series 8" Bore PL-2 Series</p>	 <p>NFFPA Style MF6</p>	 <p>NFFPA Style ME4</p> <p>7" thru 14" PA-2 Series 8" Bore PL-2 Series</p>																																																					
 <p>NFFPA Style MS2</p>	 <p>NFFPA Style MS4</p>	 <p>NFFPA Style ME5</p> <p>28A 27 Screws Not Shown</p>																																																					
 <p>NFFPA Style MT1</p>	 <p>NFFPA Style MT4</p> <p>66 67 Screws Not Shown</p>	 <p>NFFPA Style ME6</p> <p>29A</p>																																																					
 <p>NFFPA Style MP1</p>	 <p>NFFPA Style MT2</p> <p>12 86 87</p>	 <p>NFFPA Style MT2</p> <p>11</p>																																																					



Double End Rod and Piston Assembly



Note: Some piston configurations available in PH-2 only.
How to Order: Give cylinder model number, bore, stroke, serial number and symbol number shown above to insure proper replacement.

Note: For specific mounting styles see page 32.

Parts		Assemblies (Includes Symbol Numbers Shown)				
Symbol	Description	Symbol	Description	Ring Type Piston	Lipseal Type Piston	Hi-Load Type Piston
1	Head, ported, non-cushioned	C1SA	Head, ported, cushioned		1, 69, 70, 71 & 72	
7	Cap, ported, non-cushioned	C7SA	Cap, ported, cushioned		7, 69, 70, 73 & 74	
14	Gland	62	Gland cartridge kit		14, 40, 41, 43 & 45	
15	Cylinder body	—	—	—	—	—
16	Piston body, ring type					
17	Piston body, lipseal type					
18	Cushion sleeve, cushioned cylinder only					
19	Tie rod					
23	Tie rod nut					
27	Retainer					
34	Piston rod, single rod type, non-cushioned	34SA	Piston & rod assembly, single rod type — non-cushioned	16, 34 & 48	17, 34, 42 & 44*	34, 118, 119, 120 & 121*
35	Piston rod, single rod type, cushioned head end	35SA	Piston & rod assembly, single rod type — cush. head end	16, 18, 35 & 48	17, 18, 35, 42 & 44*	35, 118, 119, 120 & 121
36	Piston rod, single rod type, cushioned cap end	36SA	Piston & rod assembly, single rod type — cush. cap end	16, 36 & 48	17, 36, 42 & 44*	37, 118, 119, 120 & 121
37	Piston rod, single rod type, cushioned both ends	37SA	Piston & rod assembly, single rod type — cush. both ends	16, 18, 37 & 48	17, 18, 37, 42 & 44	37, 118, 119, 120 & 121
40	Wiperseal, gland	—	Seal Kits	—	—	—
41	Lipseal, gland					
42	Lipseal, piston					
43	Back-up washer, gland					
44	Back-up washer, piston					
45	O-ring, gland to head seal					
47	O-ring, cylinder body and seal					
48	Piston ring					
57	Piston rod, double rod type, non-cushioned	57SA	Piston & rod assembly, double rod type — non-cushioned	16, 48, 57 & 60	17, 42, 44*, 57 & 60	57, 60, 118, 119, 120 & 121
58	Piston rod, double rod type, cushioned one end	58SA	Piston & rod assembly, double rod type — cushioned one end	16, 18, 48, 58 & 60	17, 18, 42, 44*, 58 & 60	18, 58, 60, 118, 119, 120 & 121
59	Piston rod, double rod type, cushioned both ends	59SA	Piston & rod assembly, double rod type — cushioned both ends	16, 18, 48, 58 & 61	17, 18, 42, 44*, 58 & 61	18, 58, 61, 118, 119, 120 & 121
60	Piston rod extension, double rod type, non-cushioned	—	—	—	—	—
61	Piston rod extension, double rod type, cushioned					
69	O-ring, cushion adjustment & check valve screw	—	Cushion Kits See table below.	—	—	—
70	Needle valve, cushion adjustment					
70a**	Needle valve, cushion adjustment - cartridge type					
70b	Cartridge screw					
70c	O-ring, cartridge screw					
70d	Needle screw					
70e	Back-up washer - needle screw					
70f	O-ring - needle screw					
71	Ball, check valve					
72	Plug screw, check valve					
73	Cushion bushing, cap end floating check valve					
74	Retaining ring, floating cushion bushing					
75	Seal, cushion sleeve					
118	Piston, hi-load type	—	—	—	—	—
119	Outer ring	—	Seal Kits	—	—	—
120	Inner ring					
121	Wear ring					
122	Socket cap screws	—	—	—	—	—

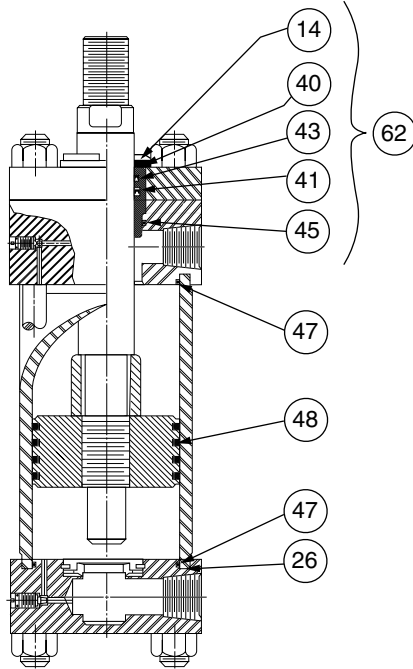
**In some cases the adjusting screw is installed in a cartridge. *Piston back-up washer (Symbol 44) not supplied on PA-2 Series air cylinders.

Cushion Hardware Kits

Bore Size	Rod Dia.	PA-2 Series				PL-2 Series			
		For Head Assemblies (Kits Include symbols 69, 70, 71, & 72)		For Cap Assemblies (Kits Include symbols 69, 70, 73, & 74)		For Head Assemblies (Kits Include symbols 69, 70, 71, & 72)		For Cap Assemblies (Kits Include symbols 69, 70, 73, & 74)	
		Standard	Fluorocarbon	Standard	Fluorocarbon	Standard	Fluorocarbon	Standard	Fluorocarbon
1	All	None	None	None	None	A63221102	A63211005	A63221102	A63211005
1 1/2	5/8	A63211503	A63211005	A63211504	A63221502	A63221503	A63221503	A6321504	A63221502
	1	A63211002	A63211005			A63211002	A63211005		
2	5/8, 1	A63211503	A63221503	A63211504	A63221502	A63221503	A63221503	A6321504	A63221502
	1 3/8	A63211002	A63211005			A63211002	A63221503		
2 1/2	5/8 - 1 3/8	A63211503	A63221503	A63211504	A63221502	A63221503	A63221503	A6321504	A63221502
	1 3/4	A63211002	A63211005			A63211002	A63211005		
3 1/4	All	A63213203	A63223203	A63213204	A63223202	A63213203	A63223203	A63213202	A63223202
4	All	A63213203	A63223203	A63213204	A63223202	A63213203	A63223203	A63213202	A63223202
5	All	A63213203	A63223203	A63213204	A63223202	A63213203	A63223203	A63213202	A63223202
6	All	A63216003	A63226003	A63216004	A63226004	A63216003	A63226003	A63216004	A63226002
7	All	A63216003	A63226003	A63216004	A63226004	—	—	—	—
8	All	A63216003	A63226003	A63216004	A63229004	A63216003	A63226003	A63216004	A63226002
10	All	A63216003	A63226003	A63219004	A63229004	—	—	—	—
12	All	A63216003	A63226003	A63219204	A63229204	—	—	—	—
14	All	A63216003	A63226003	A63219404	A63229404	—	—	—	—

Symbol	Description
14	Gland cartridge
40	Gland wiperseal
41	Gland lipseal
42	Piston lipseal
43*	Gland back-up washer
44	Piston back-up washer
45	Gland to head o-ring
47	End seal o-ring
48	Piston ring
62	Gland cartridge kit

*Not used in PL-2 cylinders.



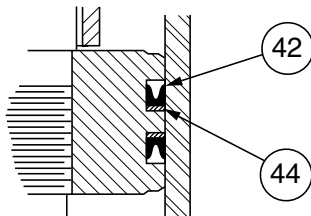
Piston Seal Options

Ring Type Piston

(as shown above)

Supplied as standard on PL-2 series hydraulic cylinders.

Lipseal Type Piston



Supplied as standard on PA-2 series air cylinders. Optional for PL-2 series hydraulic cylinders.

Seal Kits for Class 1 & 2 Service

Material: Buna-N (Nitrile) except item 41, in PL-2 series which is polyurethane.

For operating temperature and fluid compatability, see Section C, pages 54 & 55.

Gland and spanner wrenches are available to ease (rod) seal or gland cartridge removal without disassembly of the cylinder. **(For rod diameters over 2 1/2".)**

For detailed seal replacement instructions see service bulletin SB0995-M1, M2 and M3.

Rod Dia.	PA-2 Cylinders Only		PL-2 Cylinders Only		Gland Wrench	Spanner Wrench
	Gland (Symbol 62) Cartridge Kits	Rod Seal Kits	Gland (Sym. 62) Cartridge Kits	Rod Seal Kits		
	Contains Symbols 14, 40, 41, 43 & 45	Contains Symbols 40, 41, 43 & 45	Contains Symbols 14, 40, 41 & 45	Contains Symbols 40, 41 & 45		
1/2	A63210105	A63210305	A63210505	A63210705	Not Required	Not Required
5/8	A63210108	A63210308	A63210508	A63210708		
1	A63210110	A63210310	A63210510	A63210710		
1 3/8	A63210113	A63210313	A63210513	A63210713		
1 3/4	A63210114	A63210314	A63210514	A63210714		
2	A63210120	A63210320	A63210520	A63210720		
2 1/2	A63210125	A63210325	A63210525	A63210725		
3	A63210130	A63210330	A63210530	A63210730		
3 1/2	A63210135	A63210335	A63210535	A63210735		
4	A63210140	A63210340	A63210540	A63210740		
4 1/2	A63210145	A63210345	A63210545	A63210745	069596 0000	011677 0000
5	A63210150	A63210350	A63210550	A63210750	069597 0000	011677 0000
5 1/2	A63210155	A63210355	A63210555	A63210755	069598 0000	011678 0000
					069599 0000	011678 0000
					069600 0000	011678 0000

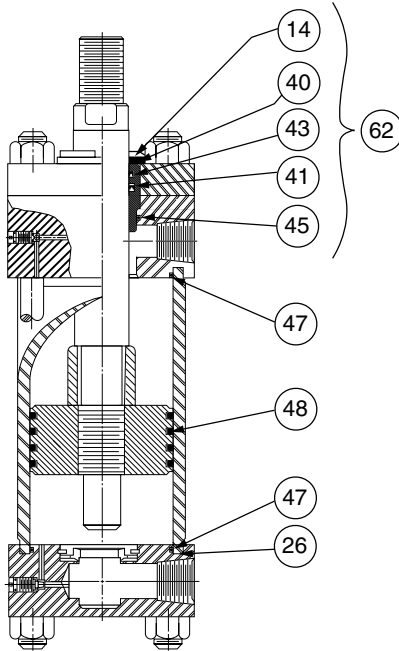
Bore Size	Piston Seal Kits	Piston Seal Kits	Piston Ring Kits
	PA-2 Series	PL-2 Series	PL-2 Series
	Contains 2 Each Symbols: 42, 44 & 47	Contains 2 Each Symbols: 42, 44 & 47	Contains 2 Each Symbols 47 & 4 Each Symbol 48
1	A63211006	A63211007	A63211008
1 1/2	A63211506	A63211507	A63211508
2	A63212006	A63212007	A63212008
2 1/2	A63212506	A63212507	A63212508
3 1/4	A63213206	A63213207	A63213208
4	A63214006	A63214007	A63214008
5	A63215006	A63215007	A63215008
6	A63216006	A63216007	A63216008
7	A63217006	—	—
8	A63218006	A63218007	A63218008
10	A63219006	—	—
12	A63219206	—	—
14	A63219406	—	—

Bore Size	Cylinder Body Seal Kits		Tie Rod Torque Specifications (Fl. Lbs.)		
	PA-2 Series	PL-2 Series	PA-2 Series		PL-2 Series
	Contains 2 Each Symbol 47	Contains 2 Each Symbol 47	Steel Cylinder Body	Brass Cylinder Body	
1	A63211010	A63211010	2	1	2
1 1/2	A63215010	A63215010	5	3	5
2	A63220010	A63220010	11	6	11
2 1/2	A63225010	A63225010	11	6	11
3 1/4	A63232010	A63232011	25	18	25
4	A63240010	A63240011	25	18	25
5	A63250010	A63250011	60	45	60
6	A63260010	A63260011	60	45	60
7	A63270010	—	90	—	—
8	A63280010	A63280011	110	80	110
10	A63290010	—	150	115	—
12	A63292010	—	172	150	—
14	A63294010	—	275	230	—

How to Order

Individual seals contained in the kits are available separately; however, we recommend purchasing complete kits because of convenience and lower replacement cost. When ordering seal kits, give part number listed above. To be sure of exact replacement, give serial number of cylinder when ordering replacement kits or seals.

Symbol	Description
14	Gland cartridge
40	Gland wiperseal
41	Gland lipseal
42	Piston lipseal
43	Gland back-up washer
44	Piston back-up washer
45	Gland to head o-ring
47	End seal o-ring
48	Piston ring
62	Gland cartridge kit

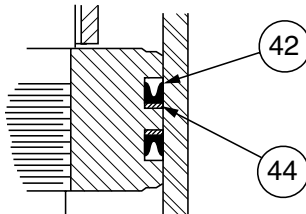


Piston Seal Options

Ring Type Piston

(as shown above)
Supplied as standard on PL-2 series hydraulic cylinders.

Lipseal Type Piston



Supplied as standard on PA-2 series air cylinders. Optional for PL-2 series hydraulic cylinders.

Seal Kits for Fluorocarbon Seals

Material: Fluorocarbon

For operating temperature and fluid compatability, see Section C, [pages 54 & 55](#).

Gland and spanner wrenches are available to ease (rod) seal or gland cartridge removal without disassembly of the cylinder. **(For rod diameters over 2 1/2".)**

For detailed seal replacement instructions see service bulletin SB0995-M1, M3 and M5.

Rod Dia.	PA-2 Cylinders Only		PL-2 Cylinders Only		Gland Wrench	Spanner Wrench
	Gland (Symbol 62) Cartridge Kits	Rod Seal Kits	Gland (Sym. 62) Cartridge Kits	Rod Seal Kits		
	Contains Symbols 14, 40, 41, 43 & 45	Contains Symbols 40, 41, 43 & 45	Contains Symbols 14, 40, 41, 43 & 45	Contains Symbols 40, 41, 43 & 45		
1/2	A63220205	A63220405	A63220605	A63220805	Not Required	Not Required
5/8	A63220208	A63220408	A63220608	A63220808		
1	A63220210	A63220410	A63220610	A63220810		
1 3/8	A63220213	A63220413	A63220613	A63220813		
1 3/4	A63220214	A63220414	A63220614	A63220814		
2	A63220220	A63220420	A63220620	A63220820		
2 1/2	A63220225	A63220425	A63220625	A63220825		
3	A63220230	A63220430	A63220630	A63220830	0695960000	0116770000
3 1/2	A63220235	A63220435	A63220635	A63220835	0695970000	0116770000
4	A63220240	A63220440	A63220640	A63220840	0695980000	0116780000
4 1/2	A63220245	A63220445	A63220645	A63220845	0838770000	0116780000
5	A63220250	A63220450	A63220650	A63220850	0695990000	0116780000
5 1/2	A63220255	A63220455	A63220655	A63220855	0696000000	0116780000

Bore Size	Piston Seal Kits PA-2 Series	Piston Seal Kits PL-2 Series	Piston Ring Kits PL-2 Series
	Contains 2 Each Symbols: 42, 44 & 47	Contains 2 Each Symbols: 42, 44 & 47	Contains 2 Each Symbols 47 & 4 Each Symbol 48
1	A63221006	A63221007	A63221008
1 1/2	A63221506	A63221507	A63221508
2	A63222006	A63222007	A63222008
2 1/2	A63222506	A63222507	A63222508
3 1/4	A63223206	A63223207	A63223208
4	A63224006	A63224007	A63224008
5	A63225006	A63225007	A63225008
6	A63226006	A63226007	A63226008
7	A63227006	—	—
8	A63228006	A63228007	A63228008
10	A63229006	—	—
12	A63229206	—	—
14	A63229406	—	—

Bore Size	Cylinder Body Seal Kits		Tie Rod Torque Specifications (Ft. Lbs.)		
	PA-2 Series	PL-2 Series	PA-2 Series		PL-2 Series
	Contains 2 Each Symbol 47	Contains 2 Each Symbol 47	Steel Cylinder Body	Brass Cylinder Body	
1	A63221020	A63221020	2	1	2
1 1/2	A63221520	A63221520	5	3	5
2	A63222020	A63222020	11	6	11
2 1/2	A63222520	A63222520	11	6	11
3 1/4	A63223230	A63223230	25	18	25
4	A63224030	A63224030	25	18	25
5	A63225030	A63225030	60	45	60
6	A63226030	A63226030	60	45	60
7	A63227030	—	90	—	—
8	A63228030	A63228030	110	80	110
10	A63229030	—	150	115	—
12	A63229230	—	172	150	—
14	A63229430	—	275	230	—

How to Order

Individual seals contained in the kits are available separately; however, we recommend purchasing complete kits because of convenience and lower replacement cost. When ordering seal kits, give part number listed above. To be sure of exact replacement, give serial number of cylinder when ordering replacement kits or seals.

In the PN Series you get all the cost saving benefits and features of the popular heavy duty PA-2 Series air cylinder including...

- Bolt On Rod Gland Assembly for positive no leak sealing.
- Piston rod, hard chrome plated and case hardened steel
- High strength rolled thread Piston Rod Stud

- Steel tube cylinder body with chrome-plated micro finish bore

PLUS the innovative "NON-LUBE" feature which further increases your benefits of lower operating and maintenance costs.

Standard Specifications

- Heavy Duty Service – ANSI/(NFPA) T3.6.7R2-1996 Mounting Dimensions Standards.
- Standard Construction – Square Head – Tie Rod Design.
- Standard Temperature – -10°F. to +165°F.

- Standard Fluid – Filtered Air.
- Strokes – Available in any Practical Stroke Length.
- Cushions – Optional at either end or both ends of stroke. "Float Check" at cap end.

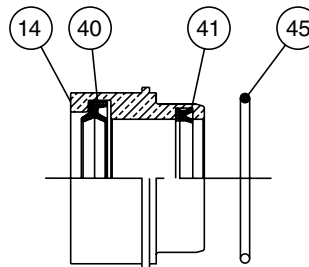
In line with our policy of continuing product improvement, specifications in this catalog are subject to change.

Seal Kits

PN Series

Gland Cartridge Kit

Rod Size	Consisting of Symbol 14, 40, 41, 45, 131 & 132
5/8	A63250108
1	A63250110
1 3/8	A63250113
1 3/4	A63250114
2	A63250120
2 1/2	A63250125
3	A63250130
3 1/2	A63250135
4	A63250140
4 1/2	A63250145
5	A63250150
5 1/2	A63250155

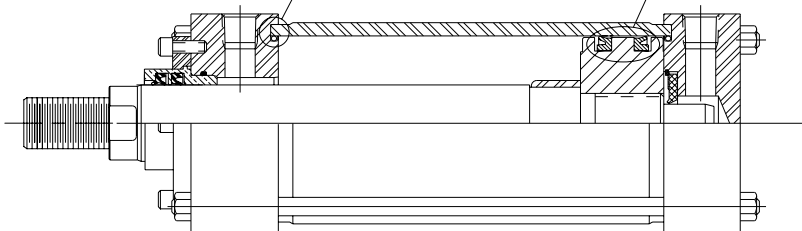


Rod Seal Kit

Rod Size	Consisting of Symbol 40, 41, 45, 131 & 132
5/8	A63250308
1	A63250310
1 3/8	A63250313
1 3/4	A63250314
2	A63250320
2 1/2	A63250325
3	A63250330
3 1/2	A63250335
4	A63250340
4 1/2	A63250345
5	A63250350
5 1/2	A63250355

See Detail "A"

See Detail "B"



Service kits of expendable parts for PN Series fluid power cylinders are stocked in principal industrial locations across the U.S.A. and other countries. For prompt delivery and complete information, contact your nearest distributor.

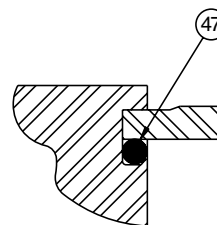
Standard Seals — Service Kits contain seals of Buna-N elastomers for standard fluid service. In addition to standard seals, each kit includes the special composite components ready for installation. These seals are suitable for use when air is the operating medium

The recommended operating temperature range for Class 1 seals is -10° F to + 165°F.

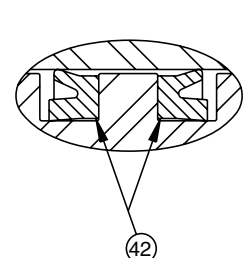
Bore Size	Piston Seal Kit Consisting of 2 Ea. Symbol 42, 129*, 130* & 47	Cylinder Body Seal Kit Consisting of 2 Ea. Symbol 47
1 1/2	A63251520	A63215010
2	A63252020	A63220010
2 1/2	A63252520	A63225010
3 1/4	A63253220	A63232010
4	A63254020	A63240010
5	A63255020	A63250010
6	A63256020	A63260010
7	A63257020	A63270010
8	A63258020	A63280010
10	A63259020	A63290010
12	A63259220	A63292010
14	A63259420	—

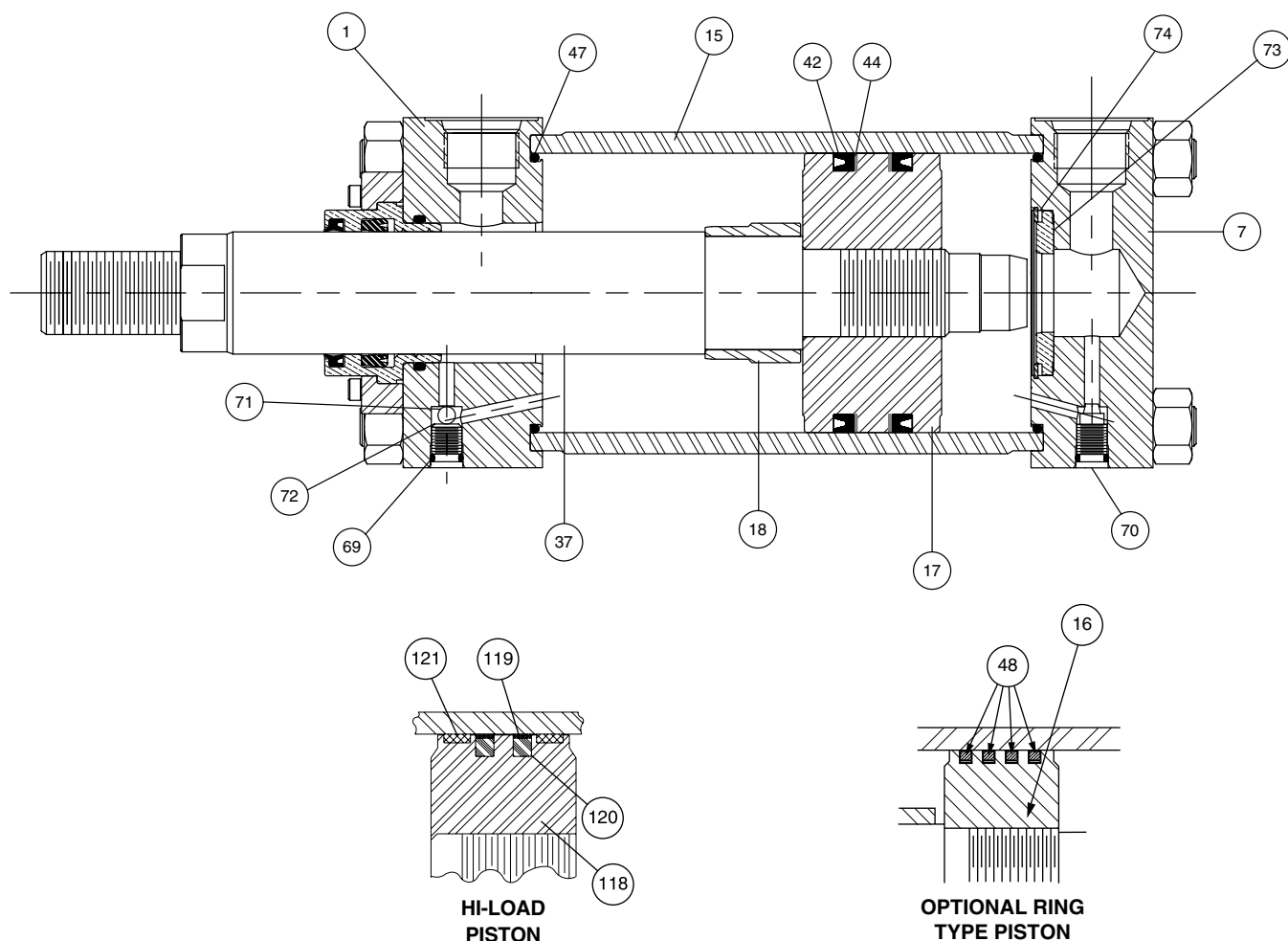
*14" bore only

Detail "A"



Detail "B"





Parts List — 1 1/2" through 6" Bore Sizes

Symbol	Description
1	Head
7	Cap
15	Cylinder body
16	Piston, ring type
17	Piston, lipseal type
18	Cushion sleeve, rod head cushion
37	Piston rod, single rod type
42	Lipseal, piston
44	Back-up washer, piston
47	O-ring, cylinder tube to head and cap seal
48	Piston ring, iron
69	O-ring, cushion adjustment and check valve plug screw
70	Needle, cushion adjustment valve
71	Ball, cushion check valve
72	Plug screw, cushion check valve
73	Bushing, float check, cushion on cap end
74	Retaining ring, float check cushion bushing
118	Piston, Hi-Load type
119	Outer Ring
120	Inner Ring
121	Wear Ring

Piston and Rod Assemblies

Factory assembled piston and rod assemblies (that include seals for piston type specified) are recommended.

Seal Kits

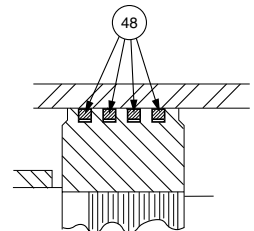
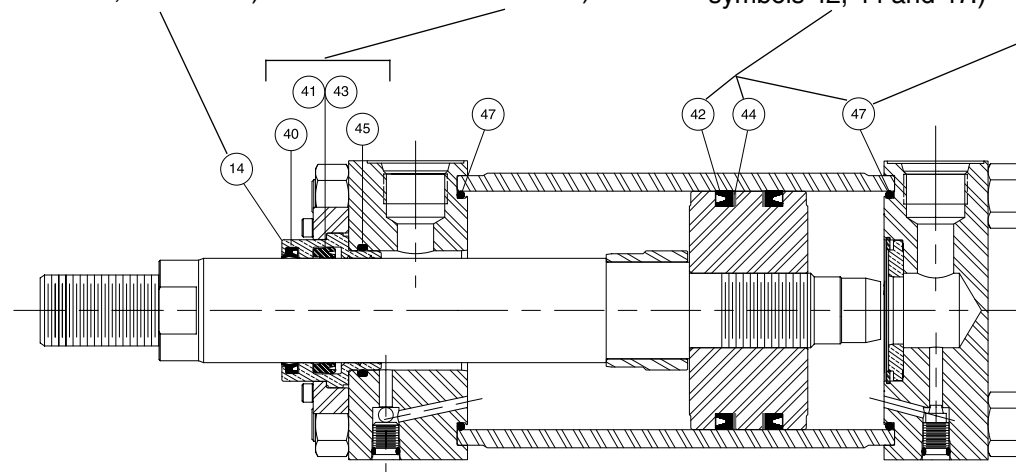
Gland Seal Kits Contain Gland and Seals for PH-2 Series
(Includes symbols 14, 40, 41, 43 and 45.)

Rod Seal Kits Contain Rod Seals for PH-2 Series
(Includes symbols 40, 41, 43 and 45.)

Lipseal Kits Contain Piston Lipseals® and Body End Seals
(Includes two each of symbols 42, 44 and 47.)

Body Seal Kits Contain Cylinder Body End Seals
(Includes two each of symbol 47.)

Piston Ring Kits Contain Piston Rings
(Includes four each symbol 48 and two each of 47.)



**OPTIONAL RING
TYPE PISTON**

Standard Seals

Cylinders built with standard seals contain Buna-N seals except for the piston rod seal which is polyurethane. They are suitable for use with air, nitrogen or hydraulic oil. The recommended operating temperature range for standard seals is -10° F (-23° C) to +165° F (+74° C).

Fluorocarbon Seals

Fluorocarbon seals can be supplied, on request, and are especially suitable for some fire resistant fluids as shown in the table in Section C for elevated temperature service.

When using Fluorocarbon seals for high temperature service or fluid compatibility within a temperature range of -10° F (-23° C) to +250° F (+121° C) specify Fluorocarbon seals. For elevated temperature service above +250° F (+121° C) specify Fluorocarbon seals plus a non-studded piston rod end thread and a pinned piston to rod connection. This recommendation should also be followed when ordering spare

piston and rod assemblies. Fluorocarbon seals can operate up to a maximum of +400° F (+204° C) with reduced service life.

WARNING!

The piston rod stud and the piston rod to piston threaded connections are secured with an anaerobic adhesive which is temperature sensitive. Cylinders ordered with Fluorocarbon seals are assembled with anaerobic adhesive having a maximum operating temperature rating of +250° F (+121° C). Cylinders ordered with all other seal compounds are assembled with anaerobic adhesive a maximum operating temperature rating of +165° F (+74° C). These temperature limitations must be strictly followed to prevent loosening of the threaded connections. When cylinders are intended to be used above +250° F (+121° C) specify a non-studded piston rod end thread and a pinned piston to rod connection.

Rod Gland and Rod Seal Kits

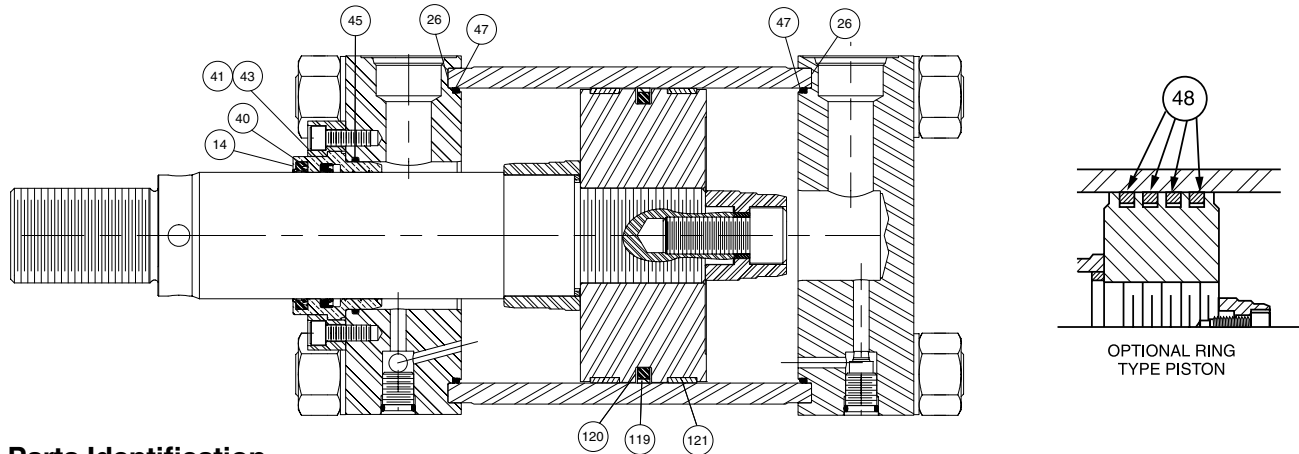
Rod Dia.	Standard Seals		Fluorocarbon Seals		Retainer Screw Torque Inch Lbs.
	Rod Gland Cartridge Kits	Rod Seal Kits	Rod Gland Cartridge Kits	Rod Seal Kits	
5/8	A63230A08	A63230C08	A63230B08	A63230D08	24
1	A63230A10	A63230C10	A63230B10	A63230D10	24
1 3/8	A63230A13	A63230C13	A63230B13	A63230D13	24
1 3/4	A63230A14	A63230C14	A63230B14	A63230D14	24
2	A63230A20	A63230C20	A63230B20	A63230D20	120
2 1/2	A63230A25	A63230C25	A63230B25	A63230D25	120
3	A63230A30	A63230C30	A63230B30	A63230D30	240
3 1/2	A63230A35	A63230C35	A63230B35	A63230D35	240
4	A63230A40	A63230C40	A63230B40	A63230D40	240

Cylinder Body and Piston Seal Kits

Bore Size	Standard Seals			Fluorocarbon Seals			Tie Rod Torque Specification Foot Lbs.
	Cylinder Body Seal Kits	Piston Ring Kit	Piston (Lipseal) Seal Kit	Cylinder Body Seal Kits	Piston Ring Kit	Piston (Lipseal) Seal Kit	
1 1/2	A63215010	A63211508	A63211507	A63221520	A63221508	A63221507	18
2	A63220010	A63212008	A63212007	A63222020	A63222008	A63222007	45
2 1/2	A63225010	A63212508	A63212507	A63222520	A63222508	A63222507	45
3 1/4	A63232011	A63213208	A63213207	A63223206	A63223208	A63223207	120
4	A63240011	A63214008	A63214007	A63224006	A63224008	A63224007	130
5	A63250011	A63215008	A63215007	A63225006	A63225008	A63225007	310
6	A63260011	A63216008	A63216007	A63226006	A63226008	A63226007	525

PH-3 Series, 7" & 8" Bore Hydraulic Cylinders

Parts Identification and Maintenance Instructions



Parts Identification

Sym. No.	Description	Sym. No.	Description
14	Rod Gland	47	End Seal O-Ring
40	Rod Wiperseal	48	Piston Ring
41	Rod Lipseal	119	Outer Ring
43	Rod Seal Back-up Washer	120	Inner Ring
26	End Seal Back Up Washer	121	Wear Ring
45	Gland to Head O-Ring		

Service kits of expendable parts for fluid power cylinders are stocked in principal industrial locations across the U.S.A. and other countries. For prompt delivery and complete information, contact your nearest Schrader Bellows distributor or office.

Service kits of expendable parts for fluid power cylinders are available for either standard seals, fluorocarbon seals or H.W.C.F. seals which are intended to use with highwater content fluids.

Standard Seals – Standard Seal Service Kits contain P.T.F.E., nitrile and polyurethane seals. These seals are suitable for use when hydraulic (mineral-type) oil is the operating medium. The recommended operating temperature range for standard seals is -10°F (-23°C) to +165°F (+74°C).

Fluorocarbon Seals – The service kits contain fluorocarbon seals and are especially suited for elevated temperature service or for some fire resistant fluids (for specific fluids not listed in current catalog consult factory). Fluorocarbon seals should be used for high temperature service within a temperature range of -10°F (-23°C) to +250°F (+120°C) the cylinder must be manufactured with a pinned piston to rod connection.

Warning – The piston rod to piston threaded connection is secured with an anaerobic adhesive which is temperature sensitive. Cylinders specified with Fluorocarbon seals are assembled with anaerobic adhesive having a maximum operating temperature range of +165°F (+74°C). These temperature limitations are necessary to prevent the possible loosening of the threaded connections. Cylinders originally manufactured with standard seals that will be exposed to ambient temperature above +165°F (+74°C) must be modified for higher temperature service. Contact the factory immediately and arrange for the piston to rod and the stud to piston rod connections to be properly reassembled to withstand the higher temperature service.

Rod Gland and Rod Seal Kits

Rod Dia.	Standard Seals		Fluorocarbon Seals		Retainer Screw Torque Inch Lbs.
	Rod Gland Cartridge Kits (Contains: 1 Each Sym. #14, 40, 41, & 45)	Rod Seal Kits (Contains: 1 Each Sym. #40, 41, & 45)	Rod Gland Cartridge Kits (Contains: 1 Each Sym. #14, 40, 41, 43, & 45)	Rod Seal Kits (Contains: 1 Each Sym. #40, 41, 43, & 45)	
3	A63230A30	A63230C30	A63230B30	A63230D30	240
3 1/2	A63230A35	A63230C35	A63230B35	A63230D35	240
4	A63230A40	A63230C40	A63230B40	A63230D40	240
5	A63230A50	A63230C50	A63230B50	A63230D50	240
5 1/2	A63230A55	A63230C55	A63230B55	A63230D55	240

Cylinder Body and Piston Seal Kits

Bore Size	Standard Seals			Fluorocarbon Seals			Tie Rod Torque Specification Foot Lbs.
	Cylinder Body Seal Kits (Contains: 2 Each Sym. #26 & 47)	Piston Ring Kits (Contains: 4 Each Sym. #48 & 2 Each Sym. #26 & 47)	Hi-Load Piston Seal Kits (Contains: 2 Each Sym. #26, 47, & 121 2 Each Sym. #119 & 120)	Cylinder Body Seal Kits (Contains: 2 Each Sym. #26 & 47)	Piston Ring Kits (Contains: 4 Each Sym. #48 & 2 Each Sym. #26 & 47)	Hi-Load Piston Seal Kits (Contains: 2 Each Sym. #26, 47, & 121 2 Each Sym. #119 & 120)	
7	A63307031	A63307001	A63307021	A63307035	A63307005	A63307025	800
8	A63308031	A63308001	A63308021	A63308035	A63308005	A63308025	1168

To Service Rod Gland Seals — The rod gland cartridge is removable without disassembly of the cylinder on all PH-3 Series 7" & 8" bore hydraulic cylinders. To remove the gland, loosen the retainer screws and remove the gland retainer. It is recommended that the used gland be replaced by a complete gland cartridge kit. Later the used gland can be inspected, and if the bearing surface is still satisfactory and not out-of-round, it can be repacked with replacement seals and stored for future use.

Assemble seals for the PH-3 Series 7" & 8" bore gland by installing the rod wiperseal and rod lipseal in their proper grooves. Install head-to-gland "O" ring in its proper groove. Lubricate all seals.

THE SEALS ARE PRESSURE-ACTUATED, SO NO FURTHER ADJUSTMENTS ARE NECESSARY.

To Service The Piston Seals — Disassemble the cylinder completely; remove the old seals and clean all of the parts. The cylinder bore and the piston should then be examined for evidence of scoring. If either is damaged, it should be replaced. The piston seal is either cast iron rings, or hi-load P.T.F.E. type.

Iron piston rings seldom need replacement. If the rings show no signs of damage or abnormal wear, they may be reused. To install piston and rings, collapse the rings one at a time, while inserting the piston into the cylinder body, using a light oil to aid this process.

The hi-load piston is supplied with one continuous P.T.F.E. outer ring, Symbol 119, which is preloaded by a synthetic rubber inner ring, Symbol 120, and two split fabric-phenolic wear rings, Symbol 121. To service the hi-load piston, remove old seals and wear rings and clean all piston surfaces. Install the inner ring in groove as shown. Install the wear ring in the

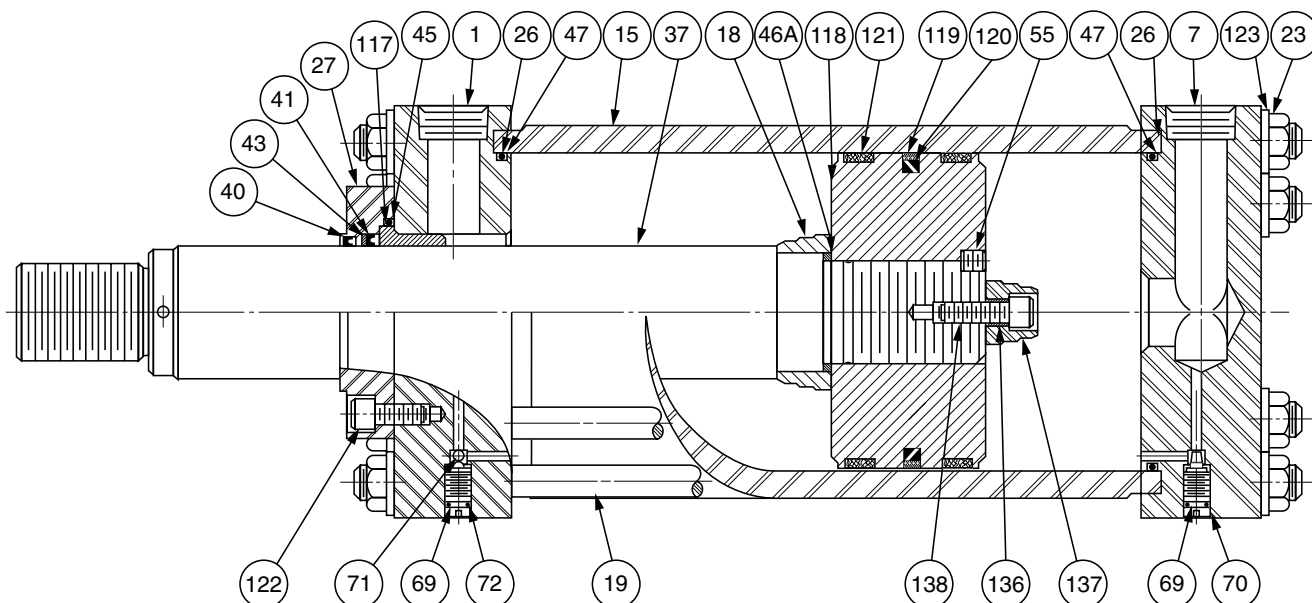
longer groove at each end of piston, also as shown. Heat the P.T.F.E. outer ring in boiling water and stretch it by hand until it will fit over the O.D. of the wear ring. Push outer ring over the wear ring and into the seal groove. With outer ring in its groove, compress it with ring compressor or use a starting sleeve having an I.D. same size as cylinder bore and tapered at one end.

To Replace Piston — If the piston or piston rod is badly scored or otherwise damaged, they should be replaced as a complete assembly. To order a piston and rod assembly, specify serial number, bore size, stroke and model number as shown on the cylinder name plate.

Cylinder Reassembly — O-rings, Symbol 47, and back-up washers, Symbol 26, should be lightly coated with lubricant, then worked into place into the cap by hand. Cylinder body can then be assembled to the cap by rocking it down over the seal until the end of the cylinder body is metal-to-metal contact with the cap. Install O-ring, Symbol 47, and back-up washers, Symbol 26, in head. Head is then fitted over the piston rod and assembled to cylinder body. Rock gently into place until body and head are in metal-to-metal contact.

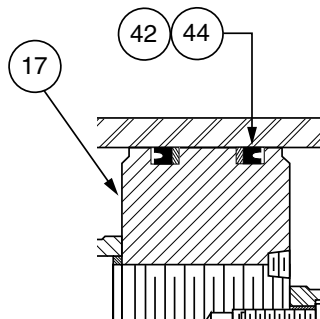
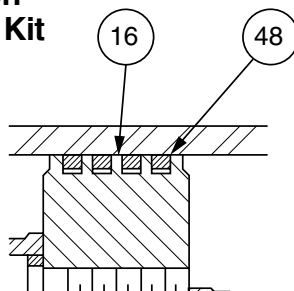
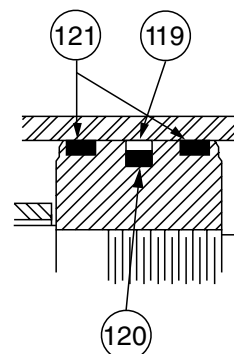
Install tie rods in holes provided in cap and thread them into the tapped holes in the head. One cap end mounting styles the tapped holes are in the cap. Install the tie rod nuts and tighten finger tight.

Inspect the surface of the piston rod for scratches, dents, raised burrs or other damage. A damaged piston rod will quickly ruin any seal through which it moves and should be replaced. Slide the gland with its seals over the piston rod until it seats against the cavity in the head. Install the gland retainer and retainer screws. Torque the tie rod nuts and gland retainer screws to the torque level shown on the previous page.

Parts Identification

Sym. No.	
1	Head
7	Cap
15	Cylinder Body
16	Piston Body – Ring Type Piston
17	Piston Body – Lipseal
18	Cushion Sleeve
19	Tie Rod
23	Tie Rod Nut – Non-Locking
26	Back-Up Washer, Cylinder Body
27	Retainer
37	Piston Rod
40	Wiperseal
41	Rod Seal (Polypak)
42	Lipseal, Piston
43	Back-Up Washer, Polypak
44	Back-Up Washer, Lipseal
45	O-Ring, Gland to Head
46A	Cushion Sealing Ring

Sym. No.	
47	O-Ring Cylinder Body
48	Piston Ring
55	Piston Lock Pin
69	O-Ring, Cushion Adj. & Check Screws
70	Cushion Adjusting Needle Screw
71	Check Valve Ball
72	Check Valve Screw
117	Rod Bearing
118	Piston Body – Hi-Load
119	Outer Piston Ring
120	Inner Piston Ring
121	Wear Ring
122	Retainer Bolt
123	Washer, Tie Rod Nut
136	Spacer, Cushion
137	Cushion Spear, Detachable
138	Bolt, Cushion Spear

**Optional
Piston
Lipseal Kit****Optional
Piston
Ring Kit****Standard
Hi-Load
Piston
Seal Kit**

Operating Fluids and Temperature Range – Fluidpower cylinders are designed for use with pressurized air, hydraulic oil and fire resistant fluids, in some cases special seals are required.

Standard Seals

Buna-N seals are supplied on all standard pneumatic and hydraulic cylinders. They are suitable for use with pressured air, nitrogen, hydraulic oil, water-in oil emulsions or water glycol fluids. The recommended operating temperature range for Buna-N seals is -10°F. (-23°C.) to +165°F (+74°C.).

Fluorocarbon Seals

Fluorocarbon seals can be supplied, on request, and are especially suitable for some fire resistant fluids as shown in the table in Section C, or for elevated temperature service.

When using Fluorocarbon seals for high temperature service or fluid compatibility within a temperature range of -10°F. (-23°C) to +250°F. (+121°C) specify Fluorocarbon seals.

For elevated temperature service above +250°F. (+121°C) specify Fluorocarbon seals plus a non-studded piston rod end thread and a pinned piston to rod connection. This recommendation should also be followed when ordering spare piston and rod assemblies. Fluorocarbon seals can operate up to a maximum of +400°F. (+204°C) with reduced service life.

The piston rod stud and the piston rod to piston threaded connections are secured with an anaerobic adhesive which is temperature sensitive. Cylinders ordered with Fluorocarbon seals are assembled with anaerobic adhesive having a maximum operating temperature rating of +250°F. (+121°C). Cylinders ordered with all other seal compounds are assembled with anaerobic adhesive having a maximum operating temperature rating of +165°F. (+74°C). These temperature limitations must be strictly followed to prevent loosening of the threaded connections. When cylinders are intended to be used above +250°F. (+121°C) specify a non-studded piston rod end thread and a pinned piston to rod connection.

Bore	Rod Dia.	Rod Seal Kits		Rod Seal Kits Including Bearing	
		Contains Symbol 40, 41, 43, 45		Contains Symbol 40, 41, 43, 45 & 117	
		Standard Kit No.	Fluorocarbon Kit No.	Standard Kit No.	Fluorocarbon Kit No.
10	4 1/2	A63300451	A63300455	A63310451	A63310455
	7	A63300701	A63300705	A63310701	A63310705
	5	A63300501	A63300505	A63310501	A63310505
	5 1/2	A63300551	A63300555	A63310551	A63310555
12	5 1/2	A63300551	A63300555	A63310551	A63310555
	8	A63300801	A63300805	A63310801	A63310805
14	7	A63300701	A63300705	A63310701	A63310705
	10*	A63301001	A63301005	A63311001	A63311005
	8*	A63300801	A63300805	A63310801	A63310805

*NOTE: For 16", 18" and 20" Bore PH-3 Cylinders with 8" and 10" rods use the seal kits listed above for 14" Bore PH-3 with 8" and 10" rods.

Cylinder Bore Size	Tie Rod Torque*	
10"	700 ft.-lbs.	949 N.m
12"	1320 ft.-lbs.	1790 N.m
14"	1000 ft.-lbs.	1356 N.m
16"/18"/20"	3000 ft.-lbs.	4068 N.m

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

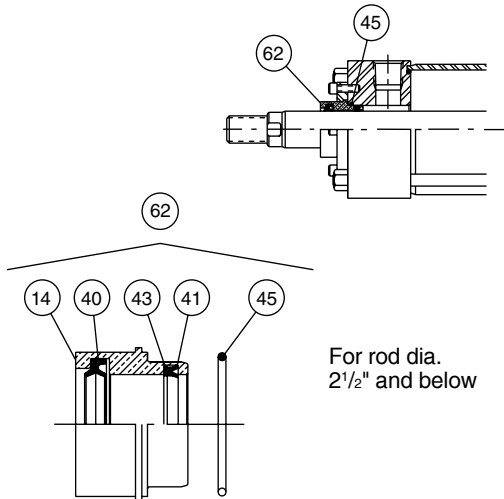
**Retainer Bolt Torque* For
Cylinders with Round or Small
Square Gland Retainer**

Screw Size	Torque*	
1/2"	40 ft.-lbs.	53 N.m
5/8"	46 ft.-lbs.	62 N.m
3/4"	180 ft.-lbs.	244 N.m

*-0%, +5% tolerance.

Piston Ring Kit†		Piston Lipseal Kit†		Hi Load Piston Seal Kit†		Cylinder Body Seal Kit†			
Bore	Contains 4 Ea. Sym. 48, 2 Ea. Sym. 47 & 26		Contains 2 Ea. Sym. 42, 44, 47 & 26		Bore	Contains 1 Ea. Sym. 119, 120, 2 Ea. Sym. 121, 47 & 26		Contains 2 Ea. Sym. 47 & 26	
	Standard	Fluorocarbon	Standard	Fluorocarbon		Standard	Fluorocarbon	Standard	Fluorocarbon
	Kit No.	Kit No.	Kit No.	Kit No.		Kit No.	Kit No.	Kit No.	Kit No.
10	A63310001	A63310005	A63310011	A63310015	10	A63310021	A63310025	A63310031	A63310035
12	A63312001	A63312005	A63312011	A63312015	12	A63312021	A63312025	A63312031	A63312035
14	A63314001	A63314005	A63314011	A63314015	14	A63314021	A63314025	A63314031	A63314035

†For 16", 18" and 20" bore piston kits – consult factory.



For rod dia.
 2 1/2" and below

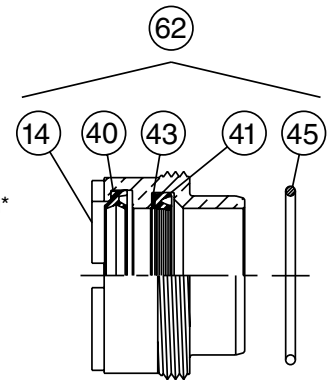
GLAND CARTRIDGE KIT

RG (symbol 62) contains 1 each of the following:
 symbol 14, gland
 symbol 40, rod Wiperseal
 symbol 41, rod Lipseal
 symbol 43, back-up washer for rod gland lipseal*
 symbol 45, O-ring gland to head seal.

ROD SEAL KIT

Contains 1 each of the following:
 symbol 40, rod Wiperseal
 symbol 41, rod Lipseal**
 symbol 41, rod Polypack Seal**
 symbol 43, backup washer for rod Lipseal*
 symbol 45, O-ring, gland to head seal.

*Required only for 1/2" dia. rod and for Class 5 service, 3" dia. rod and larger.



For rod dia. 3" and over

Service kits of expendable parts for air and hydraulic cylinders are stocked in principal industrial locations across the U.S.A. and other countries. For prompt delivery and complete information, contact your nearest Schrader Bellows distributor.

Service kits of expendable parts for fluid power cylinders are available for either Class 1 or Class 5 fluid service.

Standard Seals — Class 1 Service Kits are standard, and contain polyurethane seals. Class 1 Service Kits are suitable for use when air and hydraulic (mineral type) oil are the operating media.

The recommended operating temperature range for Class 1 seals is -10°F (-23°C) to +165°F (+74°C).

Fluorocarbon Seals — Class 5 Service Kits contain Fluorocarbon seals and are especially suited for elevated temperature service or for some fire resistant fluids (for specific fluids not listed in the latest Schrader Bellows Actuator Catalog, consult factory). Fluorocarbon seals (Class 5) should be used for high temperature service within a temperature range of -10°F (-23°C) to +250°F (+121°C). Fluorocarbon seals may be operated to +400°F (+204°C) with limited service life. For temperatures above +250°F (+121°C) the cylinder must be manufactured with a non-studded piston rod end thread and a pinned piston to rod connection.

Warning — The piston rod stud and the piston rod to piston threaded connections are secured with an anaerobic adhesive which is temperature sensitive. Cylinders specified with fluorocarbon seals are assembled with anaerobic adhesive having a maximum operating temperature rating of +250°F (+121°C). Cylinders specified with all other seal compounds are assembled with anaerobic adhesive having a maximum operating temperature rating of +165°F (+74°C). These temperature limitations are necessary to prevent the possible loosening of the threaded connections. Cylinders originally manufactured with Class 1 seals (Buna-N) that will be exposed to ambient temperatures above +165°F (+74°C) must be modified for higher temperature service. Contact the factory immediately and arrange for the piston to rod and the stud to piston rod connections to be properly reassembled to withstand the higher temperature service.

** This seal kit contains both a poly pack and a serrated lipseal as the primary piston rod seal symbol (41). Cylinders manufactured before the spring of 1999 contained the poly pack seal while cylinders built after this date contained the serrated seal with a larger cross-section. If servicing a gland which contained a poly pack rod seal, replace it with the poly pack provided. If the gland contained a serrated seal, replace it with the serrated seal provided. If it is desired to use the serrated seal regardless of the original construction order kit no. A63210510.

Rod Dia.	PL-2 Cylinders — Class 1		Rod Dia.	Fluorocarbon PL-2 Series Cylinders — Class 5	
	Gland (Symbol 62) Cartridge Kits	Rod Seal Kits		Gland (Symbol 62) Cartridge Kits	Rod Seal Kits
	Contains Symbols 14, 40, 41, 43† & 45	Contains Symbols 40, 41, 43† & 45		Contains Symbols 14, 40, 41, 43† & 45	Contains Symbols 40, 41, 43† & 45
1/2	A63210505	A63210705	1/2	A63220605	A63220805
5/8	A63210508	A63210708	5/8	A63220608	A63220808
1	A63210510	A63210710	1	A63220610	A63220810
1 3/8	A63210513	A63210713	1 3/8	A63220613	A63220813
1 3/4	A63210514	A63210714	1 3/4	A63220614	A63220814
2	A63210520	A63210720	2	A63220620	A63220820
2 1/2	A63210525	A63210725	2 1/2	A63220625	A63220825
3	A63210530	A63210730	3	A63220630	A63220830
3 1/2	A63210535	A63210735	3 1/2	A63220635	A63220835
4	A63210540	A63210740	4	A63220640	A63220840
4 1/2	A63210545	A63210745	4 1/2	A63220645	A63220845
5	A63210550	A63210750	5	A63220650	A63220850
5 1/2	A63210555	A63210755	5 1/2	A63220655	A63220855

†Required only for 1/2" diameter rod and Class 5 service 3" diameter rod and larger.

Service Assemblies and Seal Kits

Service Assembly Kits and Seal Kits for SHM cylinders simplify the ordering and maintenance processes. They contain sub-assemblies which are ready for installation, and are supplied with full instructions. When ordering Service Assemblies and Seal Kits, please refer to the identification plate on the cylinder body, and supply the following information:

Serial Number - Bore - Stroke - Model Number - Fluid Type

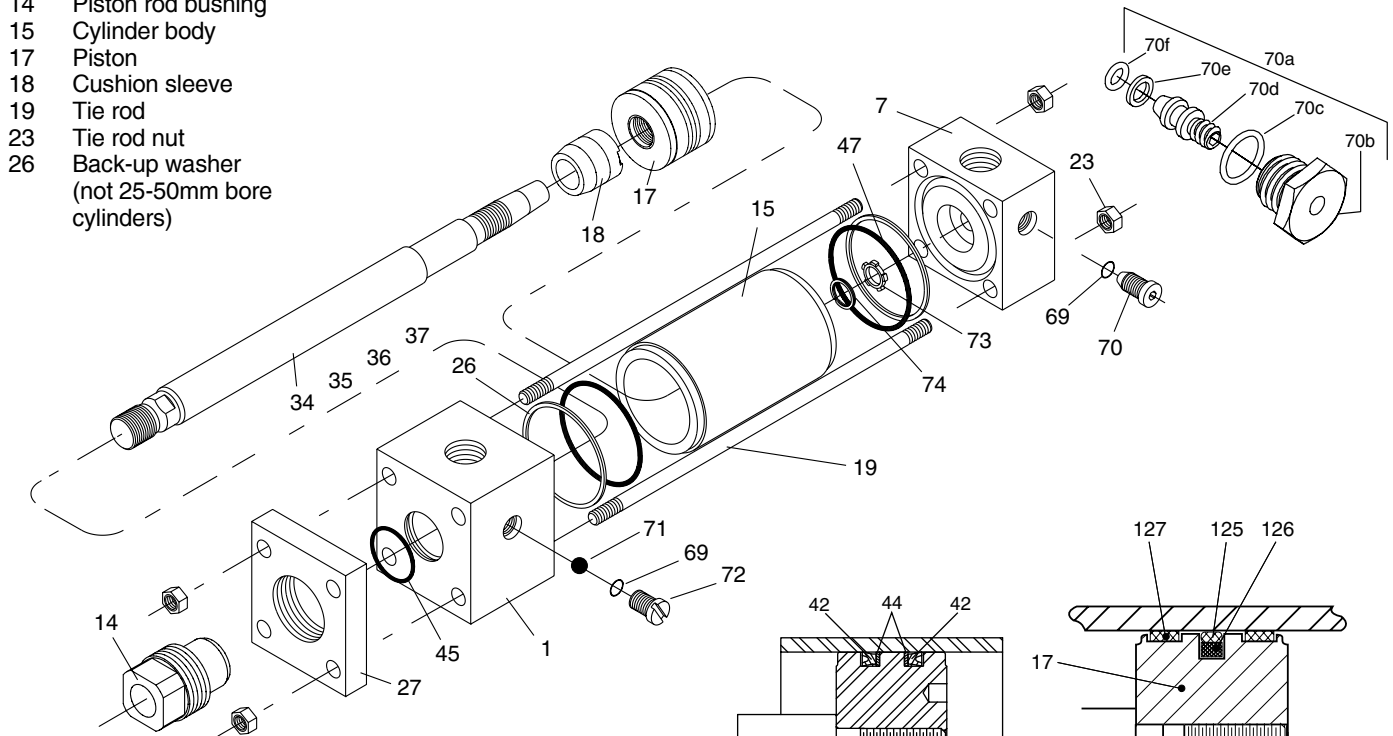
Key to Part Numbers

- 1 Head
- 7 Cap
- 14 Piston rod bushing
- 15 Cylinder body
- 17 Piston
- 18 Cushion sleeve
- 19 Tie rod
- 23 Tie rod nut
- 26 Back-up washer (not 25-50mm bore cylinders)

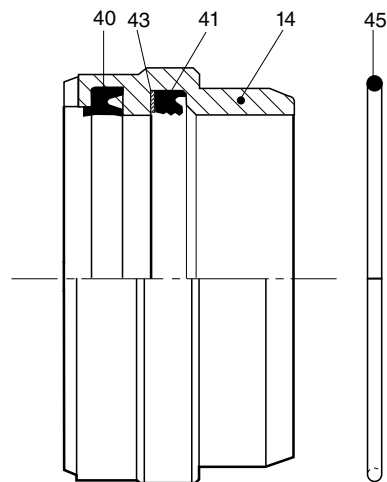
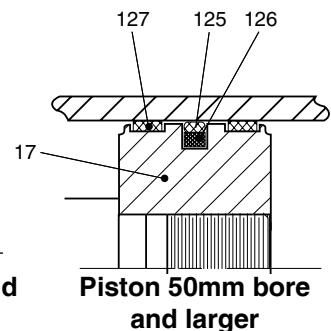
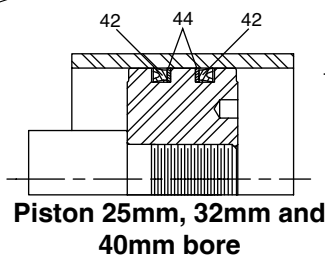
- 70f O-ring – needle screw
- 71 Ball – cushion check valve
- 72 Cushion check valve screw
- 73 Floating cushion bushing
- 74 Retaining ring for cushion bushing
- 125 Standard piston seal
- 126 Energizing ring for standard seal 125
- 127 Wear ring for standard piston

¹Not illustrated

²In some cases, the adjusting screw is installed in a cartridge.



- 27 Retainer
- 34 Piston rod – single rod, no cushion
- 35 Piston rod – single rod, cushion at head end
- 36 Piston rod – single rod, cushion at cap end
- 37 Piston rod – single rod, cushion at both ends
- 40 Wiperseal – for 14 and 122
- 41 Lipseal – for 14
- 42 Lipseal, Piston 25-40mm bores only
- 43 Back-up washer, bushing lipseal 41 (not Group 1 seals)
- 44 Back-up washer, piston lipseal
- 45 O-ring – bushing/head
- 47 O-ring – cylinder body
- 57¹ Piston rod – double rod, no cushion
- 58¹ Piston rod – double rod, cushion one end
- 60¹ Piston rod – double rod, no cushion
- 61¹ Piston rod – double rod, cushion one end
- 69 O-ring – needle valve and check valve screws
- 70² Needle valve, cushion adjustment
- 70a² Needle valve, cushion adjustment – cartridge type
- 70b Cartridge screw
- 70c O-ring – cartridge screw
- 70d Needle screw
- 70e Back-up washer – needle screw



**Contents and Part Numbers of Seal Kits
for Pistons and Rod Bushings**

(see key to part numbers opposite)

Gland Kit – Rod Bushing and Seals Contain items 14, 40, 41, 43, 45. Where the original bushing incorporates a bushing drain, please consult the factory.

Rod Seal Kit – Bushing Seals Contain items 40, 41, 43, 45

Rod Ø	Bushing Assembly		Rod Seal Kit	
	Standard	Fluorocarbon	Standard	Fluorocarbon
12	B732-944	B732-1100	B732-966	B732-1112
14	B732-945	B732-1101	B732-967	B732-1113
18	B732-946	B732-1102	B732-968	B732-1114
22	B732-947	B732-1103	B732-969	B732-1115
28	B732-948	B732-1104	B732-970	B732-1116
36	B732-949	B732-1105	B732-971	B732-1117
45	B732-950	B732-1106	B732-972	B732-1118
56	B732-951	B732-1107	B732-973	B732-1119
70	B732-952	B732-1108	B732-974	B732-1120
90	B732-953	B732-1109	B732-975	B732-1121
110	B732-954	B732-1110	B732-976	B732-1122
140	B732-955	B732-1111	B732-977	B732-1123

Body Kit – Cylinder Body End Seals Contain two each of items 47, 26 (no backup washer in 25-50mm bore).

Piston Kit**B-Style Piston Kit - (includes Cylinder Body End Seals)**

Contains two each of items 47, 26 (no backup washer in 25mm-50mm bores), two of item 127, and one each of items 125 & 126

Lipseal Piston Kit - (includes Cylinder Body End Seals)

Contains two each of items 42, 44 & 47.

Bore Ø	Body Seal Kit	
	Standard	Fluorocarbon
25	B732-956	B732-1124
32	B732-957	B732-1125
40	B732-958	B732-1126
50	B732-959	B732-1127
63	B732-960	B732-1128
80	B732-961	B732-1129
100	B732-962	B732-1130
125	B732-963	B732-1131
160	B732-964	B732-1132
200	B732-965	B732-1133

Bore Ø	Piston Seal Kits [†]		
	B-Style Piston Seals		Piston Lipseals®
	Standard	Fluorocarbon	Fluorocarbon*
25	B732-1169	B732-1179	B732-1189
32	B732-1170	B732-1180	B732-1190
40	B732-1171	B732-1181	B732-1191
50	B732-1172	B732-1182	N/A
63	B732-1173	B732-1183	
80	B732-1174	B732-1184	
100	B732-1175	B732-1185	
125	B732-1176	B732-1186	
160	B732-1177	B732-1187	
200	B732-1178	B732-1188	

[†] Piston Lipseals were made standard in 25mm - 40mm bores beginning in June 2006. Carefully check the model number for a 'B' - B-Style or 'L' - Lipseal Style piston before specifying a piston seal kit.

* Piston Lipseal Kits contain group 5 seals that are also suitable for group 1 service.

Tie Rod Torques*

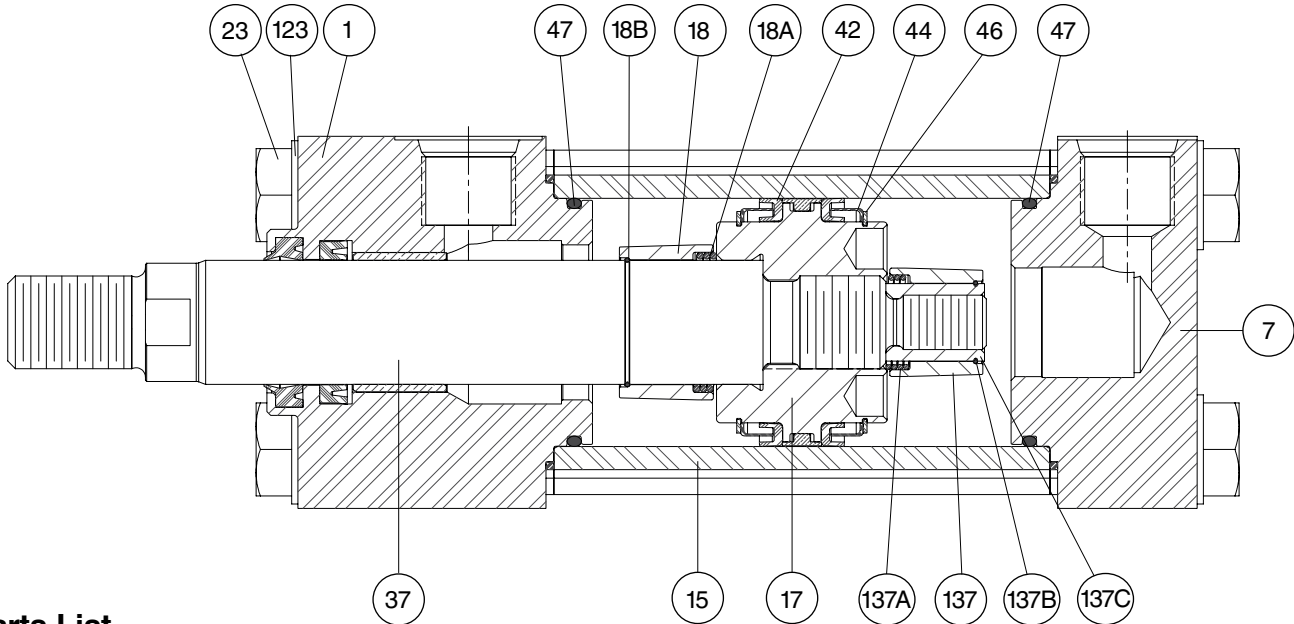
Bore Ø	Tie Rod Torque Nm
25	4.5-5.0
32	7.6-9.0
40	19.0-20.5
50	68-71
63	68-71
80	160-165
100	160-165
125	450-455
160	815-830
200	1140-1155

The tie rod torque values listed in this table are intended for SHM series cylinders having a pressure envelope pressure rating of 210 bars or 3000 p.s.i. Consult factory for tie rod torque of SHM series cylinders having a higher pressure rating.

Repairs

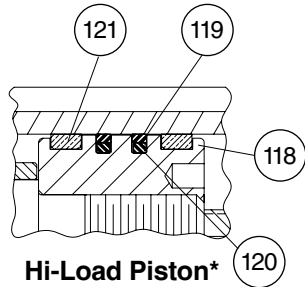
Although SHM cylinders are designed to make on-site maintenance or repairs as easy as possible, some operations can only be carried out in our factory. It is standard policy to fit a cylinder returned to the factory for repair with those replacement parts which are necessary to return it to 'as good as new' condition. Should the condition of the returned cylinder be such that repair would be uneconomical, you will be notified.

Parts Identification



Parts List

Symbol	Description
1	Head
7	Cap
15	Cylinder Body
17	Piston, lipseal type
18	Cushion sleeve, head end cushion
18A	Cushion check spring, head end cushion
18B	Cushion retaining wire, head end cushion
23	Bolt, head and cap to body
37	Piston rod, single rod type
42	Lipseal, piston
44	Anti-roll ring, piston lipseal
46	Retaining ring, piston lipseal
47	O-ring, cylinder body to head and cap seal
118	Piston, Hi-Load type*
119	Outer ring
120	Inner ring
121	Wear ring
123	Washer
137	Cushion sleeve, cap end cushion
137A	Cushion check spring, cap end cushion
137B	Cushion retaining wire, cap end cushion
137C	Cushion support, cap end cushion



Hi-Load Piston*

Piston and Rod Assemblies
Factory assembled piston and rod assemblies (that include seals for the piston type specified) are recommended.

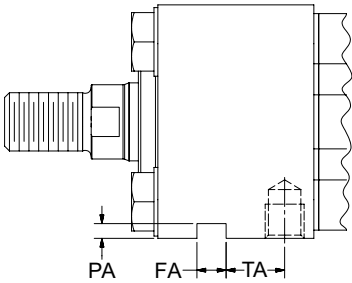
*Hi-Load Piston design available only in 1 1/2", 2" and 2 1/2" bores with oversize rod.

Thrust Key Mounting

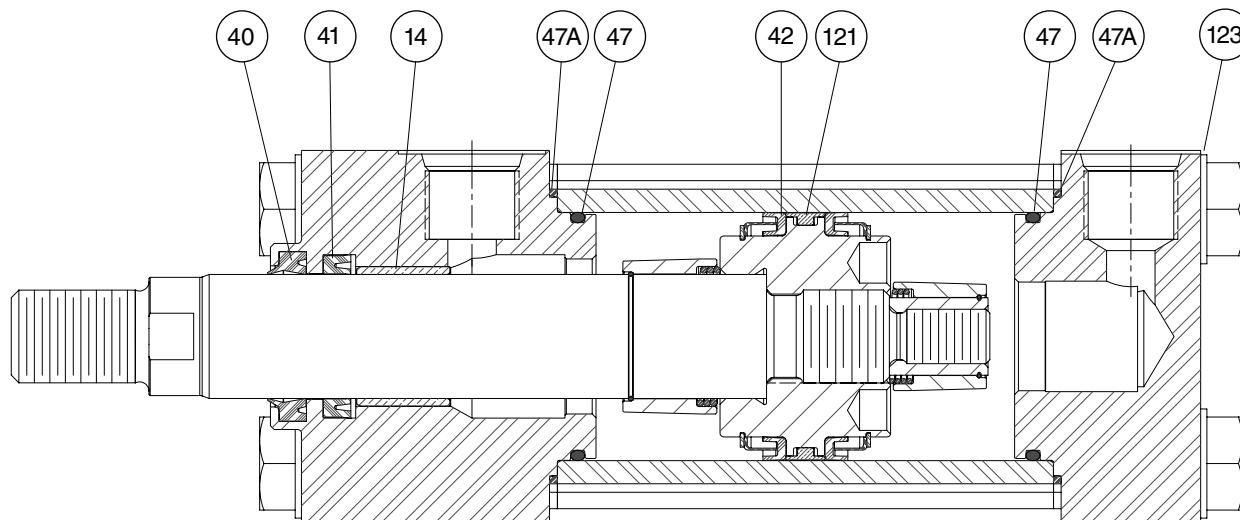
In addition to mounting bolts, Style F cylinders should be keyed to the mounting surface with a thrust key.

An optional groove can be supplied in the head for installing a thrust key.

Bore	+0.001 -0.000 FA	PA	TA
1 1/2	0.312	5/32	5/8
2	0.375	3/16	3/4
2 1/2	0.375	3/16	3/4
3 1/4	0.500	1/4	7/8
4	0.500	1/4	7/8



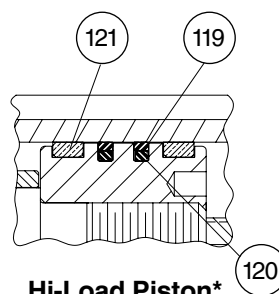
Parts Identification



Parts List

Symbol	Description	Symbol	Description
14	Rod bearing	47A	Gasket, cylinder body to head and cap seal
40	Rod wiper	119	Outer Ring
41	Rod Seal	120	Inner Ring
42	Lipseal, piston	121	Wear ring
47	O-ring, cylinder body to head and cap seal	123	Washer

*Hi-Load Piston design available only in 1½", 2" and 2½" bores with oversize rod.



Hi-Load Piston*

Seal Kits

See Model Code and Standard Specifications page for compatibility.

Piston Seal Kits

Bore Ø	Rod Ø	Class 1		Class 5	
		Piston Lipseal Kits (contains: 2 Each Sym. # 42, 47 & 47A)	Hi-Load Piston Seal Kits (contains: 2 Each Sym. # 119, 120, 121, 47 & 47A)	Piston Lipseal Kits (contains: 2 Each Sym. # 42, 47 & 47A)	Hi-Load Piston Seal Kits (contains: 2 Each Sym. # 119, 120, 121, 47 & 47A)
1 1/2	5/8	PK15SHG001	N/A	PK15SHG005	N/A
	1	N/A	PK15SHGK01	N/A	PK15SHGK05
2	1	PK20SHG001	N/A	PK20SHG005	N/A
	1 3/8	N/A	PK20SHGK01	N/A	PK20SHGK05
2 1/2	1	PK25SHG001	N/A	PK25SHG005	N/A
	1 3/4	N/A	PK25SHGK01	N/A	PK25SHGK05
3 1/4	All	PK32SHG001	N/A	PK32SHG005	N/A
4	All	PK40SHG001	N/A	PK40SHG005	N/A

Note: Lipseal piston design is not available in 1½", 2", and 2½" bores with oversize rod. Use Hi-Load piston seal kit to service these bore and rod combinations.

Rod Bearing and Seal Kits

Bore Ø	Rod Ø	Class 1	Class 5
		Rod Bearing & Seal Kits (contains: 1 Each Sym. # 14, 40, 41, 47 & 47A)	Rod Bearing & Seal Kits (contains: 1 Each Sym. # 14, 40, 41, 47 & 47A)
1 1/2	5/8	RGSHG15061	RGSHG15065
	1	RGSHG15101	RGSHG15105
2	1	RGSHG20101	RGSHG20105
	1 3/8	RGSHG20131	RGSHG20135
2 1/2	1	RGSHG25101	RGSHG25105
	1 3/4	RGSHG25171	RGSHG25175
3 1/4	1 3/8	RGSHG32131	RGSHG32135
	2	RGSHG32201	RGSHG32205
4	1 3/4	RGSHG40171	RGSHG40175
	2 1/2	RGSHG40251	RGSHG40255

Stat-O-Seal® Washer Kit
for Series SHG†

Bore Ø	Stat-O-Seal Washer Kit (contains: 8 Each Sym. # 123)	Head & Cap to Body Bolt Torque†† (ft. lbs.)
1 1/2	WK15SHG001	18 - 19
2, 2 1/2	WK25SHG001	46 - 49
3 1/4	WK40SHG001	120 - 124
4	WK40SHG001	131 - 135

† Stat-O-Seal washers must be replaced when reassembling a Series SHG cylinder.

†† Anti-seize lubricant required on bolt thread.

H-1 rated anti-seize lubricant must be used for Series SHG.