Custom Modifications, Options, Innovations and Application Engineering Data

Parker 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 selection that lets you "customize" cylinders to fit your application and help reduce your operating costs. At Parker 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.

Features and Modifications

Innovations

Application Engineering Data

C

For Cylinder Division Plant Locations – See Page II.

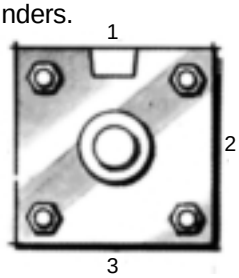
Parker Cylinder

Custom Options and Modifications

Special rod ends: If you require a rod-end configuration other than the standard catalog styles available, we can provide it. Dimensional sketches should accompany orders for cylinders equipped with such rod-ends.

Two times standard length: Studded rod-end threads: Two times standard length rod-end threads are available using high strength steel studs on many industrial type cylinders.

Port and cushion valve position changes: On NFPA type cylinders, ports, are normally at position 1. By calling out the position numbers for the desired locations for head and cap ports, many mounting styles can be assembled with ports located at 90½ or 180½ from standard.



In such special assemblies the cushion needle and check valves are also repositioned because their relation with the port position does not change.

The cushion needle valve in interchangeable with the check valve in many cylinder heads. The cushion needle valve can be assembled on side 4 with check valve on side 2 for most mountings when the port is at the standard side position.

On Trunnion mounting styles D, DB and DD, the cushion needle valves are provided only on the side position 3 or the head or cap which accommodates the mounting. The opposite head or cap can be rotated.

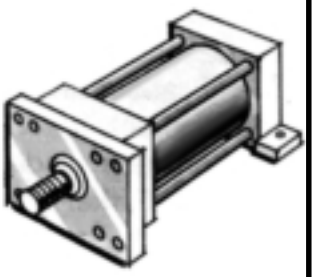
The location of the cushion needle valve or check valve can be located in relation to the port at the customers' request.

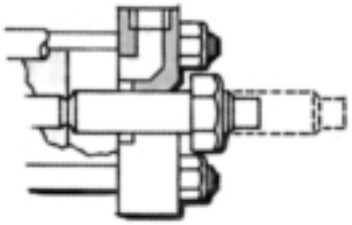
Other port options: Extra ports: If specified on your order, most industrial cylinders can be supplied with extra ports on the sides of heads or caps that are not occupied by mountings or cushion valves.

SAE ports: The SAE straight-thread O-ring port is recommended for hydraulic applications. It can be furnished on most cylinders on request.

Oversize ports: Oversize NPTF ports can be provided on most cylinders. Welded port bosses, one size larger than standard, are provided which protrude from the side of the head or cap. Special thicker heads or caps can also be supplied for extra oversize ports.

Mounting combinations: On NFPA type cylinders, we can provide standard mountings in different combinations. For example, style J, rectangular flange mount, on head end with style C, side lug mount, on cap end.





Stroke adjusters: If you require an adjustable stroke, we have several stroke adjusters, including the one shown. It is suitable for infrequent adjustment and is economical.

Spring return: Many standard double-acting cylinders can be modified to single-acting, spring return cylinders. This depends on the load conditions and friction factors as to whether the proper spring can be provided. The factory must also know whether the spring is to advance or return the piston rod. Please consult factory before ordering such cylinders.

Water service: Many standard air cylinders can be modified for water service. This involves adding corrosion-resistant plating to heads, caps and pistons. Stainless steel piston rods with hard chrome plating are also recommended. Maximum operating pressure or load and speed conditions must be considered before ordering due to the lower tensile strength of stainless steel practical for use as piston rods.

For additional information – call your local Parker Cylinder Distributor.

Features and Modifications available on Parker Hydraulic and/or Pneumatic Cylinders

Feature	Hydraulic Series					Pneumatic Series	
	2H	3H	VH	3L	HD	2A	MA
Non-Lube (N)* (1)						●	●
High Water Content Fluids (J)**	●	●	●	●	●		
Special Piston Rod Ends (1)	●	●	●	●	●	●	●
Rod End Threads 2 X Std. Length (1)	●	●	●	●	●	●	●
Port Relocation (2)	●	●	●	●	●	●	●
Extra Ports (2)	●	●	●	●	●	●	●
SAE “O” Ring Port (2)	●	●	●	●	●	●	
Oversize Port (2)	●	●	●	●	●	●	
Mounting Combinations (2)	●	●	●	●	●	●	●
Stroke Adjusters (2)	●	●	●	●	●	●	
Spring Return (2)	●	●	●	●	●	●	●
Spring Extend (2)							
Water Service (2)	●	●	●	●	●	●	●
Hi-Load Piston (4,1)	●	●	●		●		
Limit Switch Actuator (4,1)	●	●	●	●	●	●	●
Reed Switches							●
Viton Seals (3)	●	●	●	●	●	●	●
Rod End Boots (2)	●	●	●	●	●	●	
Manifold Ports (2)	●	●	●	●	●	●	
Metallic Rod Wiper (2)	●	●	●	●	●	●	
Gland Drain (2)	●	●	●	●	●		
Air Bleeds (2)	●	●	●	●	●		
Thrust Key (2)	●	●	●	●	●	●	
Spherical Bearings (4)	●			●	●	●	
EPS Proximity Switches	●	●		●	●	●	
Hall Effect Limit Switches							●
Style 55 Rod End	●	●	●	●	●	●	●

*Modification suffix ie: 2AN or MAN respectively.
**Modification suffix ie: 2HJ, 3LJ, HDJ respectively.

(1) See Catalog Section for details.
(2) See Application Engineering Section for details.
(3) See Maintenance Section for details.
(4) See Innovations Section for details.

For Cylinder Division Plant Locations – See Page II.

The Exclusive Parker HI LOAD Piston

- Virtually eliminates leakage
- HI LOAD capacity
- High contamination tolerance
- Long life
- Low friction

The revolutionary Parker HI LOAD Piston assembly was designed to increase and insure consistent quality performance of the piston seals...and your equipment. It's a major innovative refinement over typical cast iron piston ring seals, and Nitrile or Viton lipseals.

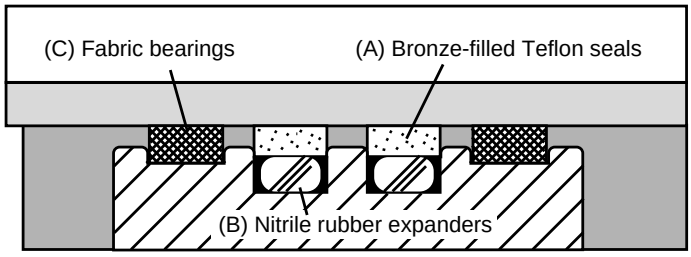
The HI LOAD piston assembly overcomes the inherent problems commonly associated with these conventional types of seals, such as scoring of the cylinder bore due to contamination, and it virtually eliminates leakage flow. It can also reduce or eliminate the need for stop tubing. It has much greater side load carrying capacity. And most importantly, even at pressures up to 3,000 psi, it has a longer wearing life than any seal we have tested to date.

For additional information – call your local Parker Cylinder Distributor.

The exclusive Parker HI LOAD Piston

The effective difference... Parker's bronze-filled Teflon* ring design.

The HI LOAD piston assembly is comprised of two square-cut bronze-filled Teflon piston rings (A) with Nitrile rubber expanders underneath (B) and two non-metallic wear rings (C) which uniquely work together, incorporating the best qualities of both elements to achieve dramatic efficiency.



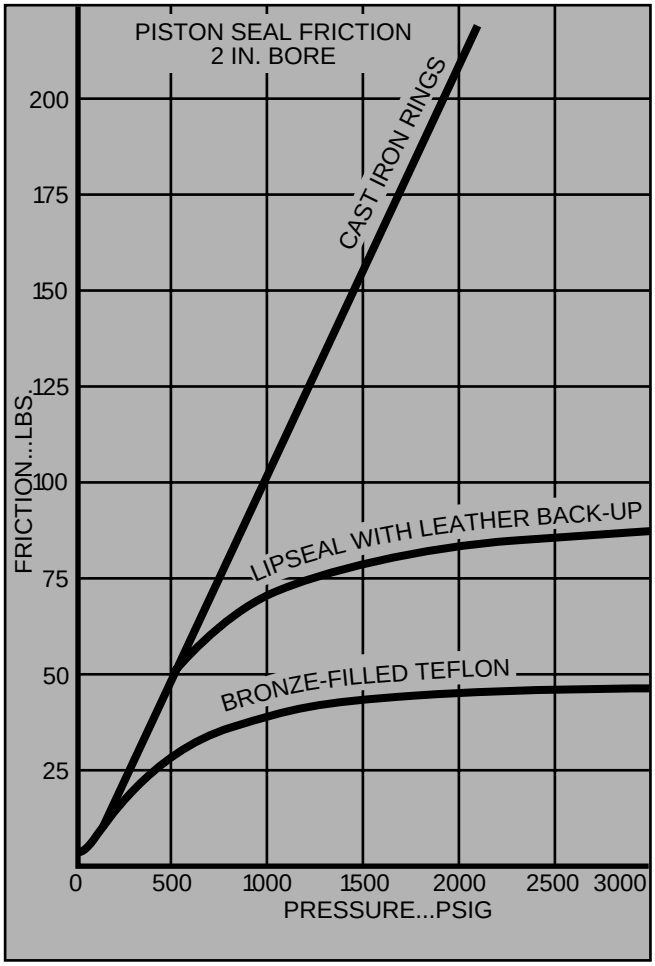
Reduced scoring. Low friction. The non-metallic wear rings eliminate all metal-to-metal contact between the piston and cylinder body. Some scoring may occur even with the use of compatible materials such as cast iron or bronze for the piston and steel for the cylinder body. The combination of the high imbeddability factor and the wiping action of the wear rings prevent contamination from getting between the piston bearing and sealing surfaces, therefore, scoring is greatly reduced. This also contributes to the extended life of the bronze-filled Teflon rings. Other benefits of the Hi Load piston are excellent lubricity and minimum wear when using water-based fluids, soluble oil and water and biodegradable fluids.

Extensive controlled contamination tests in our laboratory have shown the HI LOAD piston to operate more than **4 times longer** than lip seals when high degrees of contamination are present.

Note: Because the HI LOAD piston prevents metal-to-metal contact with the cylinder bore, steel pistons may be used which are stronger than other types.

Higher side load carrying capacity. Under severe side load conditions such as long stroke or pivot mounted cylinders the characteristics of non-metallic wear rings provides increased side load carrying capability, which is another distinctive benefit. Non-metallic bearings can also absorb shock, and with increased side load can give and thus conform more to piston and cylinder body. The action of deformation increases the area of contact, which in turn keeps the contact stresses from increasing and permits the HI LOAD piston to have a higher side load carrying capacity. This can often reduce or eliminate the need for stop tubing.

Comparative Piston Seal Friction



Virtually zero leakage. The HI LOAD piston assembly means virtually zero leakage with hydraulic and/or water base fluids because of the continuous bronze-filled Teflon rings with a homogenous inner ring of Nitrile rubber to apply seal preloading. The Nitrile expanders provide enough initial radial force to eliminate low pressure leakage. At higher pressure (above 2,000 psi) the seals are pressurized underneath, and are therefore dynamically self-sealing just as cast iron rings are.

The bronze-filled Teflon resists extrusion in the clearance between the piston much better than Nitrile, and, as a result, provides at least double the life, increasing life spans as pressure goes up.

*Registered DuPont Trademark

C

Parker EPS-6, EPS-7 AND EPS-5 (Automotive) Solid State Proximity Switches

- Completely Solid State
- Low Leakage Current
- UL Approved
- Shock and Vibration Resistant

For additional information – call your local Parker Cylinder Distributor.

Parker EPS-7 AND EPS-5 (Automotive Spec) Solid State Proximity Switches

The Parker EPS is an inductive type proximity switch that will operate in either pneumatic or hydraulic cylinders, providing full extend or retract indication. The completely solid state electronics are epoxy potted in housings that meet enclosure types listed below. The non-contact probe senses the presence of the ferrous cushion spear or sleeve. There are no cams, plungers, mechanical switches or dynamic seals to wear out or go out of adjustment. By mounting the EPS proximity switches in the cylinder head or cap, costly design and set-up time associated with external limit switches is eliminated. Also, since the probe is sealed within the cylinder body the switches cannot be tampered with. The EPS meets UL requirements and is designed to operate within one inch of resistance welder tips carrying 20,000 Amperes.

Specify EPS-7 for General Purpose, heavy duty Applications and EPS-5 for Automotive Plant Applications.

The standard Parker EPS-5 or EPS-7 is a 2-wire AC/DC switch which will operate from 50 to 220 VAC/DC. The low 1.7 mA off-state leakage current allows the EPS to operate relay coil loads or act as a direct input into a PC. The standard short circuit protection protects the switch from shorts in the load or line. Upon sensing a short condition (5 Amp or greater current) the switch assumes a non-conducting mode. The fault condition must be removed and the power removed to reset, preventing automatic restarts.

A ready LED indicator illuminates to indicate that the power is on and the switch is not conducting. The Target LED will illuminate when the switch is activated. Both LED's will flash to indicate a short circuit condition (EPS-5 & 6). (One LED will flash to indicate a short circuit condition on EPS-7.)

For more information or applications requiring intrinsically-safe **switches** contact the Parker Hannifin Cylinder Division.

C

Features

- Completely Solid State – no moving parts to wear out
- Pneumatic or Hydraulic Use – mounts directly to 2A, 2AN, 3AN, 3L and 2H Series cylinders
- Rotates in 300° – simplifies set-up (EPS-5 only)
- Low Leakage Current – directly compatible with programmable controllers
- Meets enclosure types 3, 4, and 13 requirements (EPS-5 only)
- Meets enclosure types IEC IP67 (EPS-7 only)
- Specify EPS-5 for Automotive Plant Applications
- UL Approved
- Standard Short Circuit Protection – operates safely near high magnetic fields such as those in welding equipment and large electric motors
- Shock and Vibration Resistant – withstands up to 30g's vibration to 2000 Hz

Specifications: EPS-5 and EPS-7

Pressure Rating: 3000 psi hydraulic
250 psi pneumatic

Operating Temperature: -4½ to +150½F

Repeatability: ±.004"

Switching Speed: 33 ms ± 8 ms

Actuation Point: .12" from end of stroke; ± .12"

Hysteresis (Typ): .004"

Supply Voltage: 50-220 VAC/DC EPS-5
20-220 VAC/DC EPS-7

Leakage Current: 1.7 mA max

Inrush Current: 3 Amp

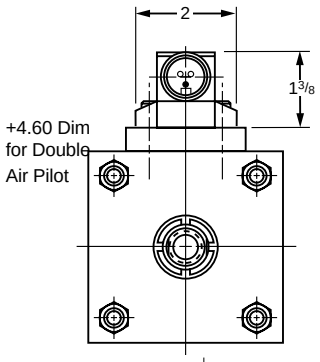
Load Current: 300 mA max; 5mA min

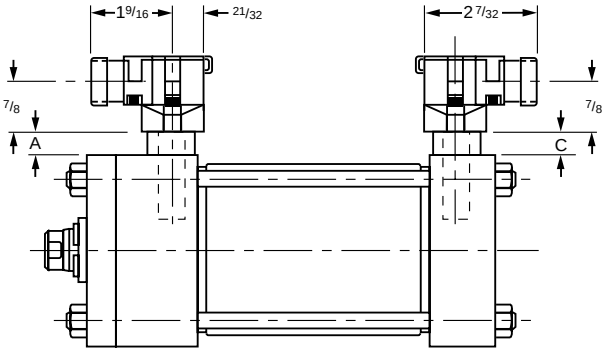
On State Voltage Drop: 10v @ 5-30 mA
<10v @ 31-500 mA

For Cylinder Division Plant Locations – See Page II.

Dimensional Data

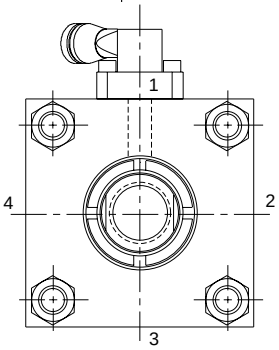
EPS-5 Automotive Applications

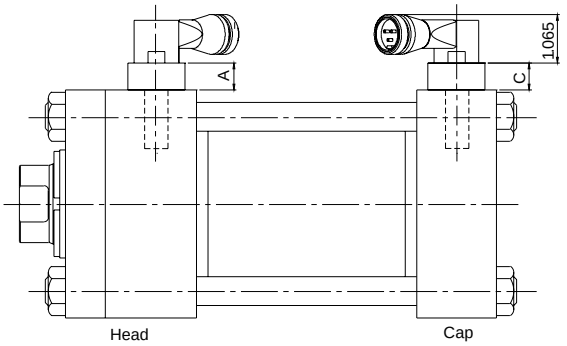




EPS-7 Heavy Duty Industrial Applications

For top view,
see EPS-6, opposite page.





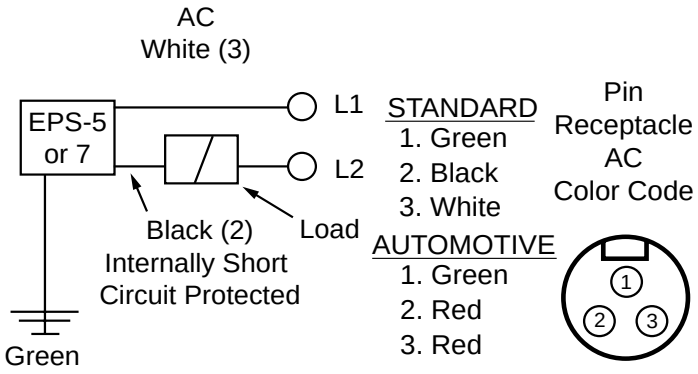
For basic cylinder dimensions, consult section A, pages 20 thru 45 for pneumatic cylinders and section B, pages 42 thru 97 for hydraulic cylinders

Series 2H, 7" & 8" 3H — "A" will not exceed 0.86";
"C" will not exceed 1.75".
For exact dimensions, see
Bulletin 0840-TSD-1

Series 3L — "A" will not exceed 1.55";
"C" will not exceed 1.05".
For exact dimensions, see
Bulletin 0840-TSD-2

Series 2A, 2AN — "A" will not exceed 1.55";
"C" will not exceed 1.30".
For exact dimensions, see
Bulletin 0840-TSD-3

Wiring Diagrams and Information



Connectors

The male quick disconnect on the Parker EPS-5 or 7 is a Brad Harrison 40909 connector.

Female connects must be purchased with one of the following cable lengths.

	Brad Harrison Part No.		Parker Part No.	
Cable Length	Automotive	Standard	Automotive	Standard
3'	40958	40901	085356003	0853550003
6'	40959	40902	085356006	0853550006
9'	40978	—	085356009	—
12'	40960	40903	0853560012	0853550012

Series and Parallel Wiring

When Parker EPS-5 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.

Parker EPS-5 or 7 switches may be hard wired for series operation, but the voltage drop through the switches (see specifications) must not drop the available voltage level below what is needed to actuate the load.

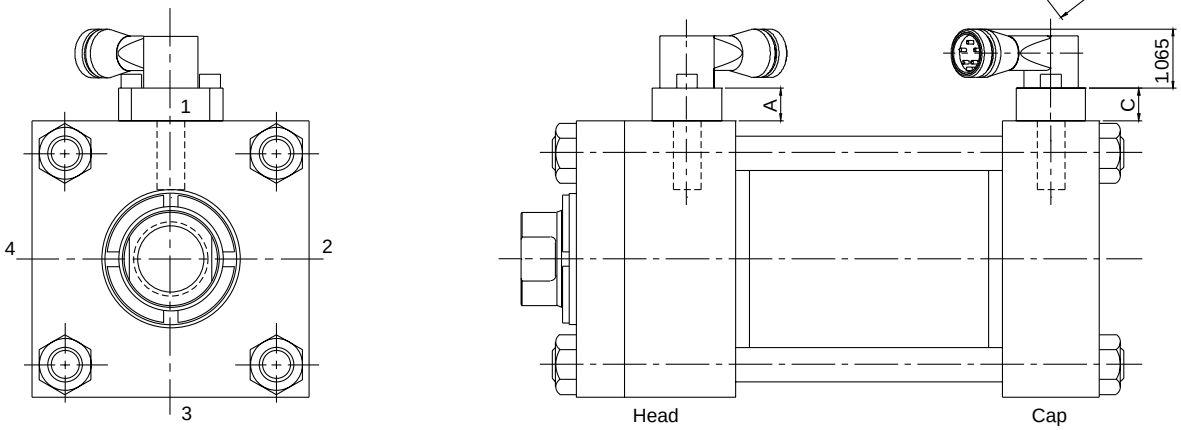
Parker EPS-5 or 7 switches may also be hard wired for parallel operation. However, the leakage current of each switch will pass through the load. The total of all leakage currents must not exceed the current required to actuate the load. In most cases, the use of two or more EPS-5 or 7 switches in parallel will require the use of a bypass (shunt) resistor. For more information on sizing a shunt resistor and wiring series and parallel operations, see Bulletin 0840-TSD-4.

For additional information – call your local Parker Cylinder Distributor.

EPS-6 Low Voltage DC Proximity Switch

Features

- Low Leakage
- Short Circuit Protection
- PNP (Sourcing) and NPN (Sinking)
- Enclosure Rated NEMA 4, 6, 13



Specifications: EPS-6

Pressure Rating: 3000 psi

Sensing Range: .080" ±10%

Repeatability: + 10%

Supply Voltage: 10 to 30 VDC

Load Current Max.: 200 mA

Operating Temperature: -4½ to 150½F

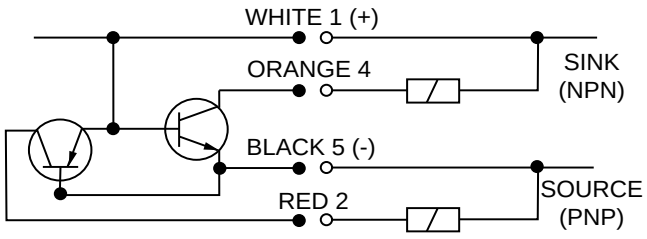
"On-State" Voltage Drop: 0.8v @ 200 mA

Hysteresis: 8% ±2% @ 20½C

Switch Frequency: 15 Hz @ 50% Duty Cycle

Switching Differential: 10%

Wiring Diagrams and Information

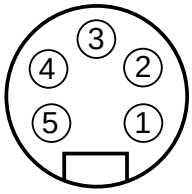


LED Function	"Ready"	"Target"
Power Applied (No Target)	ON	OFF
Target Present	OFF	ON
Short Circuit Condition	FLASH	FLASH

Connectors

The male quick disconnect on the Parker EPS-6 is a Brad Harrison 41310 connector.

Plug Pin and Cable Identification



1) +10 to 30 VDC (White)
2) Source (Red)
3) Grounded not connected nor required
4) Sink (Orange)
5) Common (Black)

For Cylinder Division Plant Locations – See Page II.

How To Order Parker EPS Proximity Switches on Parker Cylinders

Parker EPS proximity switches may be ordered on Series 2A, 2AN, and 2H 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 E, D, DB, JJ, JB, or HB should be used with caution because of possible mounting interferences. Consult bulletins 0840-TSD-1, 2 or 3 for additional information.

4) Special modifications to cylinders other than switches must have a written description.

Basic Cylinder Model Numbers

	Bore Size	Cushion Head End	Double Rod	Mtg. Style	Mtg. Mod.	Comb. Mtg. Style	Series	Piston	Ports	Common Modifications	Special Modifications	Piston Rod No.	Rod End Thread	Alternate Std. Rod End Thd. Length	Thread Type	Cushion Cap End	Stroke
	6	C	–	BB	–	–	2H	L	T	V	S	1	Style No.	2	A	C	x24,000
EXAMPLE	Specify	Specify only if Cushion Head End is req’d.	Use only if Double Rod Cyl. is req’d.	Specify mtg. style	Specify P – for Thrust Key Mtg. M – for Manifold Ports	Specify any practical mtg. style available	Specify 2A, Series 2AN, 3L, or 2H or 7" & 8" 3H	For ring type piston no letter req’d. Use – L for Lipseal Piston Use K for Hi-Load Piston	Specify Port Type req’d. U = NPTF T = S.A.E. R = BSP B = BSPT G = Metric P = S.A.E. Flange Port	If req’d. specify V=Viton Seals F=Nut Retained Piston E=E.P.R. Seals W=Water service J=High Water Content Fluid	Specify only if special modifications including proximity switches are req’d. Do not use symbol “S” for rod end modifications	Specify rod code no.	Specify Style 4 Small Male Style 8 Intermediate Male Style 9 Short Female Style 3 Special. Specify KK, A, LA or W dim req’d.	Specify only if 2 times Standard Catalog “A” dim. is req’d.	Specify A=UNF W=BSF M=Metric	Specify only if Cushion Cap End is req’d.	Specify in inches, show symbol “X” just ahead of stk. length.

How to Specify EPS Switches

5) Specify letter prefix “R” for EPS-5, “H” for EPS-7, and “D” for EPS-6, 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 = R13CGG-XXXX denotes a switch on the head end only, EPS-5

Example = HXXXX-42BGG denotes a switch on the cap end only, EPS-7

Head End

R	1	3	A	GG
Specify: “R” = EPS-5 “H” = EPS-7 “D” = EPS-6	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 Bulletins 0840-TSD-1, 2 or 3 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 Bulletins 0840-TSD-1, 2 or 3 for stroke remaining.

Note: All specified switch and port locations are as seen from rod end of cylinder.
*EPS-5 switches will be oriented so that the connectors face each other.

Figure 1

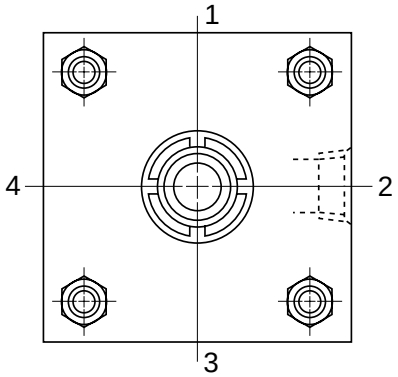
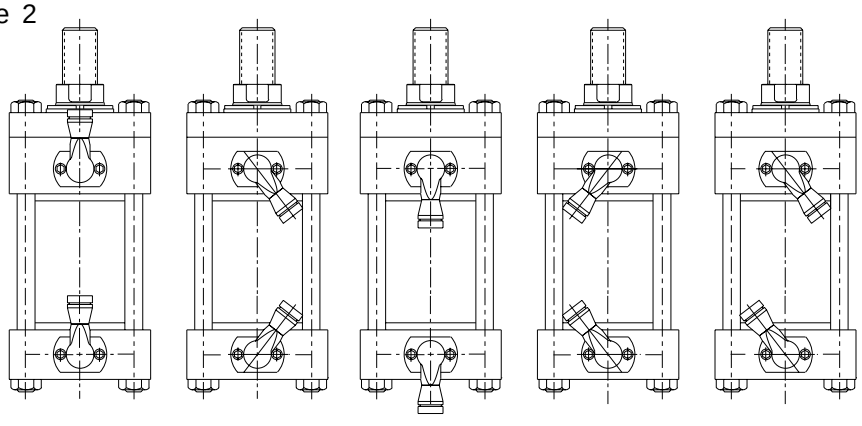


Figure 2

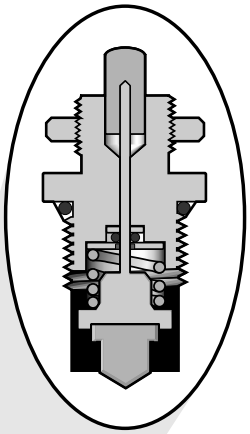


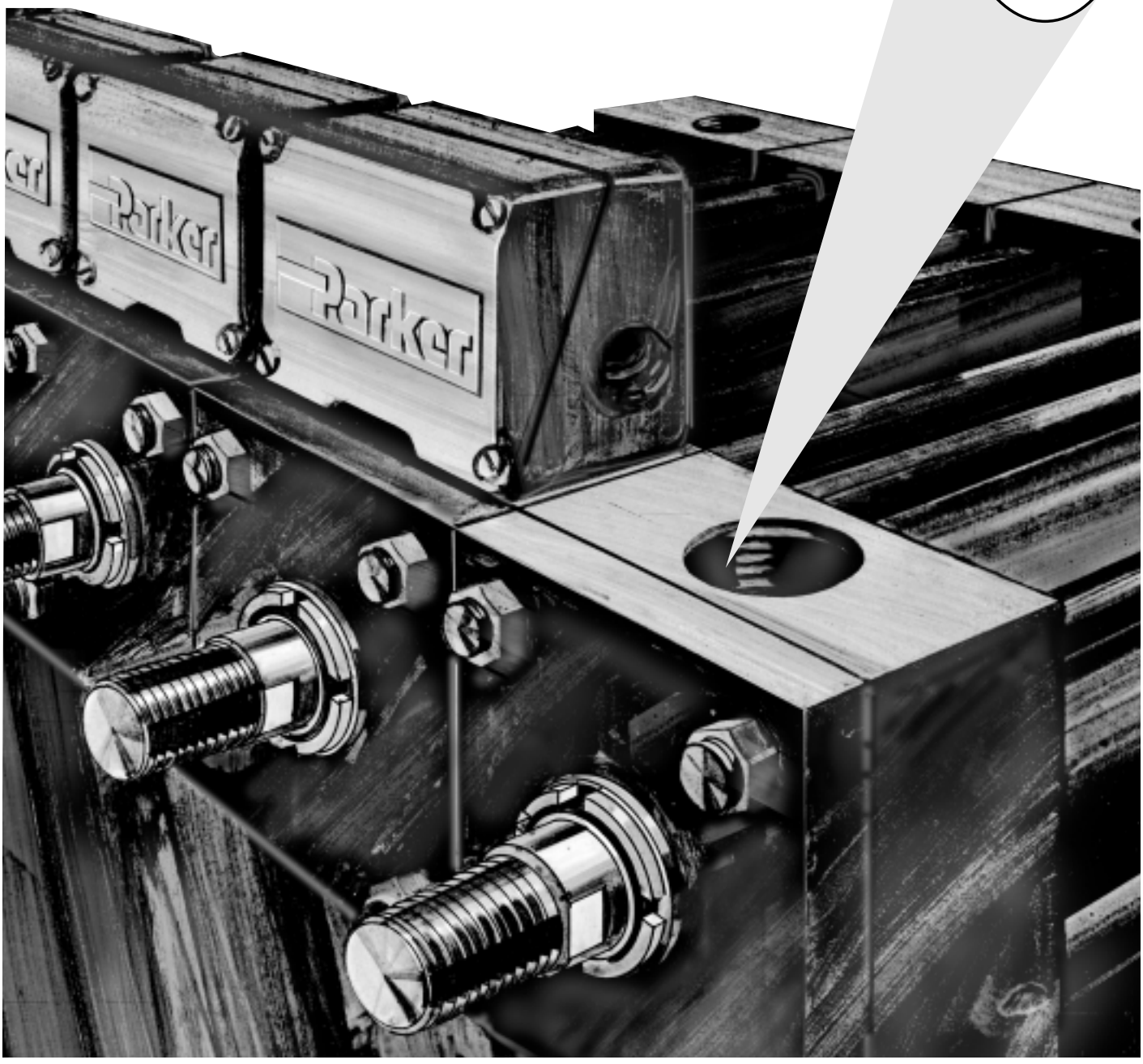
For additional information – call your local Parker Cylinder Distributor.

Limit Switch Actuators

for Hydraulic and Pneumatic Cylinders
Series 2A, 2H, 7" & 8" 3H, 3L.

Unique
Conical Plunger
spreads wear over
millions of cycles

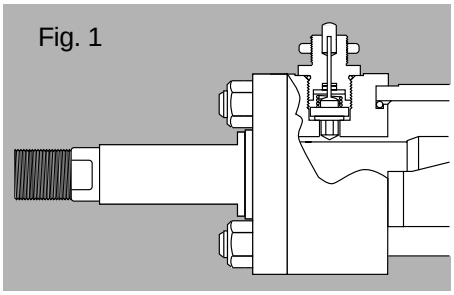




For Cylinder Division Plant Locations – See Page II.

Millions of Cycles at 3000 psi

Parker-Hannifin's unique conical plunger answers the need for a truly long-life Limit Switch Actuator.* Its conical design allows rotation on its axis which spreads wear over more surface area for a mechanical life of millions of cycles. This action also prolongs the life of the cushion sleeve or spear that actuates it. Low Friction together with a small diameter actuating rod, allows the actuator to be used on Series 2H cylinders at hydraulic pressures up to 3000 psi.

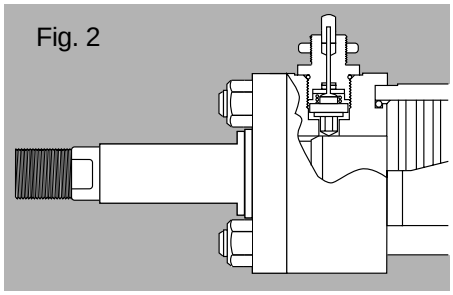


This actuator can be built into most mounting styles and rod sizes of Parker-Hannifin hydraulic and pneumatic cylinders.

Another Plus: Since the actuator is *built-into* the head or cap and actuated by cams within the cylinder, it is tamperproof and cannot be accidentally actuated.

How the Actuator Works

The conical plunger is cam operated by a cushion sleeve at the head end, or a cushion spear at the cap end. Fig. 1 shows a piston rod equipped with a cushion sleeve moving toward the head end. Since the sleeve has not contacted the plunger, the actuating rod and shoe rests in its retracted position.



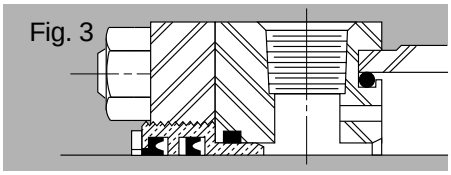
As the piston nears the end of its stroke (Fig. 2), the sleeve contacts the plunger to lift the actuating rod and shoe. The action of a cap end actuator is similar, except the cushion spear does the lifting.

The cushion sleeve or spear contacts the plunger 1/8 inch from the end of the cylinder stroke on all bore size Series 2H cylinders except those shown in the tables below. When required, 1/8-inch trip distance can be supplied on 1 1/2 and 2-inch bore sizes on a special order basis. On Series 2A and 3L cylinders the trip distance is 3/16" at head end and 5/16" at cap end except on small bore sizes as shown in tables below.

More About the Cylinder

Except for modifications to accept the actuator, the cylinder is standard. (See this Parker Catalog for complete cylinder dimensions.) A 3/4"–16 straight thread O-ring port is drilled and tapped into the head and/or cap to accept the actuator assembly. The cylinder can be supplied with this port plugged for installation of an actuator at a later date.

The conical plunger is hardened steel for all actuator styles and varies in length to cylinder bore size. The cushion sleeve or spear is hardened for longer life except on Series 2A, where lower operating pressures do not require these parts to be hardened. And the diameter, length and entry taper of each are standard – therefore, cushions can be supplied on most mounting styles.



On noncushioned cylinders, a bypass is provided through to the port (Fig. 3). The actuator shoe and conical plunger are made from square material with corners turned to fit the actuator cavity. The resulting passage allows equal pressure above and below the actuator shoe. This pressure is sealed in by the actuating rod O-ring – which is the only dynamic seal in the assembly.

2H/3H Series

Trip Distance (in inches)				
Bore Size	**Rod Size**	**Rod Code**	**Head End**	**Cap End**
1 1/2"	5/8"	1"	11/32"	11/32"
	1"	2"	11/32"	11/32"
2"	1"	1"	1/8"	1/8"
	1 3/8"	2"	11/32"	1/8"
2 1/2" thru 8"	All	All	1/8"	1/8"

2A Series

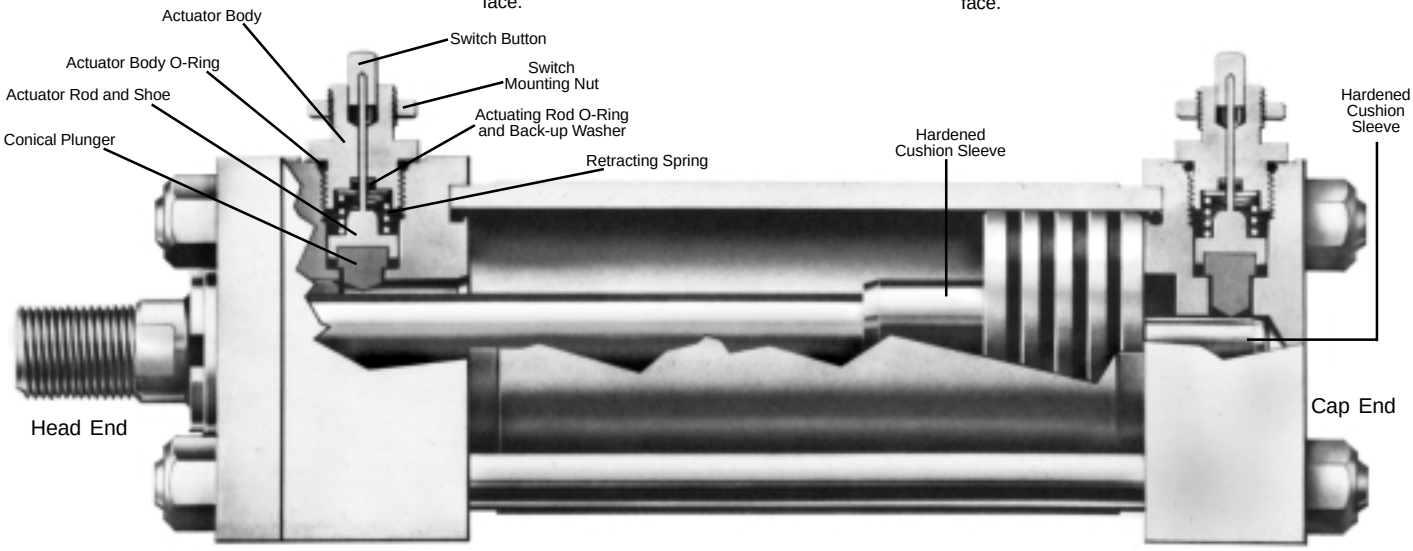
Trip Distance (in inches)				
Bore Size	**Rod Size**	**Rod Code**	**Head End**	**Cap End**
1 1/2" thru 2 1/2"	All	All	3/16"	1/32"
3 1/4" thru 14"	All	All	3/16"	5/16"

*Cap end limit switch for 1 1/2" thru 2 1/2" bore size cylinders are mounted on the centerline of the cap face.

3L Series

Trip Distance (in inches)				
Bore Size	**Rod Size**	**Rod Code**	**Head End**	**Cap End**
1 1/2" thru 2 1/2"	All	All	3/16"	1/32"
3 1/4" thru 14"	All	All	3/16"	5/16"

*Cap end limit switch for 1 1/2" thru 2 1/2" bore size cylinders are mounted on the centerline of the cap face.



For additional information – call your local Parker Cylinder Distributor.

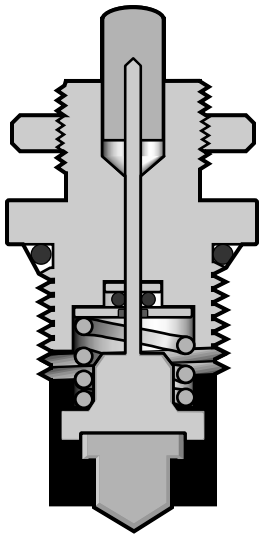
Choose from Two Styles

Style AO
Actuator Only

Designed for applications which require the mounting of a limit switch or signal device other than those offered. Includes a thin lock nut for mounting the switch or other device. Seals are “Viton” and compatible with most hydraulic fluids. The actuator pin lift distance is .030" min., .050" max.

Specify

Style AO-3 for Hydraulic Cylinders
Style AO-4 for Pneumatic Cylinders



Style AB
Actuator with Junction Box for SPDT Operation

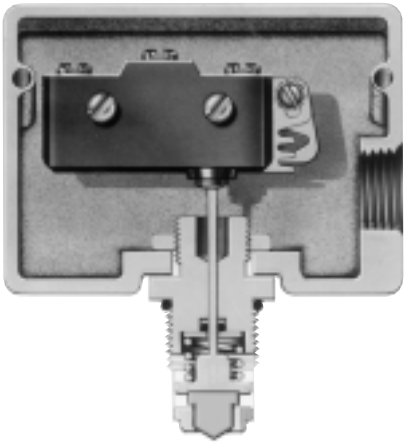
Comes with SPDT limit switch which has an electrical rating of 15 amps at 125, 250 or 480 VAC. Can be wired normally open or normally closed. Temperature rating is 180½F., continuous operation.

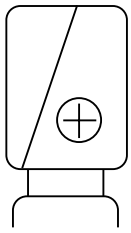
The junction box’s diagonally-jointed cover (see side view) allows easy access to all components. A cover gasket makes the box dustproof and splashproof.

A $^{1}/_{2}$-inch NPT threaded port provides a conduit connection. The box is fastened by a thin lock nut and can be rotated up to 360½ after installation.

Specify

Style AB-3 for Hydraulic Cylinders
Style AB-4 for Pneumatic Cylinders





Side View

C

Mounting Data

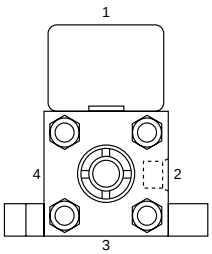


Fig. 4

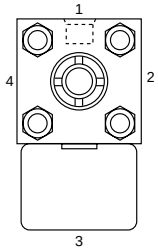


Fig. 5

Limit Switch Actuator Styles AO, and AB are designed for use on Parker Series 2A, 3L and 2H Cylinders, non-cushioned and most cushioned models, and can be supplied at both ends, head end only or cap end only.

On cylinder mounting styles C, CB, F and G, the actuator will be mounted at position (1) with the port at position (2) unless otherwise specified (see Fig. 4). If specified, the actuator can be mounted at position (2) or (4) on some bore sizes, with the port on the adjacent or opposite side. On the latter option, the port will be supplied at position (1) unless otherwise specified.

On all other cylinder mounting styles (see Fig. 5), the actuator will be mounted at position (3) with the port at position (1) unless otherwise specified. If specified, the actuator can be mounted at position (2) or (4) on most mounting styles, with the port on one of the other sides. On the latter option, the port will be supplied at position (1) unless otherwise specified. Due to interference with the mounting flange, Style AB actuators are not available on the head end of style JB or the cap end of Style HB.

Cushion availability: when equipped with Limit Switch Actuators, all cylinder mounting styles except Styles E, D and DB can be supplied with cushioning at both ends, head end only or cap end only. On Style E, cushions are not available at either end. On Style D, the head end cushion is not available. On Style DB, the cap end cushion is not available.

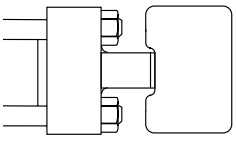


Fig. 6

Centerline Cap End Mount – On Series 2A and 3L cylinders, bore sizes 1 1/2", 2" and 2 1/2", limit switch actuators cannot be mounted on the sides of the cap, because the cap is too thin. Limit switch actuators on these bore sizes are mounted on the centerline of the cap, (Fig. 6) except where cylinder mountings interfere. To order, specify Style AO-1 for hydraulic cylinders and Style AO-2 for pneumatic cylinders.

For Cylinder Division Plant Locations – See Page II.

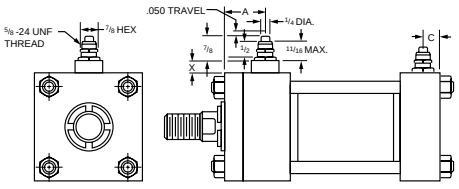
Limit Switches for Series 2A Heavy-Duty Pneumatic Cylinders

Mounting Dimensions

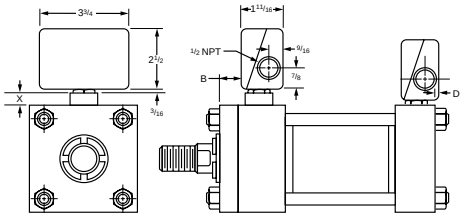
Bore Size	Rod No.	Rod Dia.	A*	B	C	D	X†
1 1/2"	1	5/8	1 9/32	17/32	–	–	17/32
	2	1	1 9/32	17/32			27/32
2"	1, 3	5/8, 1	1 9/32	17/32	–	–	17/32
	2	1 3/8	1 9/32	17/32			25/32
2 1/2"	1, 3, 4	5/8, 1, 1 3/8	1 9/32	17/32	–	–	17/32
	2	1 3/4	1 9/32	17/32			27/32
3 1/4"	1,3,4	1, 1 3/8, 1 3/4	1 7/16	11/16	33/64	27/64	–
	2	2	1 3/4	1			15/32
4"	1, 3, 4	1, 1 3/8, 1 3/4	1 7/16	11/16	33/64	27/64	–
	2	2 1/2	1 3/4	1			17/32
	5	2	1 3/4	1			15/32
5"	1, 3, 4	1, 1 3/8, 1 3/4	1 11/16	11/16	33/64	27/64	–
	2, 7	3 1/2, 3	1 3/4	1			17/32
	5, 6	2, 2 1/2	1 3/4	1			–
6"	1,3	1 3/8, 1 3/4	1 9/16	13/16	33/64	27/64	–
	2	4	1 7/8	1 1/8			17/32
	4, 5, 6, 7	2, 2 1/2, 3, 3 1/2	1 7/8	1 1/8			–
7"	1, 3	1 3/8, 1 3/4	1 9/16	13/16	33/64	27/64	–
	2	5	2	1 1/4			–
	4, 5, 6, 7, 8, 9	2, 2 1/2, 3, 3 1/2, 4, 4 1/2	1 7/8	1 1/8			–
8"	1, 3	1 3/8, 1 3/4	1 9/16	13/16	33/64	27/64	–
	2	5 1/2	2	1 1/4			–
	4, 5, 6, 7, 8	2, 2 1/2, 3, 3 1/2, 4	1 7/8	1 1/8			–
	9, 0	4 1/2, 5	2	1 1/4			–
10"	1	1 3/4	1 9/16	13/16	33/64	27/64	–
	3, 4, 5, 6, 7, 8	2, 2 1/2, 3, 3 1/2, 4, 4 1/2	1 7/8	1 1/8			–
	9, 0	5, 5 1/2	2	1 1/4			–
12"	1, 3, 4, 5, 6, 7	2, 2 1/2, 3, 3 1/2, 4, 4 1/2	1 7/8	1 1/8	33/64	27/64	–
	8, 9	5, 5 1/2	2	1 1/4			–
14"	1, 3, 4	2 1/2, 3, 3 1/2	1 7/8	1 1/8	33/64	27/64	–
	5, 6	4, 4 1/2	2 3/8	1 5/8			–
	7, 8	5, 5 1/2	2	1 1/4			–

Mounting Positions

Standard Actuator Mounting Positions Available									
Mounting Style		Bore Size (in inches)							
		1 1/2	2	2 1/2	3 1/4	4	5	6	8-10, 12-14
T, TB, DD	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	Centerline of Cap Face Only			2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
D	Head	3	3	3	3	3	3	3	3
	Cap	Centerline of Cap Face Only			2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
DB	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	Centerline of Cap Face Only			3	3	3	3	3
C	Head	1	1	1	1	1,2,4	1,2,4	1,2,4	1,2,4
	Cap	Centerline of Cap Face Only			1	1,2,4	1,2,4	1,2,4	1,2,4
E	Head	3	3	3	3	3	3	3	3
	Cap	Centerline of Cap Face Only			3	3	3	3	3
F, CB	Head	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4
	Cap	Centerline of Cap Face Only			2,4	2,4	2,4	2,4	2,4
JB	Head	AB-4 Actuator Not Available AO-4 Available at Pos. 2, 3, & 4							2,3,4
	Cap	Centerline of Cap Face Only			2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
HB	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	N/A	N/A	N/A	AB-4 Actuator N/A. AO-4. Available at Pos. 2, 3, & 4				2,3,4
J	Head	3	3	3	3	3	3	3	–
	Cap	Centerline of Cap Face Only			2,3,4	2,3,4	2,3,4	2,3,4	–
H	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	–
	Cap	N/A	N/A	N/A	3	3	3	3	–
BB, BC TC, TD	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	N/A	N/A	N/A	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
G	Head	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4
	Cap	N/A	N/A	N/A	2,4	2,4	2,4	2,4	2,4

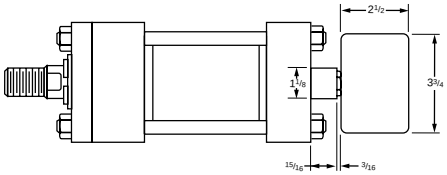


Style AO



Style AB

*A welded coupling is required to mount the actuator at the head (rod) end of some cylinder sizes. See mounting dimension table and dimension "X" for coupling height and requirement.



Dimensions

Centerline cap end, Styles **AB** for 1 1/2", 2" & 2 1/2" bore size Series **2A** cylinders.

How to Order

2A Cylinder

Specify cylinder as outlined in Section A, of this catalog. If cylinder is other than standard, please specify or send drawing. Port location shown is standard on cylinders equipped with limit switch actuators and will be supplied unless otherwise specified.

Actuator

1. Specify Actuator by Style Designation:

AO-4 – Actuator Only

AB-4 – Actuator with Switch and Junction Box, SPDT

2. Specify: "Head End Only," "Cap End Only" or "Both Ends."

3. Specify actuator mounting position location (if other than standard). Unless otherwise specified, actuator location shown above will be supplied.

*Dim. "A" for 8" bore thru 14" bore size cylinders. Includes the gland retainer (dim. "F") shown on dimension pages of this catalog.
†A welded coupling is required to mount the actuator at the head (rod) end of some cylinder sizes. See dimension "X" for coupling height.

NOTE: Actuator cannot be supplied on the same side as the supply port. When actuator is ordered in a position other than standard, be sure to specify port location.

For additional information – call your local Parker Cylinder Distributor.

Limit Switches for Series 2H and 3H 7" & 8" Bore Heavy-Duty Hydraulic Cylinders

Mounting Dimensions

Bore Size	Rod No.	Rod Dia.	A	B	C	D	Welded Coupling Required	
							Head End	Cap End
1 1/2"	1, 2	5/8, 1	1 1/2	3/4	53/64	7/64	Yes	Yes
2"	1	1	1 17/32	25/32	21/32	9/32	Yes	–
	2	1 3/8	1 3/4	1			Yes	–
2 1/2"	1	1	1 17/32	25/32	21/32	9/32	–	–
	2,3	1 3/4, 1 3/8	1 17/32	25/32			Yes	–
3 1/4"	1,3	1 3/8, 1 3/4	1 21/32	29/32	23/32	7/32	–	–
	2	2	1 31/32	1 7/32			Yes	–
4"	1	1 3/4	1 25/32	1 1/32	25/32	5/32	–	–
	2,3	2 1/2, 2	2 3/32	1 11/32			–	–
5"	All	All	2 3/32	1 11/32	29/32	1/32	–	–
6"	1,2,3	2 1/2, 4, 3	2 7/32	1 15/32	1 1/32	(-3/32)	–	–
	4	3 1/2	2 15/32	1 23/32			–	–
7"*	1, 3	3, 3 1/2	1 7/32	15/32	1 3/32	(-5/32)	–	–
	2,5	5, 4 1/2	1 11/32	19/32			–	–
	4	4	1 23/32	31/32			–	–
8"*	1	3 1/2	1 7/32	15/32	1 9/32	(-11/32)	–	–
	2	5 1/2	1 11/32	19/32			–	–
	3	4	1 31/32	1 7/32			–	–
	4,5	4 1/2, 5	1 19/32	27/32			–	–

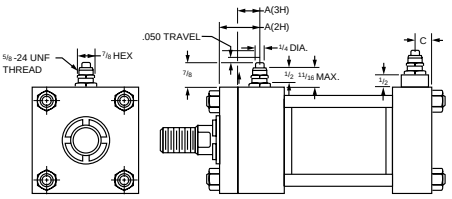
For cylinder dimensions not shown, See Series 2H, Section B, pages 42-97.
*When used with bolt-on gland retainers. For cylinder dimensions not shown, see Series 3H, Section B, page 65-103.

Mounting Positions

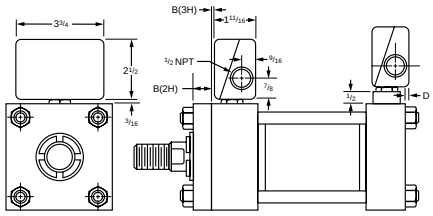
Mounting Style		Bore Size (in inches)								
		1 1/2	2	2 1/2	3 1/4	4	5	6	7	8
T, TB, TC, TD, BB, DD	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
J, D	Head	3	3	3	3	3	3	3	3	3
	Cap	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
H, DB	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	3	3	3	3	3	3	3	3	3
C	Head	1	1	1	1	1	1,2,4	1,2,4	1,2,4	1,2,4
	Cap	1	1	1	1	1	1,2,4	1,2,4	1,2,4	1,2,4
E	Head	3	3	3	3	3	3	3	3	3
	Cap	3	3	3	3	3	3	3	3	3
F, G, CB	Head	1	1	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
JB	Head	Style AB-3 Actuator Not Available. Style AO-3 Available at Positions 2, 3, & 4								
	Cap	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
HB	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	Style AB-3 Actuator Not Available. Style AO-3 Available at Positions 2, 3, & 4								

NOTE: When actuator is ordered in a position other than standard, be sure to specify port location. Actuator cannot be supplied on the same side as the supply port.

Series 2H and 3H



Style AO



Style AB

*A welded coupling is required to mount the actuator on some cylinder sizes (see "Mounting Dimensions" table). If required, add 1/2 inch to these dimensions to allow for the thickness of the coupling.

How to Order

2H Cylinder

Specify cylinder as outlined in Section B, of this catalog. If cylinder is other than standard, please specify or send drawing. Port location shown above is standard on cylinders equipped with limit switch actuators and will be supplied unless otherwise specified.

Actuator

1. Specify Actuator by Style Designation:

AO-3 – Actuator Only

AB-3 – Actuator with Switch and Junction Box, SPDT

2. Specify: "Head End Only," "Cap End Only" or "Both Ends."

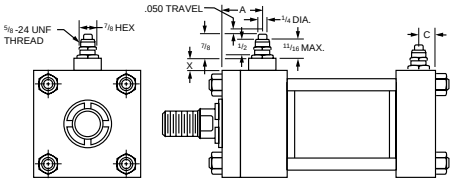
3. Specify actuator mounting position location (if other than standard). Unless otherwise specified, actuator location shown above will be supplied.

C

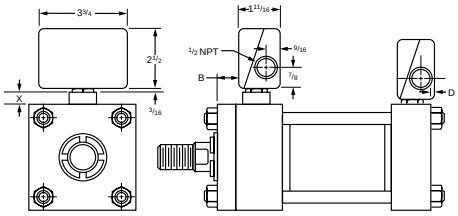
Limit Switches for Series 3L Medium-Duty Hydraulic Cylinders

Mounting Dimensions

Bore Size	Rod No.	Rod Dia.	A	B	C	D	Welded Coupling Required		X
							Head End	Cap End	
1 1/2"	1	5/8	1 9/32	17/32	–	–	Yes	–	17/32
	2	1	1 9/32	17/32	–	–	Yes	–	27/32
2"	1, 3	5/8, 1	1 9/32	17/32	–	–	Yes	–	17/32
	2	1 3/8	1 9/32	17/32	–	–	Yes	–	25/32
2 1/2"	1, 3, 7	1, 1 3/8, 5/8	1 9/32	17/32	–	–	Yes	–	17/32
	2	1 3/4	1 9/32	17/32	–	–	Yes	–	27/32
3 1/4"	1	1	1 7/16	11/16	33/64	27/64	–	–	–
	2	2	1 3/4	1			Yes	–	15/32
	3, 4	1 3/8, 1 3/4	1 7/16	1 1/16			Yes	–	15/32
4"	1, 3, 7	1 3/8, 1 3/4, 1	1 7/16	11/16	33/64	27/64	–	–	–
	2	2 1/2	1 3/4	1			Yes	–	17/32
	4	2	1 3/4	1			–	–	–
5"	1, 7, 8	1 3/4, 1, 1 3/8	1 7/16	11/16	33/64	27/64	–	–	–
	2 ,5	3 1/2, 3	1 3/4	1			Yes	–	17/32
	3, 4	2, 2 1/2	1 3/4	1			–	–	–
6"	1,7	1 3/4, 1 3/8	1 9/16	13/16	33/64	27/64	–	–	–
	2, 3, 5, 6	4, 2, 3, 3 1/2	1 7/8	1 1/8			–	–	–
	4	2 1/2	1 7/8	1 1/8			Yes	–	17/32
8"	1, 3, 4, 5, 6	2, 2 1/2, 3, 3 1/2, 4	1 7/8	1 1/8	33/64	27/64	–	–	–
	2	5 1/2	2	1 1/2			–	–	–
	7,8	1 3/8, 1 3/4	1 9/16	13/16			–	–	–
	9,0	4 1/2, 5	2	1 1/4			–	–	–



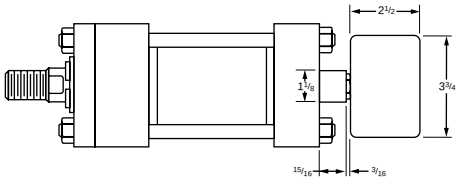
Style AO



Style AB

*A welded coupling is required to mount the actuator at the head (rod) end of some cylinder sizes. See mounting dimension "X" for coupling height and requirement.

*Dim. "A" for 8" bore cylinders include the gland retainer (Dim. "F").



Dimensions

Centerline cap end, Styles **AB** for 1 1/2", 2" & 2 1/2" bore size Series **3L** cylinders.

Mounting Positions

Mounting Style		Standard Actuator Mounting Positions Available							
		Bore Size (in inches)							
		1 1/2	2	2 1/2	3 1/4	4	5	6	8
T, TB, DD	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	Centerline of Cap Face Only			2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
D	Head	3	3	3	3	3	3	3	3
	Cap	Centerline of Cap Face Only			2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
DB	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	Centerline of Cap Face Only			3	3	3	3	3
C	Head	1	1	1	1	1	1,2,4	1,2,4	1,2,4
	Cap	Centerline of Cap Face Only			1	1	1,2,4	1,2,4	1,2,4
E	Head	3	3	3	3	3	3	3	3
	Cap	Centerline of Cap Face Only			3	3	3	3	3
F	Head	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4
	Cap	Centerline of Cap Face Only			2,4	2,4	2,4	2,4	2,4
JB	Head	AB-3 Actuator Not Available AO-3 Available at Pos. 2, 3, & 4							2,3,4
	Cap	Centerline of Cap Face Only			2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
HB	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	N/A	N/A	N/A	AB-3 Actuator N/A. AO-3. Available at Pos. 2, 3, & 4				2,3,4
J	Head	3	3	3	3	3	3	3	–
	Cap	Centerline of Cap Face Only			2,3,4	2,3,4	2,3,4	2,3,4	–
H	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	–
	Cap	N/A	N/A	N/A	3	3	3	3	–
TC, TD BB, BC	Head	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
	Cap	N/A	N/A	N/A	2,3,4	2,3,4	2,3,4	2,3,4	2,3,4
G	Head	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4
	Cap	N/A	N/A	N/A	2,4	2,4	2,4	2,4	2,4

NOTE: Actuator cannot be supplied on the same side as the supply port. When actuator is ordered in a position other than standard, be sure to specify port location.

How to Order

3L Cylinder

Specify cylinder as outlined in Section B, of this catalog. If cylinder is other than standard, please specify or send drawing. Port location shown above is standard on cylinders equipped with limit switch actuators and will be supplied unless otherwise specified.

Actuator

1. Specify Actuator by Style Designation:

AO-3 – Actuator Only

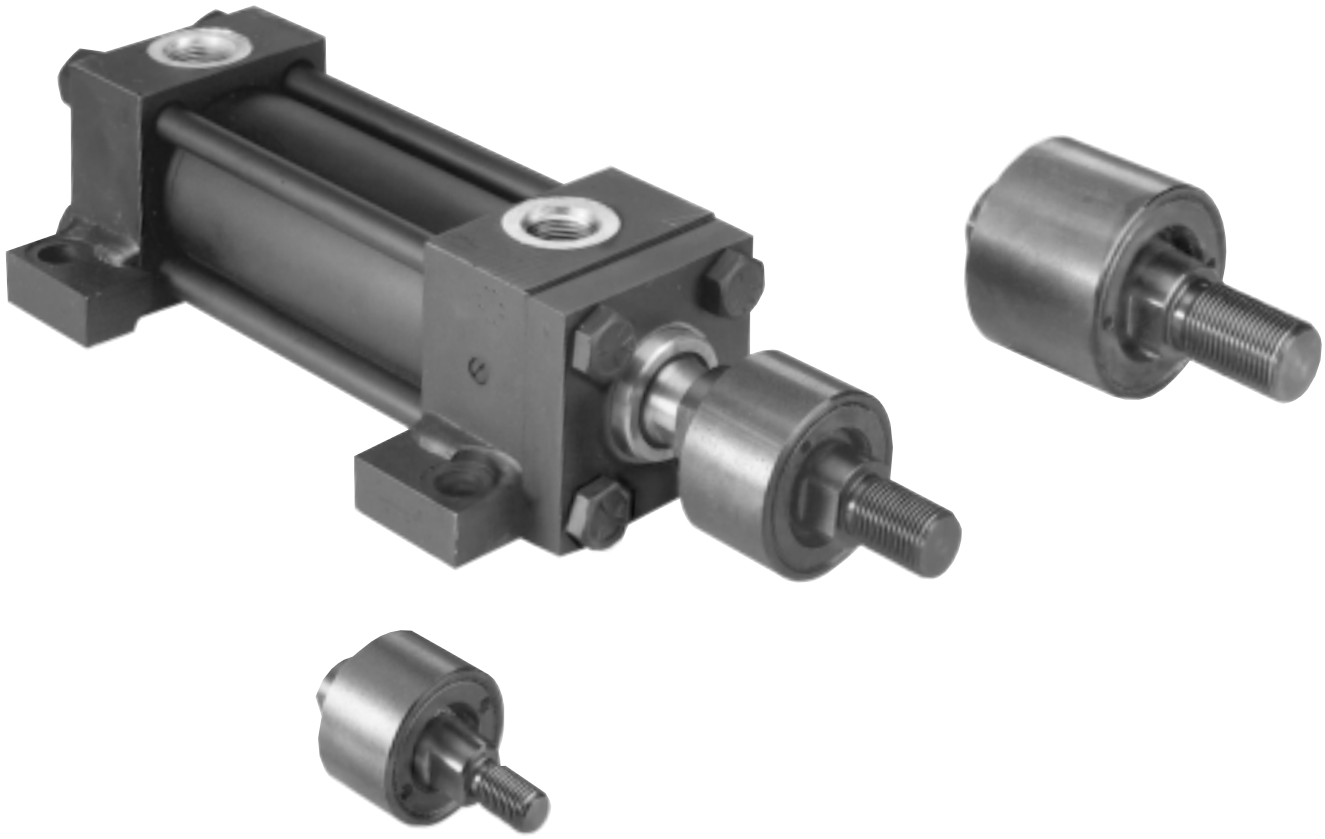
AB-3 – Actuator with Switch and Junction Box, SPDT

2. Specify: "Head End Only," "Cap End Only" or "Both Ends."

3. Specify actuator mounting position location (if other than standard). Unless otherwise specified, actuator location shown above will be supplied.

For additional information – call your local Parker Cylinder Distributor.

Linear Alignment Couplers



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

For Cylinder Division Plant Locations – See Page II.

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

Cost Saving Features and Benefits Include...

- Maximum reliabilty 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

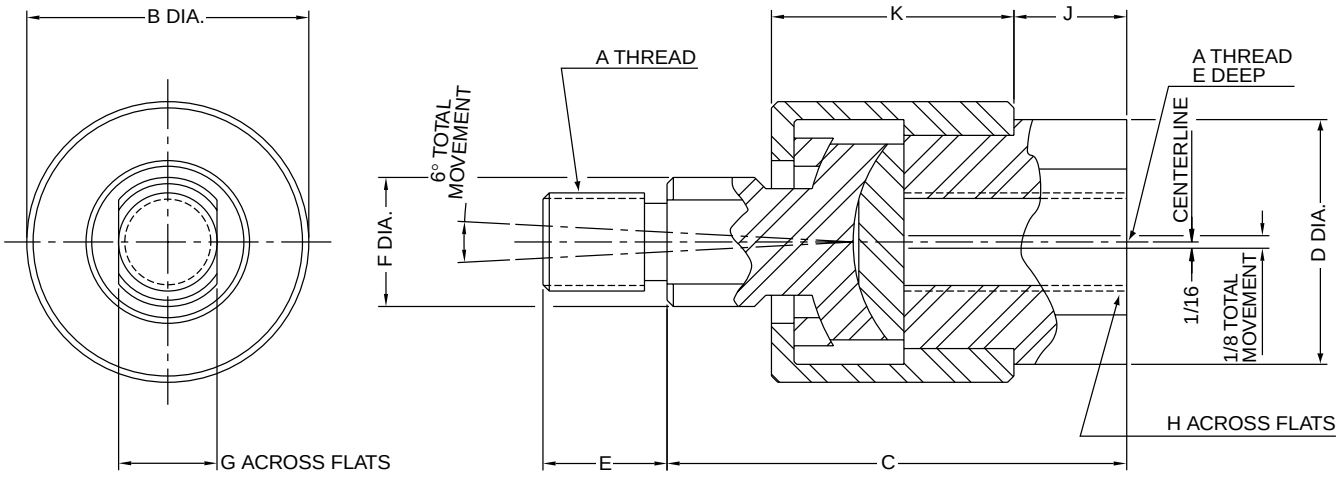


Table 1 — Part Numbers and Dimensions

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

– Shaded Dimensions are different from previous design couplers.

* – The 'C' dimension – overall length – is the same as existing couplers except where noted. In these cases it is shorter than previous design.

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 "LL" dimension is 3/4" - 16", specify coupler part number 1347570075.

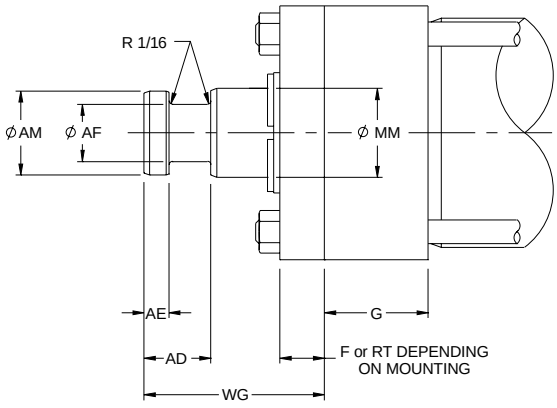
For additional information – call your local Parker Cylinder Distributor.

Parker “Style 55” Piston Rod End

Rod end flange coupling for Parker Series 3L, 2H, 3H, VH and HD Hydraulic and 2A and VP Pneumatic

- Simplifies alignment
- Reduces assembly time
- Allows full rated hydraulic pressure in push and pull directions
- Available in 5/8" through 10" piston rod diameters

Style 55 Rod End



Dimensions Style 55 Rod End

MM Rod Dia.	AD	AE	AF	AM	WG
5/8	5/8	1/4	3/8	.57	1 3/4
1	15/16	3/8	11/16	.95	2 3/8
1 3/8	1 1/16	3/8	7/8	1.32	2 3/4
1 3/4	1 5/16	1/2	1 1/8	1.70	3 1/8
2	1 11/16	5/8	1 3/8	1.95	3 3/4
2 1/2	1 15/16	3/4	1 3/4	2.45	4 1/2
3	2 7/16	7/8	2 1/4	2.95	4 7/8
3 1/2	2 11/16	1	2 1/2	3.45	5 5/8
4	2 11/16	1	3	3.95	5 3/4
4 1/2	3 3/16	1 1/2	3 1/2	4.45	6 1/2
5	3 3/16	1 1/2	3 7/8	4.95	6 5/8
5 1/2	3 15/16	1 7/8	4 3/8	5.45	7 1/2
7	4 1/16	2	5 3/4	6.95	8 7/16
8	4 1/16	2	6 1/2	7.95	8 11/16
9	4 5/8	2 3/8	7 1/4	8.95	8 3/4
10	4 5/8	2 3/8	8	9.95	9 3/4

See Cylinder Catalog for F, G and RT per bore and series.

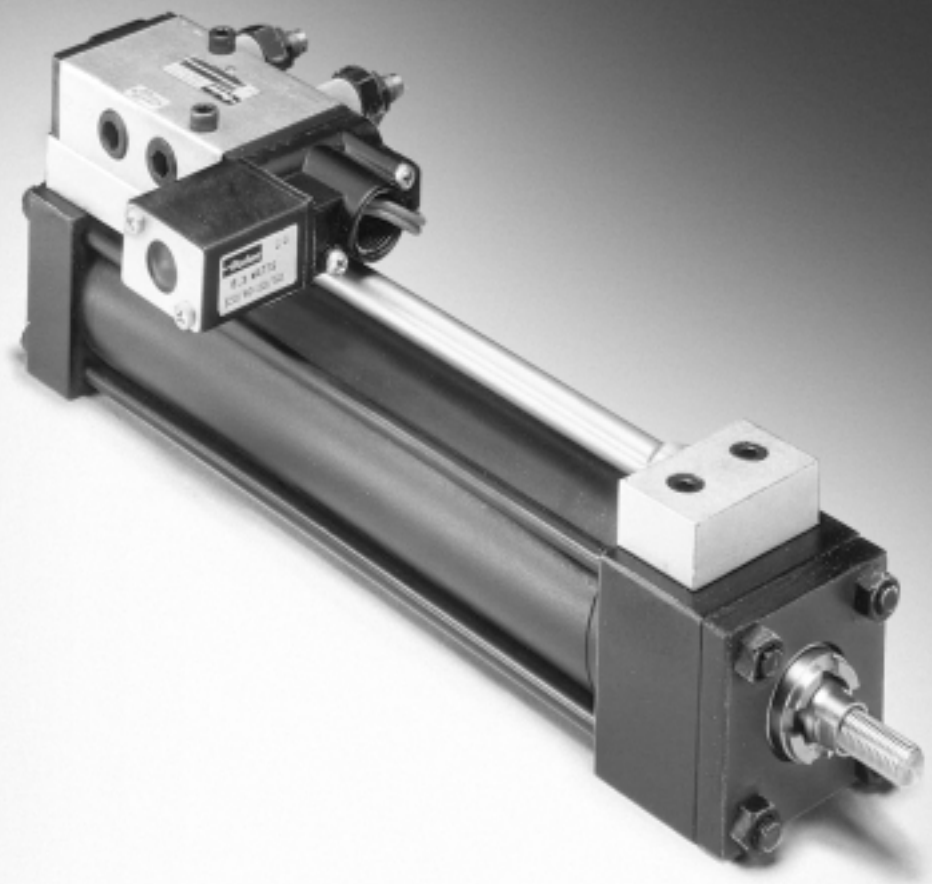
Consult Factory for availability of mounting accessories and Hardware

How To Order

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

Example: 6.0JJ2HKT355X12.0

Parker Introduces the New Compact Air Cylinder/Valve Combination Series “AC42M”…



Featuring

- Manifold Design
- High Speed Capability
- Simple Installation

For additional information – call your local Parker Cylinder Distributor.

Series AC42M
Air Cylinder/Valve Combination

The Parker Series "AC42M" is a truly compact package consisting of time proven Parker components…combining the Marathon "42" Series Inline Pneumatic 4-way Directional Control Valve with the Series 2A or Series MA N.F.P.A. air cylinder.

- N.F.P.A. and ANSI interchangeability
- 17 Standard Mountings
- Operating Pressure Range – 35 to 150 psi
- Operating Temperature Range – 0½F to +165½F
- Manifold Design
- Simple Installation
- High Speed Capability
- User Serviceable Construction

The Cylinders…

Parker Series 2A meets N.F.P.A. specifications and ANSI standard B93.15-1981. The heavy duty Series 2A features the "Jewel" Rod Gland Assembly for positive no leak sealing …the gland cartridge is externally removable without disassembling the cylinder for easier replacement of seals. Piston rods are case hardened and hard chrome plated to guarantee a smooth, dent and scratch resistant surface. One piece fine grained cast iron piston – Long thread engagement provides greater shock absorption. See Series 2A for complete specifications and dimensions.

Parker Series MA is the no compromise design N.F.P.A. industrial air cylinder with hard chrome plated piston rods of 100,000 p.s.i. yield, high tensile strength steel for reliable performance, long rod seal life and less friction.

The bolt-on gland assembly removes screwdriver-easy for fast, on the job seal replacement if needed. Extra long inboard bearing surface insures lubrication from within the cylinder for longer life.

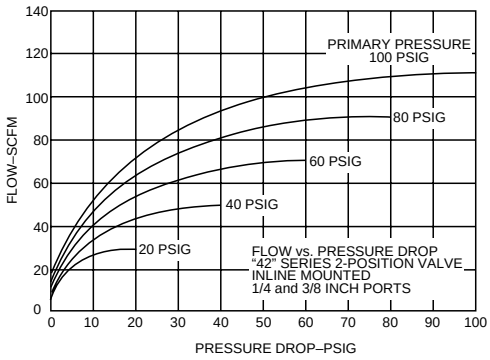
C

The Valve

Parker Marathon "42" Features

- High Flow -C_v of 1.5
- Single Piece Spool with molded Buna-N seals for long trouble-free life
- Class B, Dual Rated, AC or DC solenoids. Consult Factory for voltage specifications
- 18" leads are standard on solenoid connections
- Non-locking manual overrides standard on solenoid operated valves

Performance Characteristics



Valve Configurations

- Single and Double Solenoid Operators
- Single and Double Air Pilot Operators
- 2 position valves standard
- 3 position valves – consult factory
- Single Pressure, Dual Exhaust standard
- Dual Pressure, Common Exhaust – consult factory

Optional Port Flow Control Valves SP37*…

- Exhaust flow is controlled by adjusting orifice
- Flow adjustment is sensitive and linear
- Full size locknut secures selected flow setting
- Exhaust is muffled and dissipated by a multi-layer screen covering the exhaust ports

Specifications

- Pressures up to 150 PSI air
- Operating temperature 0½ to +160½F

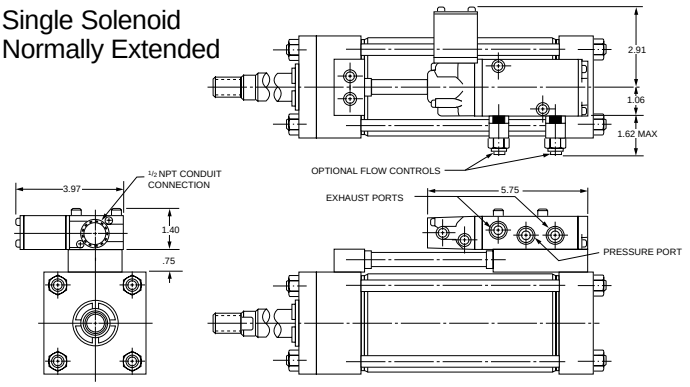
*See How to Order – "Flow Control"

For Cylinder Division Plant Locations – See Page II.

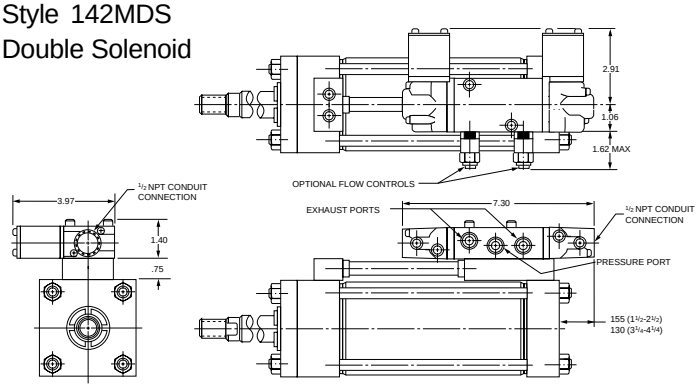
Valve Dimensions

Style 1 – Cap End Valve Dimensions

Style 142MSS
Single Solenoid
Normally Extended

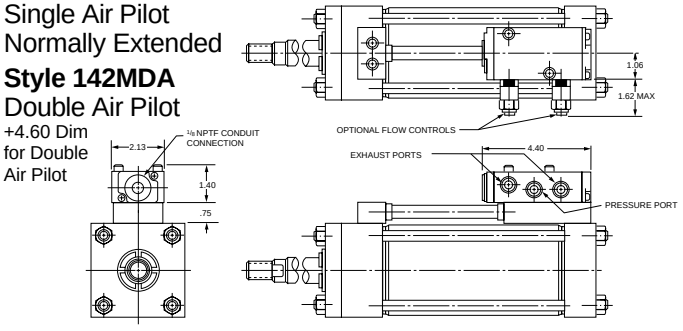


Style 142MDS
Double Solenoid



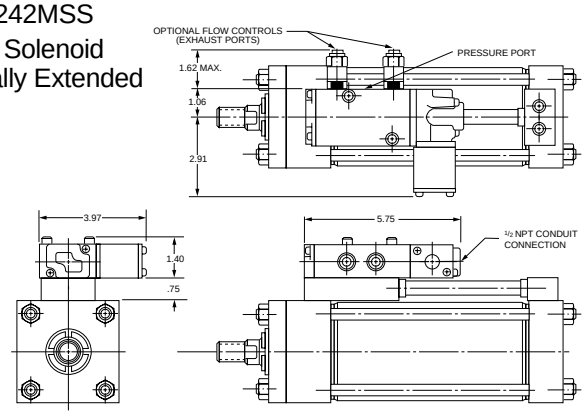
Style 142MSA
Single Air Pilot
Normally Extended

Style 142MDA
Double Air Pilot
+4.60 Dim
for Double
Air Pilot

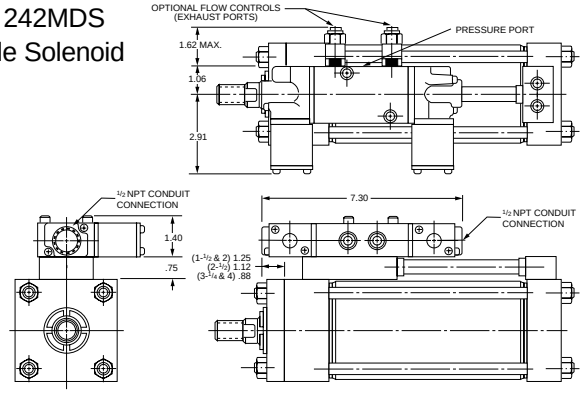


Style 2 – Head End Valve Dimensions

Style 242MSS
Single Solenoid
Normally Extended



Style 242MDS
Double Solenoid



Style 242MSA
Single Air Pilot
Normally Retracted

Style 242MDA
Double Air Pilot

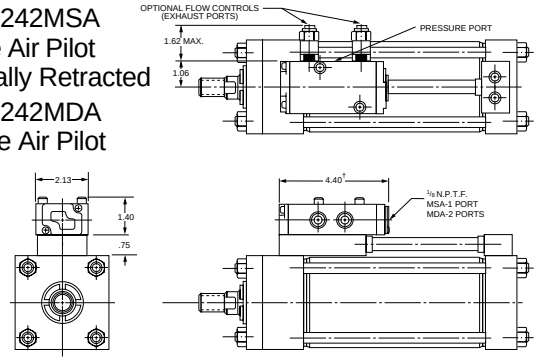


Table A – Mounting Interference by Stroke Length
Minimum stroke lengths in inches are shown as a function of 2 position valve options and cylinder mounting style.

Bore	Valve Style	TB	TC	TD	J	JB	H	HB	BB	BC	D	DB
1 1/2	142MSS	3	0	3	3	3	0	0	0	0	5	N/A
	142MDS	3	N/A	N/A	3	3	N/A	N/A	N/A	N/A	5	N/A
	142MSA/MDA	0	2	2	0	0	0	0	0	0	3	N/A
	242MSS	0	3	3	0	0	3	3	3	3	N/A	5
	242MDS	N/A	3	N/A	N/A	N/A	3	3	3	3	N/A	5
	242MSA/MDA	2	0	2	0	0	0	2	2	0	N/A	3
2	142MSS	3	0	3	3	3	0	0	0	0	5	0
	142MDS	3	N/A	N/A	3	3	N/A	N/A	N/A	N/A	5	N/A
	142MSA/MDA	0	2	2	0	0	0	0	0	0	3	0
	242MSS	0	3	3	0	0	3	3	3	3	0	5
	242MDS	N/A	3	N/A	N/A	N/A	3	3	3	3	N/A	5
	242MSA/MDA	2	0	2	0	0	0	2	2	0	0	3
2 1/2	142MSS	2	0	2	3	3	0	0	0	0	4	0
	142MDS	2	N/A	N/A	3	3	N/A	N/A	N/A	N/A	4	N/A
	142MSA/MDA	0	2	2	0	0	0	0	0	0	3	0

Bore	Valve Style	TB	TC	TD	J	JB	H	HB	BB	BC	D	DB
2 1/2	242MSS	0	3	3	0	0	3	3	3	2	0	4
	242MDS	N/A	3	N/A	N/A	N/A	3	3	3	2	N/A	4
	242MSA/MDA	2	0	2	0	0	0	2	2	0	0	3
3 1/4	142MSS	2	0	2	3	3	0	0	0	0	4	0
	142MDS	2	N/A	N/A	3	3	N/A	M/A	N/A	N/A	4	N/A
	142MSA/MDA	0	0	0	0	0	0	0	0	0	0	0
	242MSS	0	2	2	0	0	3	3	3	2	0	4
	242MDS	N/A	2	N/A	N/A	N/A	3	3	3	2	N/A	4
	242MSA/MDA	0	0	0	0	0	0	0	0	0	0	0
4	142MSS	2	0	2	3	3	0	0	0	0	4	0
	142MDS	2	N/A	N/A	3	3	N/A	N/A	N/A	N/A	4	N/A
	142MSA/MDA	0	0	0	0	0	0	0	0	0	0	0
	242MSS	0	2	2	0	0	3	3	3	2	0	4
	242MDS	N/A	2	N/A	N/A	N/A	3	3	3	2	N/A	4
	242MSA/MDA	0	0	0	0	0	0	0	0	0	0	0

N/A – Not Available due to mounting interference

For additional information – call your local Parker Cylinder Distributor.

Series AC42M
Air Cylinder/Valve Combination

How to Order the Parker Series AC42M Air Cylinder/Valve Combination

The Standard Parker Series AC42M is an air cylinder-valve combination, made up of either of two Parker air cylinders combined with a Parker Marathon 2 position, 4-way control valve.

■ Specify quantity required

■ Specify the Series MA or 2A air cylinders as required by the model number developed from data shown in Table B

■ Specify the Parker "Marathon 42" series air valve by the model number developed from the data shown in Table C.

Table B – Series MA and 2A Model Numbers – How to Develop them –

Parker Series air cylinders can be completely described by a model number consisting of coded symbols of digits and letters used in a prescribed sequence. To develop a model number, select only those symbols that represent the cylinder required, and place them in the sequence indicated by the example below. The example makes use of all places, although many model numbers will not require them all, as in the case where cushioning, double rod, or special modifications are not required.

How to Specify Series MA or 2A Air Cylinders

	Bore Size	Cushion Head End	Double Rod	Mounting Style	Series	Special Features	Piston Rod Number	Piston Rod End	Piston Rod Alternate Threads	Cushion Cap End	Stroke
EXAMPLE	**4**	**C**	**K**	**J**	**MA**	**S**	**1**	**4**	**2**	**C**	**X12**
	Specify 1½" thru 4" Larger bore sizes available on request. Consult factory for details.	Specify only if cushion head end is required.	Use only if double rod cylinder is required.	Specify Mounting Style as applicable in respect to Series ordered: T, TB, TC, TD, J, JB, H, HB, C, E, F, CB, G, BB, BC, D, DB.	Specify Series: MA, 2A	Specify only if special modifications are required, i.e., Cylinder/ valve **Note:** Do not use symbol "S" for rod end modifications.	Specify Rod Code Number.	Specify: Style 4 Small male; Style 8 Intermediate male; Style 9 Short Female; Style 3 Special: Specify KK, A, LA, LAF, W, WF dimension.	Use only for 2X longer than standard rod end thread.	Specify only if cushion cap end is required.	Specify in inches. Show symbol X just ahead of stroke length. Refer to Table for possible stroke interference.

C

Table C – How to Specify Parker Series "AC42M", Single Pressure **, 3/8" Port Size, Dual Exhaust Valve Style

Example		1	42M	DS	120/60
Feature/Description	Symbol				
Valve Mounting Configuration					
Style 1 – Cap End (see page 22)	1				
Style 2 – Head End (see page 22)	2				
All Models	42M				
Solenoid Operator:					
Single Solenoid	SS				
Double Solenoid	DS				
Single Air Pilot	SA				
Double Air Pilot	DA				
Voltage – Standard 120 volt 60 Hz is supplied. Specify if other than standard.	120/60				

Flow Control Valves

If optional flow control valve(s) is required, specify FLOW CONTROL VALVE SP-37.*

Note: Port flow control valve SP-37 is recommended for cylinders 2 ½" bore size and under. When ordered, two flow control valves will be supplied unless otherwise specified.

"Flow control" – Warning, the control of the cylinder flow will not be accurate if load conditions vary. Under extreme load change conditions the cylinder may require additional valving for your control requirements.

Note: For additional valve specifications and dimensional data, see Pneumatic Division Catallog 0600.

**If dual pressure is required, please specify when ordering.

Complete ordering information for

(Quantity) – Series AC42M Air cylinder/Valve Combination unit consisting of:

– 4.00" CJMAS14C x 12.00 Air Cylinder
– 142MDS 120/60 Air Valve
– SP37 Flow Control Valve

For Cylinder Division Plant Locations – See Page II.

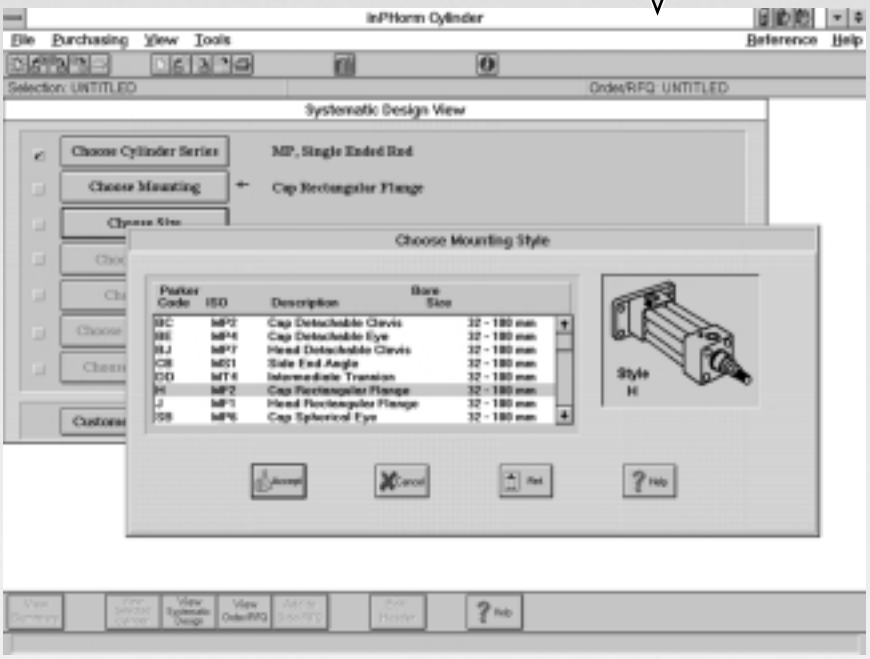
Parker *inPHorm*™ Cylinder Sizing, Selection, and Parametric CAD Software

Parker is pleased to introduce Version 1.5 of ***inPHorm*™ for Cylinders.** This program allows you to select the proper Parker cylinder for your application. ***inPHorm* for Cylinders** will increase your efficiency and minimize the engineering time required to design in cylinders. This new release, ***inPHorm* 0860 CD/USA Version 1.5** has been updated with new product lines and seal kit information.

***inPHorm* for Cylinders** is written for use with Windows, which makes it extremely user friendly. You can use the program to develop a model number. ***inPHorm* for Cylinders** guides you through the selection process, performs the calculations, and eases the process of sorting through catalog drawings, charts and tables. You can also employ the "Direct Part Number Entry" module to input a known model number. In either case, you can view a dimensioned drawing, generate a print or DXF file and even create a quote request or order form.

"Advisor" options within the program offer additional assistance with special modifications and design considerations.

THE UPDATED VERSION 1.5 NOW ON CD



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System Highlights

- **Cylinder Sizing and Selection**
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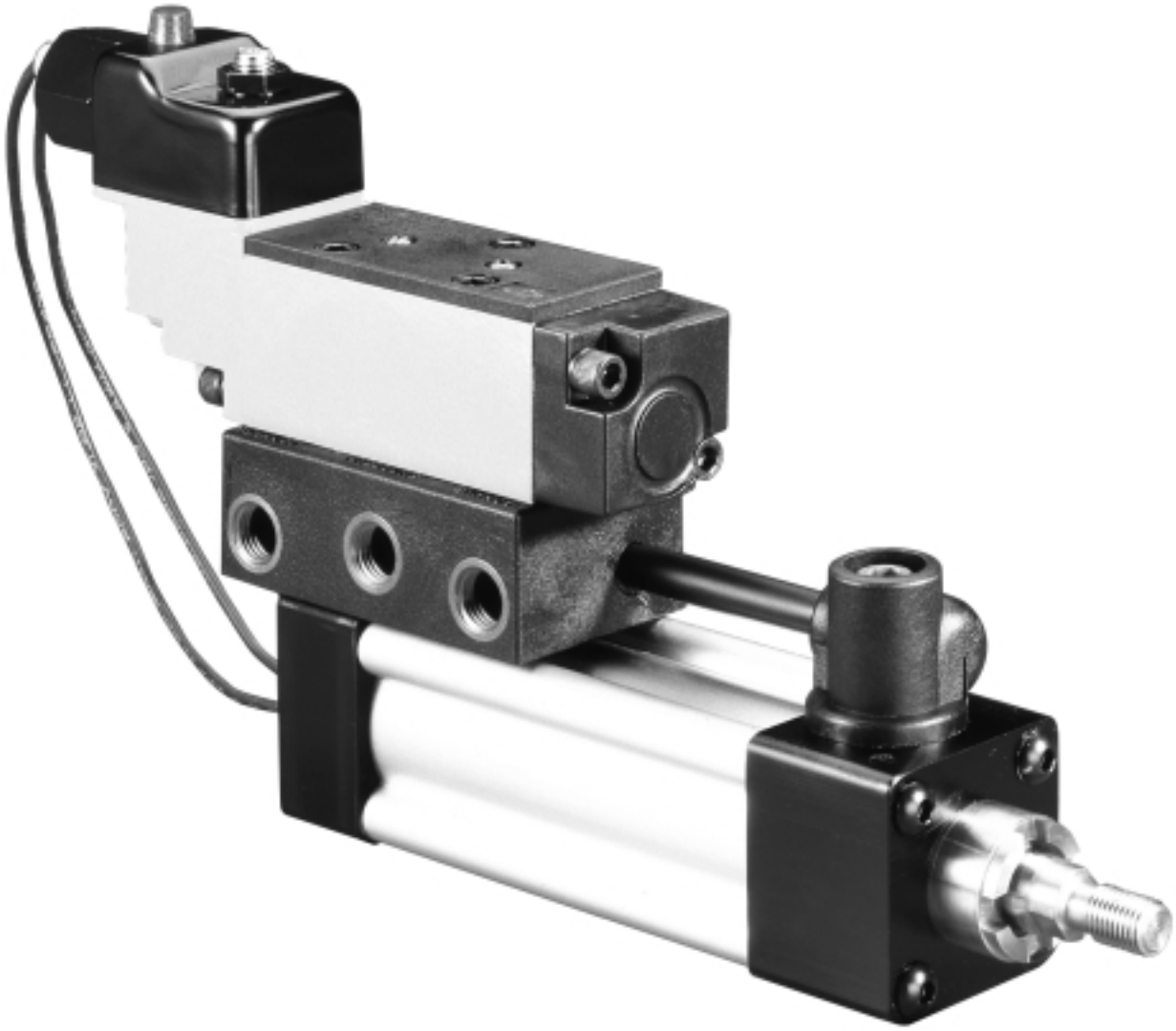
Worldclass Quality Products and Service

Parker Cylinder

Parker Introduces the New Lightweight Air Cylinder "L7" Valve Combination



C

Featuring

- Lightweight manifold design
- Easy installation
- Compact package

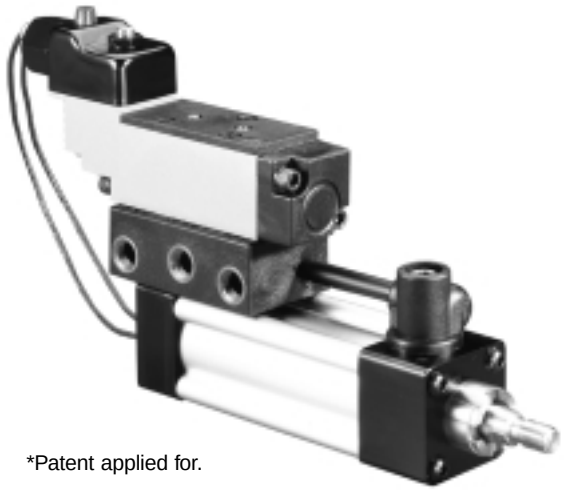
For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

“L7” Air Cylinder/Valve Combination

The “L7” Air Cylinder/Valve Combination is a lightweight compact package that is easily installed. The package incorporates a high quality, high performance pneumatic directional control valve, and a lightweight durable plastic manifold, which can be used with any standard N.F.P.A. pneumatic cylinder, $1^1/_2$" through 4" bore, with standard N.P.T. or N.P.T.F. ports.

- Lubricated or Non-Lubricated Service
- Operating Pressure Range — 35 to 150 psi
- Operating Temperature range — 0½F to +160½F
- Superior Controllability
- Lightweight Manifold Design*
- Simple Installation
- User Serviceable Construction
- Manifold/Valve Combination fits any standard NFPA Air Cylinder — 11/2" through 4" bore



*Patent applied for.

The L7...Valve Features

- **High Flow** (Nominal Cv = 1.5).
- **Suitable for Lubricated or Non-Lubricated Service.**
- **Fast Response.**
- **1/4" NPT Port.**
- **Locking Manual Overrides are Standard. Non-Locking Manual Overrides are Optional.**
- **Indicator Lights are Standard** on 120V AC models, optional on 24V DC Models.
- **Precision Ground Pre-Lubed Spool** “floats” on O-ring seals, closed center crossover design saves air.
- **Epoxy Encapsulated Coils** (Class ‘B’ rated) are designed for low power consumption and maximum life, even under continuous duty service.
- **CSA - Selected Voltages** have been approved for General Purpose Applications by the Canadian Standards Association.

Flow Capacities

The capacity curves shown in the chart are for theoretical valve having a Cv-1.0 for air at standard conditions – temperature 68½F, 36% relative humidity and 14.7 PSI absolute pressure.

To estimate the SCFM capacity of a valve, if the supply or initial pressure is known, proceed as follows:

Assuming initial pressure is 100 PSIG, select the 100 PSI initial pressure curve and follow it upward and to the left edge of the chart. Read the flow in SCFM (in this example flow is approximately 56 SCFM). Multiply the SCFM flow obtained in the chart by the Cv for valve and flow path desired shown in the accompanying table.

To estimate valve size for a known required flow and initial pressure, divide the required SCFM flow by the SCFM obtained from the flow chart. Select the required valve size from the valves listed in the table which have a Cv that slightly exceeds the quotient.

For example: Assuming 80 SCFM required flow, 100 PSIG initial pressure, divide 80 SCFM by 56 SCFM (max. flow from chart). The quotient is 1.42 (80/56-1.42). Valves with a Cv of 1.42 or greater selected from the table will provide the required flow.

To estimate flow capacity at a specific “final pressure,” locate the desired final pressure on the bottom scale of the chart. Follow a vertical line upward until it intersects the initial pressure curve. Then follow a horizontal line from that point to the left edge of the chart. Read SCFM flow. Multiply SCFM obtained in chart by Ov of selected valve for flow.

Cv Method
Data at Std. Conditions
68½F Temp
14.7 PSI Abs. Pressure
36% Relative Humidity

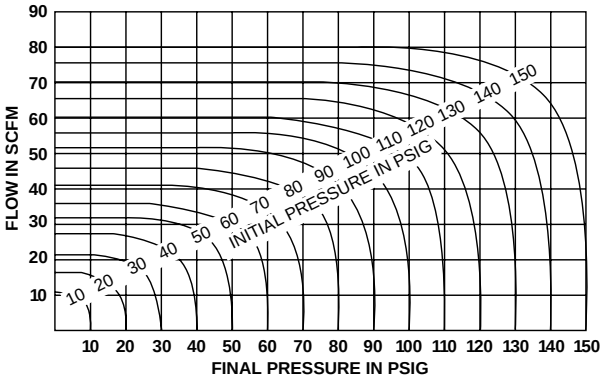
$$Q = 22.48Cv \sqrt{\frac{(\#Pc) \times (P_2)}{(T_1) \times (G)}}$$

Cv = Flow Coefficient

G = Specific Gravity of fluid related to air x 1@ 14.7 psia, 68½F, 36% Relative Humidity
P_2 = Downstream Pressure (psia)
#Pc = Component pressure drop
Q = Flow Rate (scfm) at 14.7 psia, 68½F, 36% Relative Humidity
T_1 = Upstream Temperature ½R (½R = ½F +460)
Flow Rating determined in accordance with NFPA recommended Standard NFPA/T3.21.3-1972.

Valve Configurations

- Single solenoid operator – standard
- Double solenoid operator – available
- 2 position valves standard
- 3 position valves – consult factory
- Single Pressure, Dual Exhaust standard
- Sandwich Regulators – consult factory
- Sandwich Flow Controls – consult factory

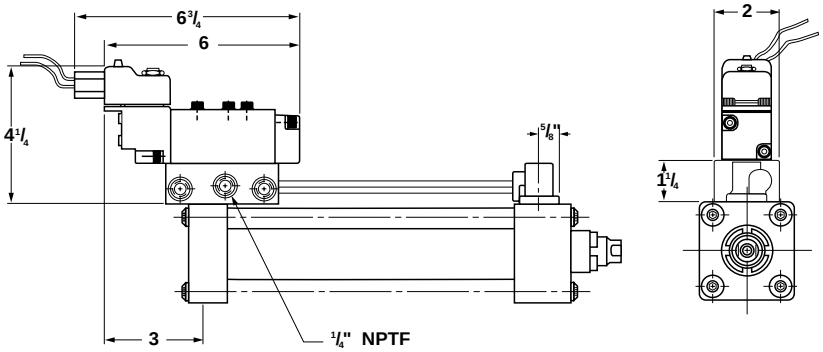


For additional information – call your local Parker Cylinder Distributor.

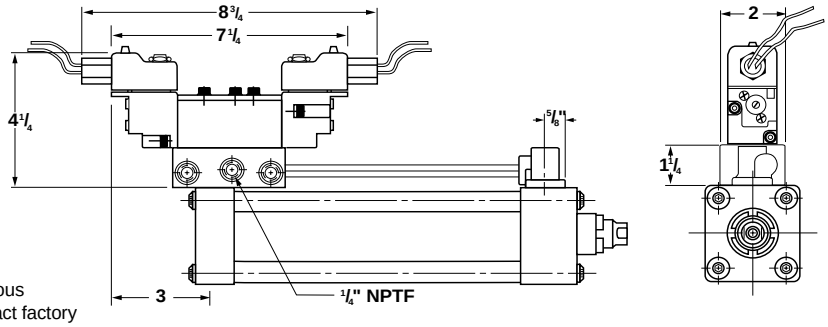
Valve Dimensions

Style 1 — Cap End Valve Dimensions

Style 1L7SS*
Single Solenoid,
Normally Retracted



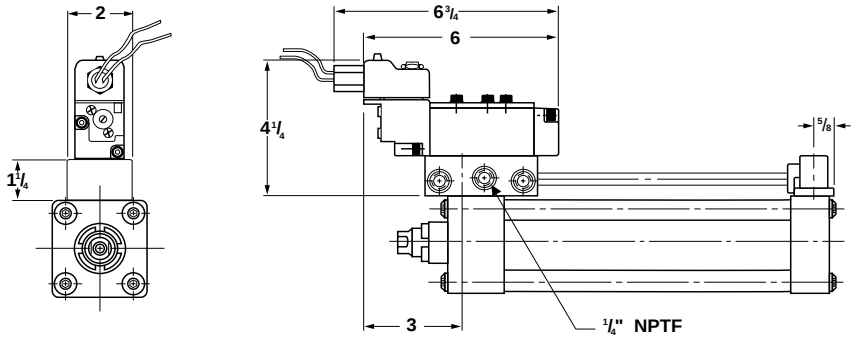
Style 1L7DS*
Double Solenoid



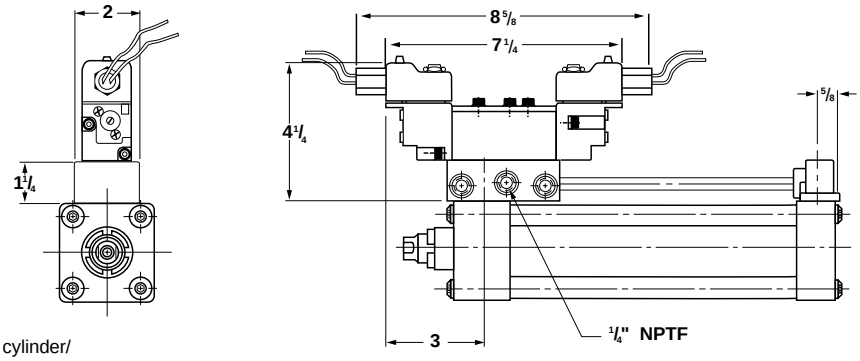
Note: The "L7" valve may interfere with various mounting styles in some applications. Contact factory for recommendations of mounting.

Style 2 — Head End Valve Dimensions

Style 2L7SS*
Single Solenoid,
Normally Retracted



Style 2L7DS*
Double Solenoid



*Note: Minimum stroke requirement for "L7" cylinder/ valve is 1" on all bore sizes.

For Cylinder Division Plant Locations – See Page II.

"L7" Valve Mounting Accessory Package

Cylinder Bore Size	Cylinder Stroke	Accessory Package Part Numbers	
		Manifold Mounting Accessory Package	Transfer Tube Accessory Package
$1^1/_2$, 2, $2^1/_2$	Thru 20"	L074270000	L074290000
	20" thru 40"		L074300000
$3^1/_4$, 4	Thru 20"	L074280000	L074290000
	20" thru 40"		L074300000

Note: Order manifold mounting accessory package and transfer tube accessory package in order to have complete assembly accessory package.

Available Valve Accessories

■ Flow control "sandwich" to meter cylinder exhaust through valve.

■ Regulators, "sandwich" 5 to 125 psig without guage.

Manifold Mounting Accessory Package Consists of:

(1) Cap Screw	(2) O-Rings, Transfer Tube
(1) Sealed Cap Screw	(2) Adapter Fittings
(2) O-Rings, Manifold	(1) Packet of Grease
(1) Manifold, Valve	(1) Manifold, Transfer

Transfer Tube Accessory Package Consists of:

(1) Transfer Tube

"L7" Valve Model Numbers

Two Position	Valve Part Number
Single Solenoid, Head or Cap End	L7452410153
Double Solenoid, Head or Cap End	L7552410253

Standard Valve Model Number Interpretation

	Type	Operator	Size	Operator Options	Enclosure	Function	Return	Voltage
L	74	5	2	4	1	0	1	53

Type
74 - Single
75 - Double

Operator
5 - Solenoid

Size
2 - 1/4" Basic Cv = 1.5

Operator Options
4 - Sol. w/Locking Override & Indicator Light (120V AC)

Enclosure
1 - Conduit Connection @ Solenoid (coil w/19" Leads)

Function
0 - 2-Position

Return
1 - Air & Spring (Use w/Single Operator Types)
2 - Operator Return (Use w/Double Operator Types)

Voltage
45 - 12V DC **53 -** 120V 60Hz **57 -** 240V 60 Hz **49 -** 24VDC

For additional information – call your local Parker Cylinder Distributor.

How to Specify “L7”, Single Pressure, 1/4" Port Size, Dual Exhaust Valve Style

Example		1	L7	DS	120/60
Feature/Description	Symbol				
Valve Mounting Configuration					
Style 1 – Cap End	1				
Style 2 – Head End	2				
All Models	L7				
Solenoid Operator:					
Single Solenoid	SS				
Double Solenoid	DS				
Voltage – Standard 120 volt 60 Hz is supplied. Specify if other than standard.	120/60				

Example When ordering 2A Cylinders with “L7” Cylinder/Valve Combination

Complete Ordering Information for

(Quantity) 2.50 F 2AUS14A x 6.00

S = 1L7SS-120/60 Air cylinder/valve combination

Consisting of:

L 7452410153 Valve
L 07429000 Transfer Tube
L 074270000 Manifold
K 342004 Flow Control

Note: For additional valve specifications and dimensional data, see Pneumatic Division Catalog.

If optional control valve(s) is required, specify FLOW CONTROL VALVE Model No. K342004. If optional sandwich regulator is required, specify Regulator Model No. L85403203N.

Optional Mounting Accessories

Specify separately the part number for desired optional mounting accessories.

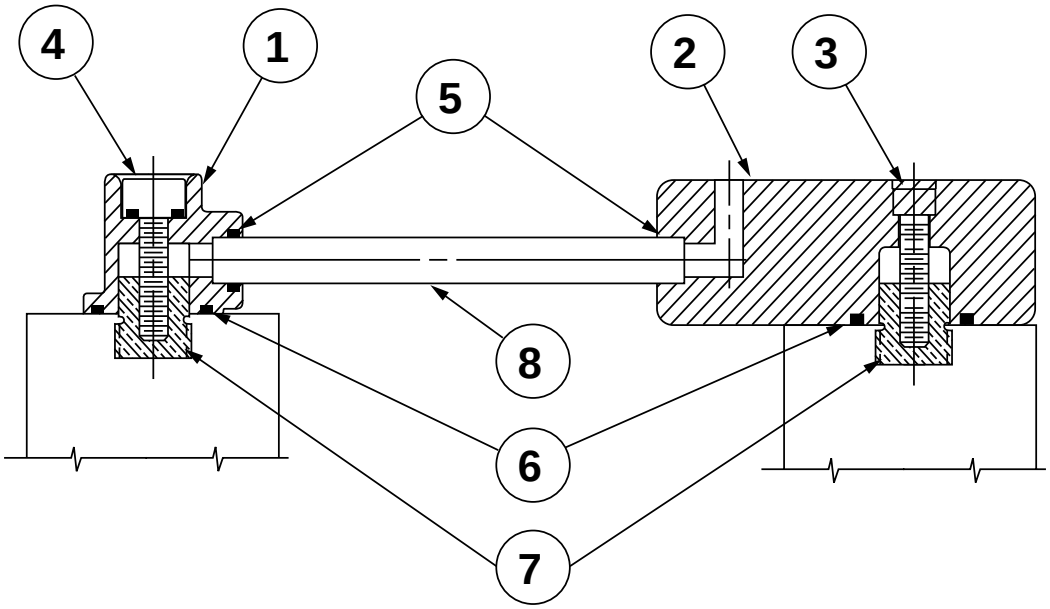
Note: TT Mounting not available with “L7” Cylinder/Valve combination. The “L7” valve may interfere with various mounting styles in some applications. Consult factory for recommendations.

C

Assembly Instructions for "L7" Cylinder/Valve Combination Mounting Kit

Warning: This valve mounting kit is designed for use only with standard N.F.P.A. Pneumatic Cylinders. Some valves are available with air pilots; these are not functional with the manifold.

Tools Required: 3/16" Allen Wrench, Tube Cutting Vise, Fine File, I.D. De Burring Tool, 1/4" Allen Wrench, 3/8" Open End Wrench, Hacksaw.



Step #1: Install adapter fittings (7) into each cylinder port. Adapter fittings should be wrench tightened into ports snugly. Sealant is not required.

Step #2: Install O-Rings (5) and (6) into each manifold using enclosed grease to lubricate seals prior to installation.

Step #3: Cut tube (8) to appropriate length, based on formula given on reverse side.

Parts Identification List

Symbol No.	Description	Quantity for Assembly
①	Transfer Manifold	1
②	Valve Manifold	1
③	Anti-Vibration Cap Screw	1
④	O-Ring Cap Screw	1
⑤	Transfer Tube O-Ring	2
⑥	Manifold O-Ring	2
⑦	Adapter Fitting	2
⑧	Transfer Tube	1

To determine the appropriate transfer tube length, first determine the distance between port centerlines for the cylinder, typically catalog dimension “P”. The cut length of the tube should be based on the following formula:

[“P” + Stroke - 2.500"] ±.015"

Example:

For a $2^{1}/_{2}$" bore, 10" stroke air cylinder with “P” dimension = $2^{3}/_{8}$", the calculation to determine the transfer tube length is:

$2^{3}/_{8}$" + 10.00" stroke - $2^{1}/_{2}$" = 9.875 ± .015

NOTE: Recommended Cutting Procedure: Use a hacksaw with a tube cutting vise. This will ensure that tube ends are square and that the tube does not have a reduced diameter, as would result from using a tube cutter.

Step #4: Remove all burrs and sharp edges from tube ends, I.D. and O.D.

Step #5: Wash tube O.D. and I.D. completely –

Tube I.D. must be free of all burrs, contaminants and foreign materials.

Step #6: Pre-assemble manifolds and transfer tube prior to placement onto adapter fittings.

Step #7: Place manifold and tube assembly onto adaptor fittings.

NOTE: Refer to Bulletin #0946-B1 to determine proper orientation of manifold and tube assembly to achieve proper function of cylinder. Example: Single solenoid normally extended.

Step #8: Place anti-vibration cap screw (3) into screw cavity of valve manifold, place O-Ring cap screw (4) into screw cavity of transfer manifold (1). Tighten each screw with appropriate allen wrench to 24 inch pounds.

NOTE: Overtorquing of these screws could cause manifold damage.

Step #9: Install valve in accordance with valve installation instructions.

C

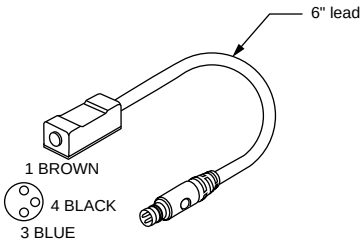
Magnet Actuated Switches with Quick Connect

Magnet Actuated Switches are available for Series SRM, P, 2MA, MP, and RC cylinders. Refer to the appropriate Catalog information for electrical specifications on each switch. The standard lead wire length is 39" (1 meter).

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

Quick Connect Option

(Switch shown without mounting brackets)



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

Switches with 6" Lead and Quick Connect Male End

Series	Reed	NPN Sinking	PNP Sourcing
SR, P	145903000C	146714000C	146715000C
MA	L07448000C	L07450000C	L07449000C
2MA			
(1½"-2½", 5",6")	L07486000C	L07488000C	L07491000C
(3¼", 4",8")	L07487000C	L07490000C	L07492000C
MP			
32mm, 40mm	L07525000C	L07528000C	L07531000C
50mm, 63mm	L07526000C	L07529000C	L07532000C
80mm, 100mm	L07527000C	L07530000C	L07533000C
RC	L07480000C	L07481000C	L07482000C

Cordset with Female Quick Connect (Order Separately)

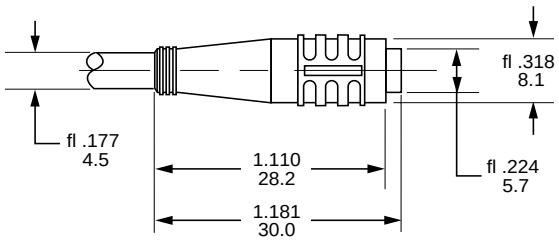
A female connector is available for all switches with the male quick connect option. The male plug will accept a snap-on or threaded connector. Cylinder Division cordset part numbers and other manufacturer's part numbers are listed below:

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

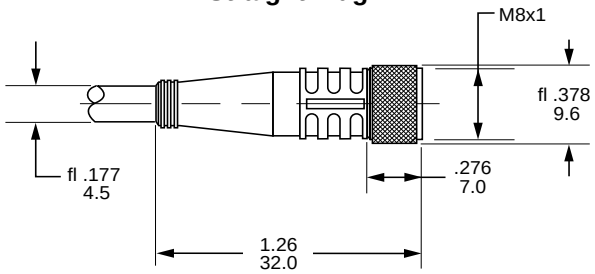
Cordset Specifications:

Connector:	Oil resistant polyurethane body material, PA6 (Nylon) contact carrier, spacings to VDE 0110 Group C, (30 VAC/36 VDC)
Contacts:	Gold-plated beryllium copper, machined from solid stock
Coupling Method:	Snap-Lock or chrome-plated brass nut
Cord Construction:	Oil resistant black PUR jacket, non-wicking, non-hygroscopic, 300V. Cable end is stripped and tinned.
Conductors:	Extra-high flex stranding, PVC insulation
Temperature:	-40 to 194½F (-40 to 90½C)
Protection:	NEMA 1,3,4,6P and IEC 1P67
Cable Length:	16.4 Ft. (5m)

Snap-On Straight Plug



Threaded Straight Plug



For additional information – call your local Parker Cylinder Distributor.

Parker *inPHorm*™ Cylinder Sizing, Selection, and Parametric CAD Software

Parker is pleased to introduce Version 1.5 of ***inPHorm***™ **for Cylinders.** This program allows you to select the proper Parker cylinder for your application. ***inPHorm*** **for Cylinders** will increase your efficiency and minimize the engineering time required to design in cylinders. This new release, ***inPHorm*** **0860 CD/USA Version 1.5** has been updated with new product lines and seal kit information.

inPHorm **for Cylinders** is written for use with Windows, which makes it extremely user friendly. You can use the program to develop a model number. ***inPHorm*** **for Cylinders** guides you through the selection process, performs the calculations, and eases the process of sorting through catalog drawings, charts and tables. You can also employ the "Direct Part Number Entry" module to input a known model number. In either case, you can view a dimensioned drawing, generate a print or DXF file and even create a quote request or order form.

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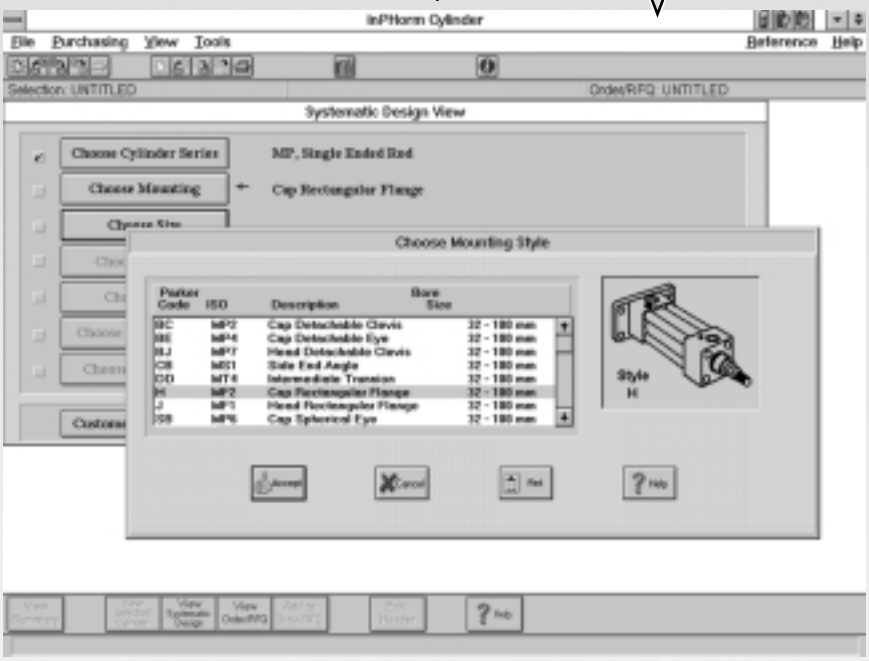

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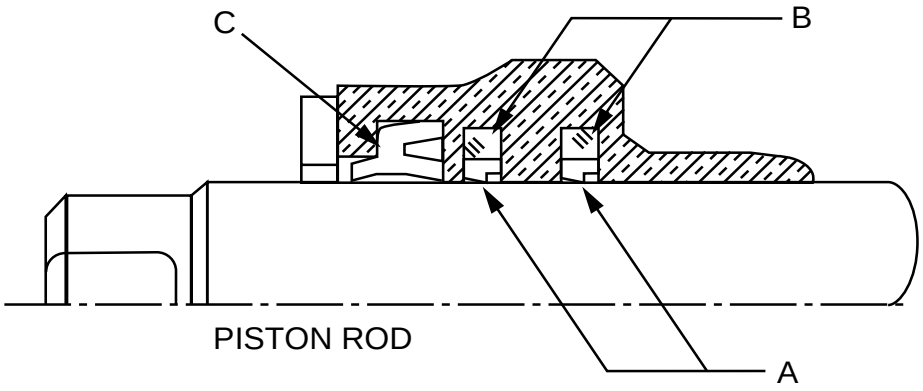
Worldclass Quality Products and Service

Parker Cylinder

Parker Series 2H Hydraulic and Series 2HX Electrohydraulic Cylinders with Low Friction Seal Option
High Performance Cylinders For Your Demanding Applications

- Smooth-running operation – reduces “slip-stick” or “chatter”
- Ideally suited for use in servo applications
- Bronze-filled PTFE material for low friction, rapid break-in and long service life
- Innovative seal geometry for maximum sealing efficiency

Low Friction Rod Gland



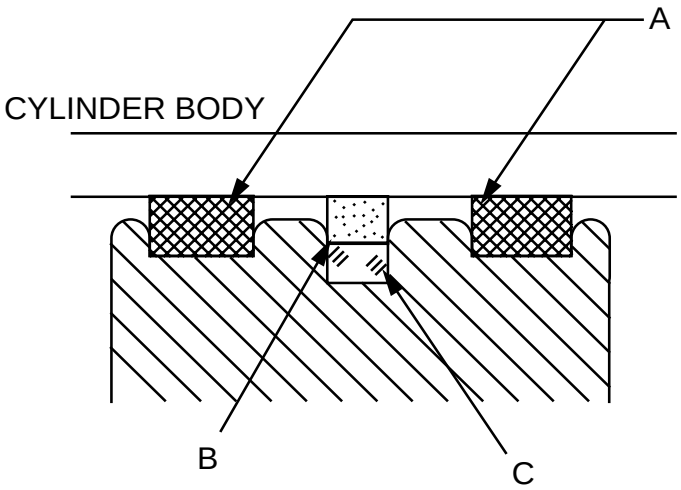
A - Dual step-seal rod seals insure positive sealing and smooth operation up to 3,000 PSI.

B - Square ring elastomer expander for pressure compensation and low pressure effectiveness.

C - Dual lip wiper keeps contaminants out.

D - Available in 1", $1^{3}/_{8}$", $1^{3}/_{4}$", 2", $2^{1}/_{2}$", 3", $3^{1}/_{2}$", 4", $4^{1}/_{2}$", 5", $5^{1}/_{2}$" diameter piston rods.

Low Friction Piston



A - Dual bronze-filled PTFE piston bearings for high load capacity, low friction and no metal-to-metal contact.

B - Bronze filled PTFE piston seal insures maximum sealing efficiency.

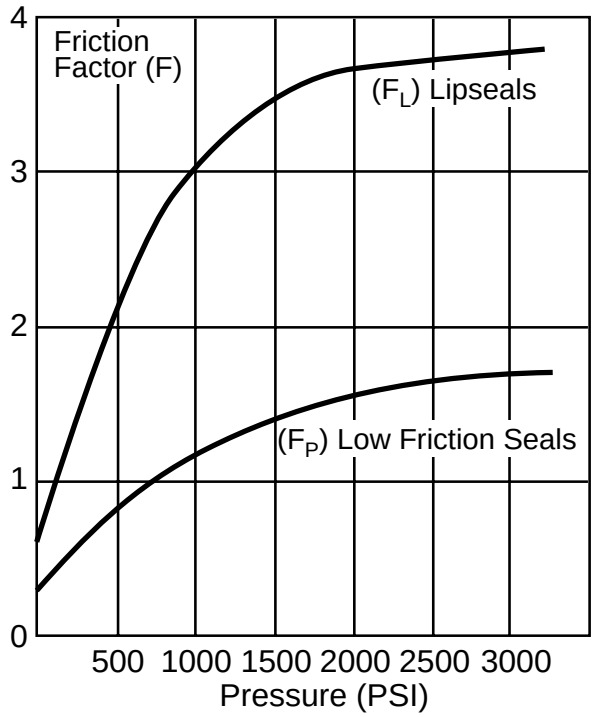
C - Square-ring elastomer expander for pressure compensation

D - Available in 2", $2^{1}/_{2}$", $3^{1}/_{4}$", 4" and 5" diameter piston rods.

For additional information – call your local Parker Cylinder Distributor.

Seal Friction

Seal friction under a given set of working conditions is not easily calculated due to the multiplicity of variables involved. The following graphs are offered as a guide for use in performance calculations, but for critical application measurements should be made under simulated or actual working conditions.



Calculation of Running Friction

The seal friction attributable to the cylinder is calculated as the sum of the friction due to the individual sealing elements = (wiper seal friction + rod seal friction + piston seal friction), using the following formulae:

Seal Option:	**Formula:**
Lipseal Rod + Piston	$12d + 12 F_Ld + 24 F_LD$
Lipseal Rod w/Low Friction Piston	$12d + 12 F_Ld + 12F_pD$
Low Friction Rod + Piston	$12 + 30 F_pd + 6 F_pD$

Where: d = rod dia. (in.) D = bore dia. (in.)
F_L = friction factor for lipseals (F_L)
F_p = friction factor for PTFE (F_p)

Breakaway Friction:

Breakaway friction may be calculated by applying the following correction factors:

Correction factors:
Lipseals: F_L x 1.5
Low Friction: F_p x 1.0

Sample Calculation:

2HX Cylinder with 3.25 dia. bore + 1.75 dia. piston rod with low friction seals at 1500 PSI.

Running Friction Calculation:

Friction (lbs. force) ♠ $12d + 30F_pd + 6F_pD$

Friction (lbs. force) ♠ 12(1.75) + 30 (1.3 x 1.75) + 6(1.3 x 3.25)

Friction (lbs.force) ♠ 115

Breakaway Friction Calculation:

F_p x 1.0 ♠ F_p

Based on zero pressure:

Friction (lbs. force) ♠ $12d + 30F_pd + 6F_pD$

Friction (lbs. force) ♠ 12(1.75) + 30(.3 x 1.75) + 6(.3 x 3.25)

Friction (lbs. force) ♠ 43

Specifications for Low Friction Option:

Operating Pressure: 0 - 3000 PSI

Operating Temperature: -10½F to +160½F.
For higher temperatures, consult factory.

Fluid Media: Petroleum based hydraulic oils.
For other fluids, consult factory.

How to Order Low Friction Option for Series 2H or 2HX Cylinders

When ordering series 2H or 2HX cylinders, place an "S" in the model number for "special" and specify the following:

"Low friction piston and rod seals."

Consult current electrohydraulic cylinder catalog for detailed cylinder model number system.

Consult factory for availability of gland drain or other options.

C

Special Cylinders

Parker has the sales, engineering and manufacturing capability and experience to provide special cylinder designs to meet your specific applications. Working with Parker expertise will help you maintain the high standards demanded by the modern technology of today …and tomorrow.

Pneumatic cylinders still stroking after 40 years

Pair of 36-inch bore tandem pneumatic cylinders. Both 12.5" stroke cylinders operate on 100 psi air.

For additional information – call your local Parker Cylinder Distributor.

NASA Space Shuttle…

In a typical aborted simulated liftoff profile, the hydraulic cylinders must accelerate the 10,000 pound sled to a speed of 2 inches per second for 10 inches, then reverse direction with a 1 G downward acceleration to 7.5 feet per second for 6 inches to simulate rebound. Sled movement must then be decelerated smoothly and stopped in 7.5 inches of additional travel.

The cylinders were designed to achieve a maximum piston speed of 7.5 feet per second and exert forces to 70,000 pounds maximum, the cylinder must handle up to 430 gpm of oil at pressures to 4000 PSI, requiring a cylinder output of 1000 hp.

The specification regarding oil leakage was extremely tight. For example, external leakage was to be zero. Internal leakage around the piston at the mid-stroke position could be no more than 5 cc per 24 hours when pressurized to 4000 psi gage on one side and zero psi gage on the other. This low leakage level was also to be maintained when the piston was pressurized on both sides.

The cylinders passed all NASA requirements and performed with excellent results.

Flight Simulator…for training pilots

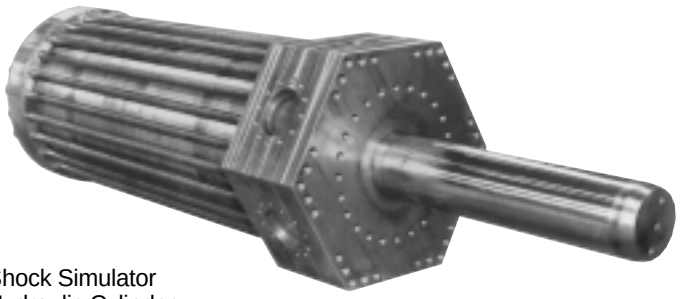
The 6 degree of motion platform is supported by six special design 3 1/2” bore x 56” net stroke hydraulic cylinders operating at 1200 PSI (nominal pressure 2000 PSI).

Design features include pressurized hydrostatic bearings for low friction operation, piccolo type cushions for predictable and reliable performance in this critical application and built in transducers in the piston rod to detect platform position.

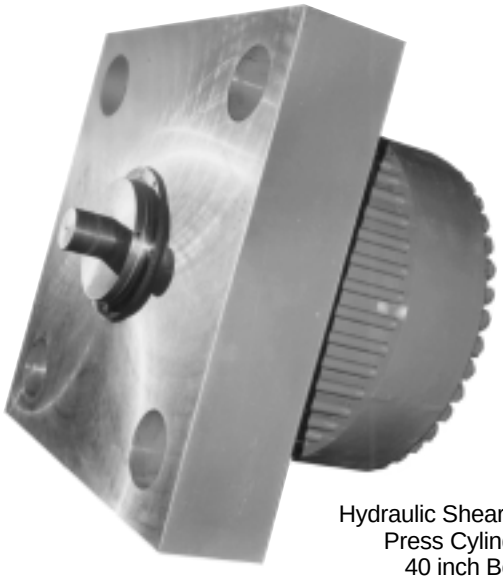
For Cylinder Division Plant Locations – See Page II.

Special Cylinders

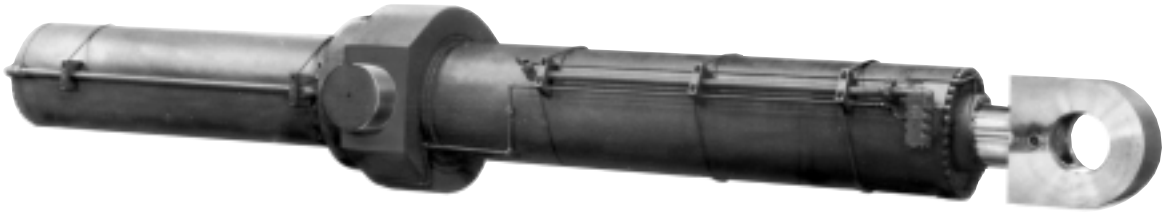
Your imagination and Parker engineering…



Shock Simulator
Hydraulic Cylinder
6000 PSI Operating Pressure
20 inch Bore x 45 1/2 inch Stroke



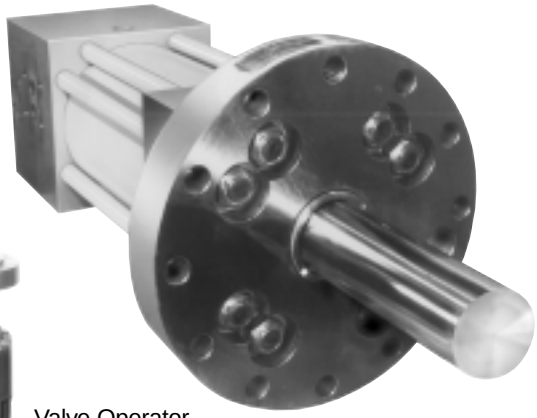
Hydraulic Shearing
Press Cylinder
40 inch Bore
x 6 inch Stroke
20 inch Diameter Rod
3000 P.S.I. operating pressure



Boom Hoist Hydraulic Cylinder
19 inch Bore x 145 inch Stroke
10 inch Diameter Rod

Duplex Hydraulic Cylinder for
Hydraulic Rotating Chuck
8 inch Bore x 2 inch Stroke
12 1/2 inch bore x 9/16 inch Stroke
1000 P.S.I. operating pressure

Special 2H Duplex Rotary Hydraulic Cylinder
All Ports Located in Piston Rod
12 inch Bore x 9/16 inch Stroke
8 inch bore x 2 inch Stroke
1000 P.S.I. operating pressure

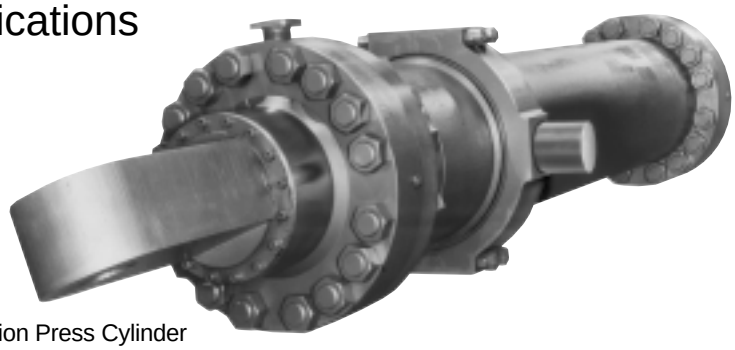


Valve Operator
8 inch Bore and 10 inch Stroke
1600 P.S.I. operating pressure

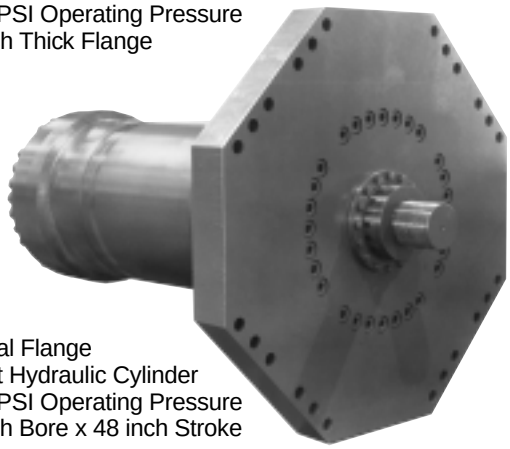
For additional information – call your local Parker Cylinder Distributor.

the keys to unexplored applications

Special Hydraulic Cylinder
40 inch Bore x 20 inch Stroke
30 inch Diameter Rod
Single Acting Rear Flange Mounted

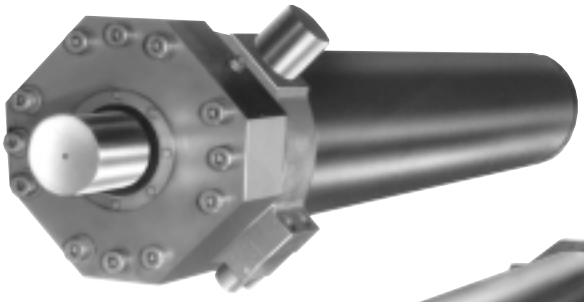


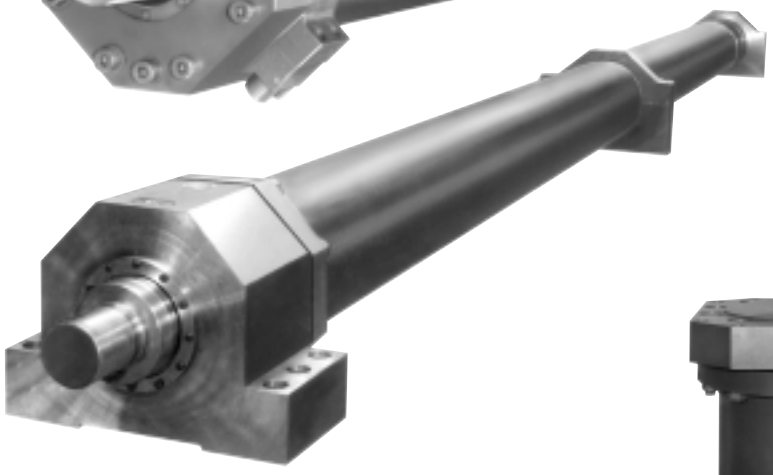
Extrusion Press Cylinder
3000 PSI Operating Pressure
12 inch Thick Flange



Special Flange
Mount Hydraulic Cylinder
2000 PSI Operating Pressure
24 inch Bore x 48 inch Stroke

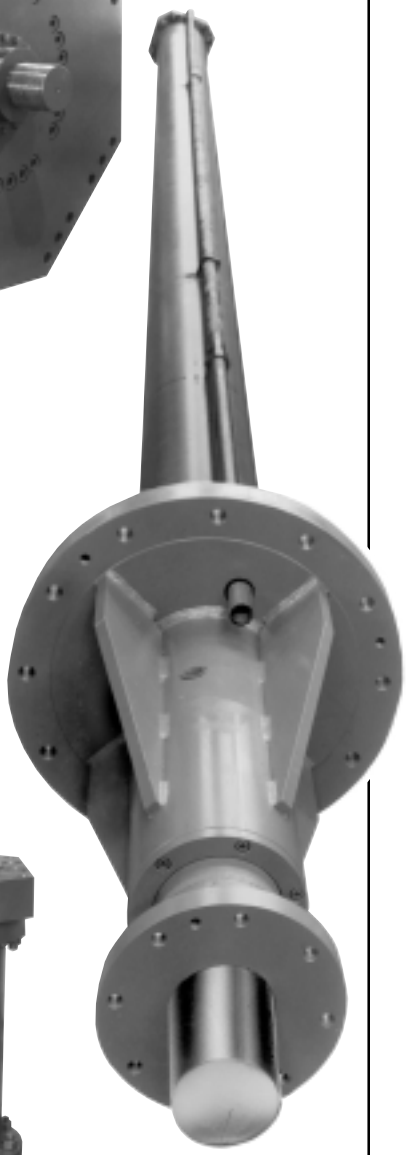
Double-Cut Shear Cylinder
3000 PSI Operating Pressure
14 inch Bore x 101 inch Stroke





Special Stroke Hydraulic Cylinder
14 inch Bore x 27 foot Stroke
Hollow $8^{1}/_{2}$ inch Diameter Rod

JB Mount, Ring Design
Air Cylinder
20 inch Bore x $21^{7}/_{8}$ inch Stroke
Cushioned Both Ends



Special Flange Mounted
Hydraulic Cylinder
2000 PSI Operating Pressure
10 inch Bore x 336 inch Stroke

C

For Cylinder Division Plant Locations – See Page II.

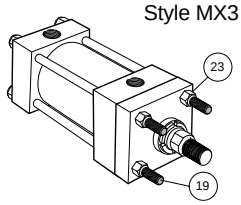
Parker
Cylinder

Cylinder Parts Identification and Seal Kit Data

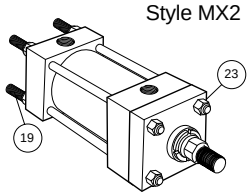
Index

For additional information – call your local Parker Cylinder Distributor.

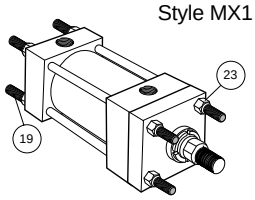
TB NFPA
Style MX3



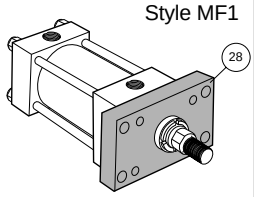
TC NFPA
Style MX2



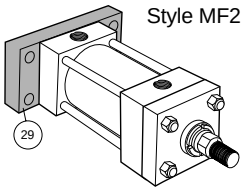
TD NFPA
Style MX1



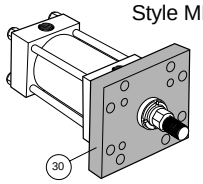
J NFPA
Style MF1



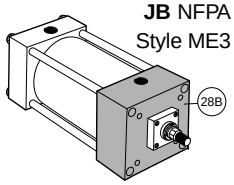
H NFPA
Style MF2



JB NFPA
Style MF5

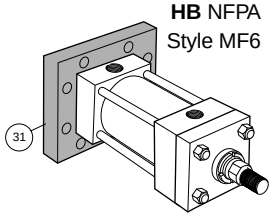


JB NFPA
Style ME3

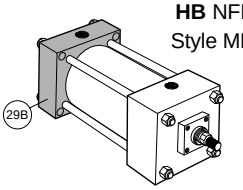


7" thru 14" Series 2A
8" Bore Series 3L

HB NFPA
Style MF6

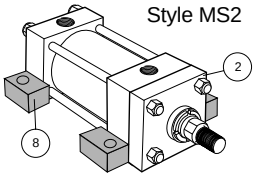


HB NFPA
Style ME4

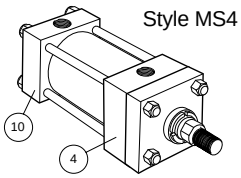


7" thru 14" Series 2A
8" Bore Series 3L

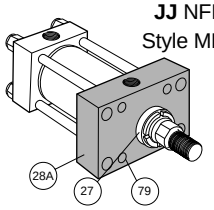
C NFPA
Style MS2



F NFPA
Style MS4

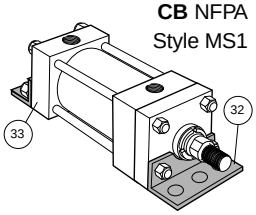


JJ NFPA
Style ME5

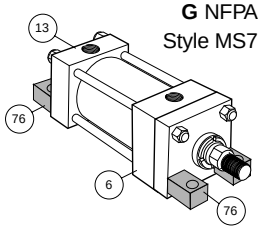


Screws Not Shown

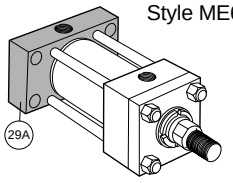
CB NFPA
Style MS1



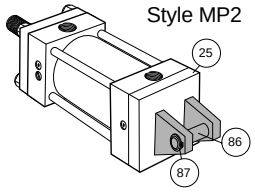
G NFPA
Style MS7



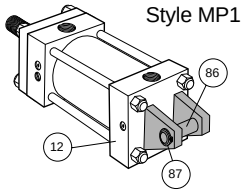
HH NFPA
Style ME6



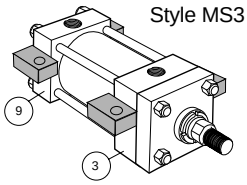
BC NFPA
Style MP2



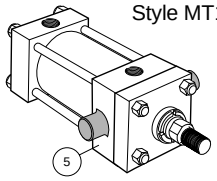
BB NFPA
Style MP1



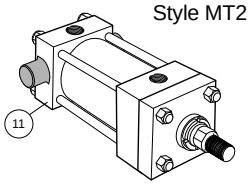
E NFPA
Style MS3



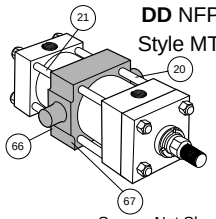
D NFPA
Style MT1



DB NFPA
Style MT2



DD NFPA
Style MT4



Screws Not Shown

Replacement Mountings & Hardware

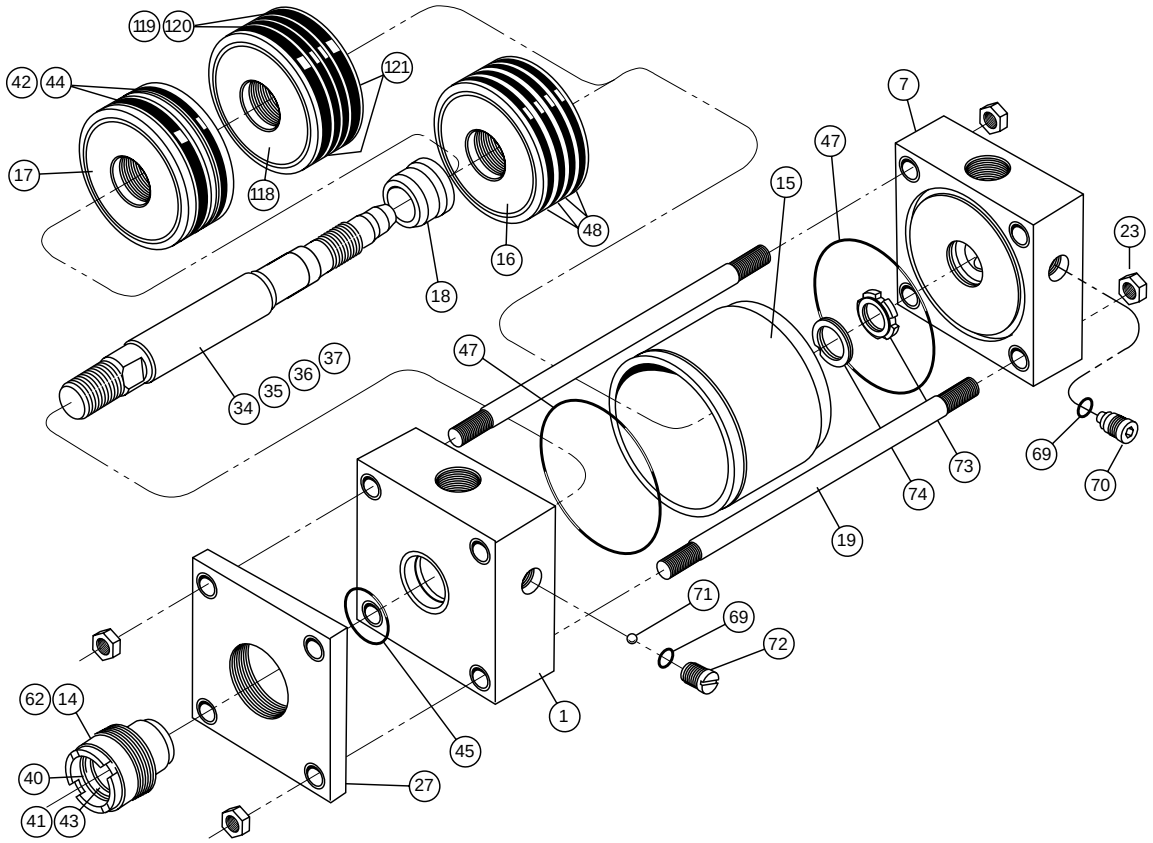
Note: For items not shown see pages 42 and 43.

Symbol	Description
2	Head, side lug mtg. Style C
3	Head, centerline lug mtg. Style E
4	Head, side tapped mtg. Style F
5	Head, trunnion mtg. Style D
6	Head, end lug mtg. Style G
8	Cap, side lug mtg. Style C
9	Cap, centerline lug mtg. Style E
10	Cap, side tapped mtg. Style F
11	Cap, trunnion mtg. Style DB
12	Cap, fixed clevis mtg. BB
13	Cap, end lug mtg. Style G
19	Tie rod
20	Tie rod, head end mtg. Style DD
21	Tie rod, cap end mtg. Style DD
23	Tie rod nut
25	Detachable clevis, mtg. Style BC
27	Retainer
28	Flange, rectangular mtg. Style J
28A	Head, rectangular mtg. Style JJ
28B	Head, square mtg. Style JB
29	Flange, rectangular mtg. H
29A	Cap, rectangular mtg. Style HH
29B	Cap, square mtg. Style HB
30	Flange, square mtg. Style JB
31	Flange, square mtg. Style HB
32	Mounting angle, head end Style CB
33	Mounting angle, cap end Style CB
66	Intermediate trunnion Style DD
67	Screws, intermediate trunnion mtg.
76	End lug, head end mtg. Style G
79	Socket head cap screws, Style JJ Mtg.
86	Clevis pin, mtg. Style BB & BC
87	Retaining ring, mtg. Style BB & BC

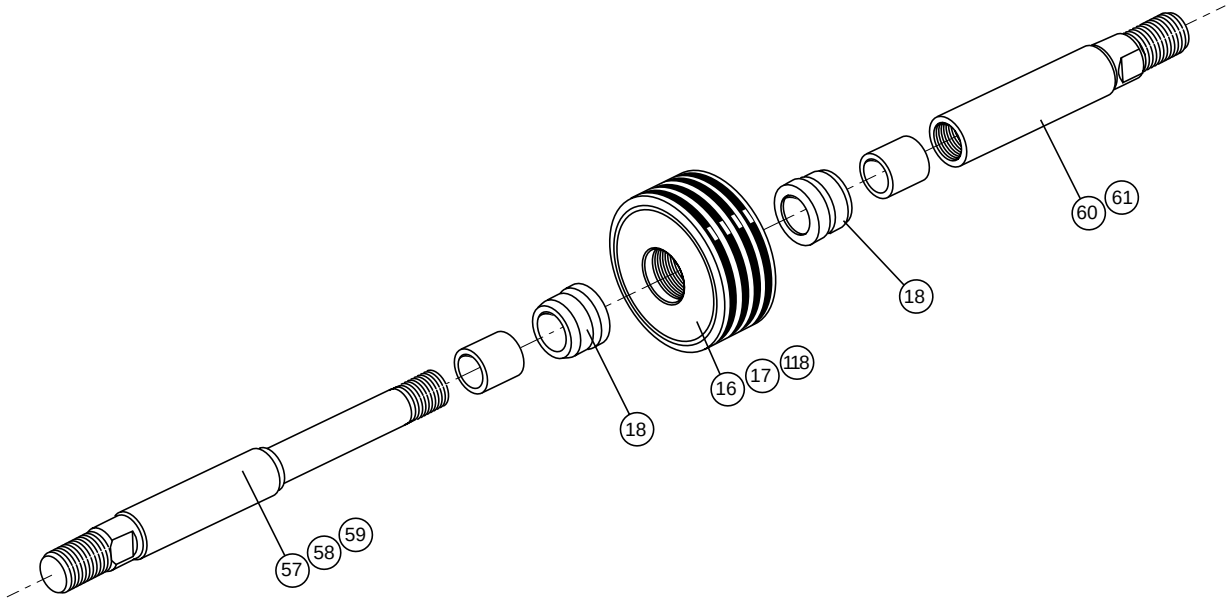
How to Order

Give cylinder model number, bore, stroke, serial number and symbol number shown above to insure proper replacement.

C



K-Type Rod Assembly



For additional information – call your local Parker Cylinder Distributor.

Note: For specific mounting styles see page 43.

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	36, 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	–		–		
41	Lipseal, gland	–		–		
42	Lipseal, piston	–		–		
43	Back-up washer, gland	–	Seal Kits	–		
44	Back-up washer, piston	–	See page 44.	–		
45	O-ring, gland to head seal	–		–		
47	O-ring, cylinder body end seal	–		–		
48	Piston ring	–		–		
57	Piston rod, double rod type, non-cushioned	57SA	Piston & Rod assembly, double rod type — non-cush.	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 — cush. 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 — cush. 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	–		–		
70	Needle valve, cushion adjustment	–	Cushion	–		
71	Ball, check valve	–	Kits	–		
72	Plug screw, check valve	–	See table	–		
73	Cushion bushing, cap end floating check valve	–	below.	–		
74	Retaining ring, floating cushion bushing	–		–		
75	Seal, cushion sleeve	–	–	–		
118	Piston, hi-load type	–	–	–		
119	Outer ring	–	Seal Kits	–		
120	Inner ring	–	See page	–		
121	Wear ring	–	44.	–		

Standard Cushion Hardware Kits

Bore Size	For Head Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 71 & 72 for One Head) Series 2H & 3H (7" - 8")	For Cap Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 73 & 74 for One Cap) Series 2H & 3H (7" - 8")	For Head Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 71 & 72 for One Head) Series "2A"	For Cap Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 73 & 74 for One Cap) Series "2A"	For Head Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 71 & 72 for One Head) Series "3L"	For Cap Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 73 & 74 for One Cap) Series "3L"
1	None	None	None	None	L065090000	L065170000
1 1/2	L065100000	L045580000	L065100000	L045800000	L065100000	L045580000
2	L065100000	L045660000	L065100000	L045800000	L065100000	L045580000
2 1/2	L065110000	L045590000	L065100000	L045800000	L065100000	L045580000
3 1/4	L065110000	L045600000	L065110000	L045810000	L065110000	L045590000
4	L065110000	L045610000	L065110000	L045810000	L065110000	L045590000
5	L065110000	L045620000	L065110000	L04581000	L065110000	L045590000
6	L065120000	L045630000	L065120000	L045820000	L065120000	L045790000
7	L065120000	L045640000	L065120000	L045820000	–	–
8	L065120000	L045650000	L065120000	L045820000	L065120000	L045630000
10	–	–	L065120000	L045830000		
12	–	–	L065120000	L045840000		
14	–	–	L065120000	L045850000		

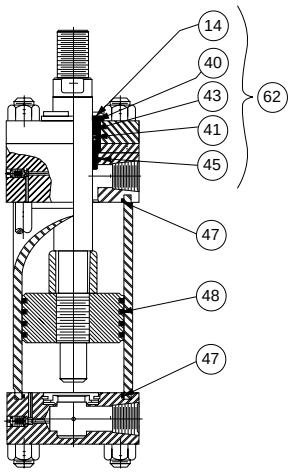
Viton Cushion Hardware Kits

*Series 2H (7" & 8") and Series 3H (7" & 8") utilize the same cushion kit. Series 3H does not require the cushion bushing, Item #73.

Bore Size	For Head Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 71 & 72 for One Head) Series 2H & 3H (7" - 8")	For Cap Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 73 & 74 for One Cap) Series 2H & 3H (7" - 8")	For Head Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 71 & 72 for One Head) Series "2A"	For Cap Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 73 & 74 for One Cap) Series "2A"	For Head Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 71 & 72 for One Head) Series "3L"	For Cap Assemblies Order Kits By Number Below: (Kits include Symbols 69, 70, 73 & 74 for One Cap) Series "3L"
1	None	None	None	None	L065090000	L065170000
1 1/2	L070740001	L070750001	L070740001	L070750010	L070740001	L070750001
2	L070740001	L070750002	L070740001	L070750010	L070740001	L070750001
2 1/2	L070740002	L070750003	L070740001	L070750010	L070740001	L070750001
3 1/4	L070740002	L070750004	L070740002	L070750011	L070740002	L070750003
4	L070740002	L070750005	L070740002	L070750011	L070740002	L070750003
5	L070740002	L070750006	L070740002	L070750011	L070740002	L070750003
6	L070740003	L070750007	L070740003	L070750012	L070740003	L070750016
7	L070740003	L070750008	L070740003	L070750012	–	–
8	L070740003	L070750009	L070740003	L070750012	L070740003	L070750007
10	–	–	L070740003	L070750013		
12	–	–	L070740003	L070750014		
14	–	–	L070740003	L070750015		

For Cylinder Division Plant Locations – See Page II.

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
119	Outer ring
120	Inner ring
121	Wear ring



Seal Kits for Class 1 & 2 Service
(For Class 1 Hydraulic Service see TS-2000 Seal Kits pg. 50)

Material: Buna-N (Nitrile)
Operating temp.: -10½F (-23½C) to +165½F (+74½C).
Recommended for: Air, nitrogen, hydraulic (mineral) petroleum base oils, water-in-oil emulsions & water/glycol fluids.
Gland and spanner wrenches are available to ease (rod) seal or gland cartridge removal without disassembly of the cylinder.
For detailed seal replacement instructions see service bulletin #0995-M1, M2 & M3.

	Series 2A, 2H, 3L & VH Cylinders			
	RG	RK		
	Gland (Sym. 62) Cartridge Kits	Rod Seal Kits		
Rod Dia.	Contains Symbols 14, 40, 41, 43 & 45	Contains Symbols 40, 41, 43 & 45	Gland Wrench	Spanner Wrench
1/2	RG2AHL 0051	RK2AHL 0051	069590 0000	0116760000
5/8	RG2AHL 0061	RK2AHL 0061	069590 0000	011676 0000
1	RG2AHL 0101	RK2AHL 0101	069591 0000	011676 0000
1 3/8	RG2AHL 0131	RK2AHL 0131	069592 0000	011703 0000
1 3/4	RG2AHL 0171	RK2AHL 0171	069593 0000	011677 0000
2	RG2AHL 0201	RK2AHL 0201	069594 0000	011677 0000
2 1/2	RG2AHL 0251	RK2AHL 0251	069595 0000	011677 0000
3	RG2AHL 0301	RK2AHL 0301	069596 0000	011677 0000
3 1/2	RG2AHL 0351	RK2AHL 0351	069597 0000	011677 0000
4	RG2AHL 0401	RK2AHL 0401	069598 0000	011678 0000
4 1/2	RG2AHL 0451	RK2AHL 0451	083877 0000	011678 0000
*5	RG2AHL 0501	RK2AHL 0501	069599 0000	011678 0000
*5 1/2	RG2AHL 0551	RK2AHL 0551	069600 0000	011678 0000

*RG & RK kits listed are not applicable to 10" & 12" bore series 2H cylinders. See bulletin 0995-M4.

	PK/Piston Seal Kits	PK/Piston Seal Kits	PR/Piston Ring Kits	Hi-Load Piston Seal Kits
	Series 2A Only	Series 2HL, 3LL & VHL	Series 2H, 3L & VH	Series 2H & VH
Bore Size	Contains 2 Ea. Symbols: 42, 44 & 47	Contains 2 Ea. Symbols: 42, 44 & 47	Contains 2 Ea. Sym. 47 & 4 Symbol 48	Contains 2 Ea. Symbols 47, 119, 120 & 121
1	PK1002A001	PK102HLL01	PR102H0001	–
1 1/2	PK1502A001	PK152HLL01	PR152H0001	PK152HK001
2	PK2002A001	PK202HLL01	PR202H0001	PK202HK001
2 1/2	PK2502A001	PK252HLL01	PR252H0001	PK252HK001
3 1/4	PK3202A001	PK322HLL01	PR322H0001	PK322HK001
4	PK4002A001	PK402HLL01	PR402H0001	PK402HK001
5	PK5002A001	PK502HLL01	PR502H0001	PK502HK001
6	PK6002A001	PK602HLL01	PR602H0001	PK602HK001
7	PK7002A001	PK702HLL01	PR702H0001	PK702HK001
8	PK8002A001	PK802HLL01	PR802H0001	PK802HK001
10	PK9002A001	PK902HLL01	PR902H0001	PK902HK001
12	PK9202A001	PK922HLL01	PR922H0001	PK922HK001
14	PK9402A001	–	–	–

	CB Cylinder Body Seal Kits		Tie Rod Torque Specifications*					
	Series 2A	Series 2H, 3L & VH	Series 2A & 3L				Series 2H & VH	
			Cylinder Body Material					
Bore Size	Contains 2 EA. Symbol 47	Contains 2 Ea. Symbol 47	Brass		Steel		Fiberglass		Steel	
1	CB102HL001	CB102HL001	12 in.-lbs.	14 cm-kg	35 in.-lbs.	41 cm-kg	–	–	–	–
1-1/2	CB152HL001	CB152HL001	36 in.-lbs.	42 cm-kg	60 in.-lbs.	69 cm-kg	–	–	18 ft.-lbs.	24 N.m
2	CB202HL001	CB202HL001	72 in.-lbs.	83 cm-kg	11 ft.-lbs.	15 N.m	–	–	45 ft.-lbs.	61 N.m
2-1/2	CB252HL001	CB252HL001	72 in.-lbs.	83 cm-kg	11 ft.-lbs.	15 N.m	–	–	45 ft.-lbs.	61 N.m
3-1/4	CB322A0001	CB322HL001	18 ft.-lbs.	24 N.m	25 ft.-lbs.	34 N.m	–	–	120 ft.-lbs.	163 N.m
4	CB402A0001	CB402HL001	18 ft.-lbs.	24 N.m	25 ft.-lbs.	34 N.m	–	–	131 ft.-lbs.	178 N.m
5	CB502A0001	CB502HL001	44 ft.-lbs.	50 N.m	60 ft.-lbs.	81 N.m	–	–	312 ft.-lbs.	423 N.m
6	CB602A0001	CB602HL001	44 ft.-lbs.	50 N.m	60 ft.-lbs.	81 N.m	–	–	528 ft.-lbs.	716 N.m
7	CB702A0001	CB702HL001	–	–	90 ft.-lbs.	122 N.m	–	–	800 ft.-lbs.	1085 N.m
8	CB802A0001	CB802HL001	80 ft.-lbs.	108 N.m	110 ft.-lbs.	149 N.m	–	–	1168 ft.-lbs.	1584 N.m
10	CB902A0001	CB902HL001	113 ft.-lbs.	153 N.m	148 ft.-lbs.	201 N.m	78 (ft. Lbs.)	106 N.m	–	–
12	CB922A0001	CB922HL001	148 ft.-lbs.	201 N.m	172 ft.-lbs.	233 N.m	78 (ft. Lbs.)	106 N.m	–	–
14	–	–	228 ft.-lbs.	309 N.m	275 ft.-lbs.	373 N.m	118 (ft. Lbs.)	160 N.m	–	–

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

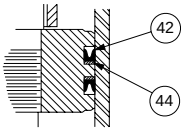
How to order – individual seals contained in the kits are available separately – however we recommend purchasing complete kits because of the convenience & lower replacement cost. When ordering seal kits give part number listed above. To be sure of exact replacement, give serial number of cylinder when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

Piston Seal Options

Ring Type Piston

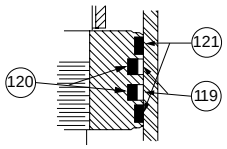
(as shown above)
Supplied as standard on series 2H, 3L & VH hydraulic cylinders.

Lipseal Type Piston



Supplied as standard on series 2A air cylinders. Optional for series 2H, 3L & VH hydraulic cylinders.

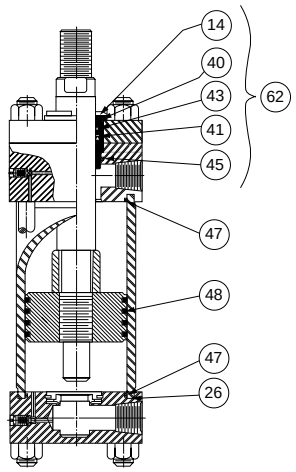
Hi-Load Type Piston



Optional on series 2H & VH hydraulic cylinders. Not available on series 2A & 3L cylinders.

For additional information – call your local Parker Cylinder Distributor.

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
119	Outer ring
120	Inner ring
121	Wear ring

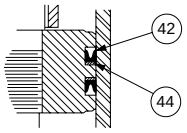


Piston Seal Options

Ring Type Piston

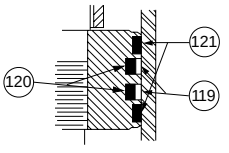
(as shown above)
Supplied as standard on series 2H, 3L & VH hydraulic cylinders.

Lipseal Type Piston



Supplied as standard on series 2A air cylinders. Less symbol #44. Optional for series 2H, 3L & VH hydraulic cylinders.

Hi-Load Type Piston



Optional on series 2H & VH hydraulic cylinders. Not available on series 2A & 3L cylinders.

Seal Kits for Class 5 Service

Material: Fluorocarbon (Viton®)

For operating temperature and fluid compatibility see Section C.

Gland and spanner wrenches are available to ease (rod) seal or gland cartridge removal without disassembly of the cylinder.

For detailed seal replacement instructions see service bulletin #0995-M1, M3 & M5.

Rod Dia.	Series 2A, 2H, 3L & VH Cylinders RG Gland (Sym. 62) Cartridge Kits Contains Symbols 14, 40, 41, 43 & 45	RK Rod Seal Kits Contains Symbols 40, 41, 43 & 45	Gland Wrench	Spanner Wrench
1/2	RG2AHL 0055	RK2AHL 0055	069590 0000	0116760000
5/8	RG2AHL 0065	RK2AHL 0065	069590 0000	011676 0000
1	RG2AHL 0105	RK2AHL 0105	069591 0000	011676 0000
1 3/8	RG2AHL 0135	RK2AHL 0135	069592 0000	011703 0000
1 3/4	RG2AHL 0175	RK2AHL 0175	069593 0000	011677 0000
2	RG2AHL 0205	RK2AHL 0205	069594 0000	011677 0000
2 1/2	RG2AHL 0255	RK2AHL 0255	069595 0000	011677 0000
3	RG2AHL 0305	RK2AHL 0305	069596 0000	011677 0000
3 1/2	RG2AHL 0355	RK2AHL 0355	069597 0000	011677 0000
4	RG2AHL 0405	RK2AHL 0405	069598 0000	011677 0000
4 1/2	RG2AHL 0455	RK2AHL 0455	083877 0000	011678 0000
*5	RG2AHL 0505	RK2AHL 0505	069599 0000	011678 0000
*5 1/2	RG2AHL 0555	RK2AHL 0555	069600 0000	011678 0000

*RG & RK kits listed are not applicable to 10" & 12" bore series 2H cylinders. See bulletin 0995-M4.

Bore Size	PK/Piston Seal Kits Series 2A Only Contains 2 Ea. Symbols: 42 & 47	PK/Piston Seal Kits Series 2HL, 3LL & VHL Contains 2 Ea. Symbols: 42, 44 & 47	PR/Piston Ring Kits Series 2H, 3L & VH Contains 2 Ea. Sym. 47 & 4 Symbol 48	Hi-Load Piston Seal Kits Series 2H & VH Contains 2 Ea. Symbols 47, 119, 120 & 121
1	PK1002A005	PK102HLL05	PR102H0005	–
1 1/2	PK1502A005	PK152HLL05	PR152H0005	PK152HK005
2	PK2002A005	PK202HLL05	PR202H0005	PK202HK005
2 1/2	PK2502A005	PK252HLL05	PR252H0005	PK252HK005
3 1/4	PK3202A005	PK322HLL05	PR322H0005	PK322HK005
4	PK4002A005	PK402HLL05	PR402H0005	PK402HK005
5	PK5002A005	PK502HLL05	PR502H0005	PK502HK005
6	PK6002A005	PK602HLL05	PR602H0005	PK602HK005
7	PK7002A005	PK702HLL05	PR702H0005	PK702HK005
8	PK8002A005	PK802HLL05	PR802H0005	PK802HK005
10	PK9002A005	PK902HLL05	PR902H0005	PK902HK005
12	PK9202A005	PK922HLL05	PR922H0005	PK922HK005
14	PK9402A005	–	–	–

BORE SIZE	CB CYLINDER BODY SEAL KITS SERIES 2A CONTAINS 2 EA. SYMBOL 47	 SERIES 2H, 3L & VH CONTAINS 2 EA. SYMBOL 47	TIE ROD TORQUE SPECIFICATIONS* SERIES 2A & 3L CYLINDER BODY MATERIAL BRASS	 STEEL	 FIBERGLASS	SERIES 2H & VH STEEL
1	CB102HL005	CB102HL005	12 in.-lbs. 14 cm-kg	35 in.-lbs. 41 cm-kg	– –	– –
1-1/2	CB152HL005	CB152HL005	36 in.-lbs. 42 cm-kg	60 in.-lbs. 69 cm-kg	– –	18 ft.-lbs. 24 N.m
2	CB202HL005	CB202HL005	72 in.-lbs. 83 cm-kg	11 ft.-lbs. 15 N.m	– –	45 ft.-lbs. 61 N.m
2-1/2	CB252HL005	CB252HL005	72 in.-lbs. 83 cm-kg	11 ft.-lbs. 15 N.m	– –	45 ft.-lbs. 61 N.m
3-1/4		CB322HL005	18 ft.-lbs. 24 N.m	25 ft.-lbs. 34 N.m	– –	120 ft.-lbs. 163 N.m
4	USE (PK)	CB402HL005	18 ft.-lbs. 24 N.m	25 ft.-lbs. 34 N.m	– –	131 ft.-lbs. 178 N.m
5	PISTON	CB502HL005	44 ft.-lbs. 50 N.m	60 ft.-lbs. 81 N.m	– –	312 ft.-lbs. 423 N.m
6	SEAL	CB602HL005	44 ft.-lbs. 50 N.m	60 ft.-lbs. 81 N.m	– –	528 ft.-lbs. 716 N.m
7	KITS	CB702HL005	– –	90 ft.-lbs. 122 N.m	– –	800 ft.-lbs. 1085 N.m
8	FOR	CB802HL005	80 ft.-lbs. 108 N.m	110 ft.-lbs. 149 N.m	– –	1168 ft.-lbs. 1584 N.m
10	THESE	CB902HL005	113 ft.-lbs. 153 N.m	148 ft.-lbs. 201 N.m	78 (ft. Lbs.) 106 N.m	– –
12	SIZES	CB922HL005	148 ft.-lbs. 201 N.m	172 ft.-lbs. 233 N.m	78 (ft. Lbs.) 106 N.m	– –
14		–	228 ft.-lbs. 309 N.m	275 ft.-lbs. 373 N.m	118 (ft. Lbs.) 160 N.m	– –

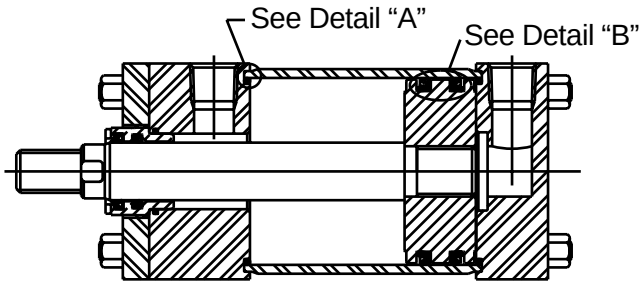
*(-0%, +5% tolerance). When assembling the cylinder, be sure to torque the tie rods evenly.

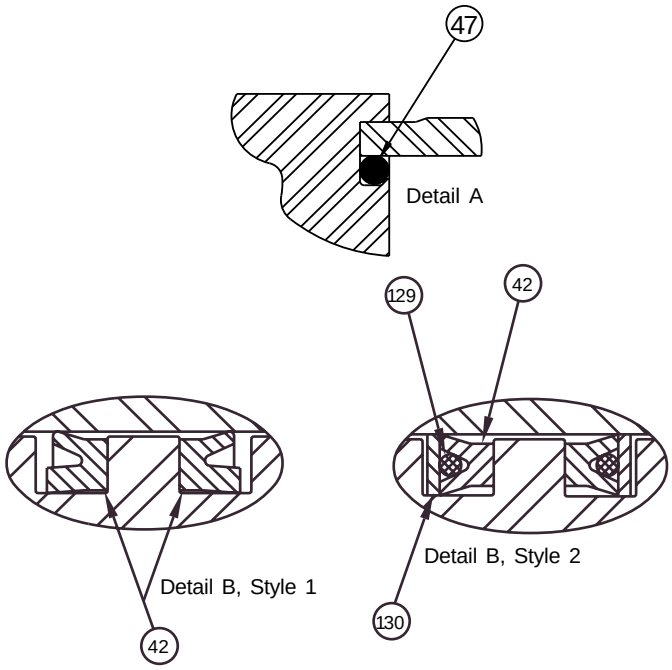
For use with High Water Content Fluids.
Class 6 Service: kit numbers listed above identify Class 5 seals only. To order with Class 6 seals (HWCF) substitute “6” for “5” as last digit of part number.
How to order – individual seals contained in the kits are available separately – however we recommend purchasing complete kits because of the convenience & 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.

For Cylinder Division Plant Locations – See Page II.

Piston and Cylinder Body Seals

For Series "2AN" and "MAN" Air Cylinders





Piston Seal Kits

PK kits for Series 2AN and MAN cylinders contain 2 each of the following:

symbol 42, Lipseal, piston
symbol 47, O-ring, cylinder body to head and cap seal
symbol 129, wick
symbol 130, washer } 14" bore only (Style 2)

Cylinder Body Seal Kits

CB kits for Series 2AN and MAN Air cylinders contain 2 each of:

symbol 47, O-rings

Service kits of expendable parts of 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.

Service kits contain seals of Nitrile (Buna-N) elastomers for standard fluid service. These seals are suitable for use when air is the operating medium.

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

Parker Lube-A-Cyl...

is recommended for use in air cylinders during normal operation, and particularly when servicing and re-assembling cylinders. It is a multi-purpose lubricant in grease form, that provides lubrication without deteriorating effects on synthetic seals. Particularly recommended for use in low pressure air cylinders because of its special ability to adhere to metal surfaces. It produces a thin film which will not blow out with exhaust air. It provides piston, rod and seal lubrication, and has excellent resistance to water and mechanical breakdown with temperature range of -10½F (-23½C) to +350½F (+177½C). Lube-A-Cyl is packaged in 4-oz. tubes, a sufficient quantity for average size air cylinder. One application should last for a period of from 6 to 18 months, depending upon service. Lube-A-Cyl is available in 4-oz. tubes. Order by part #0761630000.

Bore Size	PK Piston Seal Kit No. For Series 2AN & MAN Cylinders	CB Cylinder Body Seal Kit For Series 2AN and MAN
1 1/2"	PK1502 AN01	CB152H L001
2"	PK2002 AN01	CB202H L001
2 1/2"	PK2502 AN01	CB252H L001
3 1/4"	PK3202 AN01	CB322A 0001
4"	PK4002 AN01	CB402A 0001
5"	PK5002 AN01	CB502A 0001
6"	PK6002 AN01	CB602A 0001
7"	PK7002 AN01	CB702A 0001
8"	PK8002 AN01	CB80A 0001
10"	PK9002 AN01	CB90A 0001
12"	PK9202 AN01	CB922A 0001
14"	PK9402 AN01	CB942A 0001

Rod Dia.	Gland Cartridge Wrenches Part No.	Spanner Wrenches Part No.
5/8"	069590 0000	011676 0000
1"	060591 0000	011676 0000
1 3/8"	069592 0000	011703 0000
1 3/4"	069593 0000	011677 0000
2"	069594 0000	011677 0000
2 1/2"	069595 0000	011677 0000
3 1/2"	069597 0000	011677 0000
4"	069598 0000	011678 0000
4 1/2"	083777 0000	011677 0000
5"	069599 0000	011678 0000
5 1/2"	069600 0000	011678 0000

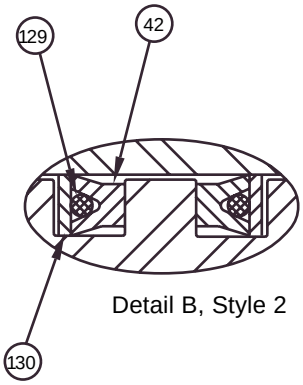
Servicing The Piston Seals

The piston is sealed and securely locked to the piston rod with anaerobic adhesive. This threaded connection should only be disassembled or reassembled by factory trained personnel.

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. Replace all damaged parts. Lubricate the **entire** interior surface of the cylinder bore with a thin film of "Lube-A-Cyl" grease.

Install one piston seal in the groove nearest the rod. The two "lips" of this Lipseal should face toward the rod end of the piston.

In addition on 14" bores only, thoroughly soak both sets of wicks and washers in standard petroleum base lubricating oil, Union Oil "UN-ax-AW-315" or equivalent. Install the flat washer, symbol 130 and wick symbol 129 on the side facing pressure. See Detail B, Style 2.



Detail B, Style 2

Apply "Lube-A-Cyl" to the outside diameter of the piston and seal. Then insert the piston in the cylinder body as shown in Figure 1. Next, turn the cylinder body on its side and push the piston through the barrel just far enough to expose the groove for the second seal (See Figure 2 below). Be careful

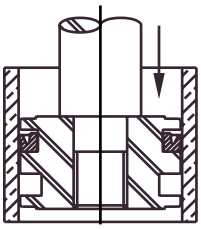


Figure 1

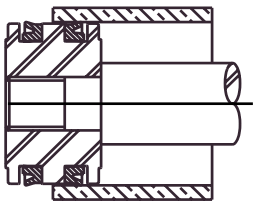


Figure 2

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

Screw Size	Torque	Torque
#10	15 in.-lbs.	17 cm-kg
1/4"	60 in.-lbs.	69 cm-kg
5/16"	10 ft.-lbs.	14 N.m
3/8"	20 ft.-lbs.	27 N.m
7/16"	35 ft.-lbs.	48 N.m

*-0%, +5% tolerance.

not to move the piston too far so as to expose the first seal. If this is done, the "lip" of this Lipseal may slip past the cylinder body and be damaged when the piston is pulled back into the cylinder body. If the piston should move too far, pass the piston rod completely through the cylinder body and again start the piston from the original end. Install the second lipseal (and wicks and washers, if required), in the exposed grooves as shown in Figure 2. Lubricate the same as the first seal and pull the piston into the cylinder body. Proceed to assemble cylinder heads, tie rods and tie rod nuts as follows:

"O" rings (symbol 47) should be lightly coated with lubricant then worked into place 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 in metal-to-metal contact with the cap. Install "O" ring (symbol 47) in head. Head is then fitted over the rod and assembled to cylinder body. Rock gently into place until body and head are in metal-to-metal contact.

Next, screw gland part way into gland retainer and slip both gland and retainer over the end of the rod. Tighten entire assembly, torquing tie rod nuts to the values specified. Finally, using a gland wrench, firmly seat the gland.

With an intermediate trunnion mounted cylinder, care must be taken to prevent binding the cylinder body when repositioning the trunnion collar. Proper reassembly of this type of cylinder is as follows:

After the piston seals have been inserted and the piston is in the cylinder body, slip the trunnion collar over the cylinder body to its approximate position.

Fit the cap with its seal onto the body. Then "stud" into the trunnion collar the four tie rods that connect the cap to the trunnion collar. Bring up the four tie rod nuts at the cap. Distances from the inner face of cap to finished face of trunnion collar should then be made equal at all four tie rods when all four tie rod nuts are in contact with the cap.

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

NOTE: An extreme pressure lubricant (such as molybdenum disulphate) should be used on the tie rod threads and nut bearing faces to control friction and reduce tie rod twist. Tie rod twist can be eliminated by chalking a straight line on each tie rod before torquing, and backing off the nut after torquing so this line is straight again. This is particularly important on long-stroke cylinders.

Tie Rod Torque* – Series 2AN, MAN

Cylinder Bore Size	Cylinder Body Material					
	Steel		Brass		Fiberglass	
1 1/2"	60 in.-lbs.	69 cm-kg	36 in.-lbs.	42 cm-kg	–	–
2" & 2 1/2"	11 ft.-lbs.	15 N-m	72 in.-lbs.	83 cm-kg	–	–
3 1/4"	25 ft.-lbs.	34 N-m	18 ft.-lbs.	24 N-m	–	–
4"	25 ft.-lbs.	34 N-m	18 ft.-lbs.	24 N-m	–	–
5"	60 ft.-lbs.	81 N-m	44 ft.-lbs.	50 N-m	–	–
6"	60 ft.-lbs.	81 N-m	44 ft.-lbs.	50 N-m	–	–
8"	110 ft.-lbs.	149 N-m	80 ft.-lbs.	108 N-m	–	–
10"	148 ft.-lbs.	201 N-m	113 ft.-lbs.	153 N-m	78 ft.-lbs.	106 (N-m)
12"	172 ft.-lbs.	233 N-m	148 ft.-lbs.	201 N-m	78 ft.-lbs.	106 (N-m)
14"	275 ft.-lbs.	373 N-m	228 ft.-lbs.	309 N-m	118 ft.-lbs.	160 (N-m)

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

C

Gland Cartridges & Rod Seals

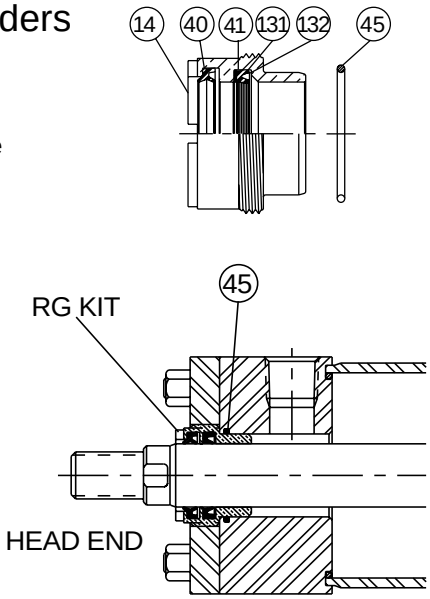
For Series "2AN" Air Cylinders

Gland Cartridge Kit

RG kit contains 1 each of the following:
- symbol 14, gland, threaded cartridge type
- symbol 40, rod Wiperseal
- symbol 41, rod Lipseal
- symbol 45, O-ring, gland to head seal
- symbol 131, wick } 3" to 5 1/2"
- symbol 132, washer } rods only

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 distributor or Parker Hannifin office.

Service kits of expendble parts for fluid power cylinders are available for Class 1 fluid service.



Rod Seal Kit

RK kit contains 1 each of the following:
- symbol 40, rod Wiperseal
- symbol 41, rod Lipseal
- symbol 45, O-ring, gland to head seal
- symbol 131, wick } 3" to 5 1/2"
- symbol 132, washer } rods only

Standard Seals – Class 1 Service Kits are standard, and contain seals of Nitrile (Buna-N) elastomers. These seals are suitable for use when air is in the operating medium.

The recommended operating temperature range for Class 1 seals is -10½F to +165½F. These seals will function at temperatures up to 200½F with reduced life.

Bore Size	RG Gland Cartridge Kit No. Includes RK Kit	RK Rod Seal Kit No. Contains Rod Seals
5/8"	RG2AN00061	RK2AN00061
1"	RG2AN00101	RK2AN00101
1 3/8"	RG2AN00131	RK2AN00131
1 3/4"	RG2AN00171	RK2AN00171
2"	RG2AN00201	RK2AN00201
2 1/2"	RG2AN00251	RK2AN00251
3"	RG2AN00301	RK2AN00301
3 1/2"	RG2AN00351	RK2AN00351
4"	RG2AN00401	RK2AN00401
4 1/2"	RG2AN00451	RK2AN00451
5"	RG2AN00501	RK2AN00501
5 1/2"	RG2AN00551	RK2AN00551

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

Screw Size	Torque	Torque
#10	15 in.-lbs.	17 cm-kg
1/4"	60 in.-lbs.	69 cm-kg
5/16"	10 ft.-lbs.	14 N-m
3/8"	20 ft.-lbs.	27 N-m
7/16"	35 ft.-lbs.	48 N-m

*-0%, +5% tolerance.

Tie Rod Torque* – Series 2AN

Cylinder Bore Size	Cylinder Body Material					
	Steel		Brass		Fiberglass	
1 1/2"	60 in.-lbs.	69 cm-kg	36 in.-lbs.	42 cm-kg	–	–
2" & 2 1/2"	11 ft.-lbs.	15 N-m	72 in.-lbs.	83 cm-kg	–	–
3 1/4"	25 ft.-lbs.	34 N-m	18 ft.-lbs.	24 N-m	–	–
4"	25 ft.-lbs.	34 N-m	18 ft.-lbs.	24 N-m	–	–
5"	60 ft.-lbs.	81 N-m	44 ft.-lbs.	50 N-m	–	–
6"	60 ft.-lbs.	81 N-m	44 ft.-lbs.	50 N-m	–	–
8"	110 ft.-lbs.	149 N-m	80 ft.-lbs.	108 N-m	–	–
10"	148 ft.-lbs.	201 N-m	113 ft.-lbs.	153 N-m	78 ft.-lbs.	106 (N-m)
12"	172 ft.-lbs.	233 N-m	148 ft.-lbs.	201 N-m	78 ft.-lbs.	106 (N-m)
14"	275 ft.-lbs.	373 N-m	228 ft.-lbs.	309 N-m	118 ft.-lbs.	160 (N-m)

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

How To Replace Cylinder Gland Packing

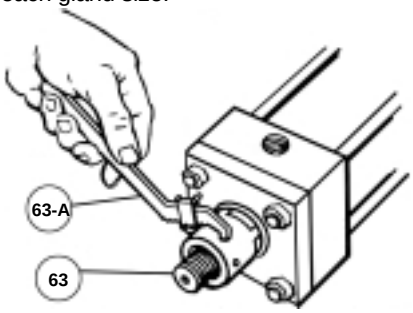
Fluid leakage around piston rod at the gland area will normally indicate a need to replace gland seals. First, remove cylinder from machine to which it is mounted or, if this is not feasible, disconnect the piston rod from rod clevis, knuckle or machine member to which it is fastened.

The Parker Hannifin gland is a unique cartridge design. It is threaded into the gland retainer plate, and all sizes are removable without disturbing the tie rod torque.

To remove the gland:

a) Inspect the piston rod to make sure it is free of burrs or other displaced metal which would prevent sliding the gland off the rod.

b) Unscrew the gland (right-hand thread) from the gland retainer plate. Or on 8" bore or larger air cylinders remove the bolted gland retainer by loosening the 4 socket headscrews. The gland protrudes from the face of the retainer and can be removed with vise grip pliers. Or use a Parker Hannifin gland wrench which is available for each gland size.



c) Lubricate the rod with Lube-A-cyl.

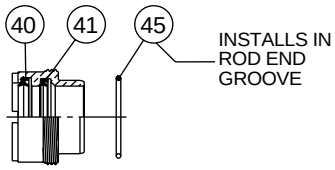
d) Slide the gland off of the piston rod and remove the seals, wicks and washers, if present. Thoroughly clean the gland and seal grooves. Inspect gland bore for wear. If bore is worn, replace – using gland cartridge kit of proper size. (See opposite side.)

e) If gland is not worn, replace seals only, using rod seal kit, with Lube-A-Cyl. Lubricate gland seal grooves and all new seals. Install wiperseal, Sym. 40, in groove closest to end of gland. Install lipseal, Sym. 41, on seal grove. Lips of seals should point toward the long bearing side of gland.

For 3" to 5 1/2" rod sizes:

If gland is not worn, replace seals only, using rod seal kit containing seals for proper size (see opposite side). Lubricate gland seal grooves and all new seals. Install wiperseal, Sym. 40, in groove closest to end of gland. Install lipseal, Sym. 41, in seal groove. **Lips of seal should point toward the long bearing side of gland.** Install wick, Sym. 131, and washer, Sym. 132. Immerse gland assembly in standard petroleum lubricating oil "Union Oil" UN-ax-AW-315 or equivalent to soak wicks.

f) An O-ring, Sym. 45, is supplied with each gland cartridge kit. It serves as a seal between the gland and the head. This O-ring is a static seal and does not normally require replacement. The original O-ring may be left in place, unless it is known to be leaking.

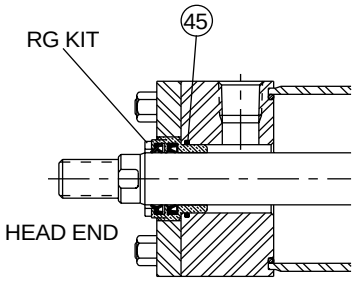


Installation

Before installing a new gland, inspect the surface of the piston rod for scratches, burrs, dents or other damage. A damaged piston rod surface will result in premature rod seal failer.

Lubricate the bore of the gland and the seals with Parker "Lube-A-Cyl," and slide the gland over the end of the piston rod. Thread the gland into the retainer until it is seated firmly against the head. the gland-to-head O-ring, Sym. 45, serves as a torque prevailing lock.

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



When replacing a gland on a rod which is threaded to the full diameter or so shaped that it could damage the seals, a slight rotary motion of the gland will help prevent damage. In addition, because full-diameter threads are usually supplied with the crest of the threads slightly truncated, a piece of shim stock or other thin, tough material can be wrapped around the threads to help protect the gland seals when they are being passed over the threads.

Gland Cartridge Wrenches

Parker's exclusive gland cartridge design makes gland replacement only a minute's work...and the Gland Cartridge Wrench Set makes it even simpler. A specially designed face-type gland wrench with flared lugs slips into an exact, sure fit on the gland, while a self-locking spanner wrench grips the gland wrench securely. No fumbling for adjustment – no accidental scoring of the piston rod, the job is done quickly...easily...safely.

You can order the Cartridge Wrench or Spanner Wrench to fit the piston rod size used in your Parker Hannifin Cylinder.

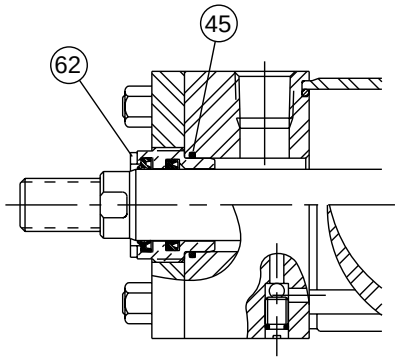
See chart below.

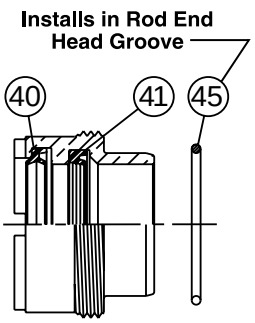
Rod Diameter	Gland Wrench (Symbol 63)	Spanner Wrench (Symbol 63-A)
5/8"	069590 0000	011676 0000
1"	060591 0000	
1 3/8"	069592 0000	011703 0000
1 3/4"	069593 0000	011677 0000
2"	069594 0000	
2 1/2"	069595 0000	011677 0000
3"	069596 0000	
3 1/2"	069597 0000	
4"	069598 0000	011678 0000
4 1/2"	083777 0000	
5"	069599 0000	
5 1/2"	069600 0000	

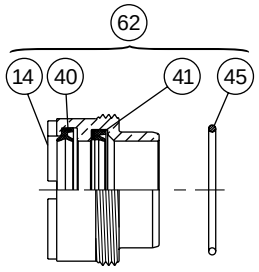
C

TS-2000 Gland Seal Kits for Hydraulic Cylinders

(Gland Cartridges & Rod Seals, including TS-2000 Rod Seals) For Series H, 2H, 7" & 8" Bore 3H, VH, L, 2L & 3L Hydraulic Cylinders







Gland Cartridge Kit

RG kit (symbol 62) contains 1 each of the following:
- symbol 14, gland, threaded cartridge type
- symbol 40, rod Wiperseal
- symbol 41, rod Lipseal
- symbol 45, O-ring gland to head seal

Rod Seal Kit

RK kit contains 1 each of the following:
- symbol 40, rod Wiperseal
- symbol 41, rod Lipseal
- symbol 45, O-ring gland to head seal

Service kits of expendable parts for 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 Parker Hannifin distributor or office.

Standard Seals – Class 1 Service Kits are standard, and contain polyurethane and Buna-N seals for standard hydraulic service. These seals are suitable for use when hydraulic (mineral-type) oil is the operating medium. The recommended operating temperature range for Class 1 seals is -10½F (-23½C) to +165½F (+74½C).

The seals contained in these kits are supplied as standard on all Series 2H,* VH, 3L and 7" and 8" bore 3H cylinders manufactured after Sept. 30, 1990 for Class 1 hydraulic (mineral) oil service.

The seals contained in these kits are interchangeable for hydraulic (mineral) oil service on all Series H,* 2H,* VH, L, 2L and 3L cylinders manufactured prior to Sept. 30, 1990.

Class 1 Hydraulic Service Only*

Rod. Dia.	Gland Cartridge Kits (Sym. #62) Class 1 (Std.) Buna-N (Nitrile) & Polyurethane	Rod Seal Kits Class 1 (Std.) Buna-N (Nitrile) & Polyurethane
1/2"	RG2HLTS051	RK2HLTS051
5/8"	RG2HLTS061	RK2HLTS061
1"	RG2HLTS101	RK2HLTS101
1 3/8"	RG2HLTS131	RK2HLTS131
1 3/4"	RG2HLTS171	RK2HLTS171
2"	RG2HLTS201	RK2HLTS201
2 1/2"	RG2HLTS251	RK2HLTS251
3"	RG2HLTS301	RK2HLTS301
3 1/2"	RG2HLTS351	RK2HLTS351
4"	RG2HLTS401	RK2HLTS401
4 1/2"	RG2HLTS451	RK2HLTS451
5"	RG2HLTS501	RK2HLTS501
5 1/2"	RG2HLTS551	RK2HLTS551

*The kits listed above do not fit 10" & 12" bore Series H & 2H Hydraulic Cylinders. See Bulletin #0995-M4.

For additional information – call your local Parker Cylinder Distributor.

How To Replace Cylinder Gland Packing

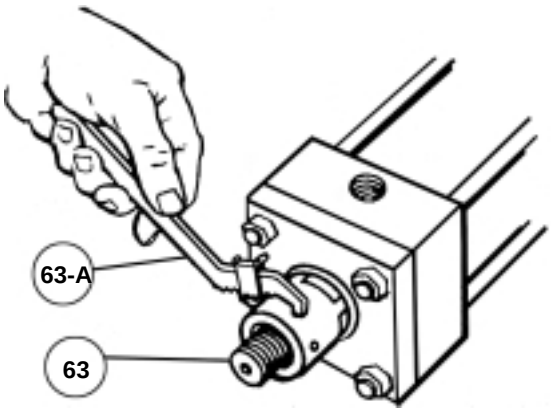
Fluid leakage around piston rod at the gland area will normally indicate a need to replace gland seals. First, remove cylinder from machine to which it is mounted or, if this is not feasible, disconnect the piston rod from rod clevis, knuckle or machine member to which it is fastened.

The Parker Hannifin "Jewel" gland is a unique cartridge design consisting of a bronze gland, primary lipseal and double lip wiperseal. It is threaded into the gland retainer plate, and all sizes are removable without disturbing the tie rod torque.

To remove the gland:

a) Inspect the piston rod to make sure it is free of burrs or other displaced metal which would prevent sliding the gland off of the rod.

b) For most cylinders, unscrew the gland (right hand thread) from gland retainer plate. On 7" and 8" bore series 3H, all JJ mounting styles and 8" bore low pressure hydraulic cylinders remove the socket head cap screws securing the round or square retainer plate. The gland protrudes from the face of the retainer and can be removed with vice grip pliers. Or use a Parker Hannifin gland and spanner wrench shown in the table below.



c) Slide the gland off of the piston rod and remove the seals. Thoroughly clean the gland and seal grooves. Inspect gland bore for wear. If bore is worn, replace – using gland cartridge (RG) kit complete with with seals.

d) If gland is not worn, replace seals only using rod seal (RK) kit. Lubricate gland seal grooves and all new seals. Install wiperseal, Sym. #40, in groove closest to end of gland. Install lipseal, Sym. #41, in seal groove. **Lips of seal should point toward the long bearing side of the gland.**

e) An O-ring, Sym. #45, is supplied with each gland cartridge kit. It serves as a seal between the gland and the head. This O-ring is a static seal and does not normally require replacement. The original O-ring may be left in place, unless it is known to be leaking (fluid flow around gland thread).

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

Screw Size	Torque*	
#10	15 in.-lbs.	17 cm-kg
1/4"	60 in.-lbs.	69 cm-kg
5/16"	10 ft.-lbs.	14 N.m
3/8"	20 ft.-lbs.	27 N.m
7/16"	35 ft.-lbs.	48 N.m

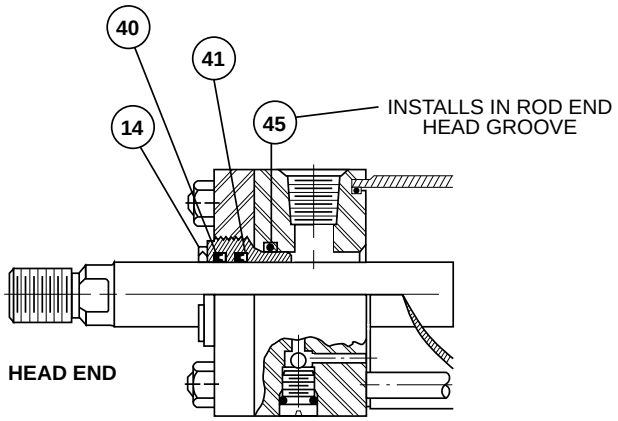
(*-0%, +5%) tolerance.

Installation

Before installing a new gland, inspect the surface of the piston rod for scratches, burrs, dents or other damage. A damaged piston rod surface will result in premature rod seal failure.

Lubricate the bore of the gland and the seals, and slide the gland over the end of the piston rod. Thread the gland into the retainer until it is sealed firmly against the head. The gland-to-head O-ring, Sym. #45, serves as a torque prevailing lock.

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



When replacing a gland on a rod which is threaded to the full diameter or so shaped that it could damage the seals, a slight rotary motion of the gland will help prevent damage. In addition, because full-diameter threads are usually supplied with the crest of the threads slightly truncated, a piece of shim stock or other thin, tough material can be wrapped around the threads to help protect the gland seals when they are being passed over the threads.

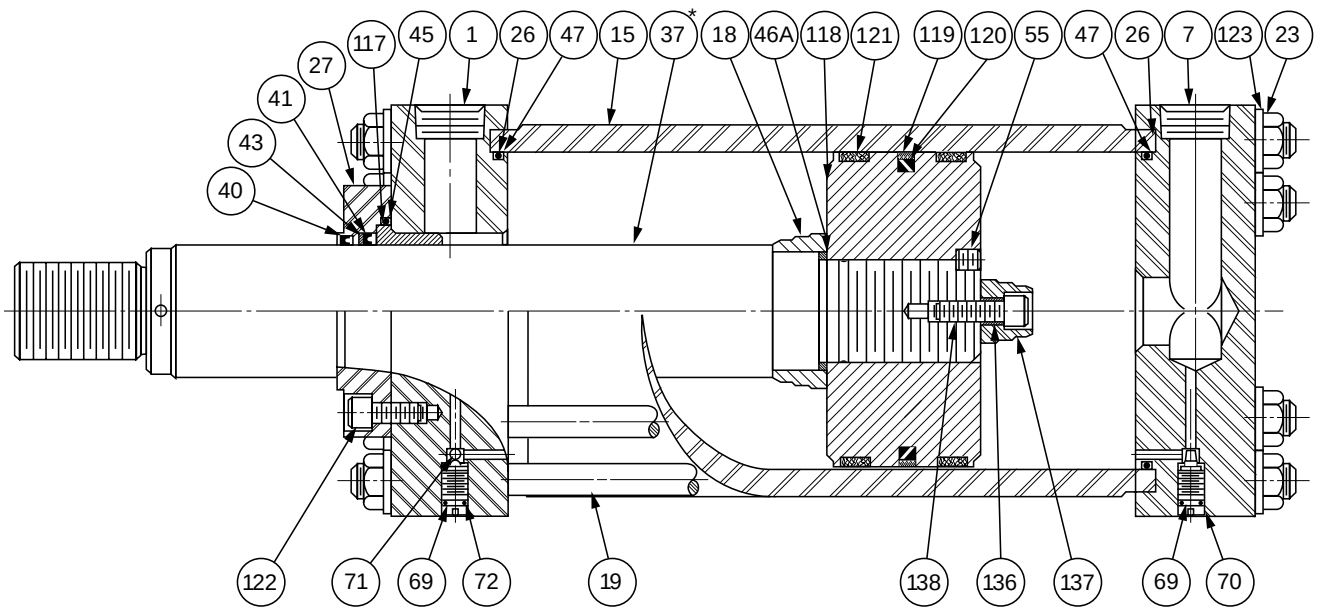
Tie Rod Torque*

Cylinder Bore Size	Cylinder Series L - 2L - 3L		Cylinder Series H - 2H -VH - 3H	
1"	35 in.-lbs.	41 cm-kg	–	–
1 1/2"	60 in.-lbs.	69 cm-kg	18 ft.-lbs.	24 N.m
2" & 2 1/2"	11 ft.-lbs.	15 N.m	45 ft.-lbs.	61 N.m
3 1/4"	25 ft.-lbs.	34 N.m	120 ft.-lbs.	163 N.m
4"	25 ft.-lbs.	34 N.m	131 ft.-lbs.	178 N.m
5"	60 ft.-lbs.	81 N.m	312 ft.-lbs.	423 N.m
6"	60 ft.-lbs.	81 N.m	528 ft.-lbs	716 N.m
6"	L, 2L = 244 ft.-lbs.	L, 2L = 281 N.m	–	–
7"	90 ft.-lbs.	122 N.m	800 ft.-lbs.	1085 N.m
8"	110 ft.-lbs.	149 N.m	1168 ft.-lbs.	1584 N.m
8"	L, 2L = 513 ft.-lbs.	L, 2L = 591 N.m	–	–

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

C

Parts Identification



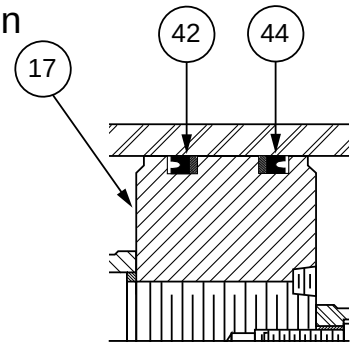
*OR 34, 35, 36

Sym. No.	
1	Head, Basic Style BB, DB, DD, HB &HH
2	Head, Style C
3	Head, Style E
5	Head, Style D
7	Cap, Basic Style D, DB, JB & JJ
8	Cap, Style C
9	Cap, Style E
11	Cap, Style DB
12	Cap, Style BB
15	Cylinder Body
16	Piston Body – Ring Type Piston
17	Piston Body – Lipseal
18	Cushion Sleeve
19	Tie Rod
20	Tie Rod, DD Style Head End
21	Tie Rod, DD Style Cap End
23	Tie Rod Nut – Non-Locking
26	Back-Up Washer, Cylinder Body
27	Retainer
28A	Head, Style JJ
28B	Head, Style JB
29A	Cap, Style HH
29B	Cap, Style HB
34	Piston Rod, Non Cushion
35	Piston Rod, Cushion Head
36	Piston Rod, Cushion Cap
37	Piston Rod, Cushion Both Ends
40	Wiperseal
41	Rod Seal (Polypak)
42	Lipseal, Piston

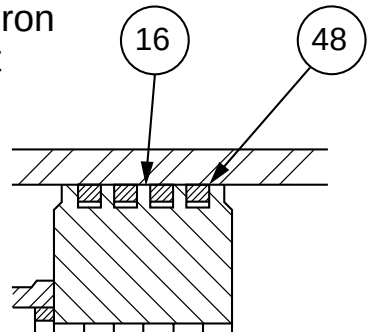
Sym. No.	
43	Back-Up Washer, Polypak
44	Back-Up Washer, Lipseal
45	O-Ring, Gland to Head
46A	Cushion Sealing Ring
47	O-Ring Cylinder Body
48	Piston Ring
55	Piston Lock Pin
57	Piston Rod – Non Cushion K-Type
58	Piston Rod, Cushion One end K-Type
59	Piston Rod, Cushion Both K-Type
60	Extension Rod, Non-Cushion K-Type
61	Extension Rod, Cushion Both Ends K-Type
66	Trunnion
67	Screws, DD Mounting
69	O-Ring, Cushion Adj. & Check Screws
70	Cushion Adjusting Needle Screw
71	Check Valve Ball
72	Check Valve Screw
86	Pivot Pin – BB Mount
87	Retaining Rings for Pivot Pin – BB Mount
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

For additional information – call your local Parker Cylinder Distributor.

Optional Piston Lipseal Kit



Optional Cast Iron Piston Ring 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.

Buna-N

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 -10½F. (-23½C.) to +165½F (+74½C.).

Viton seals

Viton seals can be supplied, on request, and are especially suitable for some fire resistant fluids as shown in the table in Section C, page 105 or for elevated temperature service.

When using Viton seals for high temperature service or fluid compatibility within a temperature range of -10½F. (-23½C) to +250½F. (+121½C) specify Class 5 seals. For elevated temperature service above +250½F. (+121½C) specify Class 5 seals. for elevated temperature service above +250½F. (+121½C) specify Class 5 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. Class 5 seals can operate up to a maximum of +400½F. (+204½C) 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 Viton seals are assembled with anaerobic adhesive having a maximum operating temperature rating of +250½F. (+121½C). Cylinders ordered with all other seal compounds are assembled with anaerobic adhesive having a maximum operating temperature rating of +165½F. (+74½C). These temperature limitations must be strictly followed to prevent loosening of the threaded connections. When cylinders are intended to be used above +250½F. (+121½C) specify a non-studded piston rod end thread and a pinned piston to rod connection.

C

		Rod Seal Kits		Rod Seal Kits Including Bearing	
		Contains Symbol 40,41,43,45		**Contains Symbol 40,41,43,45 & 117**	
	Rod	**Group 1**	**Group 5**	**Group 1**	**Group 5**
Bore	**Dia.**	**Kit No.**	**Kit No.**	**Kit No.**	**Kit No.**
10	4½"	RK3H000451	RK3H000455	RG3H000451	RG3H000455
	7"	RK3H000701	RK3H000705	RG3H000701	RG3H000705
	5"	RK3H000501	RK3H000505	RG3H000501	RG3H000505
	5½"	RK3H000551	RK3H000555	RG3H000551	RG3H000555
12	5½"	RK3H000551	RK3H000555	RG3H000551	RG3H000555
	8"	RK3H000801	RK3H000805	RG3H000801	RG3H000805
	7"	RK3H000701	RK3H000705	RG3H000701	RG3H000705
14	7"	RK3H000701	RK3H000705	RG3H000701	RG3H000705
	10"*	RK3H001001	RK3H001005	RG3H001001	RG3H001005
	8"*	RK3H000801	RK3H000805	RG3H000801	RG3H000805

*NOTE: For 16", 18" and 20" Bore 3H Cylinders with 8" and 10" rods use the seal kits listed above for 14" Bore 3H 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†	
	Contains 4 Ea. Sym. 48, 2 Ea. Sym. 47 & 26		**Contains 2 Ea. Sym. 42, 44, 47 & 26**	
	Group 1	**Group 5**	**Group 1**	**Group 5**
Bore	**Kit No.**	**Kit No.**	**Kit No.**	**Kit No.**
10	PR9023H001	PR9023H005	PK9023H001	PK9023H005
12	PR9223H001	PR9223H005	PK9223H001	PK9223H005
14	PR9423H001	PR9423H005	PK9423H001	PK9423H005

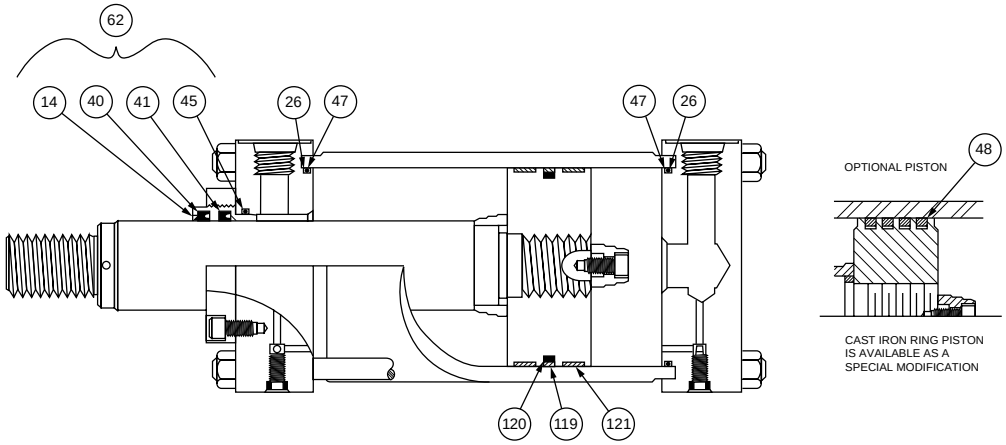
†For 16", 18" and 20" Bore Piston Kits – consult factory.

	Hi Load Piston Seal Kit†		Piston Lipseal Kit†	
	Contains 2 Ea. Sym. 48, 119, 120, 121, 47 & 26		**Contains 2 Ea. Sym. 47 & 26**	
	Group 1	**Group 5**	**Group 1**	**Group 5**
Bore	**Kit No.**	**Kit No.**	**Kit No.**	**Kit No.**
10	PK903HK001	PK903HK005	CB9023H001	CB9023H005
12	PK923HK001	PK923HK005	CB9223H001	CB9223H005
14	PK943HK001	PK943HK005	CB9423H001	CB9423H005

For Cylinder Division Plant Locations – See Page II.

Parker Series 3H, 7" & 8" Bore Hydraulic Cylinders

Parts Identification and Maintenance Instructions



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 Parker Hannifin distributor or office.

Service kits of expendable parts for fluid power cylinders are available for either Class 1, 5 or Class 6 fluid service.

Standard – Class 1 Service Kits are standard, and contain Teflon*, 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 Class 1 seals is -10½F (-23½C) to +165½F (+74½C).

Viton* Seals – Class 5 Service Kits contain viton 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). Viton seals (Class 5) should be used for high temperature service within a temperature range of -10½F (-23½C) to +250½F (+121½C). Viton seals may be operated to +400½F (+204½C) with limited service life. For temperatures above +250½F (+120½C) 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 viton seals are assembled with anaerobic adhesive having a maximum operating temperature range of +165½F (+74½C). 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 +165½F (+74½C) 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 re-assembled to withstand the higher temperature service.

High Water Content Fluid – class 6 Service Kits contain specially compounded HWB seals for High Water Content Fluid Service. These seals can also be used when hydraulic oil is the operating medium. The recommended operating temperature for Class 6 seals is +40½F (+4½C) to +165½F (+74½C).

*Registered tradename of E.I. duPont de Nemours & Co. Inc.

Parts Identification

Sym. No.	Description	Sym. No.	Description
14	Rod Gland	48	Piston Ring
40	Wiperseal	62	Gland Cartridge Assembly
41	Rod Lipseal	119	Outer Ring
26	End Seal Back Up Washer	120	Inner Ring
45	Gland to Head O-Ring	121	Wear Ring
47	End Seal O-Ring		

For Standard Cushion Hardware Kits see Series 2H (7" & 8").

Class 1 Hydraulic Service Only*

Rod. Dia.	Gland Cartridge Kits (Sym. #62) Class 1 (Std.) Buna-N (Nitrile) & Polyurethane	Rod Seal Kits Class 1 (Std.) Buna-N (Nitrile) & Polyurethane
3"	RG2HLTS301	RK2HLTS301
3 1/2"	RG2HLTS351	RK2HLTS351
4"	RG2HLTS401	RK2HLTS401
4 1/2"	RG2HLTS451	RK2HLTS451
5"	RG2HLTS501	RK2HLTS501
5 1/2"	RG2HLTS551	RK2HLTS551

* For other classes of service, refer to Bulletin 0995-MBC.

Bore Size	Cylinder Body Seal Kit CB Includes 2 ea. Symbol 47 & 26	Piston Seal Kits* PR Includes 2 ea. Sym.47 & 26; 4 ea. Sym. 48	Piston Seal Kits* Hi-Load Includes 2 ea. Sym.26, 47 & 121; 1 ea. Sym. 119 &120
7	CB703H001	PR703H001	PK703HK001
8	CB803H001	PR803H001	PK803HK001

†CB, PR & hi-load piston seal kit part numbers shown identify class 1, 2 & 6 service only. To order Class 5 seals substitute 5 for the last digit of kit number.

To Service Rod Gland Seals – The rod gland cartridge, Symbol 62, is removable without disassembly of the cylinder on all Series 3H &" & 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, Symbol 62. 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 Series 3H 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 Teflon* 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 at 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 Teflon 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 Teflon 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.

*Teflon is a registered trademark of E.I. duPont de Nemours & Co., Inc.

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. On 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 to the torque level shown in Table A below. Torque the gland retainer screws to the torque level shown in Table B below.

C

Cylinder Bore Size	Tie Rod Torque*	
7"	800 ft.-lbs.	1085 N.m
8"	1168 ft.-lbs.	1584 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*	
#10	15 in.-lbs.	17 cm-kg
1/4"	60 in.-lbs.	69 cm-kg
5/16"	10 ft.-lbs.	14 N.m
3/8"	20 ft.-lbs.	27 N.m
7/16"	35 ft.-lbs.	48 N.m

*-0%, +5% tolerance.

Service Assemblies and Seal Kits

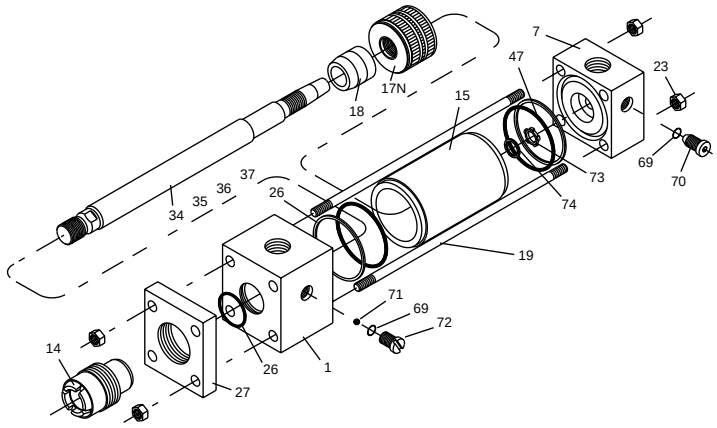
Service Assembly Kits and Seal Kits for HMI cylinders simplfy the ordering and maintenance processes. They contain sub-assemblies which are ready for installation, and are supplied with full instructions. When ordering Service Assemblies and Seal Kits, please refer to the identification plate on the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

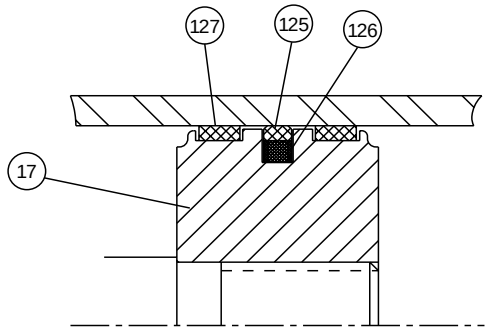
Serial Number - Bore - Stroke - Model Number - Fluid Type

Rod Φ	Gland Cartridge Wrench	Spanner Wrench
12	69590	11676
14	69590	11676
18	84765	11676
22	69591	11676
28	84766	11703
36	69592	11703
45	69593	11677
56	69595	11677
70	69596	11677
90	84768	11677
110	–	–
140	–	–

Key to Part Numbers

1 Head
7 Cap
14 Gland/bearing cartridge
15 Cylinder body
17 Piston - N-Style
18 Cushion sleeve
19 Tie rod
23 Tie rod nut
26 Back-up washer (not 25-50mm bore cylinders)
27 Retainer
34 Piston rod – single rod, no cushion
35 Piston rod – single rod, cushion at head end

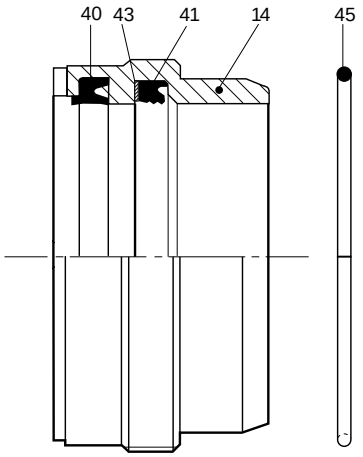




N-Style Piston

36 Piston rod – single rod, cushion at cap end
37 Piston rod – single rod, cushion at both ends
40 Wiperseal – for 14
41 Lipseal – for 14
43 Back-up washer, gland lipseal 41 (not Group 1 seals)
45 O-ring – gland/head
47 O-ring – cylinder body
57[1] Piston rod – double rod, no cusion
58[1] Piston rod – double rod, cushion one end
60[1] Piston rod – double rod, no cushion
61[1] Piston rod – double rod, cushion one end
69 O-ring – needle valve and check valve screws
70 Needle valve, cushion adjustment
71 Ball – cushion check valve
72 Cushion check valve screw
72a Cushion check valve, cartridge type
73 Floating cushion bush
74 Retaining ring for cushion bush
125 Standard piston seal
126 Energising ring for standard seal 125
127 Wear ring for standard piston

[1]Not illustrated



Gland Cartridge and Seals

Contents and Part Numbers of Seal Kits for Piston and Gland

(See key to part numbers opposite)

RG Kit – Gland Cartridge and Seals* Contain items 14, 40, 41, 43, 45. Where the original gland incorporates a gland drain, please consult the factory.

RK Kit – Gland Cartridge Seals* Contain items 40, 41, 43, 45.

Rod ϕ	RG Kit*	PK Kit*
12	RG2HM0121	RK2HM0121
14	RG2HM0141	RK2HM0141
18	RG2HM0181	RK2HM0181
22	RG2HM0221	RK2HM0221
28	RG2HM0281	RK2HM0281
36	RG2HM0361	RK2HM0361
45	RG2HM0451	RK2HM0451
56	RG2HM0561	RK2HM0561
70	RG2HM0701	RK2HM0701
90	RG2HM0901	RK2HM0901
110	RG2HM1101	RK2HM1101
140	RG2HM1401	RK2HM1401

CB Kit – Cylinder Body End Seals* Contain two each of items 47, 26 (not 25-50mm bore).

PN Kit – Standard Piston Seals* (includes cylinder body end seals) Contains two ech of items 42, 26 (not 25-50mm bore), two of item 127, and one each of items 125, 126.

Bore ϕ	CB Body Seal Kit*	N-Style Piston Seal Kit*
25	CB025HM001	PN025HM001
32	CB032HM001	PN032HM001
40	CB040HM001	PN040HM001
50	CB050HM001	PN050HM001
63	CB063HM001	PN063HM001
80	CB080HM001	PN080HM001
100	CB100HM001	PN100HM001
125	CB125HM001	PN125HM001
160	CB160HM001	PN160HM001
200	CB200HM001	PN200HM001

*Seal Groups – Ordering

The part numbers shown in the tables above are for Group 1 seals, denoted by the last character of each part number. For Group 5 seals, substitute a '5' for the '1' at the end of the number sequence.

Contents and Part Numbers of Seal Kits of Service Assembly Kits

(See key to part numbers opposite)

Head Assembly

Non-cushioned: 1, 26, 47
Cushioned: 1, 26, 47, 70, 71, 72, (72a)

Cap Assembly

Non-cushioned: 7, 26, 47
Cushioned: 7, 26, 47, 69, 70, 73, 74

Cylinder Body

All Types: 15

Cushion Screw Assembly

Screw type: 69, 70

Check Valve Screw Assembly

Screw type: 69, 71, 72

Piston Rod Assemblies

These kits contain a fully assembled piston and rod assembly which is ready to install. They comprise a piston assembly of the appropriate type, see parts list below, plus a rod assembly from the types listed below.

Piston Assemblies

N-Style: 17, 125, 126, 127 x 2

Rod Assemblies

Single rod, non-cushioned:	34
Single rod, cushioned head:	35, 18
Single rod, cushioned cap:	36
Single rod, cushioned both ends:	37, 18
Double rod, non-cushioned:	57,60
Double rod, cushioned stronger end:	58, 60, 18
Double rod, cushioned weaker end:	58, 61, 18
Double rod, cushioned both ends:	58, 61, 18 x 2

Tie Rod Torques

Please refer to the table in the mounting information section.

Repairs

Although HMI 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.

NOTE: For installation instructions for Seal Kits for Series HMI cylinders, see bulletin 0995-M17.

C

Head Assemblies

The following head assemblies, when cushioned, include symbols 69, 70, 71 and 72; when non-cushioned, they include head only. Note — When ordering service assembly, specify assembly number and "cushioned" or "non-cushioned."

Ass'y No.	Description
SA1	Basic head (symbol 1)
SA2	Side lug mounting head (symbol 2)
SA5	Trunnion mounting head (symbol 5)

Service Assembly Kits How to Order

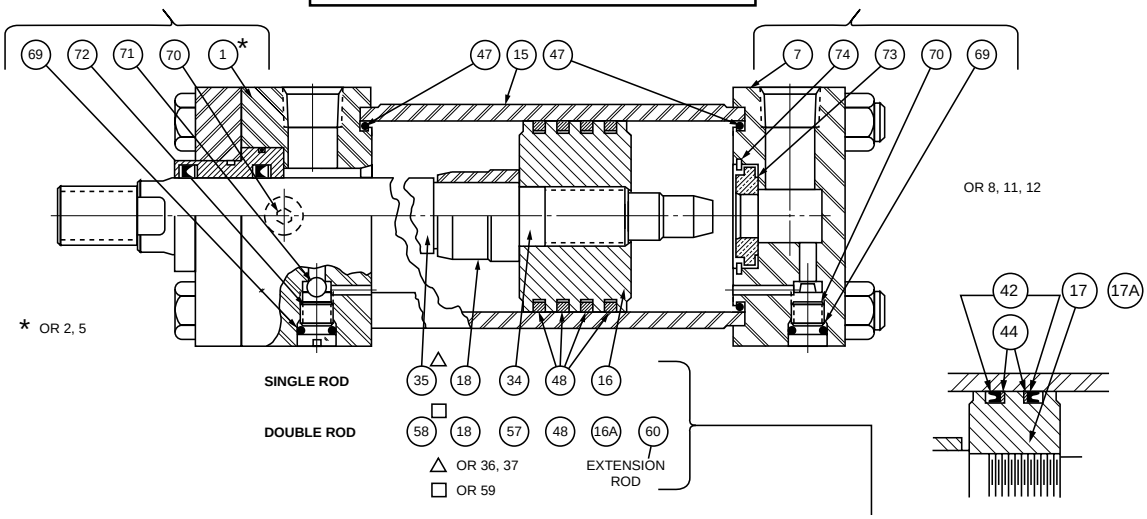
Service assemblies for servicing HD cylinders reduce your maintenance time and purchasing time. By specifying service assemblies for your power cylinder, you will receive sub-assemblies ready for installation. Instructions for installation will be included. Your paper work will be reduced by avoiding the necessity of the identification of each part.

When ordering service assemblies, specify serial number, bore, stroke and model number shown on the cylinder's name plate.

Cap Assemblies

The following cap assemblies, when cushioned, include symbols 69, 70, 73 and 74; when non-cushioned, they include cap only. Note — When ordering service assembly, specify assembly number and "cushioned" or "non-cushioned."

Ass'y No.	Description
SA7	Basic cap (symbol 7)
SA8	Side lug mounting cap (symbol 8)
SA11	Trunnion mounting cap (symbol 11)
SA12	Fixed clevis mounting cap (symbol 12)



Parts List — 1 1/2" through 8" Bore Sizes

Symbol	Part Name
1	Head, basic, styles BB, DB, DD, H, HB, J, JB, TB, TC
2	Head, side lug mounting, style C
5	Head, trunnion mounting, style D
7	Cap, basic, styles D, DD, H, HB, J, JB, TB, TC
8	Cap, side lug mounting, style C
11	Cap, trunnion mounting, style DB
12	Cap, fixed clevis mounting, style BB
15	Cylinder body, standard – plain
16	Piston body, ring type, single rod
16A	Piston body, ring type, double rod
17	Piston body, lipseal type, single rod
17A	Piston body, lipseal type, double rod
18	Cushion sleeve, rod head cushion
34	Piston rod, single rod type – non-cushioned

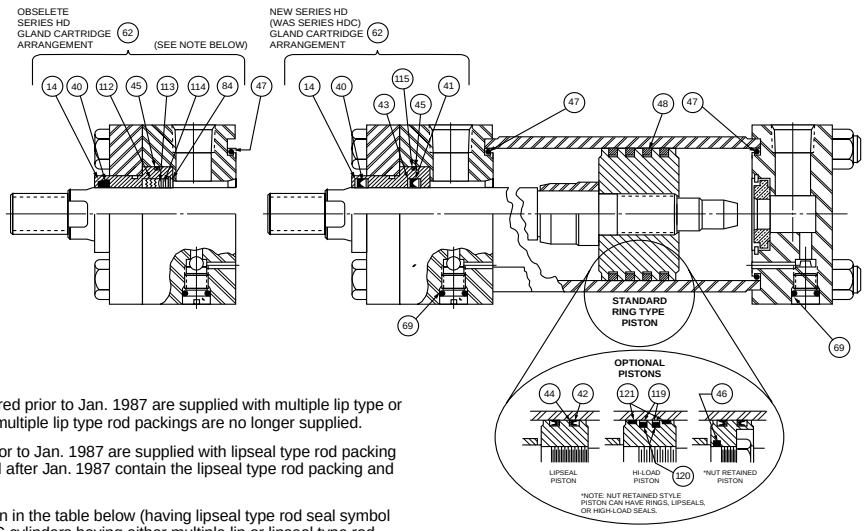
Symbol	Part Name
35	Piston rod, single rod type – cushioned head end
36	Piston rod, single rod type – cushioned cap end
37	Piston rod, single rod type – cushioned both ends
42	Lipseal, piston
44	Back-up washer, piston
47	O-ring, cylinder body to head and cap seal
48	Piston ring, iron
57	Piston rod, double rod type – non-cushioned
58	Piston rod, double rod type – cushioned one end
59	Piston rod, double rod type – cushioned both ends
60	Extension rod, double rod type – non-cushioned
61	Extension rod, double rod type – cushioned both ends
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

Piston and Rod Assemblies

Factory assembled piston and rod assemblies consisting of parts listed below, are recommended for cylinders 6" bore size or smaller in stroke lengths to 25". Factory assembled Assembly Nos. SA 34 and SA 36 are identical, as are assembly nos. SA 85 and SA 37. For larger bore sizes or longer stroke lengths, pistons and rods should be ordered separately as required.

Single Rod Types	
Ass'y No.	**Description**
SA34	Non-cushioned models; includes symbols 34, 16, 48
SA35	Cushioned head end models; includes symbols 35, 16, 18, 48
SA36	Cushioned cap end models; includes symbols 36, 16, 48
SA37	Cushioned both ends models; includes symbols 37, 16, 18, 48
Double Rod Types	
Ass'y No.	**Description**
SA57	Non-cushioned models; includes symbols 57, 16A, 48, 60
SA58	Cushioned one end models; includes symbols 58, 16A, 18, 48,60
SA59	Cushioned both ends models; includes symbols 59, 16A, 18, 48, 61

For additional information – call your local Parker Cylinder Distributor.



NOTE: "HD" Series cylinders manufactured prior to Jan. 1987 are supplied with multiple lip type or packing (symbol #112). After Jan. 1987 multiple lip type rod packings are no longer supplied.

"HDC" series cylinders manufactured prior to Jan. 1987 are supplied with lipseal type rod packing (symbol #41). All cylinders manufactured after Jan. 1987 contain the lipseal type rod packing and are now identified as series "HD".

The ("RG") rod gland cartridge kits shown in the table below (having lipseal type rod seal symbol #41) will fit all standard series HD & HDC cylinders having either multiple lip or lipseal type rod packing.

The ("RK") rod seal kits shown in the table below (having lipseal type rod seal symbol #41) **will not fit** existing rod glands (symbol #14) having multiple lip type rod packing symbol #112. Order appropriate "RG" kit shown in the table below for initial "first time" rod seal repair.

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 Parker Hannifin distributor or office.

Service kits of expendable parts for fluid power cylinders are available for either Class 1, 5 or Class 6 fluid service.

Parts Identification

Sym. No.	Description	Sym. No.	Description
14	Rod gland	62	Gland cartridge assy.
40	Rod wiperseal	69	O-ring
41	Rod lipseal	84	Retaining ring
42	Piston lipseal	112	Rod packing set
43**	Rod back-up washer	113	Shim ring
44	Piston back-up washer	114	Wave spring
45	Gland to head o-ring	115	Back-up washer
46*	Piston to rod o-ring	119	Outer ring
47	End seal o-ring	120	Inner ring
48	Piston ring	121	Wear ring

*Symbol 46 required only with nut retained lipseal and hi-load style pistons.
**Not used for class 1 seals.

Rod Gland Seal Kits+

Bore Size	RG (Sym 62) Includes Symbol No. 14, 40, 41, 43, 45 & 115	RK Includes Symbol No. 40, 41, 43, 45 & 115
5/8"	RG1HDL0061	RK1HLD0061
1"	RG1HDL0101	RK1HLD0101
1 3/8"	RG1HDL0131	RK1HLD0131
1 3/4"	RG1HDL0171	RK1HLD0171
2"	RG1HDL0201	RK1HLD0201
2 1/2"	RG1HDL0251	RK1HLD0251
3 1/2"	RG1HDL0351	RK1HLD0351
4"	RG1HDL0401	RK1HLD0401
5 1/2"	RG1HDL0551	RK1HLD0551

+Rod gland cartridge kits & rod seal kit part numbers shown identify class 1 seals only. To order class 2, 5 or 6 seals substitute 2, 5 or 6 as required for the last digit of kit number.

Standard Seals - Class 1 Service Kits are standard, and contain Buna-N and urethane seals for standard fluid service. These seals are suitable for use when air or hydraulic (mineral-type) oil are is the operating medium.

Water Service Seals - Class 2 Service Kits contain Buna-N seals for water service. These seals are recommended for use when water, water-glycol fluid or water-in-oil emlusions are the operating medium.

The recommended operating temperature range for Class 1 and 2 seals is –10° F. (–23° C.) to +165° F. (+74° C.)

Viton* Seals - Class 5 Service Kits contain viton seals and are especially suited for elevated temperature service or for some fire resistant fluids (for specific fluids not listed in Section C of this catalog consult factory). Viton seals (class 5) should be used for high temperature service within a temperature range of –10° F. (–23° C) to +250° F (+121° C) the cylinder may be operated to +400½F (+204½C) with limited service life. For temperatures above +250½F (120½C) the cylinder must be manufactured with a non-studded piston rod end thread and a pinned piston to rod connection.

Warning ⚠ The piston stud and the piston rod to piston threaded connections are secured with an anaerobic adhesive which is temperature sensitive. Cylinders specified with viton seals are assembled with an anaerobic adhesive having a maximum operating temperature rating of +250° F. (+121° C.). Cylinders specified with all other seal compounds are assembled with an anaerobic adhesive having a maximum operating temperature 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 re-assembled to withstand the higher temperature service.

High Water Content Fluid - Class 6 Service Kits contain specially compounded HWB seals for High Water Content Fluid Service. These seals can also be used when hydraulic oil is the operating medium. The recommended operating temperature range for Class 6 seals is +40° F (+4° C) to +165° F (+74° C).

***Registered tradename of E.I.duPont de Nemours & Co. Inc.

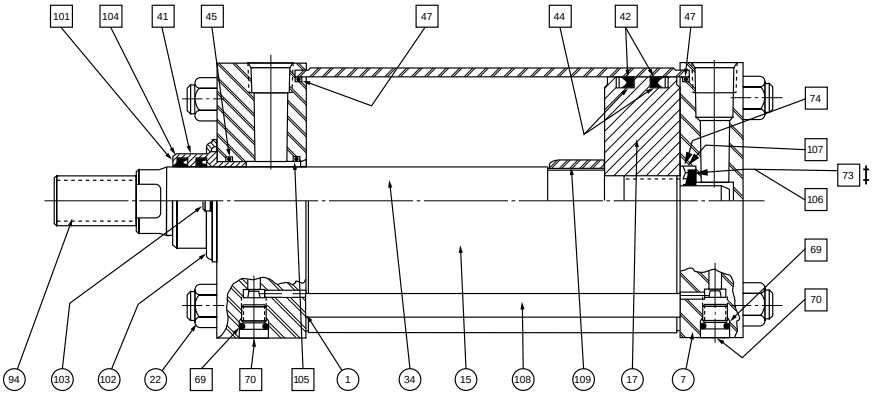
Bore Size	Cylinder Body Seal Kit	Piston Seal Kits†		
	CB	PK	PR	Hi-Load
	Includes 2 ea. Symbol No. 47	Includes 2 ea. Symbol 42, 44 & 47	Includes 2 ea. Sym.47 4 ea. Sym. 48	Includes 2 ea. Symbol 47,119, 120 & 121
1 1/2	CB152HL001	PK152HLL01	PR152H0001	PK152HK001
2	CB202HL001	PK202HLL01	PR202H0001	PK202HK001
2 1/2	CB252HL001	PK252HLL01	PR252H0001	PK252HK001
3 1/4	CB322HL001	PK322HLL01	PR322H0001	PK322HK001
4	CB402HL001	PK402HLL01	PR402H0001	PK402HK001
5	CB502HL001	PK502HLL01	PR502H0001	PK502HK001
6	CB602HL001	PK602HLL01	PR602H0001	PK602HK001
8	CB802HL001	PK802HLL01	PR802H0001	PK802HK001

†CB, PR & hi-load piston seal kit part numbers shown identify class 1, 2 & 6 service only. To order Class 5 seals substitute 5 for the last digit of kit number.

PK kit part numbers shown identify Class 1 service only. For Class 2, 5 & 6 substitute for last digit of kit number, as follows.

5–for Class 5 seals
6–for Class 2 or 6 seals

C



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

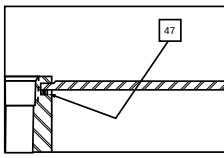
Seal Kits

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

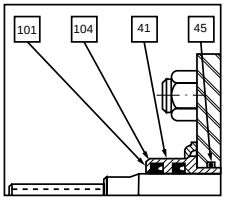
Seal kits contain seals of nitrile (Buna-N) elastomers, the same as original seals installed in Series MA cylinders. They are recommended when air is the operating medium. Normal operating temperature range is -10½F. to +165½F.

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

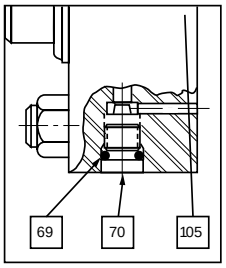
Replacement parts can be identified from list below. To order specify bore, stroke, model number and serial number shown on cylinder name plate. Order seal kits from table at right.



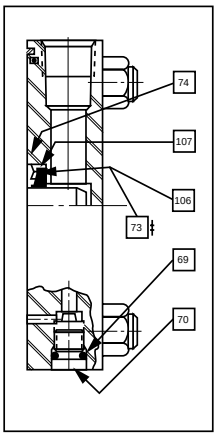
Seal Kit
(Sym. SK)



Rod Gland
Cartridge Kit
(Sym. RG)



Head End
Cushion Kit
(Sym. CH)



Cap End
Cushion Kit
(Sym. CC)

Basic Cylinder Parts Identification

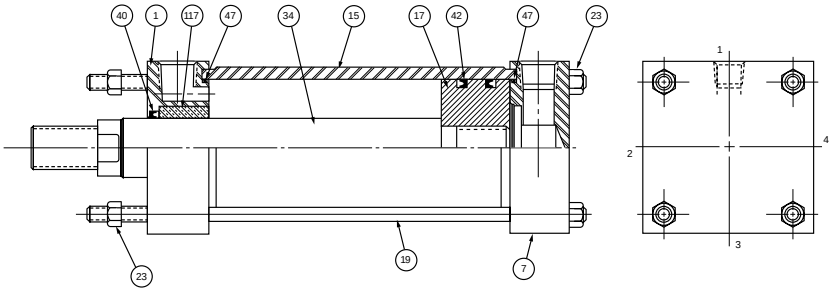
Sym.	Part Name
1	Head
7	Cap
15	Cylinder Body
17	Piston
22	Tie Rod Nut
34	Piston Rod
41	Lipseal Rod Gland
42	Lipseal, Piston
44	Back-up washer, Piston
45	O-Ring, Gland to Head
47	O-ring, End Seal
69	O-Ring, Cush. Adj.
70	Needle, Cush. Adj.
73	Bushing, Cushion
74	Retaining Ring
94	Stud, Rod End
101	Gland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

Bore Size	Rod Dia.	Sym. SK Seal Kit Contains Sym. #41, 42, 44, 45, 47 & 104 Part Number	Sym. RG Rod Gland Cartridge Kit Contains Sym.#41, 45,101 & 104 Part Number	Sym. CH Head End Cushion Kit Contains Sym. #69, 70 & 105 Part Number	Sym. CC Cap End Cushion Kit Contains Sym. #69, 70, 74, 106 & 107 Part Number	Tie Rod Nut Torque* Series MA Cylinders Steel Tube Tie Rod Nut Torque		Aluminum Tube Tie Rod Nut Torque	
1 1/2	5/8	SKL7000MAI	RGL6948MAI	CHL7011MAI	CCL7016MAI	60 in.-lbs.	69 cm-kg	20 in.-lbs.	23 cm-kg
2	5/8	SKL7001MAI	RGL6948MAI	CHL7012MAI	CCL7016MAI	11 ft.-lbs.	15 N.m	72 ft.-lbs.	83 cm-kg
	1	SKL7002MAI	RGL6949MAI	CHL7013MAI	CCL7016MAI	11 ft.-lbs.	15 N.m	72 ft.-lbs.	83 cm-kg
2 1/2	5/8	SKL7003MAI	RGL6948MAI	CHL7012MAI	CCL7016MAI	11 ft.-lbs.	15 N.m	72 ft.-lbs.	83 cm-kg
	1	SKL7004MAI	RGL6949MAI	CHL7013MAI	CCL7016MAI	11 ft.-lbs.	15 N.m	72 ft.-lbs.	83 cm-kg
3 1/4	1	SKL7005MAI	RGL6949MAI	CHL7014MAI	CCL7017MAI	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
	1 3/8	SKL7006MAI	RGL6950MAI	CHL7015MAI	CCL7017MAI	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
4	1	SKL7007MAI	RGL6949MAI	CHL7014MAI	CCL7017MAI	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
	1 3/8	SKL7008MAI	RGL6950MAI	CHL7015MAI	CCL7017MAI	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
5	1	SKL7009MAI	RGL6949MAI	CHL7014MAI	CCL7017MAI	60 ft.-lbs.	81 N.m	37 ft.-lbs.	50 N.m
	1 3/8	SKL7010MAI	RGL6950MAI	CHL7015MAI	CCL7017MAI	60 ft.-lbs.	81 N.m	37 ft.-lbs.	50 N.m
6	1 3/8	SKL7098MAI	RGL6950MAI	CHL7170MAI	CCL7171MAI	60 ft.-lbs.	81 N.m	37 ft.-lbs.	50 N.m

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

For additional information – call your local Parker Cylinder Distributor.

Series VP Parts Listing (2" thru 5" Bore Sizes)



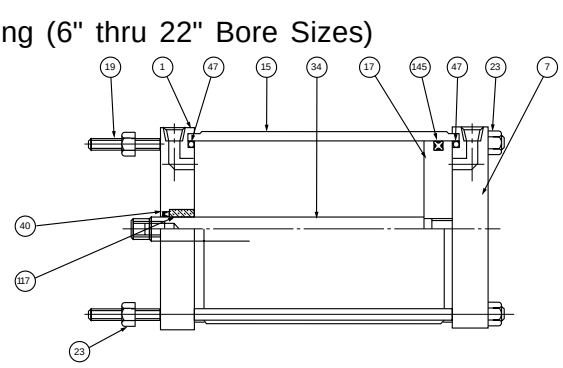
Item	Qty.	Description
1	1	Head
7	1	Cap
15	1	Cylinder Body
17	1	Piston Body
19	4	Tie Rod
23	8	Tie Rod Nut
34	1	Piston Rod
40	1	Rod (Wiper/Lipseal)
42	2	Piston Lipseal
47	2	Cylinder Body O-ring
117	1	Rod Bearing

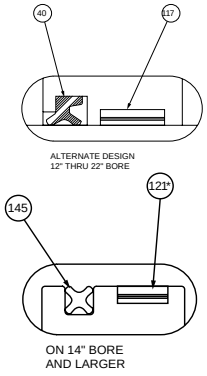
Valve Actuator Cylinder Seal Kits
are complete and consist of the following:
40 (1 ea.), 42 & 47 (2 ea.)

Bore Size	Rod Dia.	Class 1 SK Seal Kit Nos. Containing Piston and Body Seals	Class 5 SK Seal Kit Nos. Containing Piston and Body Seals	Tie Rod Size (Inches)	Tie Rod Nut Torque* ft. lbs./N-m
2"	5/8"	KT020VP061	KT020VP065	5/16-24	11/15
2 1/2"	5/8"	KT025VP061	KT025VP065	5/16-24	11/15
3 1/4"	1"	KT032VP101	KT032VP105	3/8-24	25/34
4"	1"	KT040VP101	KT040VP105	3/8-24	25/34
5"	1"	KT050VP101	KT050VP105	1/2-24	60/81

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

Series VP Parts Listing (6" thru 22" Bore Sizes)





Item	Qty.	Description
1	1	Head
7	1	Cap
15	1	Cylinder Body
17	1	Piston Body
19	4	Tie Rod
23	8	Tie Rod Nut
34	1	Piston Rod
40	1	Rod (Wiper/Lipseal)
47	2	Cylinder Body O-ring
117†	1	Rod Wear Ring
121*	1	Piston Wear Ring
145	1	Piston Quad Seal

†117 – not replaceable on current design

*121 – required only on 14" thru 22" Bore Cylinders

Valve Actuator Cylinder Seal Kits
are complete and consist of the following:
6"–10" Bore - 1 ea. #40, #145, 2 ea. #47
14"–22" Bore - 1 ea #40, #117, #121, #145, 2 ea. #47
12" Bore - 1 ea #40, #117, 2 ea. #47

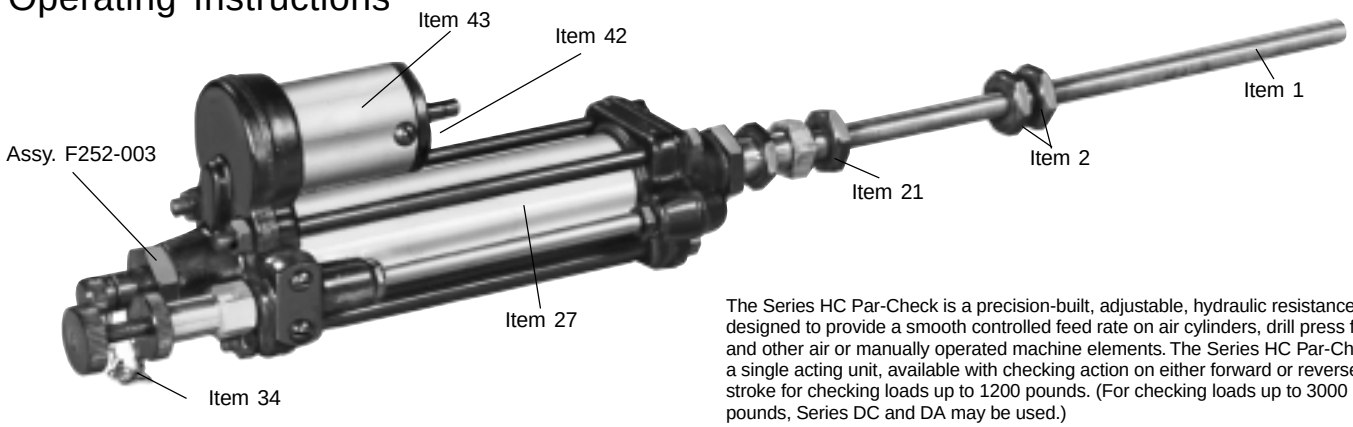
Bore Size	Rod Dia.	Class 1 SK Seal Kit Nos. Containing Piston and Body Seals	Class 5 SK Seal Kit Nos. Containing Piston and Body Seals	Tie Rod Size (Inches)	Tie Rod Nut Torque* ft. lbs./N-m
6"	1"	KT060VP101	KT060VP105	1/2-20	60/81
7"	1"	KT070VP101	KT070VP105	5/8-18	90/122
8"	1"	KT080VP101	KT080VP105	5/8-18	110/149
10"	1"	KT100VP101	KT100VP105	3/4-16	148/201
12"	1 3/8"	KT120VP131	KT120VP135	3/4-16	172/233
14"	1 3/8"	KT140VP131	KT140VP135	7/8-14	275/373
16"	1 3/4"	KT160VP171	KT160VP175	1-14	390/529
18"	2"	KT180VP201	KT180VP205	1 1/8-12	540/732
20"	2"	KT200VP201	KT200VP205	1 1/4-12	745/1010
22"	2 1/2"	KT220VP251	KT220VP255	1 1/4-12	745/1010

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

For Cylinder Division Plant Locations – See Page II.

NOTES

Series HC Par-Check
Operating Instructions



The Series HC Par-Check is a precision-built, adjustable, hydraulic resistance unit designed to provide a smooth controlled feed rate on air cylinders, drill press feeds and other air or manually operated machine elements. The Series HC Par-Check is a single acting unit, available with checking action on either forward or reverse stroke for checking loads up to 1200 pounds. (For checking loads up to 3000 pounds, Series DC and DA may be used.)

Operating Principle: The Par-Check consists basically, of a checking cylinder (Item 27), checking piston rod (Item 1), adjustable needle valve (Item 34), and a balance cylinder (Item 43).

The checking piston rod may be directly attached or linked to a moving machine part. As the piston rod is pulled out, oil in the checking cylinder is forced, by the moving piston, through the transfer tube, through the needle valve, into the rear end of the checking cylinder. On the return or non-checking stroke, the hydraulic oil returns through the piston valve and the unit is ready for another checking stroke.

The balance cylinder assembly (Item 43) automatically compensates for the volumetric displacement of the checking piston rod. An indicator rod (Item 42), attached to the balance cylinder piston, indicates the amount of oil in the Par-Check. Three grooves on the indicator rod show when and how much oil should be added to maintain correct hydraulic volume. Make-up oil is added through filling valve (Assy. F252-003) with a model B161-003 oil fill gun.

Mounting: The Par-Check can be operated in any position provided it is mounted directly in-line or parallel to the force it is to control. If unit is mounted parallel, the force or power supply should be guided by ways or guide rods to prevent side strain on the Par-Check piston rod. The in-line type of mounting is the most desirable type to use on any application. Series HC Par-Checks are available with a threaded piston rod guide and lock nut for nose mounting or pivot brackets and rod clevis for pivot mounting.

Checking Stroke Adjustment: The mechanical linkage to the element being controlled, moving between two piston rod lock nuts, actuates the Par-Check. The point at which checking action begins is determined by the position of the second lock nut (Item 2) on threaded piston rod. Thus, any portion of the full stroke length may be used for checking. The forward piston rod lock nut is used to lock the second in position. The actuating element engages the first lock nut on return stroke to retract the piston rod.

The first or innermost piston rod lock nut (Item 21) must be kept at back end of piston rod thread to prevent Par-Check piston from bottoming against rear cylinder head. This nut is locked in position with a socket head set screw.

CAUTION: Before applying checking load, be sure stroke of Par-Check is long enough to prevent power source from bottoming Par-Check piston against front head and possibly damaging Par-Check.

Adjustment of Checking Rate: Checking Speed is controlled by turning the knurled needle valve knob (Item 34). Rate is reduced as the knob is turned clockwise and increased as it is turned counterclockwise.

Oil Level: Amount of oil in Par-Check is indicated by position of balance cylinder indicator rod (Item 42). The position is determined by grooves on the rod. Proper oil level is indicated when, with threaded piston rod extended, the second indicator groove is flush with balance cylinder head. When threaded piston rod is retracted, the third innermost groove should be flush with cylinder head. Oil should be added when groove nearest end of indicator rod becomes flush with face of balance cylinder head, when threaded piston rod is fully extended.

NOTE: Use our F442 hydraulic oil only. If circumstances require temporary use of another type of oil, drain and thoroughly flush the Par-Check system. Then refill with substitute oil.

Dismantling and Reassembling: Always use care in dismantling and reassembling Par-Check to be sure cylinders, piston seals and piston rod seals are not damaged. Replace any damaged packings before reassembling.

Service Kit: A convenient means of stocking parts subject to replacement through normal operation. Order Kit Number B732-471.

Adding Oil: Before replacing filler valve, the main cylinder should be filled with our F442 hydraulic oil, as follows:

1. Stand Par-Check upright with piston rod pointed downward and fully extended.

2. Slowly pour oil into the cylinder until level with filler valve opening.

3. Move piston rod in and out slightly (1/16" to 1/8") to release any air trapped under piston assembly.

4. Allow Par-Check to stand in upright position for a short while to allow air to escape.

5. Replace filler valve.

6. Use B161-003 oil gun to bring Par-Check to proper level, indicated by grooves on indicator rod. Air must be bled from oil gun before filling Par-Check. Stand Oil Gun with nozzle pointing up. Cause oil to flow from nozzle until it runs clear of air bubbles.

7. Follow Air Bleeding procedure to remove all traces of trapped air.

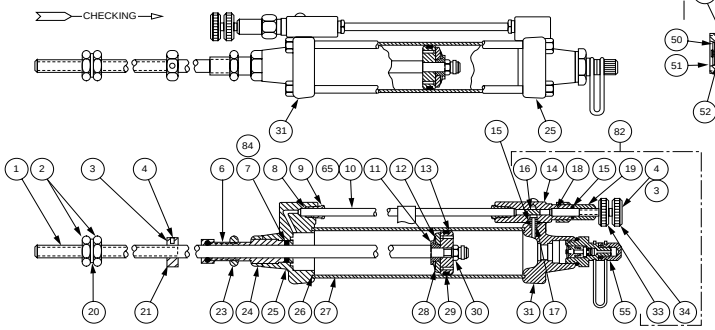
For Cylinder Division Plant Locations – See Page II.

Series HC Par-Check

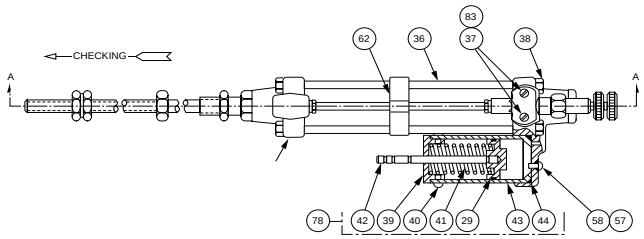
Parts List and Parts Drawing

Important:
Order by PART NUMBER only.
Do NOT order by item number.

Reverse Acting Unit



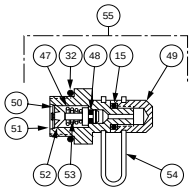
Standard Unit

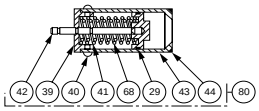


Section AA

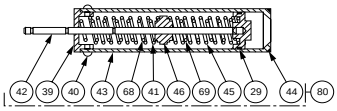
BALANCE CYLINDER ASSEMBLY FOR
MODELS WITH 2, 4 & 6" STROKE ONLY

Fill Valve Assembly

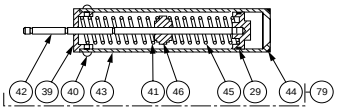




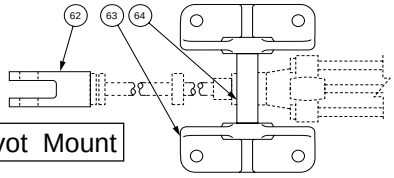
BALANCE CYLINDER ASSEMBLY FOR REVERSE
ACTING MODELS WITH 2, 4 & 6" STROKE ONLY



BALANCE CYLINDER ASSEMBLY FOR REVERSE
ACTING MODELS WITH 8, 12, 15 & 18" STROKE ONLY



BALANCE CYLINDER ASSEMBLY FOR
MODELS WITH 9, 12, 15 & 18" STROKE ONLY



Pivot Mount

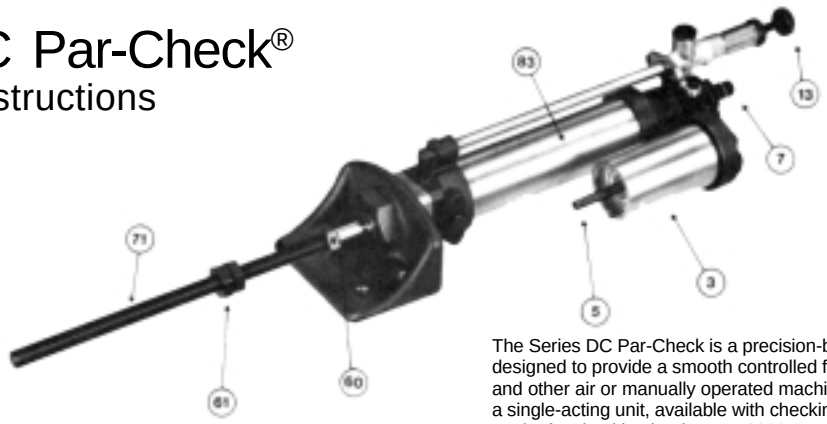
Parts List

Item No.	Description	Part No.
1	Piston Rod (Specify Stroke)	B833-057
2	Piston Rod (2 Required)	B663-023
3	Thread Protector	B733-010
4	Set Screw	H122-02
6	Piston Rod Gland	B193-033
7	“O” Ring	H134-25
8	Transfer Tube Seal (4 Required)	B893-018
9	Transfer Tube Gland	B483-013
10	Transfer Tube (Specify Stroke)	F163-010
11	Valve Plate Retainer	B803-026
12	Valve Spring	F023-046
13	Piston	B713-044
14	Control Valve Body	B123-035
15	“O” Ring	H134-16
16	Control Valve Pin	B693-025
17	Bushing Seal	B193-032
18	Control Valve Stem	F033-020
19	Control Valve Gland	B483-012
20	Washer	F193-014
21	Piston Rod Nut	B663-021
23	Mounting Nut	B663-020
24	Gland Nut	B663-024
25	Front cylinder Head	B513-160
26	Cylinder Gasket (2 Required)	B453-033
27	Main Cylinder (Specify Stroke)	F153-048
28	Valve Plate	B723-063
29	“O” Ring (2 Required)	H136-06
30	Locking Nut	H063-22
31	Rear Cylinder Head	B513-159
32	“O” Ring	H135-12
33	Control Valve Knob	B573-007
34	Control Valve Knob	B573-006
35	Transfer Tube Support (Used on 15" Stroke or Longer Units)	F073-007
36	Tie Rods (4 Required) (Specify Stroke)	B843-049
37	Machine Screw (2 Required)	H112-05
38	Nut (8 Required)	H060-05
39	Balance Cylinder Head	B513-161
40	Machine Screw (2 Required)	H112-06
41	Balance Cyl. Spring (All Strokes)	F023-048
42	Indicator Rod & Piston Assembly 2, 4 & 6" Str. Units (Specify 6" Stroke) 9, 12, 15 & 18" Stroke (Specify 18" Stroke)	B592-007
43	Balance Cylinder 2, 4 & 6" Str. Units (Specify 6" Stroke) 9, 12, 15 & 18" Stroke (Specify 18" Stroke)	F153-049 F153-049 H136-32
44	“O” Ring	
45	Balance Cylinder Spring	F023-047
46	Spring Guide	F023-044
47	Filling Valve Spring	H134-06
48	“O” Ring	B343-001
49	Valve Cover	H090-79
50	Retaining Ring	B123-002
51	Valve Body	B803-025
52	Valve Retainer	F183-003
53	Valve Stem	F043-016
54	Valve Strap	F252-003
55	Filling Valve Assembly	H134-12
57	“O” Ring	H106-06
58	Machine Screw	B273-057
62	Rod Clevis	B623-004
63	Pivot Lug (2 Required)	B183-213
64	Pivot Bracket	F163-009
*65	Transfer Tube (Filter Only) (Specify Stroke)	F023-049
68	Spring (Reverse-Acting Only) (All Strokes)	
69	Spring (Reverse-Acting Only) (9, 12, 15 & 18" Stroke Units)	F023-050
78	Balance Cyl. Assem. Forward-Acting 2, 4 & 6" Stroke (Specify 6" Stroke)	B262-003
79	Balance Cyl. Assem. Forward-Acting, 9, 12, 15 & 18" Stroke (Specify 18" Stroke)	B262-003
80	Balance Cyl. Assem. Reverse-Acting 2, 4 & 6" Stroke (Specify 6" Stroke)	B262-004
81	Balance Cyl. Assem. Reverse-Acting, 9, 12, 15 & 18" Stroke (Specify 18" Str.)	B262-004
82	Throttle Valve Assembly (Basic)	F082-2047
83	Lock Washer	H174-02
84	Back-up Ring (Reverse Acting Only)	H143-113

* = Obsolete

For additional information – call your local Parker Cylinder Distributor.

Series DC Par-Check®
Operating Instructions



The Series DC Par-Check is a precision-built, adjustable, hydraulic resistance unit designed to provide a smooth controlled feed rate on air cylinders, drill press feeds and other air or manually operated machine elements. The Series DC Par-Check is a single-acting unit, available with checking action on either forward or reverse stroke for checking loads up to 3000 pounds. (For checking loads up to 1200 pounds, Series HC Par-Checks may be used. For checking action on both forward and reverse stroke at loads up to 3000 pounds, Series DA Par-Checks may be used.)

Operating Principle

The Par-Check consists basically of a checking cylinder (item 83), checking piston rod (Item 71), adjustable needle valve (Item 13), and a balance cylinder (Item 3).

The checking piston rod may be directly attached or linked to a moving part. As the piston rod is pulled out, oil in the checking cylinder is forced, by moving piston, through the transfer tube, through the needle valve, into the rear end of the checking cylinder. On the return or non-checking stroke, the hydraulic oil returns through the piston valve and the unit is ready for another checking stroke.

The balance cylinder assembly (Item 3), automatically compensates for the volumetric displacement of the checking piston rod. An indicator rod (Item 5), attached to the balance cylinder piston, indicates the amount of oil in the Par-Check. Three grooves on the indicator rod show when and how much oil should be added to maintain correct hydraulic volume. Make-up oil is added through filling valve (Item 7).

Mounting

The Par-Check can be operated in any position provided it is mounted directly in-line or parallel to the force it is to control. If unit is mounted parallel, the force or power supply should be guided by ways or guide rods to prevent side strain on the Par-Check piston rod. The in-line type of mounting is the most desirable type to use on any application. Series DC Par-Checks are available with a threaded piston rod guide and mounting nut for nose mounting, foot bracket for foot mounting, pivot brackets and rod clevis for pivot mounting, or feed brackets for mounting on drill press feeds.

Checking Stroke Adjustment

The mechanical linkage to the element being controlled, moving between two piston rod lock nuts, actuates the Par-Check. The point at which checking action begins is determined by the position of the second lock nut (Item 61) on threaded piston rod. Thus, any portion of the full stroke length may be used for checking. The forward piston rod lock nut is used to lock the second in position. The actuating element engages the first lock nut (Item 60) on return stroke to retract the piston rod.

Irregular Checking Action

The presence of air in Par-Check will cause irregular checking action. Air can be detected by a spongy feel when pressing on balance cylinder rod, or by sound of air passing through needle valve when in operation. Follow Air Bleeding procedure to remove all traces of trapped air.

The first or innermost piston rod lock nut (Item 60) must be kept at back end of piston rod thread to prevent Par-Check piston from bottoming against rear cylinder head. This nut is locked in position with a socket head set screw.

CAUTION: BEFORE APPLYING CHECKING LOAD, BE SURE STROKE OF PAR-CHECK IS LONG ENOUGH TO PREVENT POWER SOURCE FROM BOTTOMING PAR-CHECK PISTON AGAINST FRONT HEAD AND POSSIBLY DAMAGING PAR-CHECK.

Adjustment of Checking Rate

Checking Speed is controlled by turning the knurled needle valve knob (Item 13). Rate is reduced as the knob is turned clockwise and increased as it is turned counterclockwise.

Oil Level

Amount of oil in Par-Check is indicated by position of balance cylinder indicator rod (Item 5). The position is determined by grooves on the rod. Proper oil level is indicated when, with threaded piston rod extended, the second indicator groove is flush with balance cylinder head. When threaded piston rod is retracted, the third innermost groove should be flush with cylinder head. Oil should be added when groove nearest end of indicator rod becomes flush with face of balance cylinder head, when threaded piston rod is fully extended.

Bleeding Air from Oil

Retract Par-Check piston rod and hold retracted. Fill Par-Check until oil bleeds from small hole in balance cylinder. (Air must be bled from oil gun before filling Par-Check.) Slowly cycle piston rod. Stand Par-Check for a period of time with fill valve in highest position. Using a small rod (paper clip), open fill valve and allow air to bleed off. Fill again with bleed hole in balance cylinder in the highest position and with piston rod retracted. Allow a clear stream of oil to flow from small hole in balance cylinder. Using small rod release a quantity of oil from fill valve so Par-check is not over-filled (third innermost groove on indicator rod flush with balance cylinder head with threaded rod retracted). Par-Check is now ready for use.

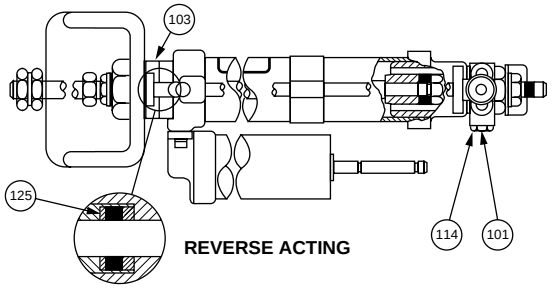
C

Parts List

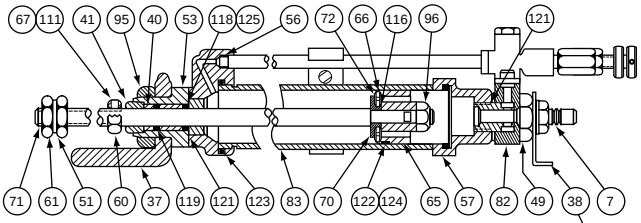
Important: Order by Part Number only. Do not order by Item Number.

Item No.	Part No.	Description
1	G450301	Solenoid Valve (Specify Voltage)*
2	B102-002	Cylinder Assy. – (Stop Assy.)
3	B262-002	Balance Cyl. Assy. 2, 4 & 6" Units (Specify 6" Stroke)
4	B262-002	Balance Cyl. Assy. 9, 12, 15 & 18" Stroke Units
5	B592-005	Indicator Rod & Piston Assy. 2, 4 & 6" Stroke Units
6	F142-006	Balance Cyl. Tube Assy. 2, 4 & 6" Stroke Units (Specify 6: Stroke) 9, 12, 15 & 18" Stroke Units (Specify 18" Stroke)
7	F252-003	Fill Valve Assy.
8	F082-2010	Std. Valve
9	F082-2011	Std. Valve (No Transfer Tube)
10	F082-2012	Precision Valve
*13	F082-2015	Std. Valve
*14	F082-2017	Std. Skip
*15	F082-2069	Std. Stop
*16	F082-2070	Std. Stop-Skip
*17	F082-2021	Precision Valve
*18	F082-2022	Precision Skip
†*19	F082-2023	Precision Stop
†*20	F082-2024	Precision Stop-Skip
*21	F082-2025	Precision - Reverse Acting
*23	F082-2026	Precision Skip - Reverse
*22	F082-2027	Precision Stop - Reverse
*24	F082-2028	Precision Stop-Skip - Reverse
25	F082-2044	Stop or Skip Sub-Assy.
26	F082-2045	Stop Assy.
27	F082-2046	Stop Assy. - Precision Reverse
28	F082-2051	Precision Valve
31	B023-012	Port Adaptor
32	B113-012	Support Block
33	B113-039	Adaptor Block
34	B123-002	Body
35	B123-003	Body
36	B133-002	Screw
37	B183-102	Foot Bracket
38	B183-103	Mtg. Bracket (Optional)
39	B183-226	Pivot
40	B193-026	Bushing
41	B193-027	Retainer
42	B193-028	Sleeve Bushing
43	B193-029	Seal Bushing
44	B193-030	Seal Bushing
45	B193-031	Rod Bushing
46	B233-012	Cylinder Cover
47	B273-060	Rod Clevis
48	B343-001	Cap
49	B423-001	Fitting
50	B453-023	Gasket
51	B453-031	Washer
52	B483-011	Valve Sleeve
53	B493-038	Gland
54	B493-055	Gland
55	B493-057	Guide
56	B513-146	Front Head
57	B513-157	Rear Head
58	B513-242	Rear Head
59	B623-004	Mtg. Bracket
60	B663-015	Lock Nut
61	B663-016	Nut
62	B663-018	Locking Nut
63	B663-019	Adjusting Knob
64	B713-035	Piston
65	B713-064	Piston
66	B723-047	Valve Plate
67	B733-010	Thread Protector
68	B733-014	Plug
69	B803-025	Spring Retainer
70	B803-054	Retainer
71	B833-055	Piston Rod
72	F023-036	Spring
73	F023-038	Spring
74	F023-044	Spring
75	F023-055	Spring
76	F023-056	Spring
77	F033-019	Valve Stem
78	F043-001	Support Bracket
79	F043-002	Support Strap
80	F043-016	Strap
81	F043-018	Support Strap
82	F073-005	Support
*83	F153-047	Cyl. Tube
*84	F163-006	Trans. Tube - Std.
‡*85	F163-007	Trans. Tube - Stop
‡*86	F163-008	Trans Tube - Std.
*87	F163-015	Trans Tube - Prec.
*88	F163-016	Trans. Tube - Prec.-Stop
*89	F163-033	Trans. Tube - Stop
90	F183-002	Metering Pin
91	F183-003	Valve Stem
92	F193-031	Washer
93	F283-001	Port Adaptor
94	H060-01	Nut
95	H062-34	Nut
96	H063-29	Lock Nut
97	H064-11	Nut
98	H064-12	Nut
99	H076-02	Close Nipple
100	H090-79	Retaining Ring
101	H096-62	Screw
102	H096-89	Screw
103	H100-41	Screw
104	H100-42	Screw
105	H100-45	Screw
106	H100-46	Screw
107	H100-53	Screw
108	H104-20	Screw
109	H106-06	Screw
110	H113-29	Screw
111	H122-02	Screw
112	H134-06	O-Ring
113	H134-12	O-Ring
114	H134-14	O-Ring
115	H134-16	O-Ring
116	H134-27	O-Ring
117	H134-30	O-Ring
118	H134-33	O-Ring
119	H135-02	O-Ring
120	H135-12	O-Ring
121	H135-24	O-Ring
122	H136-34	O-Ring
123	H137-12	O-Ring
124	H143-24	Back Up Ring
125	H143-73	Back Up Ring
126	H167-07	90½ Male Elbow
127	H167-41	Male Connector
128	H171-03	Copper Tubing
129	H175-64	Lockwasher
130	H178-05	Washer
131	H178-09	Washer
132	H194-04	Screw
133	H221-83	O-Ring

* = Specify Stroke † = 4" Min. Stroke
‡ = Obsolete replacement tubes, for units with filter

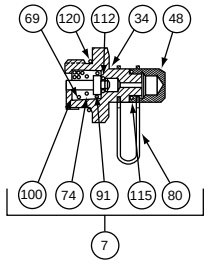


REVERSE ACTING

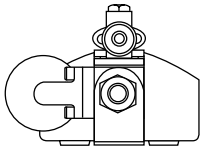


FORWARD ACTING

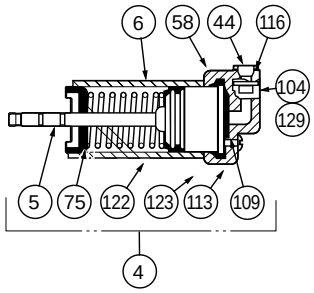
OPTIONAL – MUST BE SPECIFIED ON ORDER



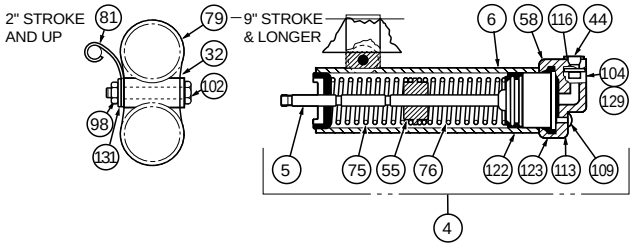
FILL VALVE ASSEMBLY



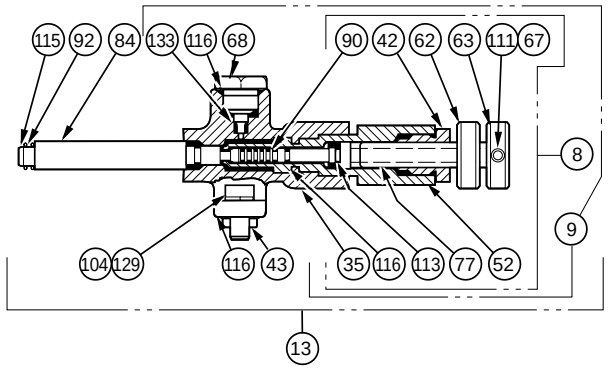
For additional information – call your local Parker Cylinder Distributor.

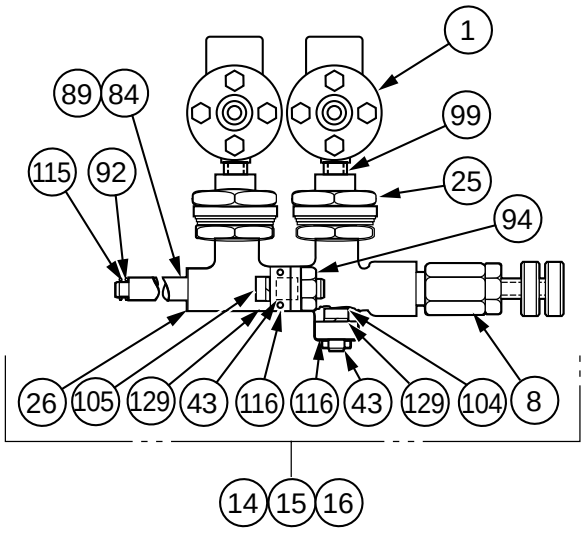


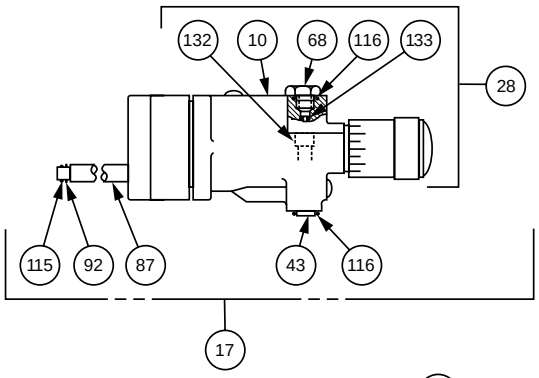
BALANCE CYLINDER ASSEMBLY
FOR PAR-CHECKS WITH
2, 4 & 6" STROKES ONLY

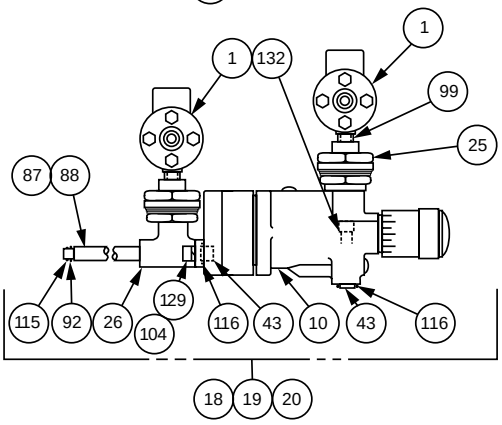


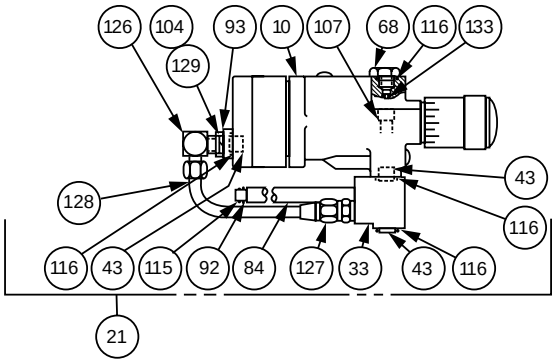
BALANCE CYLINDER ASSEMBLY
FOR PAR-CHECKS WITH 9",
15" & 18" STROKES ONLY

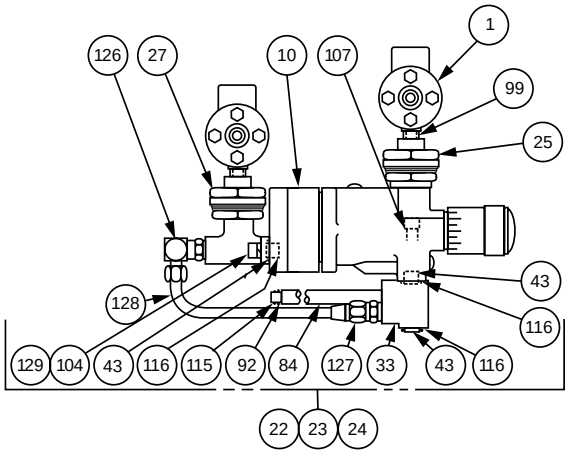




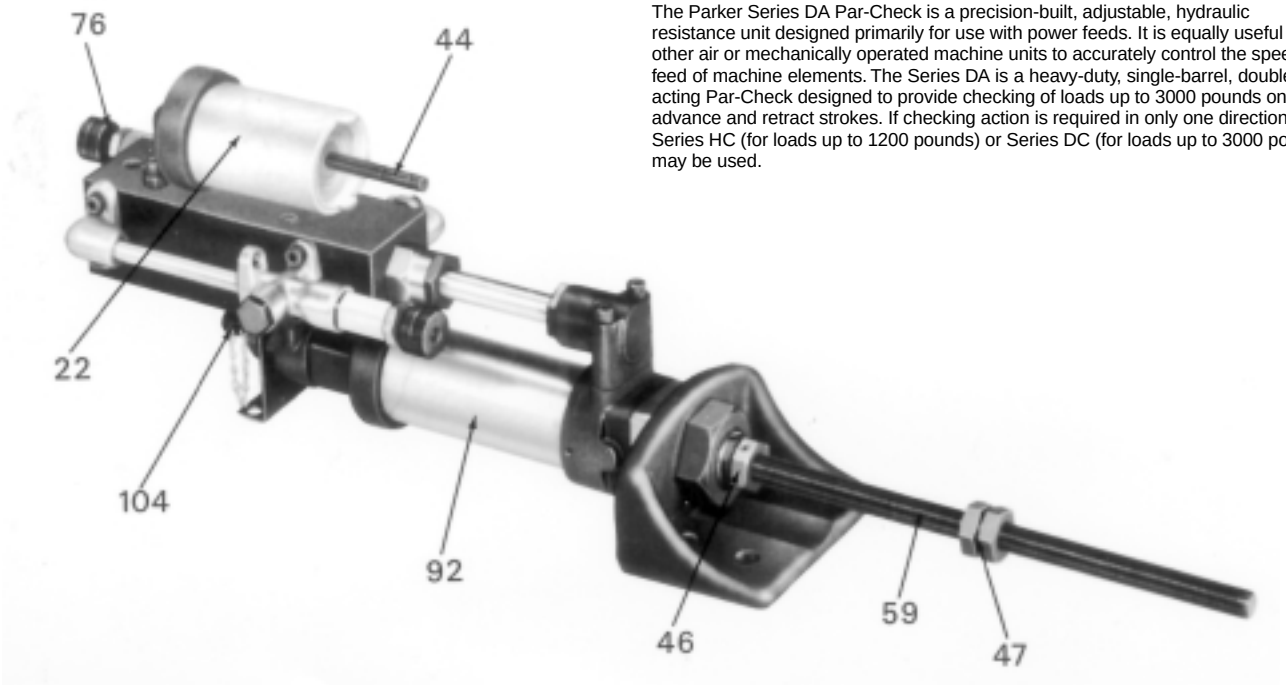








C



The Parker Series DA Par-Check is a precision-built, adjustable, hydraulic resistance unit designed primarily for use with power feeds. It is equally useful with other air or mechanically operated machine units to accurately control the speed or feed of machine elements. The Series DA is a heavy-duty, single-barrel, double-acting Par-Check designed to provide checking of loads up to 3000 pounds on both advance and retract strokes. If checking action is required in only one direction, Series HC (for loads up to 1200 pounds) or Series DC (for loads up to 3000 pounds) may be used.

Operating Principle: The Par-Check consists basically, of a checking cylinder (Item 92), checking piston rod (Item 59), two adjustable speed control valves (Item 76), and a balance cylinder (Item 22).

The checking piston rod may be directly attached or linked to a moving machine part. As the piston rod is pulled out, oil in the checking cylinder is forced, by the moving piston, through the transfer tube, through the speed control valve, into the rear end of the checking cylinder. On the return stroke, the flow of oil is reversed and directed through the other speed control valve into the front end of the cylinder.

The balance cylinder assembly (Item 22), automatically compensates for volumetric displacement of the checking piston rod. An indicator rod (Item 44), attached to the balance cylinder piston, indicates the amount of oil in the Par-Check. Three grooves on the indicator rod show when and how much oil should be added to maintain correct hydraulic volume. Make-up oil is added through filler valve (Item 104) with our Model B161-003 oil gun.

Mounting: The Par-Check can be operated in any position provided it is mounted directly in-line or parallel to the force it is to control. If unit is mounted parallel, the force or power supply should be guided by ways or guide rods to prevent side strain on the Par-Check piston rod. The in-line type of mounting is the most desirable type to use on any application. Series DA Par-Checks are available with a threaded piston rod guide and lock nut for nose mounting, foot bracket for foot mounting, pivot brackets and rod clevis for pivot mounting, or feed brackets for mounting on drill press feeds.

Checking Stroke Adjustment: The mechanical linkage to the element being controlled, moving between two piston rod lock nuts, actuates the Par-Check. The point at which checking action begins is determined by position of the second lock nut (Item 47) on threaded piston rod. Thus, any portion of the full stroke length may be used for checking. The forward piston rod lock nut is used to lock the second in position. The actuating element engages the first lock nut (Item 46) on return stroke to retract the piston rod. Adjustments affect both advance and retract strokes identically.

The first or innermost piston rod lock nut (Item 46) must be kept at back end of piston rod thread to prevent Par-Check piston from bottoming against rear cylinder head. This nut is locked in position with a socket head set screw.

Caution: Before applying checking load, be sure stroke of Par-Check is long enough to prevent power source from bottoming Par-Check piston against front head and possibly damaging Par-Check.

The polished section of the piston rod should be protected from chips and dirt to avoid possible damage to the piston rod seal due to rod scoring.

Adjustment of Checking Rate: Checking Speed is controlled by turning the knurled needle valve knob (Item 76). Rate is reduced as the knob is turned clockwise and increased as it is turned counterclockwise.

Oil Level: Amount of oil in Par-Check is indicated by position of balance cylinder indicator rod (Item 44). The position is determined by grooves on the rod. Proper oil level is indicated when, with threaded piston rod extended, the second indicator groove is flush with balance cylinder head. When threaded piston rod is retracted, the third innermost groove should be flush with cylinder head. Oil should be added when groove nearest end of indicator rod becomes flush with face of balance cylinder head, when threaded piston rod is fully extended.

Note: Use our “F442” hydraulic oil only. If circumstances require temporary use of another type of oil, drain and thoroughly flush the Par-Check system. Then refill with substitute oil.

For additional information – call your local Parker Cylinder Distributor.

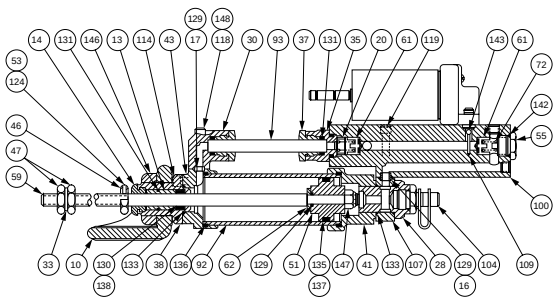
Parts List

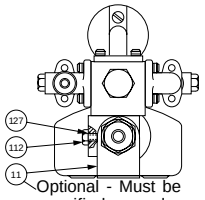
Important: Order by Part Number only. Do not order by Item Number.

Item No.	Part No.	Description
1	B023-012	Valve Adaptor
2	B102-002	Cylinder Assembly
3	B113-047	Support Block (9" Stk. & Longer)
4	B123-002	Body
6	B123-023	Body
7	B123-024	Body
8	B123-025	Body
9	B133-002	Screw
10	B183-102	Foot Bracket
11	B183-103	Mounting Bracket (Optional)
12	B183-226	Pivot Bracket
13	B193-026	Bushing
14	B193-027	Bushing
15	B193-028	Sleeve Bushing
16	B193-029	Bushing (Seal)
17	B193-030	Bushing
18	B193-031	Bushing
19	B193-067	Bushing
20	B193-068	Bushing
21	B233-012	Cylinder Cover
22		Balance Cylinder Assembly
	B262-005	2, 4 & 6" Stk. Units (Specify 6" Stk.)
23	B273-060	Rod Clevis
25	B343-001	Cover
28	B423-001	Fitting
29	B423-009	Fitting
30	B423-010	Elbow
31	G450301	Valve (Specify Voltage)*
32	B453-023	Gasket
33	B453-031	Washer
35	B483-021	Gland (Adaptor)
36	B483-022	Gland
37	B483-023	Gland (Transfer Tube)
38	B493-038	Gland (Rod Guide)
39	B493-055	Gland (Feed Mount)
40	B493-085	Guide
41	B513-157	Rear Head
42	B513-242	Rear Head
43	B513-408	Front Head
*44		Indicator Rod & Piston Assembly
	B592-005	2, 4 & 6" Stk. Units
	B592-005	9, 12, 15 & 18" Stk. Units (Specify 18" Stk.)
45	B623-004	Pivot Mounting Bracket
46	B663-015	Nut
47	B663-016	Nut
48	B663-018	Nut
49	B663-019	Nut
50	B713-035	Piston & Stem Assembly
51	B713-103	Piston
52	B713-104	Piston & Stem Assembly
53	B733-010	Thread Protector
54	B733-014	Bypass Plug
55	B733-026	Plug (Check Valve)
56	B743-016	Plunger Seat Assembly
57	B753-002	Body
58	B803-025	Retainer
*59	B833-055	Piston Rod
60	B893-034	Seal
61	B912-007	Poppet Assembly
62	B993-017	Spacer (Piston)
63	B483-011	Valve Sleeve
64	B123-003	Body
65	B023-036	Sleeve Adaptor
66	F023-038	Spring
67	F023-048	Spring
68	F023-049	Spring
69	F023-055	Spring
70	F023-088	Spring
71	F023-088	Spring
72	F023-120	Spring (Check Valve)
73	F033-019	Valve Stem
74	F082-2002	Stop Valve Assembly
75	F082-2006	High Speed Control Valve (Basic)
76	F082-2010	Std. Control Valve (Basic)
77	F082-2012	Precision Control Valve (Basic)
78	F082-2030	Std. Control Valve
80	F082-2032	Std. Control Valve w/Skip
82	F082-2071	Std. Control Valve w/Stop
83	F082-2072	Std. Control Valve w/Stop & Skip
84	F082-2036	Precision Control Valve
85	F082-2037	Precision Control Valve w/Skip
86	F082-2038	Precision Control Valve w/Stop
87	F082-2039	Precision Control Valve w/Stop & Skip
88	F082-2040	High Speed Control Valve
89	F082-2042	High Speed Control Valve w/Stop
90	F082-2044	Skip Valve Assembly
*91		Balance Cylinder Tube Assembly
	F142-006	2, 4 & 6" Stk. Units (Specify 6" Stk.)
	F142-006	9, 12, 15 & 18" Stk. Units (Specify 18" Stk.)
*92	F153-047	Main Cylinder
*93	F163-024	Transfer Tube
94	F163-025	Transfer Tube (Used on Items 82 & 83)
†95	F163-026	Transfer Tube
96	F163-027	Transfer Tube (Used on Items 84, 85, 86 & 87)
97	F163-028	Transfer Tube (Used on Items 88 & 89)
98	F183-004	Valve Needle
99	F193-031	Washer
100	F233-005	Manifold Block
101	F183-003	Valve Stem
102	F023-044	Spring
103	F043-016	Strap
104	F252-003	Fill Valve Assembly
105	F183-002	Valve Pin
106	F043-015	Support Strap (9" Stk. Units & Longer)
107	F073-005	Support
108	H072-05	Rail Pin
109	H072-066	Rail Pin
110	H076-02	Close Nipple
111	H090-79	Retaining Ring
112	H096-62	Bolt
113	H096-89	Screw (9" Stk. Units & Longer)
114	H100-41	Screw
115	H100-42	Screw
116	H100-45	Screw
117	H100-46	Screw
118	H100-49	Screw
119	H100-50	Screw
120	H104-20	Screw
121	H106-06	Screw
124	H122-02	Screw
125	H134-06	“O” Ring
126	H134-12	“O” Ring
127	H134-14	“O” Ring
128	H134-16	“O” Ring
129	H134-27	“O” Ring
130	H134-33	“O” Ring
131	H135-02	“O” Ring
132	H135-12	“O” Ring
133	H135-24	“O” Ring
135	H136-24	“O” Ring
137	H143-24	Back Up Ring
138	H143-73	Back Up Ring
139	H134-30	“O” Ring
140	H194-04	Screw
141	H221-83	“O” Ring
142	H237-04	“O” Ring
143	H002-08	Steel Ball
144	H060-01	Nut
145	H063-15	Nut (9" Stk. Units & Longer)
146	H062-34	Nut
147	H063-29	Locknut
148	H175-64	Washer

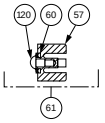
* = Specify Stroke

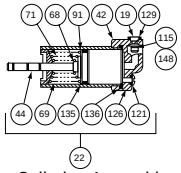
† = Obsolete - Replacement Tube for Units with Filter



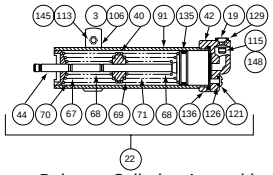


Optional - Must be specified on order

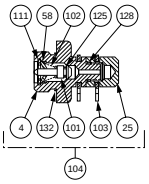




Balance Cylinder Assembly for Par-Checks with 2"; 4" & 6" Strokes Only

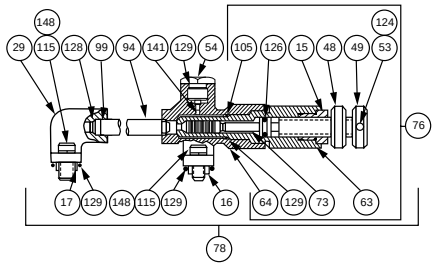


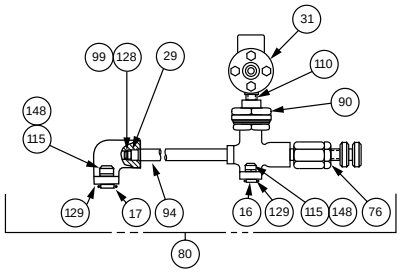
Balance Cylinder Assembly For Par-Checks with 9", 15" & 18" Strokes Only

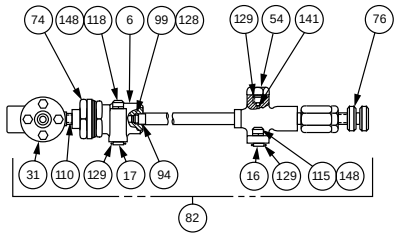


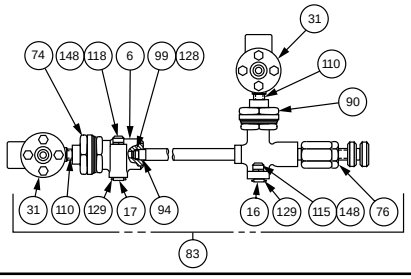
For Cylinder Division Plant Locations – See Page II.

Assemblies with Standard Control Valves

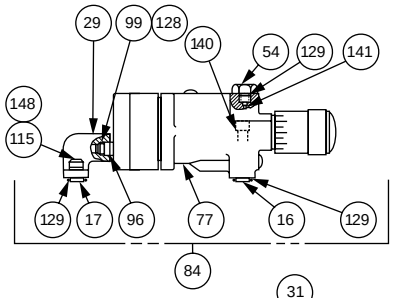


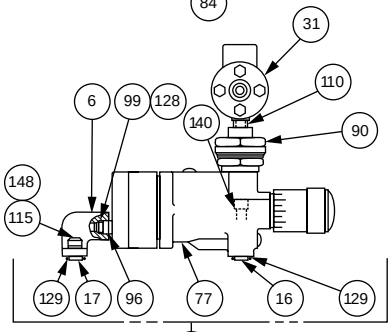


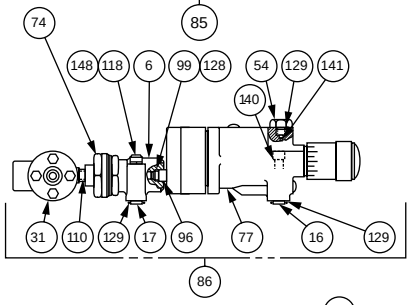


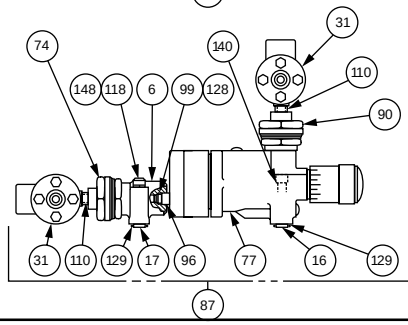


Assemblies with Precision Control Valves

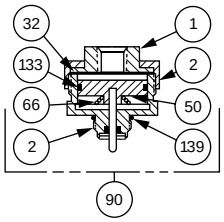




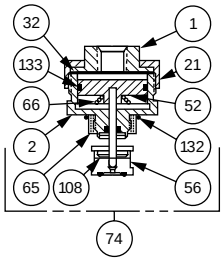




Parts Drawings

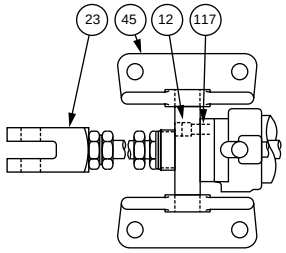


SKIP VALVE ASSEMBLY



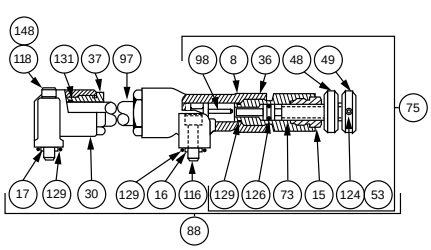
STOP VALVE ASSEMBLY

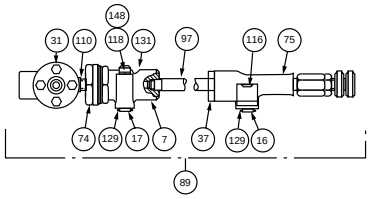
Pivot Mount



PIVOT MOUNT

Assemblies with High Speed Control Valves





For additional information – call your local Parker Cylinder Distributor.

Fluid Power Intensifiers

Series PC, PD and PS

The easier, less costly way to provide high pressure hydraulic power.

- 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 1/2 RAM -
  3000 psi (206 BAR).
- Maximum Operating Temperatures:
  -10½F to +165½F (-23½C) to (+74½C).

C

For Cylinder Division Plant Locations – See Page II.

Parker Fluidpower Intensifiers

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

A Parker Fluidpower 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.

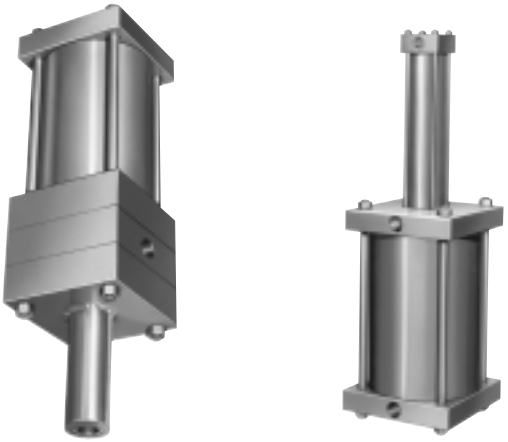
By using a Parker Intensifier you can save in many ways. First, since it requires only low pressure input and less costly control valving, you eliminate the extra expense of high pressure pumps, valving and a large electrical power sources. The simpler mountings and controls also save you valuable installation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

In addition, since Parker 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 Parker 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 Parker Fluidpower 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 Parker 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.



Parker Fluid 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 Parker Fluidpower 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. Parker 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 3¼" through 10". Fiber glass is used on 12" and 14" bore 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.

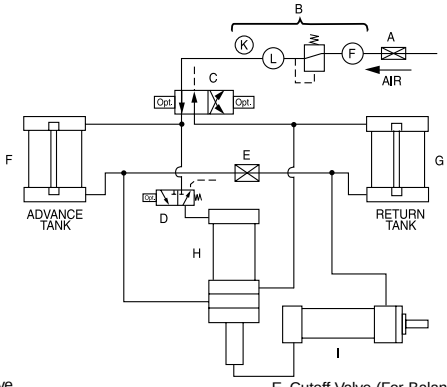
7. Intensifier operation is speeded up by the free flow of fluid in and out of the unobstructed ports. All high-pressure hydraulic ports are SAE straight thread. O-ring type for leak-proof service.

8. Serrated Lipseals® (Patent 2997318) 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
B Air Preparation Unit (Filter Regulator Lubricator-Gauge)
C 4-Way Valve (Normally 2 Position)
D 3-Way Valve
E Cutoff Valve (For Balancing Tank Fluid Levels)
F Advancing Tank (Air-Oil)
G Retracting Tank (Air-Oil)
H Intensifier
I Work Cylinder

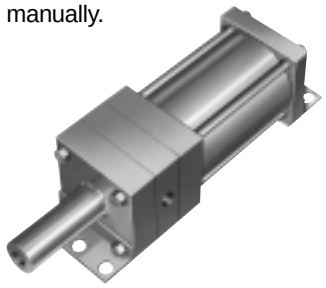
This basic circuit is for a dual pressure system supplying pressure to a double-acting work system. The circuit may be readily

For additional information – call your local Parker Cylinder Distributor.

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 Parker Fluidpower 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 3. 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:

$$\text{Intensifier stroke} = \frac{V_h + V_C}{A_r} + 2"*$$

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 Parker Series 3L and 2H hydraulic cylinders, the maximum pressures under nonshock conditions are:

3L 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

2H Series: All bore sizes – 3000 psi.

General Guidelines

1. Intensifiers are generally faster operating when:
   a. There is adequate input pressure.
   b. The ports and piping are large enough. Consider the use of oversize ports and connecting lines, to minimize pressure drop.
   c. The intensifier is pre-exhausted prior to the power stroke.
   d. Size hydraulic lines so that fluid flow velocity does not exceed 7 feet per second.
2. Bypass the intensifier with a pre-fill low pressure line by direct connection through a check valve to the pressure vessel.
3. Regulate the driving pressure to the intensifier to achieve the required high pressure output.
4. Keep all piping lengths to a minimum by having the tanks, intensifier and pressure vessel as close together as possible.
5. 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.
6. Intensifiers are generally used in circuits where limited quantities of high pressure fluid is required.

For Cylinder Division Plant Locations – See Page II.

(Series PS and PD) Cylinder to Ram Intensifiers

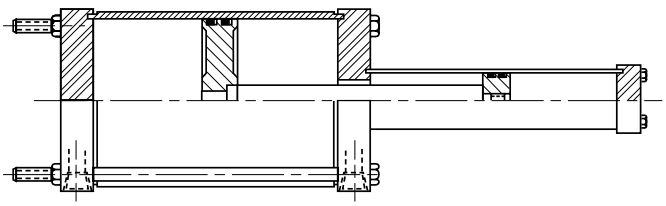
Driving Cylinder		Hydraulic Ram		Intensifier	Theoretical Intensified Hydraulic Pressure (PSI) Using An Input Pressure Of					
Bore	Area	Dia.	Area of Volume Displ. Per in Stroke	Ratio	50	80	100	200	500	1000
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11
3 1/4	8.296	5/8	.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	Theoretical Intensified Hydraulic Pressure (PSI) Using An Input Pressure Of					
Bore	Area	Bore	Area	Ratio	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	227	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 Series 3L driven cylinder, use Series 2H.

Cylinder to Cylinder Intensifier – Series PC



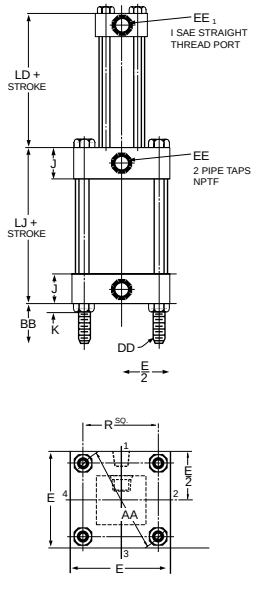
For additional information – call your local Parker Cylinder Distributor.

Parker Fluid Power 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
	Series 2A & 3L								Series 2A 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	–	–	–	–



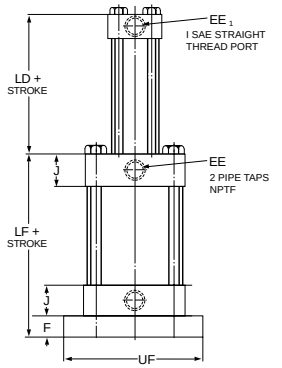
Mounting Style TC
Cap Tie Rods Extended

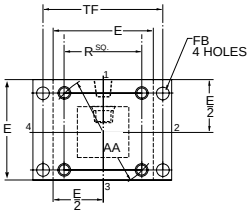
This mounting available in driving cylinder bore sizes 3 1/4-inches through 14-inches.

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
	Series 2H								
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	11/16	11/16	15/16	1 1/16	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 Series “3L” and “2H” can be found on page 106.

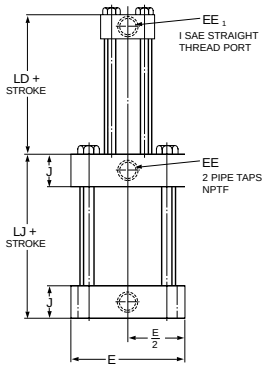


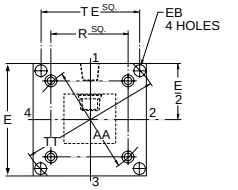


Mounting Style H
Cap Rectangular Flange

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

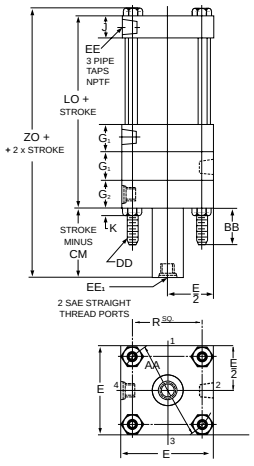
This mounting available in driving cylinder bore sizes 8-inches through 14-inches.

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

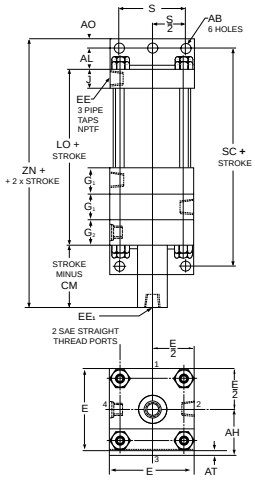
C

Parker Fluid Power 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 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.

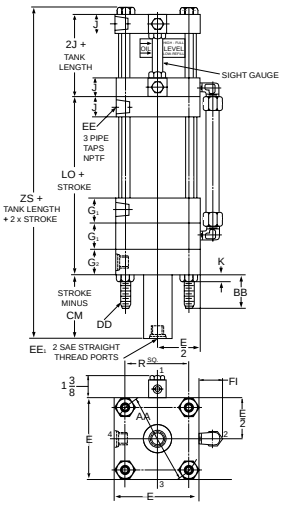


Mounting Style TB
Head Tie Rods Extended

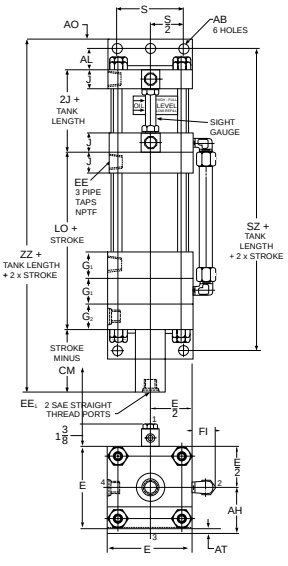


Mounting Style CB –
End Angles

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



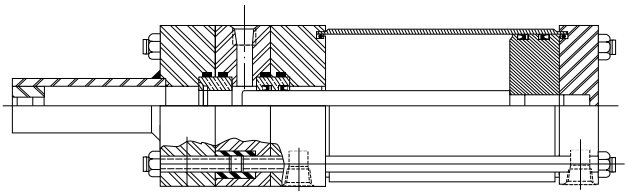
Mounting Style TB
Head Tie Rods Extended
with Integral Air-Oil Tank



Mounting Style CB –
End Angles 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
	Series 2A & 3L					Series 2A Only		
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
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	4 13/64	4 13/64	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	6 61/64	6 61/64	7 5 /16	7 15/16	8 11/64	9 41/64	10 9/64	11 3/4
ZS	9 29/64	9 29/64	9 13/16	10 15/16	11 11/64	13 41/64	14 9/64	16 1/4
ZZ	10 1/8	10 7/8	11 3/8	12 1/2	13 1/8	16	16 1/2	19

Dimensions Dependent on Ram Size

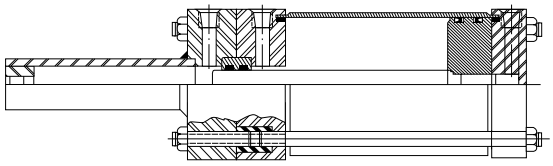
Bore	3 1/4	4	5	6	8	10	12	14
	Series 2A & 3L					Series 2A Only		
						Ram Sizes		
					1 3/8		2, 2 1/2	2 1/2, 3
					1 3/4, 2	1 3/4, 2	3, 3 1/2, 4	3 1/2, 4
G_2	–	–	–	–	2	2	2 1/4	2 1/4
CM	–	–	–	–	1 1/2	1 5/8	1 7/8	2 1/8
LO	–	–	–	–	9 1/8	10 5/8	11 3/8	13 1/8
SC	–	–	–	–	10 3/4	12 7/8	13 3/8	15 3/4
SZ					13 3/4	16 7/8	17 3/8	20 1/4
						Ram Sizes		
					2 1/2, 3 3 1/2, 5 5 1/2	2 1/2, 3 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 1/4	14 3/4	15 3/4	19 1/8	19 5/8	23

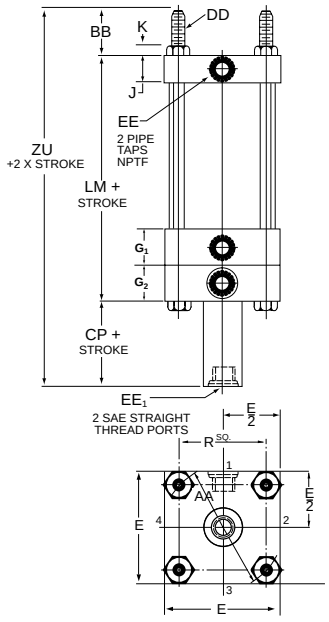
For additional information – call your local Parker Cylinder Distributor.

Parker Fluid Power 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.

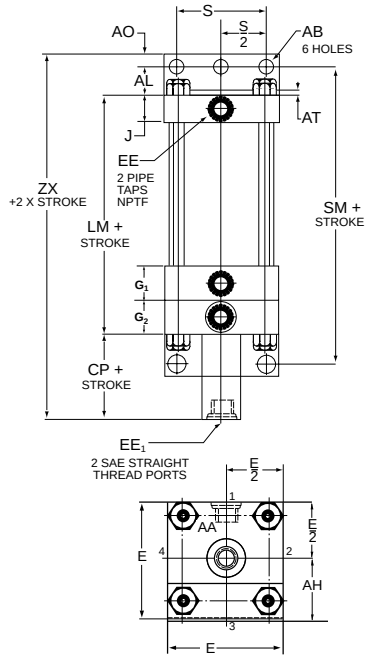
Special Note: It is recommended that Series PS single pressure intensifiers be mounted vertically with the pressure chamber up.





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

Dimensions Independent of Ram Size

Bore	3 1/4	4	5	6	8	10	12	14
	Series 2A & 3L					Series 2A Only		
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	2 111/16	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
	Series 2A & 3L					Series 2A 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 3 1/2, 5 5 1/2	2 1/2, 3 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
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

C

How To Order Parker Fluidpower Intensifiers

How To Order

When ordering Parker Intensifiers, please specify:

a. Quantity

b. Driving Cylinder bore size

c. Mounting style – specify by using style letters given beneath dimension drawings.

d. Driving cylinder operating fluid medium

e. Intensifier series (PS, PD or PC)

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

g. Driving cylinder stroke

h. 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 Parker Fluidpower 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 Fluid Power 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	2A (Air) or 3L* (HYD.) Specify One Series Only	–	PD, PS, PC	2H (3000 PSI Maximum) or CL (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 61.
*3L supplied with cast iron piston rings unless otherwise specified.

Specifications

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 1/2 RAM - 3000 psi (206 BAR).

Maximum Operating Temperatures:

-10½F to +165½F (-23½C) to (+74½C).

For additional information – call your local Parker Cylinder Distributor.

Hydraulic and Pneumatic Cylinder
Appendix Application Engineering Data

Index Page

Cylinder Operation

Cylinders are used in the majority of applications to convert fluid energy into straight line motion. For this reason, they are often called linear actuators.

Cylinders are manufactured in a variety of diameters, stroke lengths, and mounting styles. They may be classified, according to construction, into four types: tie-rod, threaded, welded, and flanged. Cylinders are also made using retaining rings.

$$\text{Area} = \frac{\pi D^2}{4} \quad \text{or Area} = .7854 \times D^2$$

When calculating force developed on the return stroke, pressure does not act on the rod area of the piston, therefore the rod area must be subtracted from the total piston area.

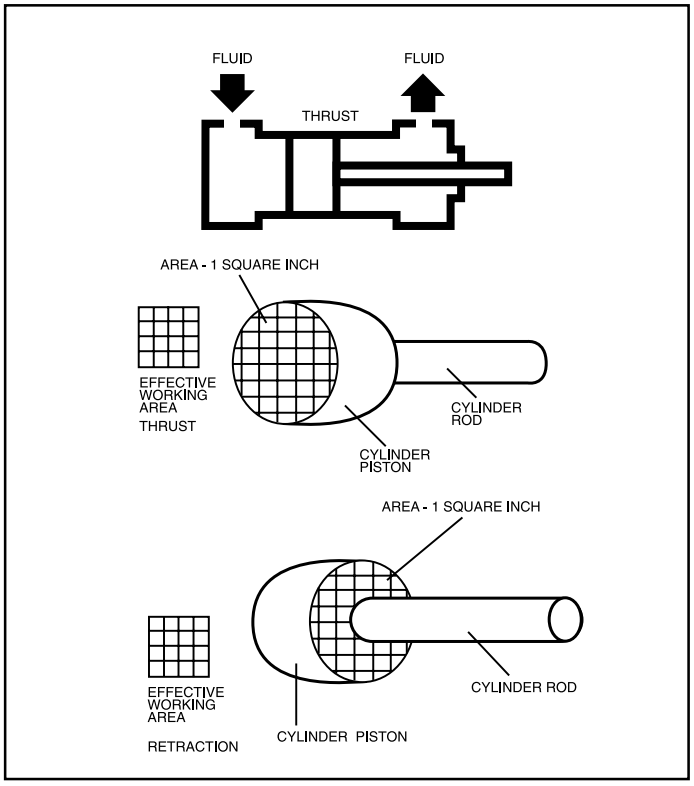
Basic Construction

The major components of a cylinder are the head, cap, tube tie rods, piston, piston rod, rod bearing and seals.

Cylinder Heads and Caps are usually made from rolled steel or cast iron. Some are also from aluminum or bronze.

Cylinder Tubes are usually brass, steel or aluminum. The inside, and sometimes the outside, is plated or anodized to improve wear characteristics and reduce corrosion.

Illustration B-28



Pistons vary in design and materials used. Most are made of cast iron or steel. Several methods of attaching the piston to the rod are used. Cushions, are an available option on most cylinders and most often, can be added with no change in envelope dimensions.

Piston Rods are generally high strength steel, case-hardened, ground, polished and hard chrome plated for wear and corrosion resistance. Corrosive atmosphere conditions usually require rods of stainless steel, which may be chrome plated for wear resistance.

Rod Glands or Bearings are used on the head end of most industrial cylinders to support the piston rod as it travels back and forth. The gland also acts as a retainer for the rod packing and seals. Most are made of ductile iron or bronze and usually are removable without disassembling the entire cylinder.

The gland usually contains a piston rod wiper or scraper on the outboard side to remove dirt and contamination from the rod, and prevent foreign material from being drawn into the packings. A primary seal is used to seal the cylinder pressure.

Seals are generally made from Nitrile or fluoro carbon elastomers, polyurethane, leather or Teflon®. The Lipseal® shape is commonly used for both piston and piston rod seals. Generally, O-Rings are used for static applications such as head to tube, piston to rod, and head to gland. Cup or V-packings are used for sealing piston and piston rod. Piston rings are usually cast iron.

Tie-Rods are usually high tensile steel with either cut or rolled threads, prestressed during assembly. Prestressing with proper torque prevents separation of parts when subjected to pressure and reduces the need for locknuts, although locknuts are sometimes used.

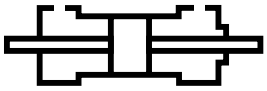
Fundamental Cylinders

Illustration B29

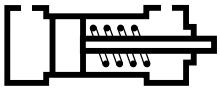
Standard Double-Acting Cylinders
Power stroke is in both directions and is used in the majority of applications.

Single-Acting Cylinders
When thrust is needed in only one direction, a single-acting cylinder may be used. The inactive end is vented to atmosphere through a breather/filter for pneumatic applications, or vented to reservoir below the oil level in hydraulic application.

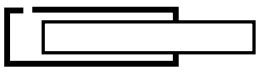
Double-Rod Cylinders
Used when equal displacement is needed on both sides of the piston, or when it is mechanically advantageous to couple a load to each end. The extra end can be used to mount cams for operating limit switches, etc.



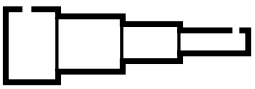
Spring Return, Single-Acting Cylinders
Usually limited to very small, short stroke cylinders used for holding and clamping. The length needed to contain the return spring makes them undesirable when a long stroke is needed.



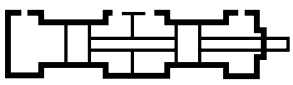
Ram Type, Single-Acting Cylinders
Containing only one fluid chamber, this type of cylinder is usually mounted vertically. The weight of the load retracts the cylinder. They are sometimes know as “displacement cylinders”, and are practical for long strokes.



Telescoping Cylinders
Available with up to 4 or 5 sleeves; collapsed length is shorter than standard cylinders. Available either single or double-acting, they are relatively expensive compared to standard cylinders.



Tandem Cylinders
A tandem cylinder is made up of two cylinders mounted in line with pistons connected by a common piston rod and rod seals installed between the cylinders to permit double acting operation of each. Tandem cylinders allow increased output force when mounting width or height are restricted.



Duplex Cylinders
A duplex cylinder is made up of two cylinders mounted in line with pistons not connected and with rod seals installed between the cylinders to permit double acting operation of each. Cylinders may be mounted with piston rod to piston (as shown) or back to back and are generally used to provide three position operation.

C

Theoretical Push and Pull Forces for Pneumatic and Hydraulic Cylinders

Push Force and Displacement

Cyl. Bore Size (Inches)	Piston Area (Sq. In.)	Cylinder Push Stroke Force In Pounds At Various Pressures										Cu. Ft. Free Air At 80 Lbs. Pressure, Required To Move Max. Load 1 Inch	Displacement Per Inch Of Stroke (Gallons)
		25	50	65	80	100	250	500	1000	2000	3000		
1	.785	20	39	51	65	79	196	392	785	1570	2355	.00293	.00340
1 1/2	1.767	44	88	115	142	177	443	885	1770	3540	5310	.00659	.00765
2	3.14	79	157	204	251	314	785	1570	3140	6280	9420	.01171	.0136
2 1/2	4.91	123	245	319	393	491	1228	2455	4910	9820	14730	.01830	.0213
3 1/4	8.30	208	415	540	664	830	2075	4150	8300	16600	24900	.03093	.0359
4	12.57	314	628	817	1006	1257	3143	6285	12570	25140	37710	.04685	.0544
5	19.64	491	982	1277	1571	1964	4910	9820	19640	39280	58920	.07320	.0850
6	28.27	707	1414	1838	2262	2827	7068	14135	28270	56540	84810	.10541	.1224
7	38.49	962	1924	2502	3079	3849	9623	19245	38490	76980	115470	.14347	.1666
8	50.27	1257	2513	3268	4022	5027	12568	25135	50270	100540	150810	.18740	.2176
10	78.54	1964	3927	5105	6283	7854	19635	39270	78540	157080	235620	.29280	.3400
12	113.10	2828	5655	7352	9048	11310	28275	56550	113100	226200	339300	.42164	.4896
14	153.94	3849	7697	10006	12315	15394	38485	76970	153940	307880	461820	.57389	.6664

Deductions for Pull Force and Displacement

Piston Rod Dia. (Inches)	Piston Area (Sq. In.)	Piston Rod Diameter Force In Pounds At Various Pressures To determine Cylinder Pull Force or Displacement, deduct the following Force or Displacement corresponding to Rod Size, from selected Push Stroke Force or Displacement corresponding to Bore Size in table above.										Cu. Ft. Free Air At 80 Lbs. Pressure, Required To Move Max. Load 1 Inch	Displacement Per Inch Of Stroke (Gallons)
		25	50	65	80	100	250	500	1000	2000	3000		
1/2	.196	5	10	13	16	20	49	98	196	392	588	.00073	.0009
5/8	.307	8	15	20	25	31	77	154	307	614	921	.00114	.0013
1	.785	20	39	51	65	79	196	392	785	1570	2355	.00293	.0034
1 3/8	1.49	37	75	97	119	149	373	745	1490	2980	4470	.00554	.0065
1 3/4	2.41	60	121	157	193	241	603	1205	2410	4820	7230	.00897	.0104
2	3.14	79	157	204	251	314	785	1570	3140	6280	9420	.01171	.0136
2 1/2	4.91	123	245	319	393	491	1228	2455	4910	9820	14730	.01830	.0213
3	7.07	177	354	460	566	707	1767	3535	7070	14140	21210	.02635	.0306
3 1/2	9.62	241	481	625	770	962	2405	4810	9620	19240	28860	.03587	.0416
4	12.57	314	628	817	1006	1257	3143	6285	12570	25140	37710	.04685	.0544
4 1/2	15.90	398	795	1033	1272	1590	3975	7950	15900	31800	47708	.05929	.0688
5	19.64	491	982	1277	1571	1964	4910	9820	19640	39280	58920	.07320	.0850
5 1/2	23.76	594	1188	1544	1901	2376	5940	11880	23760	47520	71280	.08857	.1028
7	38.49	962	1924	2502	3079	3849	9623	19245	38490	76980	115470	.14347	.1666
8 1/2	56.75	1419	2838	3689	4540	5675	14187	28375	56750	113500	170250	.21157	.2455

General Formula

The cylinder output forces are derived from the formula:

$$F = P \times A$$

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

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

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

Where V_1 = Free air consumption per inch of stroke (cubic feet).
V_2 = Cubic feet displaced per inch of stroke.
P_2 = Gauge pressure required to move maximum load.

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 (class 1)

Class 1 seals are what is normally provided in a cylinder unless otherwise specified. They are intended for use with fluids such as: air, nitrogen, mineral base hydraulic oil or MIL-H-5606 within the temperature range of -10°F (-23°C) to +165°F (+74°C). Generally they are nitrile excpet for piston rod seals in hydraulic cylinders. However the individual seals may be nitrile (Buna-N) enhanced polyurethane, polymyte, P.T.F.E. or filled P.T.F.E.

Water Base Fluid Seals (class 2)

Generally class 2 seals are intended for use with water base fluids within the temperature of -10°F (-23°C) to +165°F (+74°C) except for High Water Content Fluids (H.W.C.F.) in which case Class 6 seals should be used. Typical water base fluids are: Water, Water-Glycol, Water-in Emulsion, Houghto-Safe 27, 620, 5040, Mobil Pyrogard D, Shell Irus 905, Ucon Hydrolube J-4. These seals are nitrile. Lipseal will have polymyte or P.T.F.E. back-up washer when required. O-rings will have nitrile back-up washers when required.

Ethylene Propylene (E.P.R.) Seals (class 3)

Class 3 seals are intended for use with some Phosphate Ester Fluids between the temperatures of -10°F (-23°C) to +130°F (+54°C). Typical fluids compatible with E.P.R. seals are Skydrol 500 and 700. E.P.R. are Ethylene Propylene. Lipseals will have a P.T.F.E. back-up washer when required. O-rings will have EPR back-up washers when required. Note: E.P.R. seals are not compatible with mineral base hydraulic oil or greases. Even limited exposure to these fluids will cause severe swelling. P.T.F.E. back-up washer may not be suitable when used in a radiation environment.

Low Temperature Nitrile Seals (class 4)

Class 4 seals are intended for low temperature service with the same type of fluids as used with Class 1 seals within the temperature range of -50°F (-46°C) to +150°F (+66°C). Lipseals will have leather, polymyte or P.T.F.E. back-up washers when required. O-rings will have nitrile back-up washers when required.

Fluorocarbon Seals (class 5)

Class 5 seals are intended for elevated temperature service or for some Phosphate Ester Fluids such as Houghto-Safe 1010, 1055, 1120; Fyrquel 150, 220, 300, 350; Mobile Pyrogard 42, 43, 53, and 55. Note: In addition, class 5 seals can be used with fluids listed below under standard service. However, they are not compatible with Phosphate Ester Fluids such as Skydrols. Class 5 seals can operate with a temperature range of -10°F (-23°C) to +250°F (+121°C). Class 5 seals may be operated to +400°F (+204°C) with limited service life. For temperatures above +250°F (+120°C) the cylinder must be manufactured with non-studded piston rod and thread and a pinned piston to rod connection. Class 5 Lipseals will have P.T.F.E. back-up washers when required. O-rings will have fluorocarbon back-up when required.

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 Class 5 seals are assembled with anaerobic adhesive having a maximum temperature rating of +250°F (+74°C). Cylinders specified with all other seal compounds are assembled with anaerobic adhesive having a maximum operating temperature rating +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 (Nitrile) 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 re-assembled to withstand the higher temperature service.

H.W.C.F. Seals (class 6)

Class 6 seals are intended for High Water Content Fluids (H.W.C.F.) such as Houghto Hydrolubic 120B and Sonsol Lubrizol within the temperature range of +40°F (+4°C) to +120°F (+49°C). Class 6 seals are special nitrile compound dynamic seals. Lipseals will have P.T.F.E. and or polymyte back-up washers when required. O-rings will have nitrile back-up washers when required. Because of the viscosity of these fluids, cylinders specified with class 6 seals, will also be modified to have lip seal piston seals and straight cushions.

Hi-Load Seals

Hi-load seals consist of one or two filled teflon dynamic piston seals with an elastomer expander underneath. Hi-load piston arrangement normally consists of a wear ring on each end of the piston with the seals in the middle. These types of seals are virtually leak free seals under static conditions and can tolerate high pressure. The wear rings on the piston can also tolerate high side loads. The dynamic portion of the seal is bronze filled teflon and compatible with all conditions and fluids listed on this page. However, carbon filled teflon will provide better seal life when used with class 6 fluids. A nitrile expander will be provided unless Class 3 or 5 seals are specified. In those cases the expander will be of E.P.R. or Viton respectively. Note: It may be necessary to cycle the piston seals 40 or 50 times before achieving leakage free performance.

Lipseal Pistons

Under most conditions lipseals provide the best all around service for pneumatic applications. Lipseals with a back-up washer are often used for hydraulic applications when virtually zero static leakage is required. Lipseals will function properly in these applications when used in conjunction with moderate hydraulic pressures. A high load piston option is recommended when operating at high pressures and especially with large bore hydraulic cylinders.

Low Friction Hydraulic Seals

Low Friction hydraulic seals are available as an option for both piston and rod seals for 2H, 3H and 3L Series cylinders. They are sometimes used when a cylinder is controlled by servo or proportional valve. The seal assembly itself is a two piece assembly consisting of a filled teflon dynamic seal with an elastomer expander. A piston seal assembly consists of one seal assembly in the middle of the piston with a filled teflon wear ring on each side of the piston. The piston rod seal assembly consists of two seal assemblied and an elastomer wiper seal. The filled teflon seals are compatible with the fluids listed on this page and provide virtually leak free sealing. The expanders and rod wiper will be fluorocarbon unless E.P.R. or Viton seals are specified. In those cases the expanders and wiper will be E.P.R. and Viton respectively. When specifying low friction seals specify if piston, piston rod seals or both are required. Note: It may be necessary to cycle these seals 40 or 50 times before achieving leakage free performance.

Cast Iron Piston Rings

Cast iron rings are the standard piston seals for 2H and 3L Series cylinders. They offer the widest operating conditions by tolerating high operating pressures, wide temperature range and are compatible with most fluids. The only drawback of cast iron rings is that they allow a small amount of leakage. The leakage for a 4" bore cylinder, operating at 2000 psi, with mineral base hydraulic fluid will be less than 10in³/min. Leakage will increase as pressure, bore size and viscosity of the operating hydraulic fluid increases. For these reasons cast iron rings are not recommended when using water or (H.W.C.F.) fluids.

Water Service

For pressures up to 250 psi 2A and 3L series cylinders can be modified to make them more suitable for use with water as the operating medium. The modifications include chrome-plated cylinder bore; cadmium-plated head, cap and piston; chrome-plated 17-4 stainless steel piston rod; chrome plated cushion sleeve or cushion spear.

Modified cylinders may also be used for higher operating pressures, up to 2000 psi, depending on bore size. See pressure rating for Hydraulic Cylinders (medium duty on page 56. 3L, 2H and 3H Series hydraulic cylinders can also be modified for water operation and supplied with chrome-plated cylinder bore; cadmium-plated head, cap and piston; chrome-plated precipitation hardened stainless steel piston rod, chrome-plated cushion sleeve or cushion spear. When high water base fluids are the operating medium, hydraulic cylinders are usually supplied with high water base rod wiper and seals. Water and high water base fluid operated cylinders are best used on short stroke applications or where high pressure is applied only to clamp the load.

Warranty

Parker Hannifin will warrant cylinders modified for water or high water content fluid service to be free of defects in materials or workmanship, but cannot accept responsibility to premature failure due to excessive wear due to lack of lubricity or where failure is caused by corrosion, electrolysis or mineral deposits within the cylinder.

Pre-Lubricated Air Cylinders

Parker Hannifin air cylinders are factory pre-lubricated with Lube-A-Cyl applied to seals, piston, cylinder bore, piston rod and gland surfaces, provides for normal cylinder operations with lubricated air.

Non-Lubricated Air Cylinders

For heavier duty operation, Series 2AN is recommended for non-lubricated air service. Series 2AN includes an innovative special composite material wick and ring reservoir assembly in each seal groove to retain the extreme pressure lubricant applied at time of assembly. This lubricant coats the cylinder bore and piston rod and mating surfaces.

Class No.	Typical Fluids	Temperature Range
1 (Standard) (Nitrile Polyurethane)	Air, Nitrogen Hydraulic Oil, Mil-H-5606 Oil	-10½F(-23½C)to +165½F(+74½C)
2 Optional Water Base Fluid Seal	Water, Water-Glycol, H.W.C.F. — See Class 6 below. Water-in-Oil Emulsion Houghto-Safe, 271, 620, 5040 Mobil Pyrogard D, Shell Irus 905 Ucon Hydrolube J-4	-10½F(-23½C)to +165½F(+74½C)
3 Special (E.P.R.) (At extra cost)	Some Phosphate Ester Fluids Skydrol 500, 7000	-10½F(-23½C)to +130½F(+54½C)
Note: (E.P.R.) seals are not compatible with Hydraulic Oil		
4 Special (Nitrile) (At extra cost)	Low Temperature Air or Hydraulic Oil	-50½F(-46½C)to +150½F(+66½C)
5 Optional (At extra cost) (Fluorocarbon Seals)	High Temperature Houghto-Safe 1010, 1055, 1120 Fyrquel 150, 220, 300, 550 Mobil Pyrogard 42,43,53,55	See above paragraph on Fluorocarbon seals for recommended temperature range.
Note: Fluorocarbon seals are not suitable for use with Skydrol fluid, but can be used with hydraulic oil if desired		
6 Optional (HWCF) (At extra cost)	Houghton, Hydrolubric 120B Sonsol Lubrizol, for other HWCF — consult factory.	+40½F(+4½C)to +120½F(+49½C)

For Cylinder Division Plant Locations – See Page II.

Application Data

The proper application of a fluid power cylinder requires consideration of the operating pressure, the fluid medium, the mounting style, the length of stroke, the type of piston rod connection to the load, thrust or tension loading on the rod, mounting attitude, the speed of stroke, and how the load in motion will be stopped. Information given here provides pressure rating data for pneumatic and hydraulic cylinders.

Pneumatic Cylinders

Standard operating fluid — filtered air which is free of moisture. 2A and 2AN Series cylinders are recommended for maximum 250 psi heavy duty service; Series MA industrial cylinders may be used at pressures up to 200 psi.

Pressure Ratings Fluid Medium Air

Bore Size (Inches)	Standard Piston Rod Diameters (Inches)	Series 2A, 2AN Max. Heavy-Duty Operating Pressure (PSI)	Series MA Maximum Operating Pressure (PSI)
1	1/2	250	—
1 1/2	5/8	250	200
2	5/8	250	200
2 1/2	5/8	250	200
3 1/4	1	250	200
4	1	250	200
5	1	250	200
6	1 3/8	250	—
8	1 3/8	250	—
10	1 3/4	250	—
12	2	250	—
14	2 1/2	250	—

Hydraulic Cylinders (Heavy duty)

Standard operating fluid - clean, filtered hydraulic oil. Pressure ratings for heavy duty hydraulic cylinders are shown in the following table:

Pressure Ratings

Series 2H, 3H (7" & 8"), VH and HD hydraulic cylinders are recommended for pressures to 3000 p.s.i. for heavy-duty service with hydraulic oil. The 4:1 design factor ratings shown are based on tensile strength of material and are for code 1 rod dia. only. The rating is conservative for continuous severe applications. Design factors at other pressures can be calculated from this rating. In addition, mounting styles, stroke, etc., should be considered because of the limiting effect they may have on these ratings.

Maximum Pressure Ratings

Bore Size (Inches)	Rod Diameter (Inches)	4:1* Design Factor (Tensile) (PSI)	Heavy-Duty Service (PSI)
1 1/2	5/8	2530	3000
2	1	2950	3000
2 1/2	1	2340	3000
3 1/4	1 3/8	2250	3000
4	1 3/4	2130	3000
5	2	2170	3000
6	2 1/2	2270	3000
7	3	2030	3000
8	3 1/2	2040	3000

*Applies to all mountings except J and H. See Series 2H

Hydraulic Cylinders (Medium duty)

Pressure ratings for "Series 3L" hydraulic cylinders vary by bore size and rod size as shown in table below. For pressures higher than those indicated, Series 2H heavy duty cylinders should be used.

Series 3L Hydraulic Cylinders Maximum Pressure Rating

Bore Size	Rod No.	Rod Diameters	Pressure Rating At 4:1 Design* Factor (On Tensile)
1	1	1/2	1960
	2	5/8	1960
1 1/2	1	5/8	2280
	2	1	2500
2	1	5/8	1235
	3	1	1925
	2	1 3/8	1925
2 1/2	7	5/8	775
	1	1	1550
	3	1 3/8	1550
	2	1 3/4	1550
3 1/4	1	1	1030
	3	1 3/8	1200
	4	1 3/4	1200
	2	2	1200
4	7	1	670
	1	1 3/8	845
	3	1 3/4	845
	4	2	845
	2	2 1/2	845
5	7	1	545
	8	1 3/8	700
	1	1 3/4	780
	3	2	780
	4	2 1/2	780
	5	3	780
	2	3 1/2	780
6	7	1 3/8	500
	1	1 3/4	600
	3	2	660
	4	2 1/2	660
	5	3	660
	6	3 1/2	660
	2	4	660
8	7	1 3/8	310
	8	1 3/4	400
	1	2	450
	3	2 1/2	630
	4	3	630
	5	3 1/2	630
	6	4	630
	9	4 1/2	630
	0	5	630
	2	5 1/2	630

*Applies to all mountings except J. See Series 3L

Single rod type, fluid power cylinders are commonly available in 20 standard mounting styles ranging from head or cap end mounts to intermediate mounts. Many mounting styles are also available in double rod type cylinders. Refer to NFPA Std. B93.15-1981 or Parker air or hydraulic cylinder catalogs for detailed description.

Standard mounting styles for fluid power cylinders fall into three basic groups. The groups can be described as follows.

Group 1 – Straight line force transfer with fixed mounts which absorb force on cylinder centerline.

Group 3 – Straight line force transfer with fixed mounts which do not absorb force on cylinder centerline.

Group 2 – Pivot force transfer with pivot mounts which absorb force on cylinder centerline and permit cylinder to change alignment in one plane.

Cylinder mounting directly affects the maximum pressure at which the fluid power cylinder can be used, and proper selection of mounting style will have a bearing on cylinder operation and service life. Whether the cylinder is used in thrust or tension, its stroke length, piston rod diameter and the method of connection to load also must be considered when selecting a mounting style.

Fluidpower cylinders are offered for use with air pressure up to 250 psi; medium-duty hydraulic, depending on bore size, up to 2200 psi; and heavy-duty hydraulic service of up to 3000 psi. The industrial tie rod types, known as NFPA cylinders, with square steel heads and caps, plus steel mountings lend themselves to standardized mounts which are similar in appearance for both air and hydraulic cylinders.

Because of the all steel construction, Parker air cylinders have a design factor of better than 4:1, and the various mounts can be used without limitations up to the cylinder manufacturer's maximum rated pressure. Medium-duty and heavy-duty hydraulic cylinders, in some mounting styles, may not be used at full rated pressure, depending on mounting style, stroke length and thrust or tension loading, as discussed in the following:

Straight Line Force Transfer (Group 1)

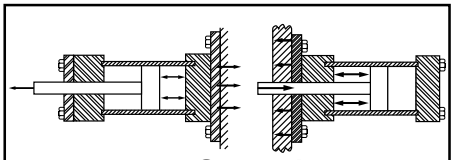
Cylinders with fixed mounts (Group 1) which absorb the force on centerline are considered the best for straight line force transfer. Tie rods extended, flange or centerline lug mounts are symmetrical and allow the thrust or tension forces of the piston rod to be distributed uniformly about the cylinder centerline. Mounting bolts are subjected to simple tension or simple shear without compound forces, and when properly installed damaging cylinder bearing sideloading is kept to a minimum.

Tie Rods Extended are considered to be of the centerline mount type. The cylinder tie rods are designed to withstand maximum rated internal pressure and can be extended and used to mount the cylinder at cap or head end. This often overlooked mounting will securely support the cylinder when bolted to the panel or machine member to which the cylinder is mounted. The torque value for the mounting nuts should be the same as the tie rod nut torque recommended by the cylinder manufacturer. Cylinders are available with tie rod extended both ends. In such applications one end is used for mounting and the opposite end to support the cylinder or to attach other machine components.

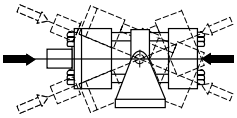
Tie rod mount cylinders may be used to provide thrust or tension forces at full rated pressures.

Tie rods extended head end (Parker Style TB), cap end (Parker Style TC) or extended both ends (Parker Style TD) are readily available and fully dimensioned in Parker cylinder product catalogs.

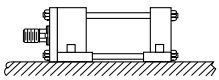
Flange Mount cylinders are also considered to be centerline mount type and thus are among the best mounts for use on straight line force transfer applications. The machine designer has a choice of three mounting styles at each end, such as head rectangular flange (Style J), head square flange (Style JB), head rectangular (Style JJ), cap rectangular flange (Style H), cap square flange (Style HB), and cap rectangular (Style HH). Selection of a flange mounting style depends, in part, upon whether the major force applied to the load will result in compression (push) or tension (pull) stresses of the cylinder piston rod. Cap end mounting styles are recommended for thrust loads (push), while head end mounting styles are recommended where the major load puts the piston rod in tension (pull).



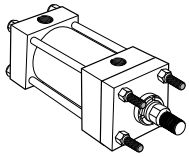
Group 1



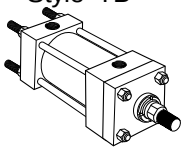
Group 2



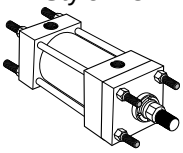
Group 3



Tie rods extended head end, Style TB

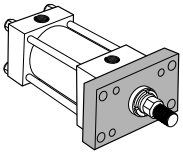


Tie rods extended cap end, Style TC

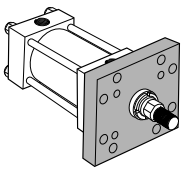


Tie rods extended both ends, Style TD

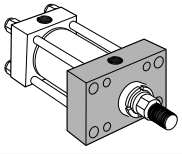
J



JB



JJ



C

Flange mounts are best used when end face is mounted against the machine support member. (Fig. 1) This is especially true where head rectangular flange type (Style J) is used with major load in tension. In this mode, the flange is not subjected to flexure or bending stresses, nor are the mounting bolts stressed to unusually high levels. The use of head rectangular flange (Style J) mount with major load in compression (see Fig. 2) is not recommended except on reduced pressure systems. The use of Style J mount in compression subjects the flange to bending and the mounting bolts to tension stresses, which could result in early fatigue failure. For maximum allowable pressure with Style J head rectangular mount used for compression (push) or rear face of flange mounted, see pressure rating in product catalogs for medium- or heavy-duty hydraulic cylinders. For applications where push forces require full rated system pressure, head square flange (Style JB) or head rectangular (Style JJ) mounts are recommended. The best head style mounting for either push or pull applications at full rated pressure is Style JJ.

Style JJ mount has the same mounting hole pattern and rectangular dimensions as the Style J mount. To substitute the head rectangular Style JJ mount for the head rectangular flange, Style J mount, it is necessary to use spacers to fill in the cataloged “F” dimension previously occupied by the “J” flange. The spacers are installed as shown in Fig. 3.

Cap flange mounts are also best used when end face is mounted against the machine support member. The use of cap rectangular flange mount, Style H, is not recommended on applications where the major load is in tension (pull) except at reduced pressure. For maximum allowable pressure with cap rectangular flange, Style H, used in tension application (pull) or front of flange mounted, see maximum pressure rating in product catalogs for medium- and heavy-duty hydraulic cylinders.

For applications where pull forces involved require full rated system pressure, cap square flange, Style HB, or cap rectangular, Style HH, mounts are recommended. The best cap style mounting for either push or pull applications at full rated pressure is the cap rectangular Style HH.

The Style HH mount has the same mounting hole pattern and rectangular dimensions as the Style H mount. To substitute the Style HH for Style H, it is necessary to use spacers or order a cylinder with piston rod extension to make up for the cataloged “F” dimension previously occupied by the “H” flange.

Straight Line Force Transfer (Group 3)

Centerline Lug Mount cylinders are considered fixed mount types which absorb force on centerline and are used on straight line force transfer applications. They are least popular of the fixed mount type cylinders. When used at higher pressures or under shock conditions, the lugs should be dowel-pinned to the machine. (See Page 109 for dowel pin uses for fixed mount cylinders.)

Side Mount cylinders are considered to be fixed mounts which do not absorb force on their centerline. Cylinders of this group have mounting lugs connected to the ends, and one style has side tapped holes for flush mounting. The plane of their mounting surfaces is not through the centerline of the cylinder, and for this reason side mounted cylinders produce a turning moment as the cylinder applies force to the load. (Fig. 4) This turning moment tends to rotate the cylinder about its mounting bolts. If the cylinder is not well secured to the machine member on which it is mounted or the load is not well-guided, this turning moment results in side load applied to rod gland and piston bearings. To avoid this problem, side mount cylinders should be specified with a stroke length at least equal to the bore size.

Shorter stroke, large bore cylinders tend to sway on their mountings when subjected to heavy loads, especially side end lug or side and angle mounts. (Fig. 5)

Side mount cylinders are available in several mounting styles, such as side lug (Style C), Side tapped (Style F), side end lug (Style G) and side end angle (Style CB). Of these, the side lug mount its the most popular and reliable, since the mounting lugs are welded to head and cap to form an integral unit at each end.

Side tapped mount is the choice when cylinders must be mounted side by side at minimum center-to-center distance. Another narrow side mount style is the side end lug mount which has lugs threaded to the tie rods. Thus the end lugs serve a dual function of holding the cylinder together and act as a means of mounting. This mounting style should be used only on medium- to light-duty applications, because the end lugs are subjected to compound stresses which could result in early failure.

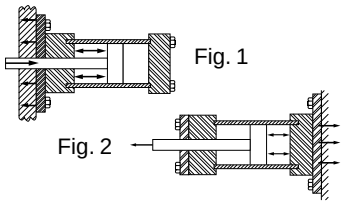


Fig. 1

Fig. 2

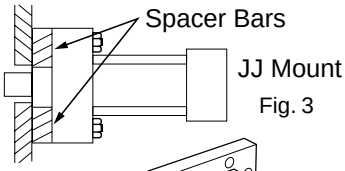
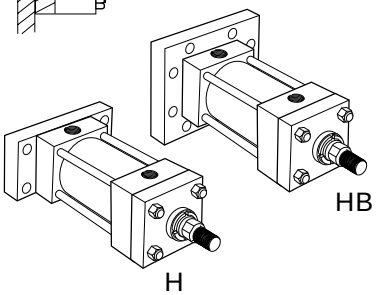
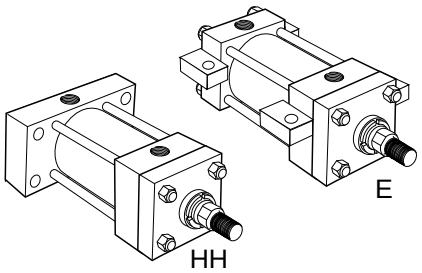
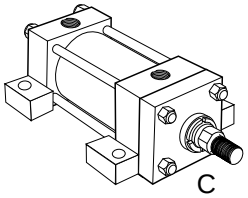


Fig. 3



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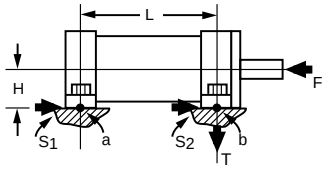


Fig. 4

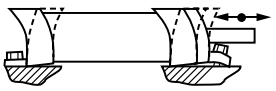
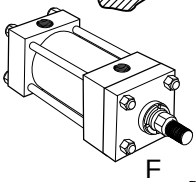


Fig. 5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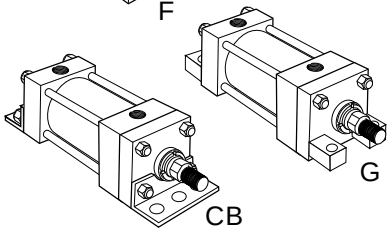


The side end angle mount is also a narrow mount type, but is the weakest of the side mount styles. Its use should be limited to a maximum pressure of 500 psi and minimum stroke length of two times the bore size. For pressure rating of longer strokes, consult the cylinder manufacturer.

Consideration should also be given to design of the machine frame used to support cylinders non-centerline mount, since stronger members are often required to resist bending moments. (See Fig. 6)

Side mount cylinders depend wholly on the friction of their mounting surfaces in contact with the machine member to absorb the force produced. Thus the torque applied to the mounting bolts is an important consideration. Since the mounting bolts are the same diameter as the tie rods for a given cylinder, it is recommended that the torque applied to the mounting bolts be the same as the tie rod torque recommended by the cylinder manufacturer for the given bore size.

For heavy loads or high shock conditions, side mounted cylinders should be held in place to prevent shifting by keying or pinning. A shear key, consisting of a plate extending from side of cylinder, can be supplied on most cylinders. (Fig. 7) This method may be used where a keyway can be milled into a machine member. It serves to take up shear loads and also provides accurate alignment of the cylinder.

Side lug (and centerline lug) mounts are designed so as to allow dowel pins to be used to pin the cylinder to the machine member. Pins, when used, are installed on both sides of the cylinder but not at both ends. (See Fig. 8)

The use of a separate shear key is fairly common. It should be placed at the proper end of the cylinder to absorb the major load. (see Fig. 9)

Side mount cylinders should not be pinned or keyed at both ends. Changes in temperature and pressure under normal operating conditions cause the cylinder to increase (or decrease) in length from its installed length and therefore must be free to expand and contract. If pinned or keyed at both ends, the advantages of cylinder elasticity in absorbing high shock loads will be lost. (Fig. 10)

If high shock loads are the major consideration, the cylinder should be mounted and pins or shear key so located as to take full advantage of the cylinder's inherent elasticity. For major shock load in tension, locate key at rear face of head or pin the head in place. For major shock load in thrust, pin cap in place or locate key at front face of cap.

Pivot Force Transfer (Group 2)

Cylinders with pivot mounts which absorb force on centerline should be used on applications where the machine member to be moved travels in a curved path. There are two basic ways to mount a cylinder so that it will pivot during the work cycle: clevis or trunnion mounts, with variations of each. Pivot mount cylinders are available in cap fixed clevis (Style BB), cap detachable clevis (Style BC), cap spherical bearing (Style SB), head trunnion (Style D), cap trunnion (Style DB), and intermediate fixed trunnion (Style DD).

Pivot mount cylinders can be used on tension (pull) or thrust (push) applications at full rated pressure, except long stroke thrust cylinders are limited by piston rod column strength. See Piston Rod Selection Chart on Page 83.

Clevis or single ear mounts are usually an integral part of the cylinder cap (though one style is detachable) and provide a single pivot point for mounting the cylinder. A pivot pin of proper length and of sufficient diameter to withstand the maximum shear load developed by the cylinder at rated operating pressure is included as a part of the clevis mount style. The fixed clevis mount, Style BB, is the most popular of the pivot force transfer types and is used on applications where the piston rod end travels in a curved path in one plane. It can be used vertically or horizontally or any angle in between. On long stroke push applications it may be necessary to use a larger diameter piston rod to prevent buckling or stop tube to minimize side loading due to "jackknife" action of cylinder in extended position. Fixed clevis mount cylinders will not function well if the curved path of piston rod travel is other than one plane. Such an application results in misalignment and causes the gland and piston bearing surfaces to be subjected to unnecessary side loading. For applications where the piston rod will travel in a path not more than 3½ either side of the true plane motion, a cap spherical bearing mount is recommended. A spherical bearing rod eye should be used at rod end. Most spherical bearing mounts have limited pressusre ratings. Consult cylinder manufacturer's product catalog.

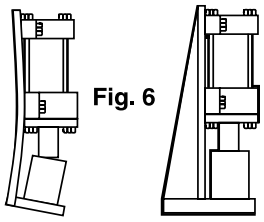


Fig. 6

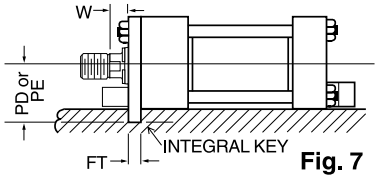


Fig. 7

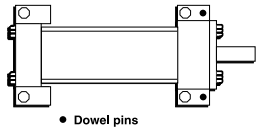


Fig. 8

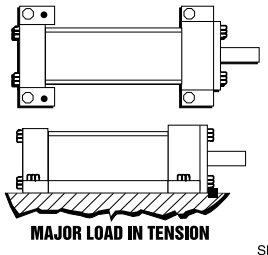


Fig. 9
Right

■ Shear key

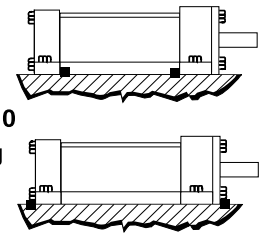
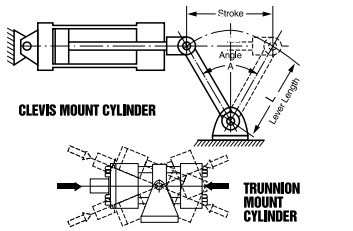
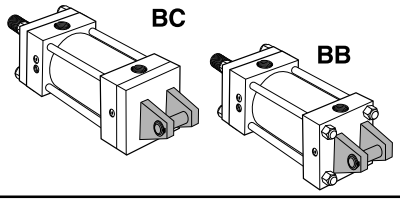


Fig. 10
Wrong

■ Shear key





C

Cap detachable clevis mounts are usually not available in heavy-duty hydraulic cylinders. They are used more for air or medium hydraulic service. Cap detachable clevis mounts are longer, centerline of pivot pin to shoulder of piston rod, than fixed clevis mount in any given bore size. They are most often specified to avoid port relocation charges. Application parameters are the same as described for fixed clevis mounting.

Trunnion mount cylinders are a second type of pivot mounts used on applications where the piston rod travels in a curved path in one plane. Three styles are available – head trunnion (Style D), cap trunnion (Style DB) and intermediate fixed trunnion (Style DD). Trunnion pins are designed for shear loads only and should not be subjected to bending stresses. Pillow blocks, rigidly mounted with bearings at least as long as the trunnion pins, should be used to minimize bending stresses. The support bearings should be mounted as close to the head, cap or intermediate trunnion shoulder faces as possible.

Cap end trunnion mounts are used on cylinder applications similar to fixed clevis mounts, and the same application data applies.

Head trunnion mount cylinders can usually be specified with smaller diameter piston rods than cylinders with pivot point at cap end or at an intermediate position. This is evident in data shown in piston rod selection chart on Page 83. On head end trunnion mount, long stroke, cylinder applications consideration should be given to the overhanding weight at cap end of cylinder. To keep trunnion bearing loading within limits, stroke lengths should be not more than 5 times the bore size. If cylinder stroke is greater than 5 times the bore size and piston speed exceeds 35 ft/minute, consult factory.

Intermediate fixed trunnion mount is the best of the trunnion mount types. The trunnion can be located so as to balance the weight of the cylinder, or it can be located at any point between the head or cap to suit the application. It is of fixed design, and the location of the trunnion must be specified (XI) dimension) at time of order. The location cannot be easily changed once manufactured.

Thrust exerted by a pivot transfer cylinder working at an angle is proportional to the angle of the lever arm which it operates. In Fig. 12 that vector force, T, which is at right angle to the lever axis, is effective for turning the lever. The value of T varies with the acute angle A between cylinder centerline and lever axes. To calculate effective thrust T, multiply cylinder thrust by the power factor shown in table below.

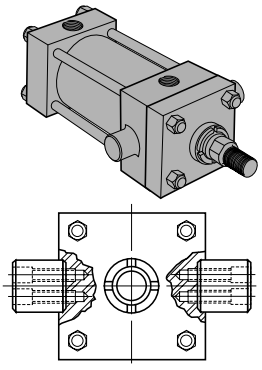
Accessories

Rod clevises or rod knuckles are available for use with either fixed or pivot mount cylinders. Such accessories are usually specified with pivot mount cylinders and are used with pivot pin centerline in same axis as pivot pin centerline on cylinder. Pivot pins for accessories must be ordered separately.

Pin size of rod clevis or rod knuckle should be at least equal in diameter to the pin diameter of the cap fixed clevis pin for the cylinder bore size specified. Larger accessories are more costly and usually result in a mis-match of pin diameters, especially when used with oversize piston rods.

Removable Trunnion Pins

Removable trunnion pins are a convenience when machine structures or confined space prohibit the use of separate pillow blocks situated close to the cylinder sides. Parker offers a removable pin design in 11/2" through 8" bores sizes. (See following table for recommended maximum operating pressure.) Mounting pin diameters and lengths are identical to those in Mounting Styles D and DB for any given bore size. These removable trunnion pins can be provided on the cap end (Style DBR) of Series “2A” cylinders with any rod diameter. They can also be provided on the head end (Style DR) of cylinders with standard rods.



Pressure Ratings – Removable Trunnion Pin Mounting

Bore Size	1 "	1 1/2"	2"	2 1/2"	3 1/4"	4"	5"	6"	8"
Std. Pressure Rating (PSI)	–	250	250	250	250	250	150	200	125
Extreme Pressure Rating	–	450	400	275	375	250	150	200	125
Hydraulic Rating (PSI)	–	750	700	450	625	400	250	325	200

Spherical Bearing Mount

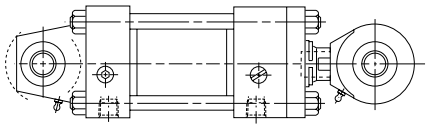
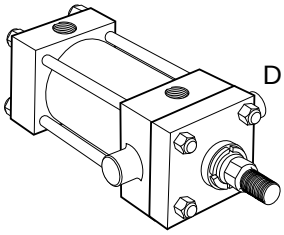


Fig. 11



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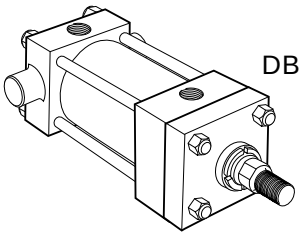
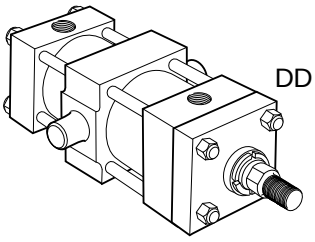


DB



DD

Clevis Mount Cylinder

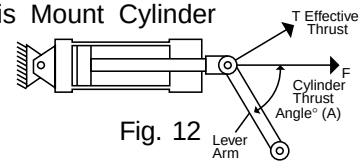


Fig. 12

Power Factor Table

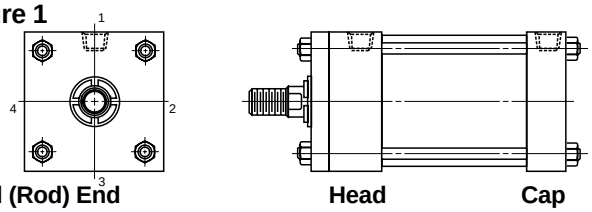
Angle A Degrees	Pwr. Factor (SIN A)	Angle A Degrees	Pwr. Factor (SIN A)
5	0.087	50	0.766
10	0.174	55	0.819
15	0.259	60	0.867
20	0.342	65	0.906
25	0.423	70	0.940
30	0.500	75	0.966
35	0.573	80	0.985
40	0.643	85	0.996
45	0.707	90	1.000

Ports

Parker hydraulic and pneumatic cylinders can be supplied with S.A.E. straight O-ring ports or N.P.T.F. pipe thread ports. For the type of port recommended and port size, see respective product catalogs. If specified on your order, extra ports can be provided on the sides of heads or caps that are not occupied by mountings or cushion valve on all cylinders except Series C and S.

Standard port location is position 1 as shown on line drawings in product catalog and Figure 1 below. Cushion adjustment needle and check valves are at positions 2 and 4 (or 3), depending on mounting style. Heads or caps which do not have an integral mounting can be rotated and assembled with ports at 90½ or 180½ from standard position. Mounting styles on which head or cap can be rotated at no extra charge are shown in Table A below. To order, specify by position number. In such assemblies the cushion adjustment needle and check valve rotate accordingly, since their relationship with port position does not change.

Figure 1



Head (Rod) End **Head** **Cap**

Table A

Mounting Style	Port Position Available	
	Head End	Cap End
T, TB, TC, TD, BC, CB, H, HB, J, JB, DD	1, 2, 3 or 4	1, 2, 3 or 4
BB, DB, HH	1,2, 3 or 4	1 or 3
D, JJ	1 or 3	1, 2, 3 or 4
C, E, F, G	1	1

Applies to Series MA, MAN, 2A, 2AN, 3L, DH, 3H, VH and HD.

Cylinder Port Options

Option "T" SAE Straight Thread O-Ring Port. Recommended for most hydraulic applications.

Option "U" Conventional NPTF Ports (Dry-Seal Pipe Threads). Recommended for pneumatic applications only.

Option "R" BSPP Port (British Parallel Thread). ISO 228 port commonly used in Europe. See Figure R-G on pg. C-112.

Option "P" SAE Flange Pots Code 61 (3000 psi). Recommended for hydraulic applications requiring larger port sizes.

Option "B" BSPT (British Tapered Thread).

Option "G" Metric Straight Thread Port similar to Option "R" with metric thread. Popular in some European applications. See Figure R-G on pg. C-112.

Option "Y" ISO-6149-1 Metric Straight Thread Port. Recommended for all hydraulic applications designed per ISO standards. See Figure Y on pg. C-112.

Ports can be supplied at positions other than those shown in Table A at an extra charge. To order, specify port position as shown in Figure 1.

C

Available Ports for 2H, 3H, HD Series Cylinders

Bore	"T" SAE Standard	"U" NPTF Pipe Thread	"R" BSPP Parallel Thread	"P" SAE 4-Bolt Flange Nom. Size	"B" BSPT Taper Thread	"G" Metric Straight Thread	"Y" ISO-6149-1 Metric Straight Thread
1 1/2	#10	1/2	1/2	N/A	1/2	M22 x 1.5	M22 x 1.5
2	#10	1/2	1/2	N/A	1/2	M22 x 1.5	M22 x 1.5
2 1/2	#10	1/2	1/2	1/2	1/2	M22 x 1.5	M22 x 1.5
3 1/4	#12	3/4	3/4	3/4	3/4	M27 x 2	M27 x 2
4	#12	3/4	3/4	3/4	3/4	M27 x 2	M27 x 2
5	#12	3/4	3/4	3/4	3/4	M27 x 2	M27 x 2
6	#16	1	1	1	1	M33 x 2	M33 x 2
7	#20	1 1/4	1 1/4	1 1/4	1 1/4	M42 x 2	M42 x 2
8	#24	1 1/2	1 1/2	1 1/2	1 1/2	M48 x 2	M48 x 2

Available Ports for 3L Series Cylinders

Bore	"T" SAE Standard	"U" NPTF Pipe Thread	"R" BSPP Parallel Thread	"B" BSPT Taper Thread	"G" Metric Straight Thread	"Y" ISO-6149-1 Metric Straight Thread
1	#6	1/4	1/4	1/4	M14 x 1.5	M14x 1.5*
1 1/2	#6	3/8	3/8	3/8	M14 x 1.5	M14 x 1.5*
2	#6	3/8	3/8	3/8	M14 x 1.5	M14 x 1.5
2 1/2	#6	3/8	3/8	3/8	M14 x 1.5	M14 x 1.5
3 1/4	#10	1/2	1/2	1/2	M22 x 1.5	M22 x 1.5
4	#10	1/2	1/2	1/2	M22 x 1.5	M22 x 1.5
5	#10	1/2	1/2	1/2	M22 x 1.5	M22 x 1.5
6	#12	1/2	1/2	1/2	M26 x 1.5	M27 x 2
8	#12	3/4	3/4	3/4	M26 x 1.5	M27 x 2

*Not available on code II rods

Straight Thread Ports

The S.A.E. straight thread O-ring port is recommended for hydraulic applications. Parker will furnish this port configuration at positions shown in Table A on page C99. This port can also be provided at positions other than those shown in Table A at an extra charge. S.A.E. port size numbers are listed next to their N.P.T.F. pipe thread counterparts for each bore size in the respective product catalogs. Size number, tube O.D. and port thread size for S.A.E. ports are listed in Table C.

Table C

S.A.E. Straight Thread "O" Ring Ports

Size No.	Tube O.D. (In.)	Thread Size	Size No.	Tube O.D. (In.)	Thread Size
2	1/8"	5/16 - 24	12	3/4"	1 1/16 - 12
3	3/16"	3/8 - 24	—	—	—
4	1/4"	7/16 - 20	16	1"	1 5/16 - 12
5	5/16"	1/2 - 20	20	1 1/4"	1 5/8 - 12
6	3/8"	9/16 - 18	24	1 1/2"	1 7/8 - 12
8	1/2"	3/4 - 16	32	2"	2 1/2 - 12
10	5/8"	7/8 - 14	—	—	—

Note: For the pressure ratings of individual connectors, contact your connector supplier. Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at the cylinder piston rod end. The rod end pressure is approximately equal to:

$$\frac{\text{effective cap end piston area}}{\text{effective rod end piston area}} \times \text{Operating Pressure}$$

International Ports

Other port configurations to meet international requirements are available at extra cost. Parker cylinders can be supplied, on request, with British standard taper port (BSPT). Such port has a taper of 1 in 16 measured on the diameter (1/16" per inch). The thread form is Whitworth System, and size and number of threads per inch are as follows:

Table D

British Standard Pipe Threads

Nominal Pipe Size	No. Threads Per Inch	Pipe O.D.
1/8	28	.383
1/4	19	.518
3/8	19	.656
1/2	14	.825
3/4	14	1.041
1	11	1.309
1 1/4	11	1.650
1 1/2	11	1.882
2	11	2.347

British standard parallel internal threads are designated as BSP and have the same thread form and number of threads per inch as the BSPT type and can be supplied, on request, at extra cost. Unless otherwise specified, the BSP or BSPT port size supplied will be the same nominal pipe size as the N.P.T.F. port for a given bore size cylinder.

Metric ports options G or Y can also be supplied to order at extra cost.

Flange Ports (Code 61, 3000 psi)

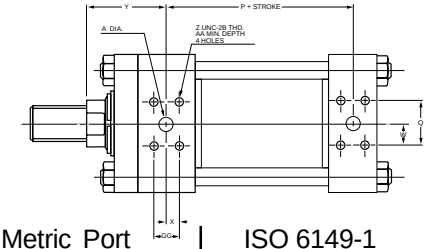
SAE 4 Bolt Flange Ports for 2H, 3H (7"-8"), HD

Bore Size	Rod Code	SAE Dash No.	Y	A	P	Q	W	X
2 1/2*†	1	8	2.39	.50	2.97	1.50	.75	.34
3 1/4†	1	12	2.80	.75	3.41	1.87	.94	.44
	2		3.17					
	3		3.05					
4†	1	12	3.05	.75	3.72	1.87	.94	.44
	2		3.39					
	3		3.17					
5†	1	12	3.17	.75	4.22	1.87	.94	.44
	2		3.39					
	3		3.39					
	4		3.39					
6	All	16	3.52	1.00	4.85	2.06	1.03	.52
7	All	20	3.70	1.25	5.59	2.31	1.16	.59
8	All	24	3.84	1.50	6.31	2.75	1.37	.70

Bore Size	Rod Code	SAE Dash No.	Z	AA	GG
2 1/2*†	1	8	5/16 - 18	.81	.69
3 1/4†	1	12	3/8 - 16	.75	.87
	2				
	3				
4†	1	12	3/8 - 16	.75	.87
	2				
	3				
5†	1	12	3/8 - 16	.75	.87
	2				
	3				
	4				
6	All	16	3/8 - 16	.87	1.03
7	All	20	7/16 - 14	1.00	1.19
8	All	24	1/2 - 13	1.06	1.41

*2 1/2" bore head, flange port available with code 1 & 3 rod only.

†2 1/2", 3 1/4", 4" & 5" bores cap-flange port not available on HB mounting. H mounting not available at position 2 or 4. Port flange overhangs cap on HH mounting.



BSPP or Metric Port options "R" and "G" for Series 3L, 2H, 3H, HD

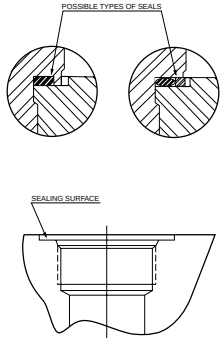


Figure R-G

ISO 6149-1 Port option "Y" for Series 3L, 2H, 3H, HD

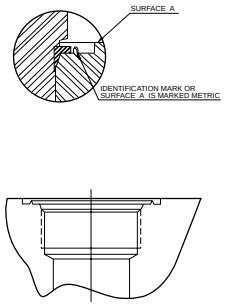


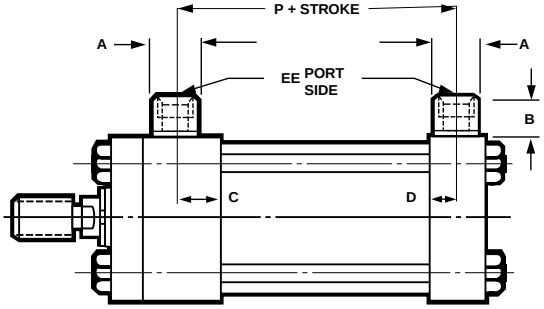
Figure Y

For additional information – call your local Parker Cylinder Distributor.

Oversize Ports

Oversize NPTF or SAE straight thread ports can be provided, at an extra charge, on pneumatic and hydraulic cylinders. For ports one size larger than standard, welded port bosses which protrude from the side of the head or cap are supplied. For dimensions, see drawings and tables below. 2H and 3L cylinders equipped with cushions at the cylinder cap end can sustain damage to the cushion check valve (cushion bushing) if excessive oil flow enters the cylinder from the cap end port. Cylinders which are equipped with cap end cushions and ordered with one size oversize ports having hydraulic fluid flow exceeding 25 ft./sec. in the line entering the cap end of the cylinder should be ordered with a "solid cushion" at cap end such as provided with the "VH" Series. All cylinders ordered with double oversize ports should always be ordered with a "solid cushion" at cap end such as provided with the "VH" Series.

Cylinders which are connected to a meter out flow control with flow entering the cap end of a cylinder provided by an accumulator may also experience damage to the cushion bushing due to high instantaneous fluid flows. This condition can be eliminated by using a meter in flow control or "solid cushions" at cap end such as provided with the "VH" Series.



Oversize NPTF Port Boss Dimensions

Series 2A, MA and 3L Cylinders

Bore	EE (NPTF)	A (Dia.)	B	C	D	P
1	3/8	7/8	3/4	9/16	1/2	2 1/16
1 1/2	1/2	1 1/8	15/16	9/16	1/2	2 3/16
2	1/2	1 1/8	15/16	9/16	1/2	2 3/16
2 1/2	1/2	1 1/8	15/16	9/16	1/2	2 5/16
3 1/4	3/4	1 3/8	1	11/16	5/8	2 9/16
4	3/4	1 3/8	1	11/16	5/8	2 9/16
5	3/4	1 3/8	1	11/16	5/8	2 13/16
6	1	1 3/4	1 3/16	15/16	3/4	3 3/16
7-8	1	1 3/4	1 3/16	15/16	3/4	3 5/16
10	1 1/4	2 1/4	1 5/16	1 1/8	1	4 1/4
12	1 1/4	2 1/4	1 5/16	1 1/8	1	4 3/4
14	1 1/2	2 1/2	1 9/16	1 1/4	1 1/8	5 1/2

Series 2H, 3H (7" & 8"), HD Cylinders

Bore	EE (NPTF)	A (Dia.)	B	C	D	P
1 1/2	3/4	1 3/8	1	3/4	25/32	2 29/32
2	3/4	1 3/8	1	3/4	25/32	2 29/32
2 1/2	3/4	1 3/8	1	3/4	25/32	3 1/32
3 1/4	1	1 3/4	1 3/16	29/32	7/8	3 17/32
4	1	1 3/4	1 3/16	29/32	7/8	3 25/32
5	1	1 3/4	1 3/16	29/32	7/8	4 9/32
6	1 1/4	2 1/4	1 5/16	1 1/8	1 1/8	5 1/8
7	1 1/2	2 1/2	1 9/16	1 3/8	1 3/8	5 3/4
8	2	3	1 11/16	1 1/2	1 1/2	6 1/2

Oversize SAE Straight Thread Port Boss Dimensions

Series 3L Cylinders

Bore	EE (SAE)	A (Dia.)	B	C	D	P
1	8	1 1/8	15/16	9/16	1/2	2 1/16
1 1/2	8	1 1/8	15/16	9/16	1/2	2 3/16
2	8	1 1/8	15/16	9/16	1/2	2 3/16
2 1/2	8	1 1/8	15/16	9/16	1/2	2 5/16
3 1/4	12	1 3/8	1	11/16	5/8	2 9/16
4	12	1 3/8	1	11/16	5/8	2 9/16
5	12	1 3/8	1	11/16	5/8	2 13/16
6	16†	1 3/4	1 3/16	15/16	3/4	3 3/16
8	16†	1 3/4	1 3/16	15/16	3/4	3 5/16

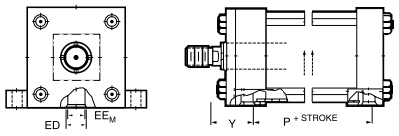
Series 2H, 3H (7" & 8"), HD Cylinders

Bore	EE (SAE)	A (Dia.)	B	C	D	P
1 1/2	12*	1 3/8	1	13/16	25/32	2 31/32
2	12*	1 3/8	1	13/16	25/32	2 31/32
2 1/2	12**	**	**	**	**	3 5/32
3 1/4	16	1 3/4	1 3/16	7/8	7/8	3 7/16
4	16	1 3/4	1 3/16	7/8	7/8	3 11/16
5	16	1 3/4	1 3/16	7/8	7/8	4 3/16
6	20**	**	**	**	**	5 3/16
7	24**	**	**	**	**	5 1/2
8	32**	**	**	**	**	6 1/4

†Available at head end only. For cap end, consult factory.
*Port tapped directly into head on these cylinders with code 1 rods.
Rod code 2 and cap use port boss.
**Port tapped directly into head and cap.

Manifold Ports

Side mounted cylinders, Style C can be furnished with the cylinder ports arranged for mounting and sealing to a manifold surface. The ports are drilled and counterbored for O-ring seals which are provided. With These specifications, the mounting is designated Style CM or KCM.



Dimensions — Manifold Ports for Single and Double Rod Cylinders

Series 2H, 3H (7" & 8"), HD Cylinders

Bore	Rod Code	Rod Dia. MM	Y±1/32	P±1/32	P_K±1/32	EE_M	ED
1 1/2	1	5/8	2	2 7/8	2 7/8	3/4	1 1/8
	2	1	2 3/8				
2	1	1	2 3/8	2 7/8	2 7/8	3/4	1 1/8
	2	1 3/8	2 5/8				
2 1/2	1	1	2 3/8	3	3	3/4	1 1/8
	2	1 3/4	2 7/8				
	3	1 3/8	2 5/8				
3 1/4	1	1 3/8	2 3/4	3 1/2	3 1/2	1	1 3/8
	2	2	3 1/8				
	3	1 3/4	3				
4	1	1 3/4	2 27/32	4	4 1/16	1	1 3/8
	2	2 1/2	3 7/32				
	3	2	2 31/32				
5	1	2	3 1/8	3 3/8	4 1/4	1	1 3/8
	2	3 1/2					
	3	2 1/2					
	4	3					
6	1	2 1/2	3 1/2	5 1/8	4 7/8	1 1/4	1 5/8
	2	4					
	3	3					
	4	3 1/2					
7	1	3	3 13/16	5 7/8	5 3/8	1 1/2	1 7/8
	2	5					
	3	3 1/2					
	4	4					
	5	4 1/2					
8	1	3 1/2	3 15/16	6 5/8	6 1/8	1 1/2	1 7/8
	2	5 1/2					
	3	4					
	4	4 1/2					
	5	5					

Series 2A, 3L Cylinders

Bore	Rod Code	Rod. Dia. (MM)	Y±1/32	P±1/32	EE_M	ED
1	All	All	1 15/16	2 1/8	3/8	11/16
1 1/2	1	5/8	2	2 1/8	1/2	13/16
	2	1	2 3/8			
2	1	5/8	2	2 1/8	1/2	13/16
	2	1 3/8	2 5/8			
	3	1	2 3/8			
2 1/2	1	5/8	2	2 1/4	1/2	13/16
	2	1 3/4	2 7/8			
	3	1	2 3/8			
	4	1 3/8	2 5/8			
3 1/4	1	1	2 7/16	2 5/8	5/8	15/16
	2	2	3 1/16			
	3	1 3/8	2 11/16			
	4	1 3/4	2 15/16			
4	1	1	2 7/16	2 5/8	5/8	15/16
	2	2 1/2	3 5/16			
	3	1 3/8	2 11/16			
	4	1 3/4	2 15/16			
	5	2	3 1/16			
5	1	1	2 7/16	2 7/8	5/8	15/16
	2, 6 & 7	3 1/2, 2 1/2 & 3	3 5/16			
	3	1 3/8	2 11/16			
	4	1 3/4	2 15/16			
	5	2	3 1/16			
6	1	1 3/8	2 13/16	3 1/8	7/8	1 3/16
	2, 5, 6, 7	4, 2 1/2, 3 & 3 1/2	3 7/16			
	3	1 3/4	3 1/16			
	4	2	3 3/16			
7 - 8	1	1 3/8	2 13/16	3 1/4	7/8	1 3/16
	2, 5, 6, 7, 8, 9 & 0	5 1/2, 2 1/2, 3, 3 1/2, 4, 4 1/2 & 5	3 7/16			
	3	1 3/4	3 1/16			
	4	2	3 3/16			
10	1	1 3/4	3 1/8	4 1/8	1 3/16	1 1/2
	3	2	3 1/4			
	4, 5, 6, 7, 8, 9 & 0	2 1/2, 3, 3 1/2, 4, 4 1/2, 5 & 5 1/2	3 1/2			
12	1	2	3 1/4	4 5/8	1 3/16	1 1/2
	3, 4, 5, 6, 7, 8 & 9	2 1/2, 3, 3 1/2, 4, 4 1/2, 5 & 5 1/2	3 1/2			
14	All	All	3 13/16	5 1/2	1 9/16	1 7/8

C

Rod End Data

Rod end dimension symbols as shown comply with the National Fluid Power Association dimensional code. The following chart indicates the symbols used in this catalog.

Description	Symbol
Thread diameter and pitch	KK or CC
Length of thread	A
Length of rod extension from face of gland retainer to end of retracted rod	LA or LAF (Male Thread) W (Female Thread)

Three rod ends for Parker cylinders are offered as shown on the dimension pages of this catalog. They are Parker styles 4, 8 and 9, and all three are optional without price penalty. If a rod end style is not specified, the Parker style 4 (N.F.P.A. Style SM) will be supplied. Styles 4 and 8 are supplied with high strength rolled thread studs on piston rods through 2" diameter. Longer studs in Parker Standard sizes are available, see table below.

Warning!

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

On occasion cylinders are ordered with double rods. In some cases a stop is threaded onto one of the piston rods and used as an external stroke adjuster. This can cause a potential safety concern and can also lead to premature piston rod failure. The external stop will create a pinch point and the cylinder user should consider appropriate use of guards. If an external stop is not parallel to the final contact surface it will place a bending moment on the piston rod. An external stop will also negate the effect of a cushion and will subject the piston rod to an impact loading. These two (2) conditions can cause piston rod failure. The use of external stroke adjusters should be reviewed with our Engineering Department.

Piston Rod End Threads

Standard piston rod end thread lengths are shown as dimension “A” in Catalog dimension pages. Special rod end threads which are two times standard length can be supplied at a small extra cost. Available thread lengths are shown in the table below. To order, add suffix “2” to piston rod model number code and specify as Style #42 or Style #82.

Optional Piston Rod End Studs

Piston Rod Dia.	Rod End Thread Style #42		Rod End Thread Style #82	
	Thread Dia. & Pitch (KK)	Length (= 2 × A)	Thread Dia. & Pitch (CC)	Length (= 2 × A)
5/8	7/16 - 20	1 1/2	1/2 - 20	1 1/2
1	3/4 - 16	2 1/4	7/8 - 14	2 1/4
1 3/8	1 - 14	3 1/4	1 1/4 - 12	3 1/4
1 3/4	1 1/4 - 12	4	1 1/2 - 12	4
2	1 1/2 - 12	4 1/2	1 3/4 - 12	4 1/2

International Rod End Threads

Piston rod threads to meet international requirements are available at extra cost. Parker cylinders can be supplied with British standard fine (W) or metric (M). To order, specify in model number. For dimensions, consult factory.

Special Rod Ends

If a rod end configuration other than the standard styles 4, 8 and 9 is required, such special rod ends can be provided. The designation “Style 3” is assigned to such specials and is incorporated in the cylinder model number. To order, specify “Style 3” and give desired dimensions for CC or KK, A, LA or LAF, or W if female end. If otherwise special, send a dimensioned sketch.

Special Assemblies from Standard Parts

Each dimensioned drawing in this catalog has position numbers shown on the end view to identify the four sides of the cylinder. These aid in communications and simplify the writing of specifications that cover changes in port positions, etc. Following are several suggested special assemblies that can be made up from standard parts.

a) By calling out the position numbers for the desired locations for head and cap ports, many mounting styles can be assembled with ports located at 90½ or 180½ from standard. In such special assemblies, the cushion needle and check valves are also repositioned since their relation with the port position does not change.

b) The cushion needle valve is interchangeable with the check valve in the cylinder heads. The cushion needle valve can be assembled on side position 4 with the check valve on side 2 for most mounting styles when the port is in the standard side position 1.

   On mounting styles D, DB and DD, the cushion needle valves are provided only on the side position 3 on the head or cap which accommodates the mounting. The opposite head or cap can be rotated.

c) Standard mountings in different combinations can be provided: for example Style J mounting on head end with Style C on the cap end. This would be made up from standard parts and would be designated Model JC-2HU14A.

Single-Acting Cylinders

Double-acting cylinders are supplied as standard. They can also be used a single-acting cylinders where fluid force is applied to only one side of the piston, with the load or other external forces acting to “return” the piston after pressure is exhausted.

Spring-Returned, Single-Acting Cylinders – Single-acting, spring-returned models can also be provided. Load conditions and friction factors must be considered in supplying the proper spring for the application. In addition, it is necessary that information be supplied as to which side of the piston the spring should act upon. Specify "Spring to return piston rod” or “Spring to advance piston rod.”

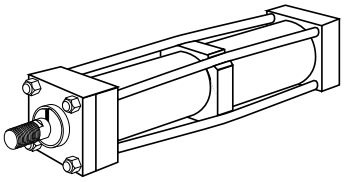
On longer stroke spring-returned cylinders, it is recommended that tie rod extensions be specified on the cylinder end in which the spring is located so that the cap or head against which the spring is acting can be “backed-off” slowly until compression of the spring is relieved. In such cases it should also be specified that the tie rod nuts be welded to the tie rods at the opposite end of the cylinder to further insure safe disassembly.

Consult factory when ordering spring-returned cylinders.

Stroke Data

Parker cylinders are available in any practical stroke length. The following information should prove helpful to you in selecting the proper stroke for your cylinder application.

Stroke Tolerances – Stroke length tolerances are required due to build-up of tolerances of piston, head, cap and cylinder body. Standard production stroke tolerances run +1/32" to -1/64" up to 20" stroke, +1/32" to -.020" for 21" to 60" stroke and +1/32" to -1/32" for greater than 60" stroke. For closer tolerances on stroke length, it is necessary to specify the required tolerance plus the operating pressure and temperature at which the cylinder will operate. Stroke tolerances smaller than .015" are not generally practical due to elasticity of cylinders. If machine design requires such close tolerances, use of a stroke adjuster (below) may achieve the desired result.



Tie Rod Supports

Rigidity of Envelope – The pre-stressed tie rod construction of Parker cylinders has advantages in rigidity within the limits of the cylinder tube to resist buckling. For long stroke cylinders within practical limits. Parker provides exclusive TIE ROD SUPPORTS (see table below) which move the tie rod centerlines radially outward (patent number 3011844).

Standard tie rod supports are kept within the envelope dimensions of the head and cap, and generally do not interfere with mounting a long cylinder.

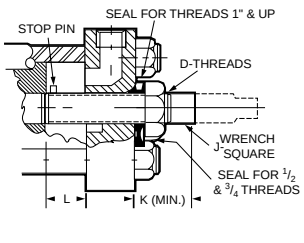
Number of Supports Required	Stroke (Inches)												
	Bore	36	48	60	72	84	96	108	120	132	144	156	168
	1	—	1	1	1	2	Consult Factory						
	1 1/2	—	—	1	1	1	2	2	2	3	3	3	4
	2	—	—	—	1	1	1	1	2	2	2	2	3
	2 1/2	—	—	—	—	—	1	1	1	1	1	2	2
	3 1/4	—	—	—	—	—	—	—	1	1	1	1	1
	4	—	—	—	—	—	—	—	—	—	1	1	1

Note: 5" through 14" bore sizes — no supports required.

Stroke Adjusters

Stroke Adjusters – For the requirement where adjusting the stroke is specified. Parker has several designs to offer, one of which is illustrated below. This is suitable for infrequent adjustment and is economical.

Bore Size					
Series 2A-MA 3L	Series 2H, VH HD/HDC	D	J	K	L (Max.)
1 1/2, 2	1 1/2"	1/2 - 20	5/16	15/16	5
2 1/2, 3 3/4, 4	2"	3/4 - 16	7/16	1 1/4	8
5, 6	2 1/2", 3 1/4"	1 - 14	5/8	1 11/16	9
8	4"	1 1/2 - 12	15/16	2 1/8	18
10	5"	2-12	1 5/16	2 11/16	20
12, 14	6"	2 1/2 - 12	1 11/16	3 1/8	20
—	7"	3-12	2	3 1/4	20
—	8"	3 1/2 - 12	2 3/8	3 1/2	20

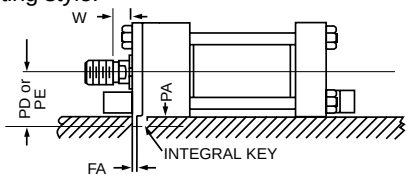


Here a "retracting stroke adjuster" must be called for in specifications, and the length *of the adjustment must be specified.*

Where frequent adjustment or cushions at the cap end are required, other designs are available according to application needs.

Thrust Key Mountings

Thrust key mountings eliminate the need of using fitted bolts or external keys on side mounted cylinders. Parker cylinders in mounting styles CP, FP, GP and CBP can be provided with the gland retainer plate extended below the mounting side of the cylinder (see illustration below). This extended retainer plate can then be fitted into a keyway milled into the mounting surface of the machine member. This is referred to as the "P" Modification of any side mounting style.



Series 2A, 2AN and 3L

Bore	Dim. FA	Dim. PA	Dim. PD Mtg. Styles CP, FP &GP†	Dim. PD Mtg. Styles CBP*
1	.312 +.000 -.002	3/16	15/16	1 3/16
1 1/2			1 3/16	1 3/8
2			1 7/16	1 5/8
2 1/2			1 11/16	1 13/16
3 1/4	.562 +.000 -.002	5/16	2 3/16	2 1/4
4			2 9/16	2 9/16
5			3 1/16	3 1/16
6	.687 +.000 -.002	3/8	3 5/8	3 5/8

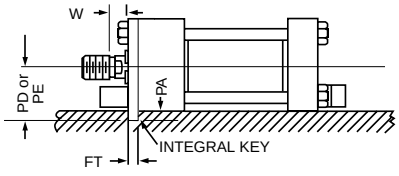
†GP Mtg. not available in 1" Bore.

*1" bore CBP Mounting available with No. 1 (1/2" diameter) rod only.

Series 2H, 3H (7" & 8"), VH Cylinders

Bore	Dim. FA	Dim. PA	Dim. PD Mtg. Styles CP, FP &GP	Dim. PE Mtg. Style CBP
1 1/2	.312 +.000 -.002	3/16	1 7/16	1 9/16
2	.562 +.000 -.002	5/16	1 13/16	2
2 1/2	.562 +.000 -.002	5/16	2 1/16	2 1/4
3 1/4	.687 +.000 -.003	3/8	2 5/8	2 15/16
4	.812 +.000 -.003	7/16	2 15/16	3 1/4
5	.812 +.000 -.003	7/16	3 11/16	4 1/8
6	.937 +.000 -.003	1/2	4 1/4	4 3/4
7	.937 +.000 -.003	1/2	4 3/4	5 7/16
8	.937 +.000 -.003	1/2	5 1/4	6

Thrust Key Mountings



Series HD/HDC

Bore	+.000" -.001" Dim. FT	Dim. PA	Dim. PD Mtg. Styles CP, FP & GP
1 1/2	.361	3/16	1 7/16
2	.611	5/16	1 13/16
2 1/2	.611	5/16	2 1/16
3 1/4	.736	3/8	2 5/8
4	.861	7/16	2 15/16
5	.861	7/16	3 11/16
6	.986	1/2	4 1/4
8	.986	1/2	5 1/4

C

Acceleration and Deceleration Force Determination

The uniform acceleration force factor chart and the accompanying formula can be used to rapidly determine the forces required to accelerate and decelerate a cylinder load. To determine these forces, the following factors must be known: total weight to be moved, maximum piston speed, distance available to start or stop the weight (load), direction of movement, i.e. horizontal or vertical, and load friction. By use of the known factors and the "g" factor from chart, the force necessary to accelerate or decelerate a cylinder load may be found by solving the formula (as shown in chart below) application to a given set of conditions.

Nomenclature

V = Velocity in feet per minute
S = Distance in inches
F = Force in lbs.
W = Weight of load in pounds
g = Force factor
f = Friction of load on machine ways in pounds

To determine the force factor "g" from the chart, locate the intersection of the maximum piston velocity line and the line representing the available distance. Project downward to locate "g" on the horizontal axis. To calculate the "g" factor for distances and velocities exceeding those shown on the chart, the following formula can be used:

$g = v^2/s \times .0000517$

Example: Horizontal motion of a free moving 6,000 lb. load is required with a distance of 1/2" to a maximum speed of 120 feet per minute.

Formula (1) F = Wg should be used.

F = 6,000 pounds x 1.50 (from chart) = 9,000 pounds

Assuming a maximum available pump pressure of 1,000 p.s.i., a 4" bore cylinder should be selected, operating on push stroke at approximately 750 p.s.i. pressure at the cylinder to allow for pressure losses from the pump to the cylinder.

Assume the same load to be sliding on ways with a coefficient of friction of 0.15. The resultant friction load would be 6,000 x 0.15 = 900 lbs.

Formula (2) F = Wg + f should be used.

F = 6,000 lbs. x 1.5 (from chart) + 900 = 9,900 lbs.

Again allowing 750 p.s.i. pressure at the cylinder, a 5" bore cylinder is indicated.

Example: Horizontal deceleration of a 5000 pound load is required by using a 1" long cushion in a 5" bore cylinder having a 1 3/4" diameter piston rod. Cylinder bore area (19.64 Sq. In.) minus the rod area results in a minor area of 17.23 Sq. In. at head end of cylinder. A pump delivering 500 p.s.i. at the cylinder is used to push the load at 120 feet per minute. Friction coefficient is 0.15 or 750 lbs.

In this example, the total deceleration force is the sum of the force needed to decelerate the 5,000 pounds load, and the force required to counteract the thrust produced by the pump.

W = Load in lbs. = 5000
S = Deceleration distance in inches = 1"
V = Maximum piston speed in feet per minute = 120
g = .74 (from chart)
f = 750 pounds

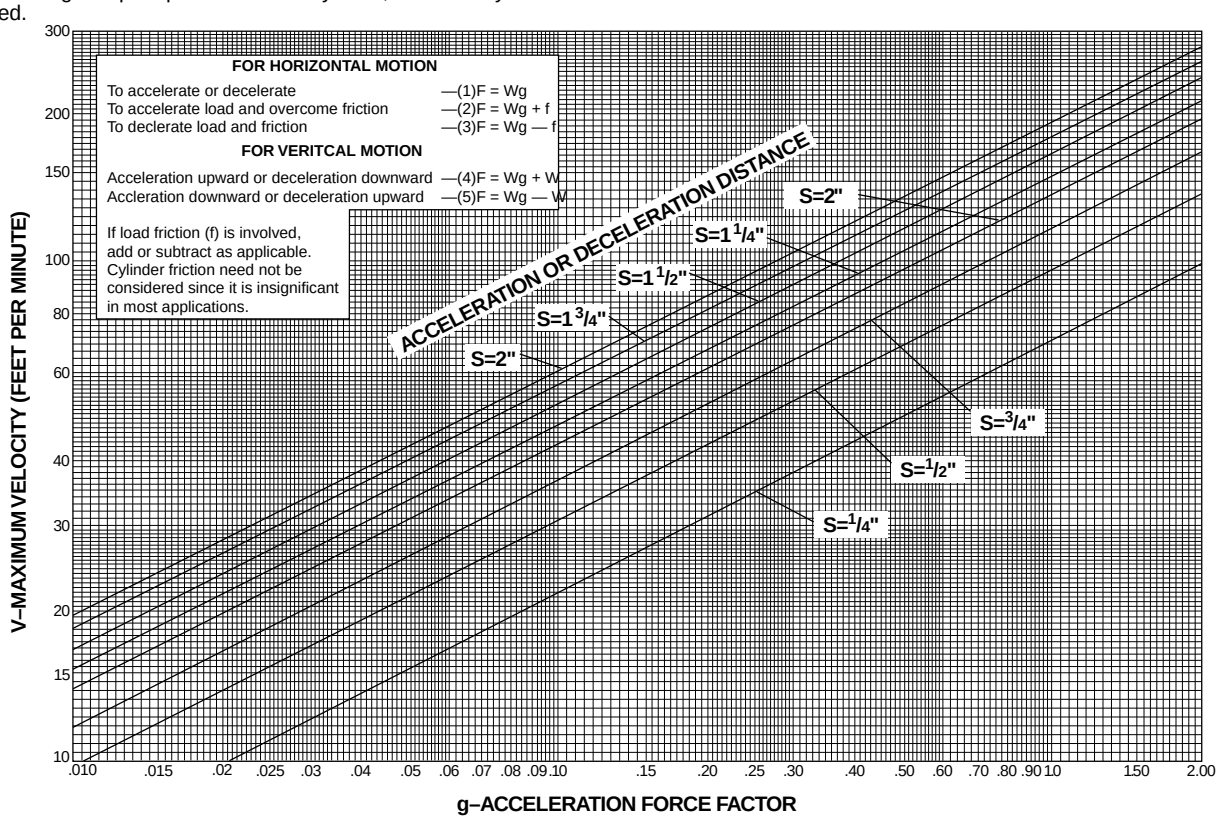
Use formula (3) F = Wg - f

(F = Wg - f) = (F = 5000 x .74 - 750) = 2,950 Pounds

The pump is delivering 500 p.s.i. acting on the 19.64 Sq. In. piston area producing a force (F_2) of 9820 pounds. This force must be included in our calculations. Thus $F + F_2 = 2950 + 9820 = 12{,}770$ pounds total force to be decelerated.

The total deceleration force is developed by the fluid trapped between the piston and the head. The fluid pressure is equal to the force (12,770 pounds) divided by the minor area (17.23 Sq. In.) equals 741 p.s.i. This pressure should not exceed the non-shock rating of the cylinder.

Cushioning practice is to select a "g" factor between .2 and 1.5.

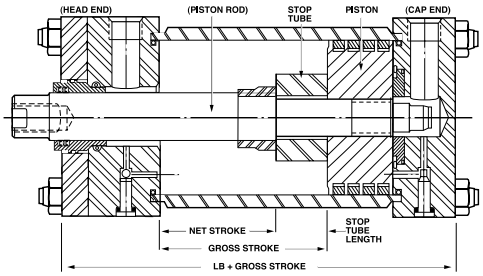


For additional information – call your local Parker Cylinder Distributor.

Stop Tubing

Long stroke cylinders, fixed or pivot mounted, tend to jackknife or buckle on push load applications, resulting in high bearing loading at the rod gland or piston. Use of a stop tube to lengthen the distance between the gland and piston when cylinder rod is fully extended is recommended to reduce these bearing loads. The drawing below shows stop tube construction for fluid power cylinders. Refer to piston rod/stroke selection chart to determine stop tube length.

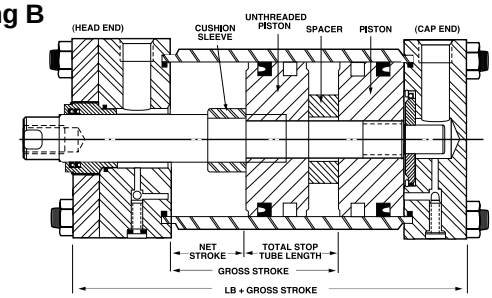
Drawing A



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

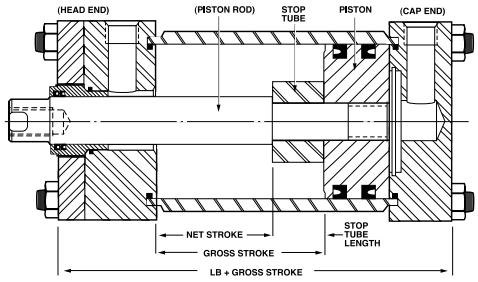
Refer to piston rod/stroke selection chart to determine stop tube length.

Drawing B



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

Drawing C



This design is supplied on all non cushion cylinders.

Series 2A, MA, 3L, HD, 2H, 3H Cylinders

Mounting Classes

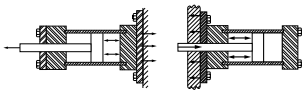
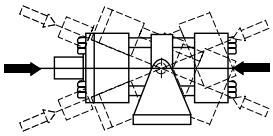
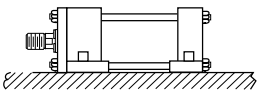
Standard mountings for fluid power cylinders fall into three basic groups. The groups can be summarized as follows:

Group 1 – Straight Line Force Transfer with fixed mounts which absorb force on cylinder centerline.

Group 2 – Pivot Force Transfer. Pivot mountings permit a cylinder to change its alignment in one plane.

Group 3 – Straight Line Force Transfer with fixed mounts which do not absorb force on cylinder centerline.

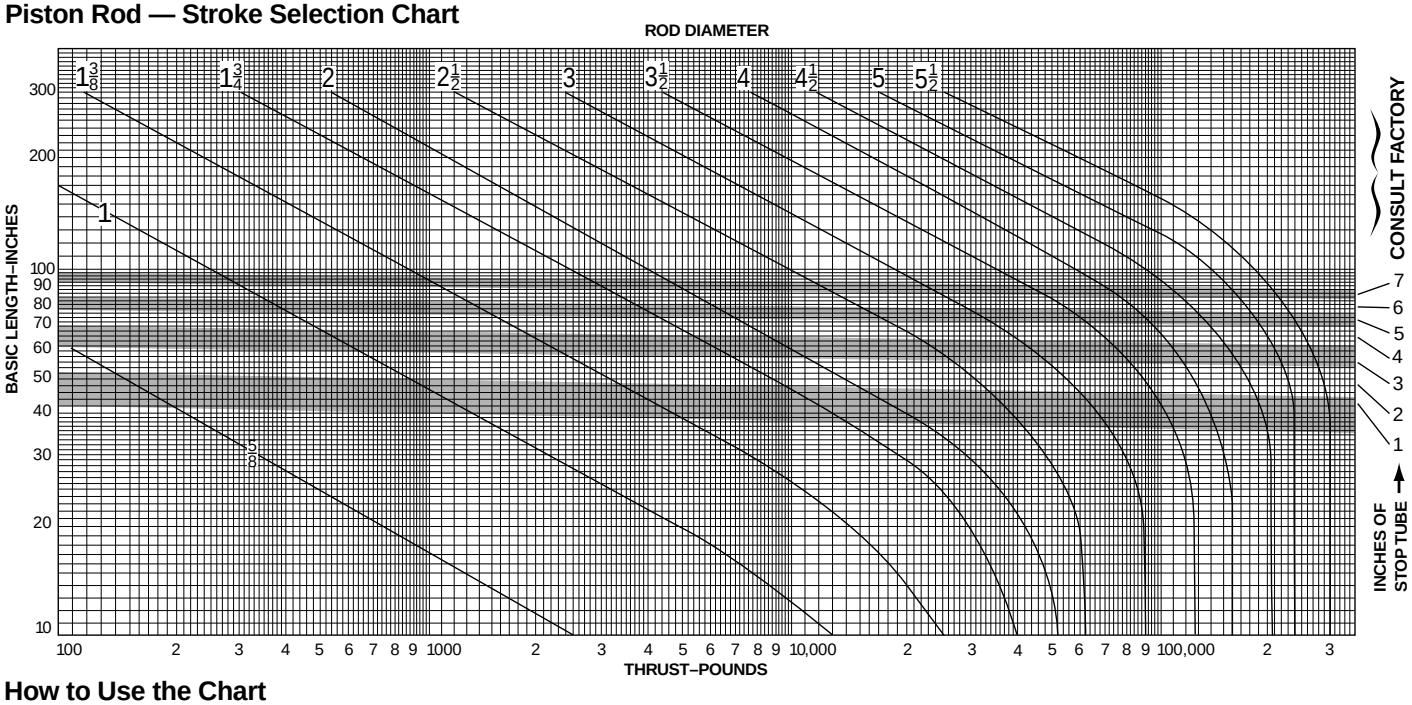
Because a cylinder's mounting directly affects the maximum pressure at which the cylinder can be used, the chart below should be helpful in selection of the proper mounting combination for your application. Stroke length, piston rod connection to load, extra piston rod length over standard, etc., should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

Group 1 FIXED MOUNTS which absorb force on cylinder centerline.	
	
Heavy-Duty Service For Thrust Loads For Tension Loads	 Mtg. Styles HB, TC, E Mtg. Styles JE, TB, E
Medium -Duty Service For Thrust Loads For Tension Loads	 Mtg. Styles H, JB Mtg. Styles J, HB
Light-Duty Service For Thrust Loads For Tension Loads	 Mtg. Style FJ Mtg. Style H
Group 2 PIVOT MOUNTS which absorb force on cylinder centerline.	
	
Heavy-Duty Service For Thrust Loads For Tension Loads	 Mtg. Styles DD, D Mtg. Styles BB, BC, DD, D, DB
Medium-Duty Service For Thrust Loads For Tension Loads	 Mtg. Styles BB, BC Mtg. Styles BB, BC
Light-Duty Service For Thrust Loads For Tension Loads	 ——— ———
Group 3 FIXED MOUNTS which do not absorb force on the centerline.	
	
Heavy-Duty Service For Thrust Loads For Tension Loads	 Mtg. Style C, CP Mtg. Style C, CP
Medium-Duty Service For Thrust Loads For Tension Loads	 Mtg. Style G, GP, F, FP Mts. Style G, GP, F, FP
Light-Duty Service For Thrust Loads For Tension Loads	 Mtg. Style CBP, CB* Mtg. Style CBP, CB*

* Mounting style CB recommended for maximum pressure of 150 p.s.i.

C

Piston Rod — Stroke Selection Chart



How to Use the Chart

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

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

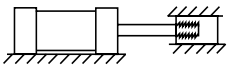
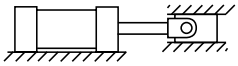
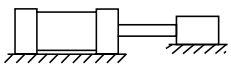
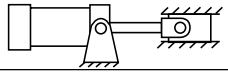
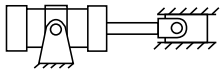
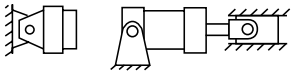
$$\text{Basic Length} = \text{Actual Stroke} \times \text{Stroke Factor}$$

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

3. Find the load imposed for the thrust application by multiplying the full bore area of the cylinder by the system pressure.
4. Enter the graph along the values of "basic length" and "thrust" as found above and note the point of intersection:
   A) The correct piston rod size is read from the diagonally curved line labeled "Rod Diameter" next *above* the point of intersection.
   B) The required length of stop tube is read from the right of the graph by following the shaded band in which the point of intersection lies.
   C) If required length of stop tube is in the region labeled "consult factory," submit the following information for an individual analysis:
   1) Cylinder mounting style.
   2) Rod end connection and method of guiding load.
   3) Bore, required stroke, length of rod extension (Dim. "LA") if greater than standard, and series of cylinder used.
   4) Mounting position of cylinder. (Note: If at an angle or vertical, specify direction of piston rod.)
   5) Operating pressure of cylinder if limited to less than standard pressure for cylinder selected.

Warning ⚠

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

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

NOTES

One of the factors involved in determining the speed of a hydraulic cylinder piston is fluid flow in connecting lines, generally measured in gallons per minute, introduced to, or expelled from, cap end cylinder port. (Due to piston rod displacement, the flow at head end port will be less than at cap end.) Fluid velocity, however, is measured in feet per second. In connecting lines this velocity should generally be limited to 15 feet per second to minimize fluid turbulence, pressure loss and hydraulic shock.

Piston speed for cylinders can be calculated from data shown in **table B-5**. The table shows fluid velocity flow for major cylinder areas as well as for the net area at the rod end for cylinders 1" through 14" bore size.

If desired piston speed results in fluid flow in excess of 15 feet per second in connecting lines, consider the use of larger lines up to cylinder port, using either oversized ports or two ports per cap.

If heavy loads are involved or piston speeds are in excess of 20 feet per minute and the piston will make a full stroke, cushions are recommended. Cushions increase cylinder life and reduce undesirable noise.

Table b-5

Cylinder Bore (Inches)	Piston Rod		Cylinder Net Area	Fluid Displacement at 10 Ft. Per Min. Piston Velocity		Fluid Velocity (In Feet Per Second) Through Extra Heavy Pipe at 10 F.P.M. Piston Speed. For Series 2H Cylinders Standard Port Size is First to Left of Heavy Black Line.								
	Dia. (Inches)	Area (Sq. In.)	(Sq. In.)	GPM	CFM	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
1	0	0	.785	.41	.054	1.82	.92	.56	.30	.183	.102	.074	.045	—
	1/2	.196	.589	.30	.041	1.33	.68	.41	.21	.134	.075	.055	.033	—
	5/8	.307	.478	.16	.033	.71	.36	.22	.12	.071	.040	.029	.017	—
1 1/2	0	.0	1.77	.92	.123	4.09	2.09	1.259	.680	.410	.230	.167	.100	—
	5/8	.307	1.46	.76	.101	3.38	1.73	1.040	.562	.338	.190	.138	.082	—
	1	.785	.98	.51	.068	2.27	1.16	.699	.378	.228	.128	.093	.055	—
2	0	0	3.14	1.63	.218	7.27	3.71	2.238	1.209	.728	.408	.296	.177	—
	5/8	.307	2.84	1.48	.197	6.56	3.35	2.019	1.091	.657	.368	.267	.160	—
	1	.785	2.36	1.23	.164	5.45	2.79	1.678	.907	.546	.306	.222	.133	—
	1 3/8	1.485	1.66	.86	.115	3.84	1.96	1.180	.638	.384	.215	.156	.094	—
2 1/2	0	0	4.91	2.55	.341	11.36	5.80	3.496	1.890	1.138	.638	.463	.277	—
	5/8	.307	4.60	2.39	.319	10.65	5.44	3.278	1.771	1.067	.598	.434	.260	—
	1	.785	4.12	2.14	.286	9.54	4.87	2.937	1.587	.956	.536	.389	.233	—
	1 3/8	1.485	3.42	1.78	.237	7.93	4.05	2.439	1.318	.794	.445	.323	.193	—
	1 3/4	2.405	2.50	1.30	.174	5.96	2.96	1.783	.963	.580	.325	.236	.141	—
3 1/4	0	0	8.30	4.31	.576	19.20	9.81	5.909	3.193	1.923	1.078	.783	.468	—
	1	.785	7.51	3.90	.521	17.38	8.88	5.349	2.891	1.741	.976	.708	.424	—
	1 3/8	1.485	6.81	3.54	.473	15.77	8.05	4.851	2.622	1.579	.885	.642	.384	—
	1 3/4	2.405	5.89	3.06	.409	13.64	6.96	4.196	2.268	1.366	.765	.556	.333	—
	2	3.142	5.15	2.68	.357	11.93	6.09	3.671	1.984	1.195	.670	.486	.291	—
4	0	0	12.57	6.53	.872	29.09	14.85	8.95	4.84	2.91	1.63	1.19	.709	—
	1	.785	11.78	6.12	.818	27.27	13.93	8.39	4.54	2.73	1.53	1.11	.665	—
	1 3/8	1.485	11.08	5.76	.769	25.65	13.10	7.89	4.27	2.57	1.44	1.05	.625	—
	1 3/4	2.405	10.16	5.28	.705	23.52	12.01	7.24	3.91	2.36	1.32	.96	.574	—
	2	3.142	9.42	4.89	.654	21.82	11.14	6.71	3.63	2.19	1.22	.89	.532	—
	2 1/2	4.909	7.66	3.98	.532	17.73	9.05	5.45	2.95	1.78	1.00	.72	.432	—
5	0	0	19.64	10.20	1.363	45.45	23.21	13.99	7.56	4.55	2.55	1.85	1.108	—
	1	.785	18.85	9.79	1.308	43.64	22.28	13.43	7.26	4.37	2.45	1.78	1.064	—
	1 3/8	1.485	18.15	9.43	1.260	42.01	21.45	12.93	6.99	4.21	2.36	1.71	1.024	—
	1 3/4	2.405	17.23	8.95	1.196	39.88	20.37	12.27	6.63	3.99	2.24	1.63	.973	—
	2	3.142	16.49	8.57	1.144	38.18	19.50	11.75	6.35	3.82	2.14	1.56	.931	—
	2 1/2	4.909	14.73	7.65	1.022	34.09	17.41	10.49	5.67	3.41	1.91	1.39	.831	—
	3	7.069	12.57	6.53	.872	29.09	14.85	8.95	4.84	2.91	1.63	1.19	.709	—
	3 1/2	9.621	10.01	5.21	.695	23.18	11.84	7.13	3.86	2.32	1.30	.95	.565	—
6	0	0	28.27	14.69	1.962	65.45	33.42	20.14	10.88	6.55	3.67	2.67	1.596	—
	1 3/8	1.485	26.79	13.92	1.859	62.01	31.67	19.08	10.31	6.21	3.48	2.53	1.512	—
	1 3/4	2.405	25.87	13.44	1.795	59.88	30.58	18.43	9.96	5.60	3.36	2.44	1.460	—
	2	3.142	25.13	13.06	1.744	58.18	29.71	17.90	9.67	5.83	3.27	2.37	1.418	—
	2 1/2	4.909	23.37	12.14	1.622	54.1	27.6	16.64	8.99	5.42	3.04	2.20	1.32	—
	3	7.069	21.21	11.02	1.472	49.1	25.1	15.10	8.16	4.92	2.76	2.00	1.20	—
	3 1/2	9.621	18.65	9.69	1.294	43.2	22.1	13.29	7.18	4.32	2.42	1.76	1.05	—
	4	12.566	15.71	8.16	1.09	36.4	18.6	11.19	6.05	3.64	2.04	1.48	.89	—

Table b-5 (cont.)

Cylinder Bore (Inches)	Piston Rod Dia. (Inches)	Piston Rod Area (Sq. In.)	Cylinder Net Area (Sq. In.)	Fluid Displacement at 10 Ft. Per Min. Piston Velocity GPM	Fluid Displacement at 10 Ft. Per Min. Piston Velocity CFM	Fluid Velocity (In Feet Per Second) Through Extra Heavy Pipe at 10 F.P.M. Piston Speed. For Series 2H Cylinders Standard Port Size is first to Left of Heavy Black Line. 1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
7	0	0	38.49	20.00	2.671	89.1	45.5	27.41	14.81	8.92	5.00	3.63	2.17	—
	1 3/8	1.485	37.00	19.22	2.568	85.7	43.7	26.35	14.24	8.58	4.81	3.49	2.09	—
	1 3/4	2.405	36.08	18.74	2.504	83.5	42.7	25.70	13.89	8.36	4.69	3.40	2.04	—
	2	3.142	35.34	18.36	2.453	81.8	41.8	25.17	13.60	8.19	4.59	3.33	2.00	—
	2 1/2	4.909	33.58	17.44	2.330	77.7	39.7	23.92	12.92	7.78	4.36	3.17	1.90	—
	3	7.069	31.42	16.32	2.181	72.7	37.1	22.38	12.09	7.28	4.08	2.96	1.77	—
	3 1/2	9.621	28.86	14.99	2.003	66.8	34.1	20.56	11.11	6.69	3.75	2.72	1.63	—
	4	12.566	25.92	13.47	1.799	60.0	30.6	18.46	9.98	6.01	3.37	2.45	1.46	—
	4 1/2	15.904	22.58	11.73	1.567	52.3	26.7	16.08	8.69	5.23	2.93	2.12	1.28	—
	5	19.635	18.85	9.79	1.308	43.6	22.3	13.43	7.26	4.37	2.45	1.78	1.06	—
8	0	0	50.27	26.12	3.489	116.4	59.4	35.80	19.35	11.65	6.53	4.74	2.84	1.977
	1 3/8	1.485	48.78	25.34	3.385	112.9	57.7	34.74	18.78	11.31	6.34	4.60	2.75	1.918
	1 3/4	2.405	47.86	24.86	3.321	110.8	56.6	34.09	18.42	11.09	6.22	4.51	2.70	1.882
	2	3.142	47.12	24.48	3.270	109.1	55.7	33.56	18.14	10.92	6.12	4.45	2.66	1.853
	2 1/2	4.909	45.36	23.57	3.149	105.0	53.61	32.31	17.46	10.51	5.892	4.278	2.560	1.784
	3	7.069	43.20	22.44	2.998	100.0	51.06	30.77	16.63	10.01	5.612	4.074	2.438	1.699
	3 1/2	9.621	40.65	21.12	2.821	94.1	48.04	28.95	15.65	9.42	5.279	3.834	2.294	1.598
	4	12.566	37.70	19.59	2.616	87.3	44.56	26.85	14.51	8.74	4.897	3.556	2.128	1.483
	4 1/2	15.904	34.36	17.85	2.385	79.5	40.62	24.47	13.23	8.20	4.464	3.241	1.939	1.351
	5	19.635	30.63	15.91	2.126	70.9	36.21	21.82	11.79	7.10	3.979	2.889	1.729	1.205
	5 1/2	23.758	26.51	13.77	1.840	61.4	31.33	18.88	10.20	6.15	3.444	2.500	1.496	1.043
10	0	0	78.54	40.80	5.451	181.8	92.84	55.94	30.23	18.21	10.203	7.408	4.433	3.089
	1 3/4	2.405	76.14	39.56	5.284	176.2	89.99	54.23	29.31	17.65	9.890	7.181	4.297	2.994
	2	3.142	75.40	39.17	5.233	174.5	89.12	53.70	29.02	17.48	9.795	7.112	4.255	2.965
	2 1/2	4.909	73.63	38.25	5.110	170.4	87.03	52.44	28.34	17.07	9.565	6.945	4.156	2.896
	3	7.069	71.47	37.13	4.960	165.4	84.48	50.91	27.51	16.57	9.284	6.741	4.034	2.811
	3 1/2	9.621	68.92	35.80	4.783	159.5	81.47	49.09	26.53	15.98	8.953	6.501	3.890	2.710
	4	12.566	65.97	34.27	4.578	152.7	77.98	46.99	25.39	15.29	8.570	6.223	3.724	2.595
	4 1/2	15.904	62.64	32.54	4.347	145.0	74.04	44.61	24.11	14.52	8.137	5.908	3.535	2.463
	5	19.635	58.91	30.60	4.088	136.4	69.63	41.96	22.67	13.65	7.652	5.556	3.325	2.317
	5 1/2	23.758	54.78	28.46	3.802	126.8	64.75	39.02	21.09	12.70	7.116	5.167	3.092	2.154
	6	28.274	50.27	26.12	3.489	116.4	59.42	35.80	19.35	11.65	6.530	4.741	2.837	1.977
	6 1/2	33.183	45.36	23.57	3.148	105.0	53.6	32.31	17.46	10.52	5.89	4.278	2.560	1.784
	7	38.485	40.06	20.81	2.780	92.7	47.4	28.53	15.42	9.29	5.20	3.778	2.261	1.575
12	0	0	113.10	58.76	7.849	261.8	133.7	80.55	43.53	26.22	14.69	10.668	6.383	4.448
	2	3.142	109.96	57.12	7.631	254.5	130.0	78.32	42.32	25.49	14.28	10.371	6.206	4.324
	2 1/2	4.909	108.19	56.21	7.508	250.4	127.9	77.06	41.64	25.08	14.05	10.205	6.106	4.255
	3	7.069	106.03	55.08	7.359	245.4	125.3	75.52	40.81	24.58	13.77	10.001	5.984	4.170
	3 1/2	9.621	103.48	53.76	7.182	239.5	122.3	73.70	39.83	23.99	13.44	9.760	5.840	4.069
	4	12.566	100.53	52.23	6.977	232.7	118.8	71.60	38.70	23.30	13.06	9.482	5.674	3.954
	4 1/2	15.904	97.19	50.49	6.745	225.0	114.9	69.23	37.41	22.53	12.63	9.168	5.486	3.822
	5	19.635	93.46	48.55	6.486	216.4	110.5	66.57	35.98	21.67	12.14	8.816	5.275	3.676
	5 1/2	23.758	89.34	46.41	6.200	206.8	105.6	63.63	34.39	20.71	11.61	8.427	5.042	3.513
	6	28.274	84.82	44.06	5.887	196.4	100.3	60.42	32.65	19.66	11.02	8.001	4.787	3.336
	6 1/2	33.183	79.92	41.52	5.547	185.0	94.5	56.92	30.76	18.53	10.38	7.538	4.510	3.143
	7	38.485	74.61	38.77	5.179	172.7	88.2	53.14	28.72	17.30	9.69	7.038	4.211	2.934
	7 1/2	44.179	68.92	35.80	4.783	159.5	81.5	49.09	26.53	15.98	8.95	6.501	3.890	2.710
	8	50.266	62.83	32.64	4.360	145.4	74.3	44.75	24.19	14.57	8.16	5.926	3.546	2.471
	8 1/2	56.745	56.35	29.27	3.911	130.5	66.6	40.14	21.69	13.06	7.32	5.315	3.181	2.216
14	0	0	153.94	79.97	10.683	356.3	182.0	109.6	59.25	35.68	20.00	14.52	8.688	6.054
	2 1/2	4.909	149.03	77.42	10.343	345.0	176.2	106.2	57.36	34.55	19.36	14.06	8.411	5.861
	3	7.069	146.87	76.30	10.193	340.0	173.6	104.6	56.53	34.05	19.08	13.85	8.289	5.776
	3 1/2	9.621	144.32	74.97	10.016	334.1	170.6	102.8	55.55	33.45	18.75	13.61	8.145	5.676
	4	12.566	141.37	73.44	9.811	327.3	167.1	100.7	54.42	32.77	18.37	13.33	7.979	5.560
	4 1/2	15.904	138.03	71.71	9.579	319.5	163.2	98.3	53.13	32.00	17.93	13.02	7.791	5.428
	5	19.635	134.30	69.77	9.320	310.9	158.8	95.7	51.70	31.13	17.45	12.67	7.580	5.282
	5 1/2	23.758	130.18	67.63	9.035	301.3	153.9	92.7	50.11	30.18	16.91	12.28	7.347	5.120

Cushion ratings for **Air Cylinders Only** are described in **table b-7** and **graph b-3**. To determine whether a cylinder will adequately stop a load without damage to the cylinder, the weight of the load (including the weight of the piston and the piston rod from **table b-6**) and the maximum speed of the piston rod must first be determined. Once these two factors are known, the **Kinetic Energy Graph** may be used. Enter the graph at its base for the value of weight determined, and project vertically to the required speed value. The point of intersection of these two lines will be the cushion rating number required for the application.

To determine the total load to be moved, the weight of the piston and rod must be included.

Total Weight = weight of the piston and non-stroke rod length (column 1) + weight of the rod per inch of stroke x the inches of stroke (Column 2) + the load to be move.

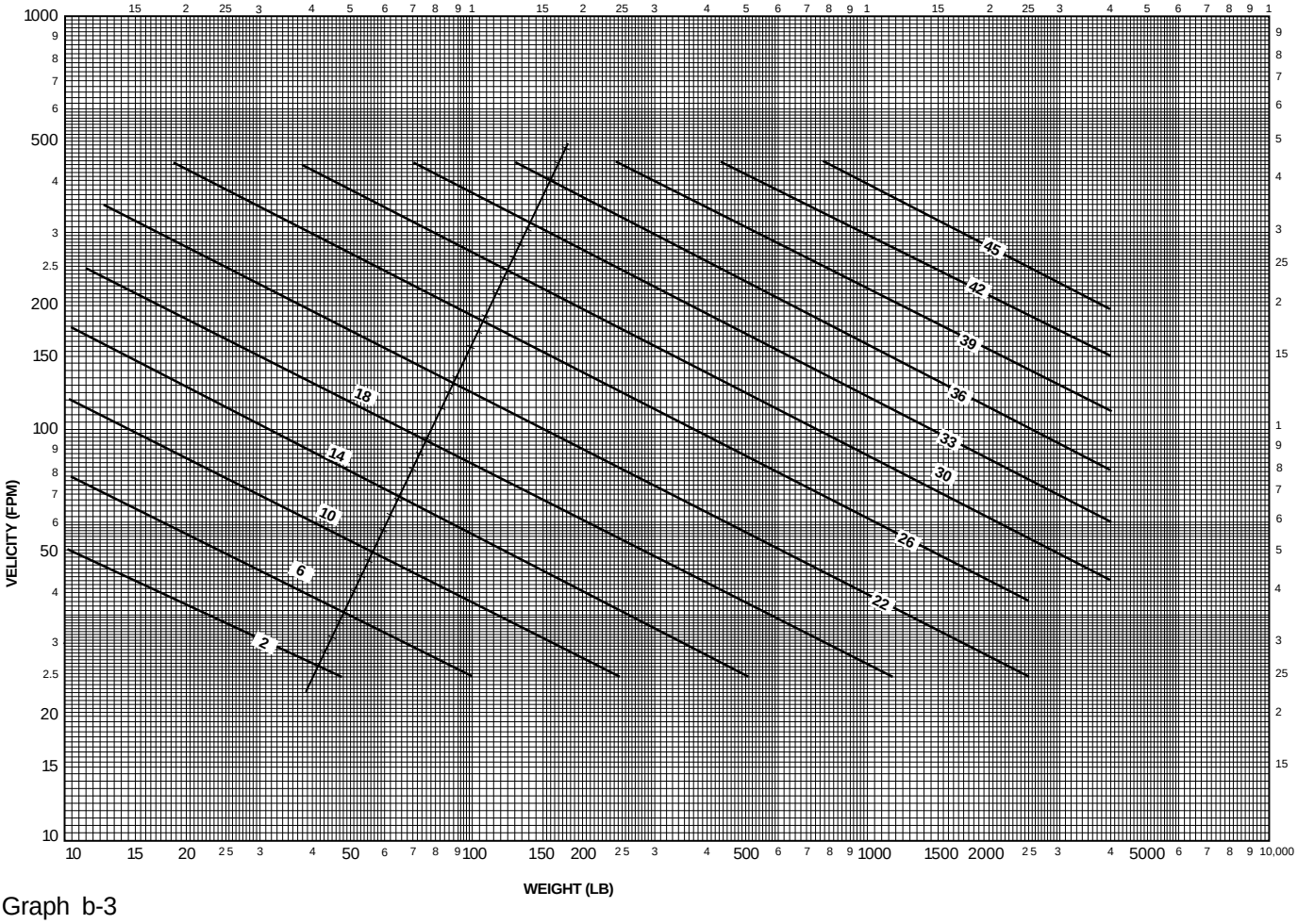
Weight Table

Bore Dia.	Column 1 Basic Wgt. (lbs.) for Piston & Non-Stroke Rod	Rod Dia.	Column 2 Basic Wgt. (lbs.) for 1" Stroke
1 1/2	1.5	5/8	.087
2	3.0	1	.223
2 1/2	5.4	1 3/8	.421
3 1/4	8.3	1 3/4	.682
4	14.2	2	.89
5	29.0	2 1/2	1.39
6	41.0	3	2.0
8	89.0	3 1/2	2.73
10	115.0	4	3.56
12	161.0	5	5.56
14	207.0	5 1/2	6.73

Table b-6

Example: *a 3 1/4" bore cylinder, having a 1" diameter rod and 25" stroke; load to be moved is 85 pounds. Total load to be moved is then 8.3 lbs. + .223 lbs./in. x 25 in. + 85 lbs. or a total of 99 lbs.*

Kinetic Energy Graph – Air Cylinders



Graph b-3

Now refer to **table b-7** and find the cushion ratings, using bore size and rod diameter of the cylinder selected. If a simple circuit is used, with no meter out or speed control, use the "no back pressure, Column A" values. If a meter out or speed control is to be used, use the back pressure column values. If the cushion rating found in **table b-7**, **below**, is **greater** than the number determined in **graph b-3,** then the cylinder will stop the load adequately. If the cushion rating in **table b-7** is **smaller** than the number found in **graph b-3**, then a larger bore cylinder should be used. In those applications where back pressures exist in the exhaust lines, it is possible to exceed the cushion ratings shown in **table b-7**. In these cases, consult the factory and advise the amount of back pressure.

Air Cylinder Cushion Ratings Table

Bore Dia.	Rod Dia.	Rating With No Back Pressure	Rating With Back Pressure
1 1/2	Cap End	12	17
	5/8	8	14
	1	3	8
2	Cap End	14	20
	5/8	12	18
	1	9	15
	1 3/8	6	11
2 1/2	Cap End	17	23
	5/8	14	20
	1	14	19
	1 3/8	12	18
	1 3/4	8	13
3 1/4	Cap End	21	26
	1	18	24
	1 3/8	17	23
	1 3/4	16	22
	2	13	19
4	Cap End	23	28
	1	20	27
	1 3/8	20	26
	1 3/4	19	25
	2	17	23
	2 1/2	17	22
5	Cap End	26	31
	1	23	28
	1 3/8	23	28
	1 3/4	22	28
	2	20	26
	2 1/2	19	25
	3	18	24
	3 1/2	15	20
6	Cap End	26	31
	1 3/8	26	31
	1 3/4	26	31
	2	24	29
	2 1/2	24	29
	3	22	28
	3 1/2	21	27
	4	20	26
7	Cap End	28	33
	1 3/8	28	33
	1 3/4	28	33
	2	26	31
	2 1/2	25	30
7	3	24	30
	3 1/2	24	30
	4	23	29
	4 1/2	22	28
	5	21	27
8	Cap End	29	35
	1 3/8	29	35
	1 3/4	29	34
	2	27	33
	2 1/2	26	32
	3	26	32
	3 1/2	26	32
	4	25	31
	5	23	29
	5 1/2	22	28
10	Cap End	33	39
	1 3/4	32	38
	2	31	37
	2 1/2	31	36
	3	30	36
	3 1/2	30	36
	4	30	36
	5	28	34
	5 1/2	27	33
12	Cap End	35	41
	2	33	39
	2 1/2	33	38
	3	33	38
	3 1/2	32	38
	4	32	38
	5	31	36
	5 1/2	31	36
14	Cap End	38	43
	2 1/2	37	42
	3	36	42
	3 1/2	36	41
	4	36	41
	5	35	40
	5 1/2	34	40

Table b-7

Air Requirement Per Inch of Cylinder Stroke

The amount of air required to operate a cylinder is determined from the volume of the cylinder and its cycle in strokes per minute. This may be determined by use of the following formulae which apply to a single-acting cylinder.

$$V = \frac{3.1416\ L\ D^2}{4} \qquad C = \frac{\partial V}{1728}$$

Where: V = Cylinder volume, cu. in.
L = Cylinder stroke length, in.
D = Internal diameter of cylinder in.
C = Air required, cfm
∂ = Number of strokes per minute

The air requirements for a double-acting cylinder is almost double that of a single-acting cylinder, except for the volume of the piston rod.

The air flow requirements of a cylinder in terms of cfm should not be confused with compressor ratings which are given in terms of free air. If compressor capacity is involved in the consideration of cylinder air requirements it will be necessary to convert cfm values to free air values. This relationship varies for different gauge pressures.

Thrust (pounds) = operating pressure x area of cylinder bore.

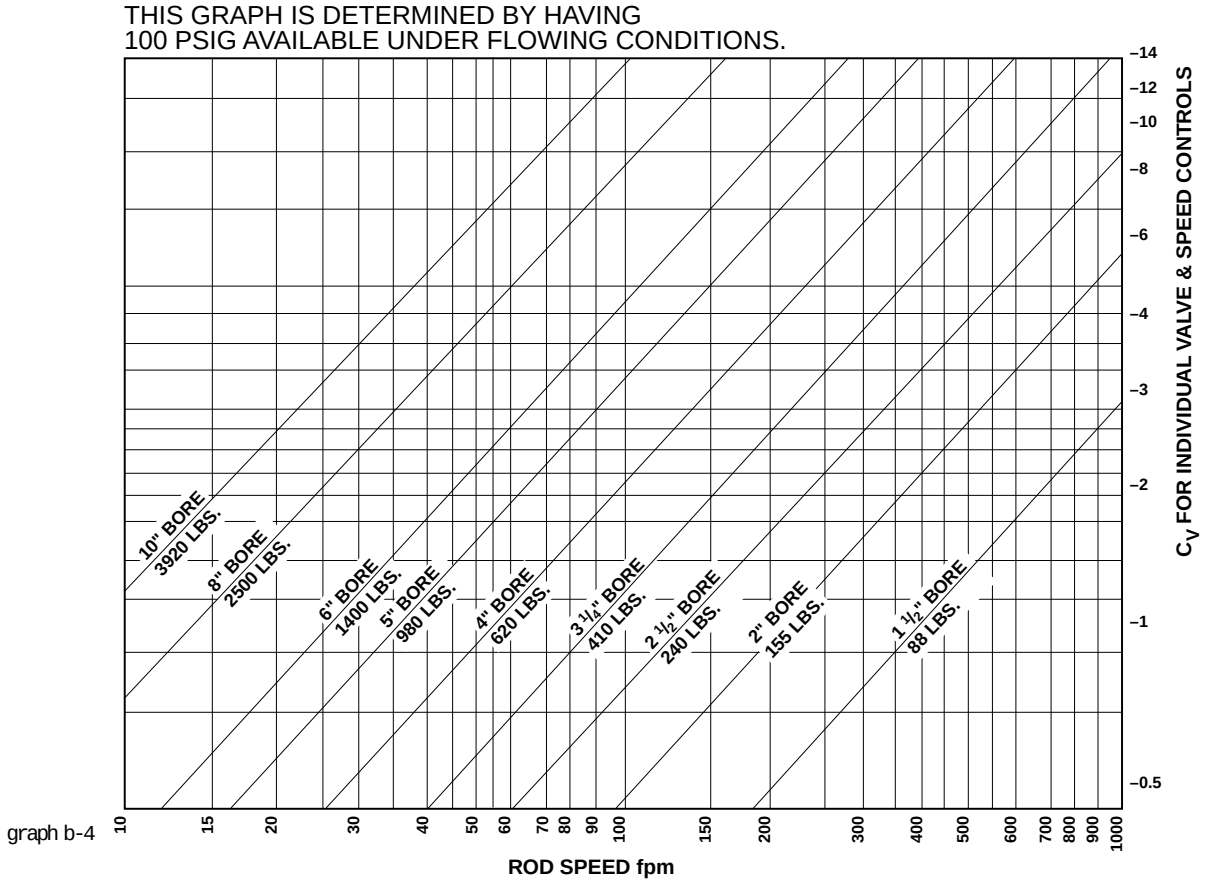
Note: *That on the "out" stroke the air pressure is working on the entire piston area but on the "in" stroke the air pressure works on the piston area less the rod area.*

Graph b-4 and **b-5** offer a simple means to select pneumatic components for dynamic cylinder applications. It is only necessary to know the force required, the desired speed and the pressure which can be maintained at the inlet to the F-R-L "Combo." The graphs assume average conditions relative to air line sizes, system layout, friction, etc. At higher speeds, consider appropriate cushioning of cylinders.

The general procedure to follow when using these graphs is:

1. Select the appropriate graph depending upon the pressure which can be maintained to the system – **graph b-4** for 100 psig and **graph b-5** for 80 psig.

2. Determine appropriate cylinder bore. Values underneath the diagonal cylinder bore lines indicate the maximum recommended dynamic thrust developed while the cylinder is in motion. The data in the table at the bottom of each graph indicates available static force applications in which clamping force is a prime consideration in determing cylinder bore.



graph b-4

Table b-8
Thrust Developed

BORE SIZE	1 1/2"	2"	2 1/2"	3 1/4"	4"	5"	6"	8"	10"
DYNAMIC THRUST (lbs.)	88	155	240	410	620	980	1400	500	3920
STATIC THRUST (lbs.)	177	314	491	830	1250	1960	2820	5020	7850

3. Read upward on appropriate rod speed line to intersection with diagonal cylinder bore line. Read right from intersection point to determine the required C_v of the valve and the speed controls. Both the valve and speed controls must have this C_v.

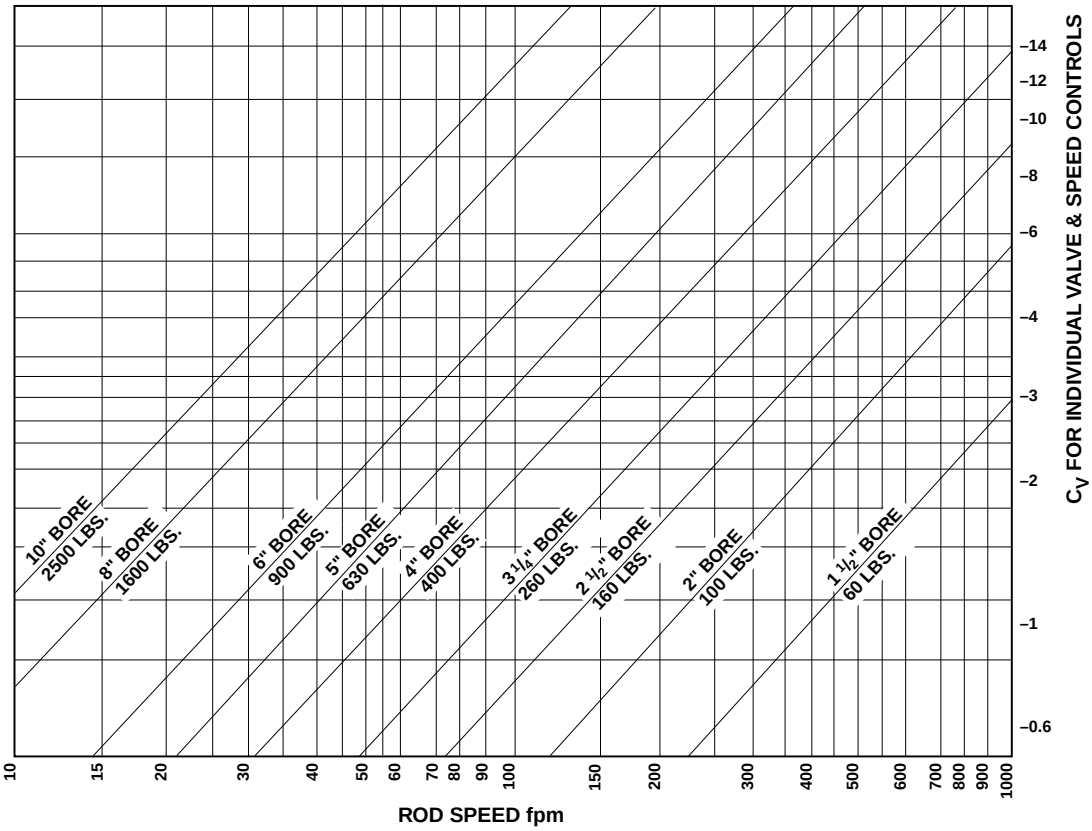
The following examples illustrate use of the graphs:

Example 1: *Assume it is necessary to raise a 900-pound load 24 inches in two seconds. With 100 psig maintained at the inlet to the F-R-L, use* **graph b-4**. *The 5-inch bore cylinder is capable of developing the required thrust while in motion. Since 24 inches in two seconds is equal to 60 fpm, read upward on the 60 fpm line to the intersection of the 5-inch bore diagonal line. Reading to the right indicates that the required valve and speed controls must each have a C_v of over 1.9.*

Example 2: *Assume similar conditions to Example 1 except that only 80- psig will be available under flowing conditions. Using* **graph b-5**, *a 6-inch bore cylinder is indicated. Read upward on the 60 fpm line to the intersection point. Interpolation of the right-hand scale indicates a required valve and speed control C_v of over 2.8.*

Example 3: *Assume similar conditions to Example 1 except that the load is being moved in a horizontal plane with a coefficient of sliding friction of 0.2. Only a 180-pound thrust is now required (900 lb. x 0.2). Consult* **graph b-4**. *The 2 1/2 inch bore cylinder will develop sufficient thrust, and at 60 fpm requires a valve and speed control C_v of about 0.5.*

THIS GRAPH IS DETERMINED BY HAVING
80 PSIG AVAILABLE UNDER FLOWING CONDITIONS.



graph b-5

Table b-9
Thrust Developed

BORE SIZE	1 1/2	2	2 1/2	3 1/4	4	5	6	8	10
DYNAMIC THRUST (lbs.)	60	100	160	260	400	630	900	1600	2500
STATIC THRUST (lbs.)	141	251	393	663	1000	1570	2260	4010	6280

Modifications: The following modifications can be supplied on most Parker cylinders. For specific availability see modification chart on page 3.

Metallic Rod Wiper

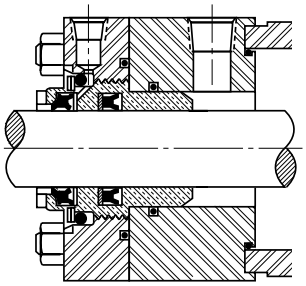
When specified metallic rod wipers can be supplied instead of the standard synthetic rubber wiperseal. Recommended in applications where contaminants tend to cling to the extended piston rod and would damage the synthetic rubber wiperseal. Installation of metallic rod wiper does not affect cylinder dimensions. It is available at extra cost.

Gland Drain – Series 2H. For other cylinders, consult factory.

Hydraulic fluids tend to adhere to the piston rods, during the extend stroke, and an accumulation of fluid can collect in the cavity behind the gland wiperseal on long stroke cylinders.

A $^1/_8$" N.P.T.F. gland drain port can be provided in the gland retainer. A passage in the gland between the wiperseal and lipseal is provided to drain off any accumulation of fluid between the seals. See drawing below.

It is recommended that the gland drain port be piped back to the fluid reservoir and that the reservoir be located below the level of the head of the cylinder.

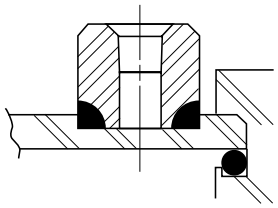


On $1^1/_2$" bore size Series 2H cyls., the drain port is located in the head adjacent to the port and on code 2 rod, the retainer thickness increases to $^5/_8$". On 2" thru 8" bore sizes the drain port is located in the retainer as shown.

Air Bleeds

In most hydraulic circuits, cylinders are considered self-bleeding when cycled full stroke. If air bleeds are required and specified, $^1/_8$" NPTF Air Bleed Ports for venting air can be provided at both ends of the cylinder body, or on the head or cap. To order, specify "Bleed Port", and indicate position desired.

Air Bleed Port



Rod End Boots

Cylinders have a hardened bearing surface on the piston rod to resist external damage, and are equipped with the high efficiency "Wiperseal" to remove external dust and dirt. Exposed piston rods that are subjected to contaminants with air hardening properties, such as paint, should be protected. In such applications, the use of a collapsing cover should be considered. This is commonly referred to as a "boot". Calculate the longer rod end required to accommodate the collapsed length of the boot from the following data.

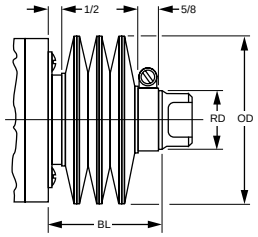
LF	.13	.13	.13	.13	.13	.13	.13	.10	.10	.10	.10	.10
OD	2 1/4	2 1/4	2 5/8	3	3 3/8	3 3/4	4 3/8	5 1/8	5 5/8	6 1/4	7	7 1/2
RD	1/2	5/8	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4	5	5 1/2

To determine extra length of piston rod required to accommodate boot, calculate

BL = Stroke x LF + $1^1/_8$"

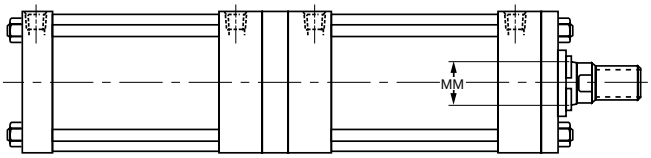
BL + Std. LA = length of piston rod to extend beyond the retainer.

NOTE: Check all Boot O.D's against std. "E" dimension from catalog. This may be critical on footmounted cylinders.



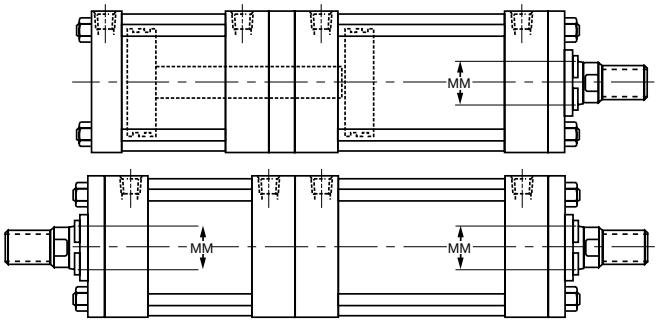
Tandem Cylinders

A tandem cylinder is made up of two cylinders mounted in line with pistons connected by a common piston rod and rod seals installed between the cylinders to permit double acting operation of each. Tandem cylinders allow increased output force when mounting width or height are restricted.



Duplex Cylinders

A duplex cylinder is made up of two cylinders mounted in line with pistons not connected and with rod seals installed between the cylinders to permit double acting operation of each. Cylinders may be mounted with piston rod to piston (as shown) or back to back and are generally used to provide three position operation.



The weights shown in Tables A and B are for Parker Series 2H, 3H (7" & 8"), HD, VH, 3L, 2A, 2AN and MA cylinders with various piston rod diameters. To determine the net weight of a cylinder, first select the proper basic weight for zero stroke, then calculate the weight of the cylinder stroke and add the result to the basic weight. For extra rod extension use piston rod weights per inch shown in Table C. Weights of cylinders with intermediate rods may be estimated from table below by taking the difference between the piston rod weights per inch and adding it to the Code 1 weight for the cylinder bore size involved. To determine the net weight of Series VH cylinders, use data in Table A and multiply by 1.10.

Table A Cylinder Weights, in pounds, for Series 2H, 3H (7" & 8"), HD and VH hydraulic cylinders

Bore Size	Rod Dia.	Rod Code	Single Rod Cylinders Basic Wt. Zero Stroke F, H, HB, J, JB T, TB, TC, TD	Single Rod Cylinders Basic Wt. Zero Stroke BB, C, CB, D, DB DD, E, G, HH, JJ	Add Per Inch of Stroke	Double Rod Cylinders Basic Wt. Zero Stroke KF, KJ KJB KT, KTB, KTD	Double Rod Cylinders Basic Wt. Zero Stroke KC, KCB, KD KDD, KE, KJJ	Add Per Inch of Stroke
1 1/2"	5/8"	1	7.8	9.0	.5	9.7	10.8	.6
	1"	2	8.4	9.3	.6	9.1	10.7	.8
2"	1"	1	11.6	13.2	.8	14.6	16.8	1.0
	1 3/8"	2	13.5	17.1	1.0	19.4	20.6	1.4
2 1/2"	1"	1	17.0	19.5	1.1	21.0	24.5	1.3
	1 3/4"	2	22.5	25.5	1.5	27.0	30.0	2.2
3 1/4"	1 3/8"	1	32.0	41.0	1.8	43.0	52.0	2.2
	2"	2	37.0	46.0	2.2	48.0	57.0	3.1
4"	1 3/4"	1	48.0	53.0	2.5	59.0	63.0	3.2
	2 1/2"	2	52.0	58.0	3.2	92.0	97.0	4.6
5"	2"	1	76.0	82.0	3.4	96.0	102.0	4.8
	3 1/2"	2	88.0	86.0	5.2	117.0	123.0	7.9
6"	2 1/2"	1	125.0	133.0	5.2	153.0	159.0	6.6
	4"	2	133.0	140.0	7.3	182.0	190.0	10.9
7"	3"	1	233.0	242.0	6.7	320.0	339.0	8.7
	5"	2	240.0	253.0	10.3	341.0	360.0	15.9
8"	3 1/2"	1	262.0	276.0	9.0	323.0	331.0	11.7
	5 1/2"	2	300.0	309.0	13.0	390.0	411.0	19.7

Table B Cylinder Weights, in pounds, for Series 2A, 2AN, 3L and MA cylinders

Bore Size	Rod Dia.	Single Rod Cylinders Basic Wt. Zero Stroke T, TB, TC, TD, F, H, J	Single Rod Cylinders Basic Wt. Zero Stroke BB, C, CB, D, DB DD, E, HB, JB	Add Per Inch of Stroke 2A, 2AN, 3L	Add Per Inch of Stroke Series MA	Double Rod Cylinders Basic Wt. Zero Stroke KF, KJ KT KTB, KTD	Double Rod Cylinders Basic Wt. Zero Stroke KC, KCB, KD KDD, KE, KJB	Add Per Inch of Stroke 2A, 2AN, 3L	Add Per Inch of Stroke Series MA
1"	1/2"	2.5	2.9	.20	–	4.7	5.5	.40	–
	5/8"	2.6	3.0	.23	–	4.9	5.7	.46	–
1 1/2"	5/8"	3.7	4.3	.3	.25	4.2	4.8	.6	.5
	1"	4.5	5.1	.4	.35	5.8	6.7	.8	.7
2"	5/8"	6.5	6.9	.5	.4	8.2	8.6	1.0	.8
	1"	7.0	7.5	.63	.5	9.0	9.5	1.3	1.0
	1 3/8"	8.5	8.9	.8	–	11.2	11.6	1.6	–
2 1/2"	5/8"	9.0	9.7	.6	.5	11.4	12.1	1.2	1.0
	1"	9.5	10.0	.73	.6	12.0	12.5	1.5	1.2
	1 3/4"	13.2	13.6	1.1	–	19.8	20.5	2.2	–
3 1/4"	1"	16.5	17.5	.8	.65	22.0	23.0	1.6	1.3
	1 3/8"	17.0	18.0	1.0	.8	22.5	23.5	2.0	1.6
	2"	27.0	28.0	1.4	–	43.0	44.0	2.8	–
4"	1"	26.0	31.0	1.0	.8	33.0	38.0	2.0	1.6
	1 3/8"	26.5	31.5	1.2	1.0	33.5	38.5	2.5	2.0
	2 1/2"	36.0	42.0	2.0	–	53.0	58.0	4.0	–
5"	1"	39.0	46.0	1.1	.9	48.0	55.0	2.2	1.8
	1 3/8"	39.5	46.5	1.3	1.1	48.5	55.5	2.6	2.2
	3 1/2"	63.0	66.0	3.6	–	96.0	103.0	7.2	–
6"	1 3/8"	68.0	77.0	1.5	–	80.0	89.0	3.0	–
	4"	100.0	102.0	4.5	–	144.0	153.0	9.0	–
7"	1 3/8"	80.0	85.0	2.0	–	92.0	97.0	4.0	–
	2"	82.0	87.0	3.5	–	96.0	101.0	7.0	–
8"	1 3/8"	94.0	99.0	2.0	–	108.0	113.0	4.0	–
	5 1/2"	168.0	172.0	8.0	–	256.0	261.0	16.0	–
10"	1 3/4"	182.0	188.0	2.5	–	178.0	184.0	5.0	–
	5 1/2"	258.0	264.0	8.5	–	330.0	335.0	17.0	–
12"	2"	274.0	282.0	3.5	–	270.0	280.0	7.0	–
	5 1/2"	350.0	358.0	9.5	–	420.0	430.0	19.0	–
14"	2 1/2"	435.0	448.0	4.5	–	440.0	655.0	9.0	–
	5 1/2"	510.0	519.0	10.0	–	490.0	705.0	20.0	–

Table C

Rod Dia.	Piston Rod Wt. Per Inch	Rod Dia.	Piston Rod Wt. Per Inch	Rod Dia.	Piston Rod Wt. Per Inch
5/8"	.09	2"	.89	4"	3.56
1"	.22	2 1/2"	1.40	4 1/2"	4.51
1 3/8"	.42	3"	2.00	5"	5.56
1 3/4"	.68	3 1/2"	2.72	5 1/2"	6.72

For Cylinder Division Plant Locations – See Page II.

Mounting Styles

General guidance for the selection of ISO and DIN mounting styles is given on page 6. The notes which follow provide information for use in specific applications and should be read in conjunction with the information on page 6.

Trunnions

Trunnions require lubricated pillow blocks with minimum bearing clearances. Blocks should be aligned and mounted to eliminate bending moments on the trunnion pins. Self-aligning mounts must not be used to support the trunnions as bending forces can develop.

Intermediate trunnions may be positioned at any point on the cylinder body. This position, dimension XI, should be specified at the time of order. Trunnions are not field adjustable.

Flange Mountings

Front flange-mounted (style JJ) cylinders incorporate a pilot diameter for accurate alignment on the mounting surface – see rod end dimensions for HMI cylinders. The gland retainer is integral with the head on 25, 32 and 40mm bore cylinders, while on 50mm bores and above, the circular retainer is bolted to the head.

Extended Tie Rods

Cylinders may be ordered with extended tie rods in addition to another mounting style. The extended tie rods may then be used for mounting other systems or machine components.

Pivot Mountings

Pivot pins are supplied with style BB cap fixed clevis mounted cylinders. Pivot pins are not supplied with the cap fixed eye mounting, style B, or the cap with spherical bearing, style SB, where pin length will be determined by the customer's equipment.

Spherical Bearings

The service life of a spherical bearing is influenced by such factors as bearing pressure, load direction, sliding velocity and frequency of lubrication. When considering severe or unusual working conditions, please consult the factory.

WARNING!

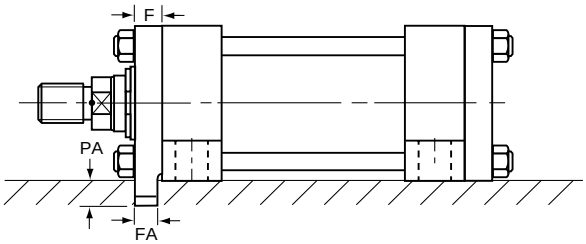
Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod end to fail. If these types of additional loads are expected to be imposed on the piston rods, their magnitude should be made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

Foot Mountings and Thrust Keys

The bending moment which results from the application of force by a foot mounted cylinder must be resisted by secure mounting and effective guidance of the load. A thrust key modification is recommended to provide cylinder location.

Thrust key mountings eliminate the need for fitted bolts or external keys on style C side mounted cylinders. The gland retainer plate is extended below the nominal mounting surface to fit into a keyway milled into the mounting surface of the machine member. See 'Mounting Modifications' in the HMI order code.

Bore ϕ	F Nominal	FA -0.075	PA -0.2
25	10	8	5
32	10	8	5
40	10	8	5
50	16	14	8
63	16	14	8
80	20	18	10
100	22	22	11
125	22	22	11
160	25	25	13
200	25	25	13



Mounting Bolts and Nuts

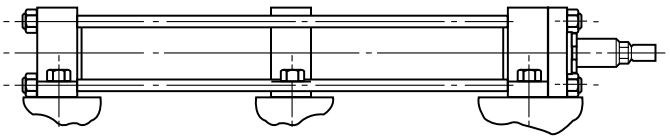
Parker recommends that mounting bolts with a minimum strength of ISO 898/1 grade 10.9 should be used for fixing cylinders to the machine or base. This recommendation is of particular importance where bolts are placed in tension or subjected to shear forces. Mounting bolts, with lubricated threads, should be torque loaded to their manufacturer's recommended figures. Tie rod mounting nuts should be to a minimum strength of ISO 898/2 grade 10, torque loaded to the figures shown.

Bore ϕ	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

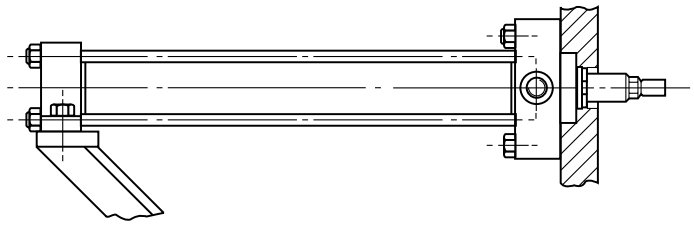
All dimensions are in millimeters unless otherwise stated.

Intermediate or Additional Mountings

Long cylinders with fixed mountings such as extended tie rods may require additional support to counter sagging or the effects of vibration. This may be provided mid-way along the cylinder body in the form of an intermediate mounting or, with end-mounted cylinders, as an additional mounting supporting the free end of the cylinder. Please contact the factory for further information. The maximum unsupported stroke lengths which Parker recommends for each bore size are shown in the table below.



Intermediate Foot Mounting



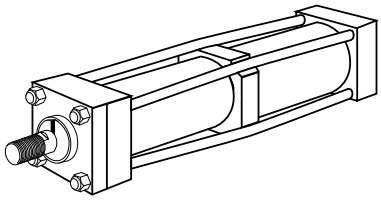
End Support Mounting

Maximum Stroke Lengths of Unsupported Cylinders (in mm)

Bore ϕ	Intermediate Mounting	End Support Mounting
25	1500	1000
32		
40		
50	2000	1500
63		
80		
100	3000	2000
125		
160	3500	2500
200		

All dimensions are in millimeters unless otherwise stated.

Tie Rod Supports



To increase the resistance to buckling of long stroke cylinders, tie rod supports may be fitted. These move the tie rods radially outwards and allow longer than normal strokes to be used without the need for an additional mounting.

Bore ϕ	Stroke (meters)												No. of Supports Required
	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	
25	1	1	2	Consult Factory									
32	-	1	1	2									
40	-	-	1	1	1	2	2						
50	-	-	-	1	1	1	2	2	2	2	2	3	
63	-	-	-	-	-	1	1	1	1	1	2	2	
80	-	-	-	-	-	-	-	1	1	1	1	1	
100	-	-	-	-	-	-	-	-	-	1	1	1	

Stroke Tolerances

Stroke length tolerances are required due to the build-up of tolerances of piston, head, cap and cylinder body. Standard production stroke tolerances are 0 to +2mm on all bore sizes and stroke lengths. For closer tolerances, please specify the required tolerance plus the operating temperature and pressure. Stroke tolerances of less than 0.4mm are generally impracticable due to the elasticity of cylinders. In these cases, the use of a stroke adjuster should be considered. Tolerances of stroke dependent dimensions for each mounting style are shown in the table below.

Stroke Dependent Tolerances

Mounting Style	Dimensions	Tolerance - for strokes up to 3m
All styles - port dimensions	Y	±2
	PJ	±1.25
JJ (ME5)	ZB	max
HH (ME6)	ZJ	±1
BB (MP1) B(MP3)	XC	±1.25
SB (MP5)	XO	±1.25
C (MS2)	XS	±2
	ZB	max
	SS	±1.25
D (MT1)	XG	±2
	ZB	max
DB (MT2)	XJ	±1.25
	ZB	max
DD (MT4)	XV	±2
	ZB	max
TD (MX1) TC (MX2) TB (MX3)	BB	+3 0
TB (MX3)	ZB	max
TD (MX1) TB (MX3)	WH	±2
TD (MX1) TC (MX2) TB (MX3)	ZJ	±1

C

Calculation of Cylinder Diameter

General Formula

The cylinder output forces are derived from the formula:

$$F = \frac{P \times A}{10000}$$

Where F = Force in kN.

P = Pressure at the cylinder in bar.

A = Effective area of cylinder piston in square mm.

Prior to selecting the cylinder bore size, properly size the piston rod for tension (pull) or compression (push) loading (see the Piston Rod Selection Chart).

If the piston rod is in compression, use the 'Push Force' table below, as follows:

1. Identify the operating pressure closest to that required.
2. In the same column, identify the force required to move the load (always rounding up).
3. In the same row, look along to the cylinder bore required.

If the cylinder envelope dimensions are too large for the application, increase the operating pressure, if possible, and repeat the exercise.

If the piston rod is in tension, use the 'Deduction for Pull Force' table. The procedure is the same but, due to the reduced area caused by the piston rod, the force available on the 'pull' stroke will be smaller. To determine the pull force:

1. Follow the procedure for 'push' applications as described above.
2. Using the 'pull' table, identify the force indicated according to the rod and pressure selected.
3. Deduct this from the original 'push' force. The resultant is the net force available to move the load.

If this force is not large enough, repeat the process and increase the system operating pressure or cylinder diameter if possible. For assistance, contact your local authorized Parker distributor.

Push Force

Bore ϕ mm	Bore Area sq. mm	Cylinder Push Force in kN						
		10 bar	40 bar	63 bar	100 bar	125 bar	160 bar	210 bar
25	491	0.5	2.0	3.1	4.9	6.1	7.9	10.3
32	804	0.8	3.2	5.1	8.0	10.1	12.9	16.9
40	1257	1.3	5.0	7.9	12.6	15.7	20.1	26.4
50	1964	2.0	7.9	12.4	19.6	24.6	31.4	41.2
63	3118	3.1	12.5	19.6	31.2	39.0	49.9	65.5
80	5027	5.0	20.1	31.7	50.3	62.8	80.4	105.6
100	7855	7.9	31.4	49.5	78.6	98.2	125.7	165.0
125	12272	12.3	49.1	77.3	122.7	153.4	196.4	257.7
160	20106	20.1	80.4	126.7	201.1	251.3	321.7	422.2
200	31416	31.4	125.7	197.9	314.2	392.7	502.7	659.7

Deduction for Pull Force

Piston Rod ϕ mm	Piston Rod Area sq. mm	Reduction in Force in kN						
		10 bar	40 bar	63 bar	100 bar	125 bar	160 bar	210 bar
12	113	0.1	0.5	0.7	1.1	1.4	1.8	2.4
14	154	0.2	0.6	1.0	1.5	1.9	2.5	3.2
18	255	0.3	1.0	1.6	2.6	3.2	4.1	5.4
22	380	0.4	1.5	2.4	3.8	4.8	6.1	8.0
28	616	0.6	2.5	3.9	6.2	7.7	9.9	12.9
36	1018	1.0	4.1	6.4	10.2	12.7	16.3	21.4
45	1591	1.6	6.4	10.0	15.9	19.9	25.5	33.4
56	2463	2.5	9.9	15.6	24.6	30.8	39.4	51.7
70	3849	3.8	15.4	24.2	38.5	48.1	61.6	80.8
90	6363	6.4	25.5	40.1	63.6	79.6	101.8	133.6
110	9505	9.5	38.0	59.9	95.1	118.8	152.1	199.6
140	15396	15.4	61.6	97.0	154.0	192.5	246.3	323.3

Piston Rod Size Selection

To select a piston rod for thrust (push) applications, follow these steps:

1. Determine the type of cylinder mounting style and rod end connection to be used. Consult the Stroke Factor table on page 20 and determine which factor corresponds to the application.
2. Using the appropriate stroke factor from page 20, determine the 'basic length' from the equation:

   Basic Length = Net Stroke x Stroke Factor

(The graph is prepared for standard rod extensions beyond the face of the gland retainers. For rod extensions greater than standard, add the increases to the net stroke to arrive at the 'basic length.')

3. Calculate the load imposed for the thrust application by multiplying the full bore area of the cylinder by the system pressure, or by referring to the Push and Pull Force charts on page 18.
4. Using the graph below, look along the values of 'basic length' and 'thrust' as found in 2 and 3 above, and note the point of intersection.

The correct piston rod size is read from the diagonally curved line labelled 'Rod Diameter' above the point of intersection.

Stop Tubes

The required length of stop tube, where necessary, is read from the vertical columns on the right of the graph below by following the horizontal band within which the point of intersection, determined in steps 2 and 3 opposite, lies.

Note that stop tube requirements differ for fixed and pivot mounted cylinders.

If the required length of stop tube is in the region labelled 'consult factory,' please submit the following information:

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

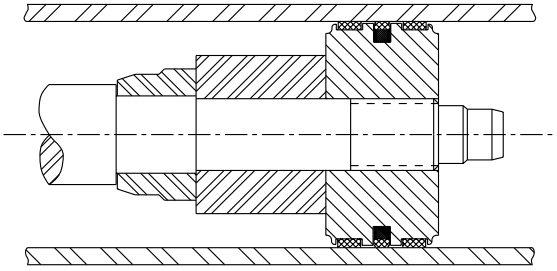
When specifying a cylinder with a stop tube, state the **gross** stroke of the cylinder and the length of the stop tube. The gross stroke is equal to the net (working) stroke of the cylinder plus the stop tube length. See the example below:

Ex. 80-JJ-HMI-R-E-S-14-M1375M1100

1) Stop tube = 175

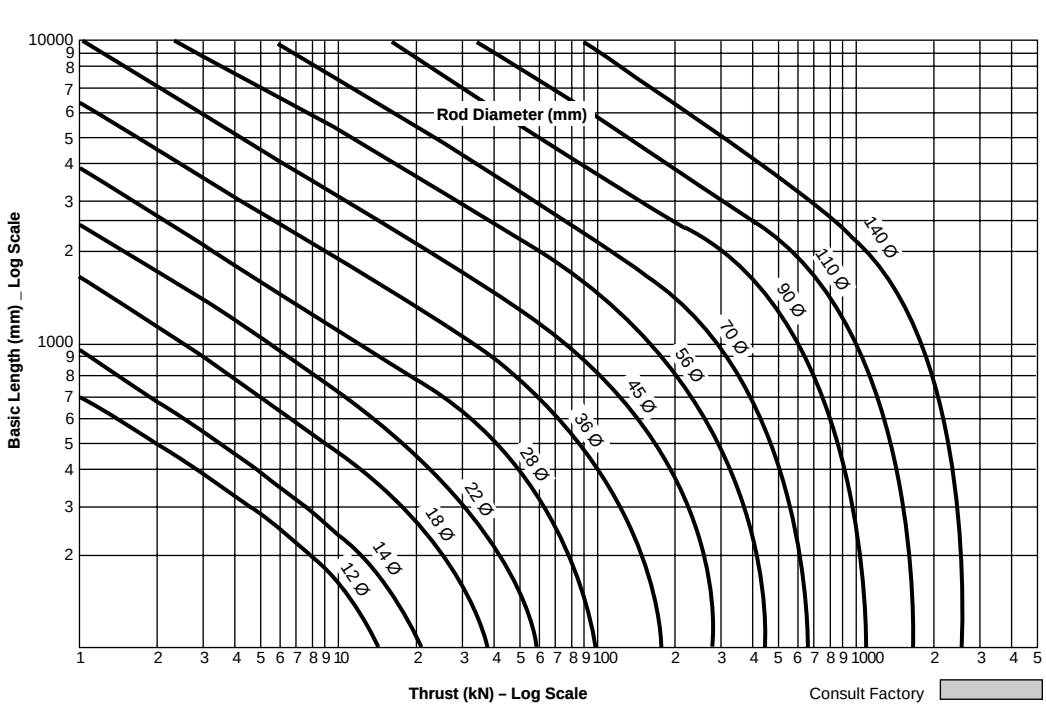
2) Net stroke = 1200

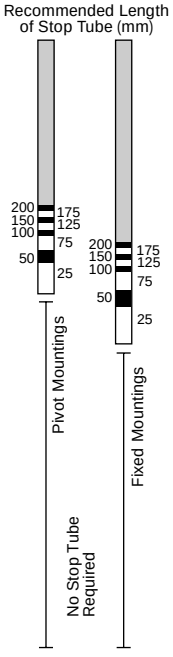
– the cylinder net stroke will be 1200mm with 175mm of stop tube.



C

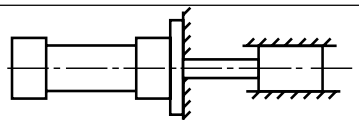
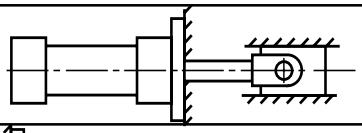
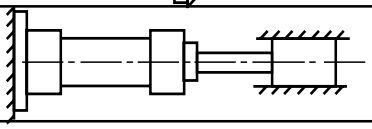
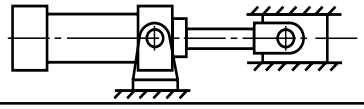
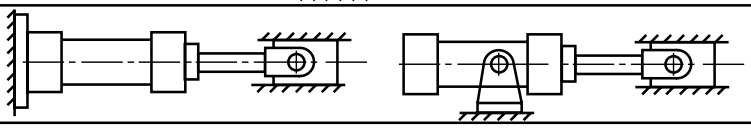
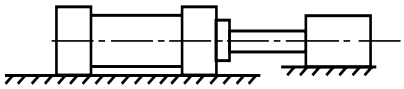
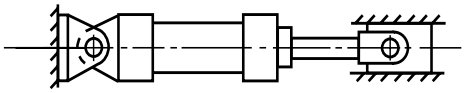
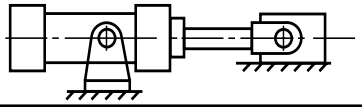
Piston Rod Selection Chart





Stroke Factors

The stroke factors below are used in the calculation of cylinder 'basic length' – see Piston Rod Size Selection.

Rod End Connection	Mounting Style	Type of Mounting	Stroke Factor
Fixed and Rigidly Guided	TB, TD, C, JJ		0.5
Pivoted and Rigidly Guided	TB, TD, C, JJ		0.7
Fixed and Rigidly Guided	TC, HH		1.0
Pivoted and Rigidly Guided	D		1.0
Pivoted and Rigidly Guided	TC, HH, DD		1.5
Supported but not Rigidly Guided	TB, TD, C, JJ		2.0
Pivoted and Rigidly Guided	B, BB, DB, SB		2.0
Pivoted and Supported but not Rigidly Guided	DD		3.0

Long Stroke Cylinders

When considering the use of long stroke cylinders, the piston rod should be of sufficient diameter to provide the necessary column strength.

For tensile (pull) loads, the rod size is selected by specifying standard cylinders with standard rod diameters and using them at or below the rated pressure.

For long stroke cylinders under compressive loads, the use of stop tubes should be considered, to reduce bearing stress. The Piston Rod Selection Chart in this catalog provides guidance where unusually long strokes are required.

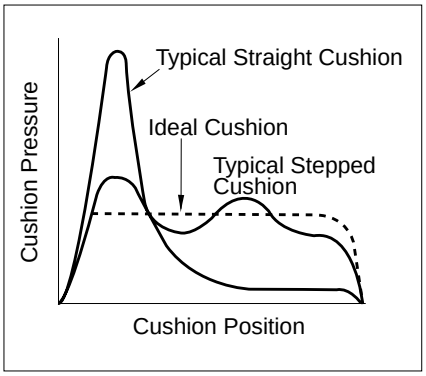
An Introduction to Cushioning

Cushioning is recommended as a means of controlling the deceleration of masses, or for applications where piston speeds are in excess of 0.1m/s and the piston will make a full stroke. Cushioning extends cylinder life and reduces undesirable noise and hydraulic shock.

Built-in "cushions" are optional and can be supplied at the head and cap ends of the cylinder without affecting its envelope or mounting dimensions.

Standard Cushioning

Ideal cushion performance shows an almost uniform absorption of energy along the cushioning length, as shown. Many forms of cushioning exist, and each has its own specific merits and advantages. In order to cover the majority of applications, HMI cylinders are supplied with profiled cushioning as standard. Final speed may be adjusted using the cushion screws. The performance of profiled cushioning is indicated on the diagram, and cushion performance for each of the rod sizes available is illustrated graphically in the charts on the next page.



Note: Cushion performance will be affected by the use of water or high water based fluids. Please consult the factory for details.

Cushion Length

Where specified, HMI cylinders incorporate the longest cushion sleeve and spear that can be accommodated within the standard envelope without reducing the rod bearing and piston bearing lengths. See table of cushion lengths on page 113. Cushions are adjustable via recessed needle valves.

Cushion Calculations

The charts on the next page show the energy absorption capacity for each bore/rod combination at the head (annulus) and the cap (full bore) ends of the cylinder. The charts are valid for piston velocities in the range 0.1 to 0.3m/s. For velocities between 0.3 and 0.5m/s, the energy values derived from the charts should be reduced by 25%. For velocities of less than 0.1m/s where large masses are involved, and for velocities of greater than 0.5m/s, a special cushion profile may be required. Please consult the factory for details.

The cushion capacity of the head end is less than that of the cap, and reduces to zero at high drive pressures due to the pressure intensification effect across the piston.

The energy absorption capacity of the cushion decreases with drive pressure.

Formula

Cushioning calculations are based on the formula $E = {}^1/_2mv^2$ for horizontal applications. For inclined or vertically downward or upward applications, this is modified to:

$E = {}^1/_2mv^2 + mgl \times 10^{-3} \times \sin\alpha$

(for inclined or vertically downward direction of mass)

$E = {}^1/_2mv^2 - mgl \times 10^{-3} \times \sin\alpha$

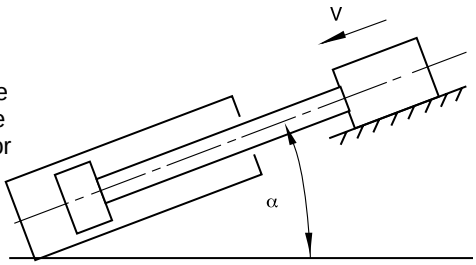
(for inclined or vertically upward direction of mass)

Where:

E	=	energy absorbed in Joules
g	=	acceleration due to gravity = $9.81 m/s^2$
v	=	velocity in meters/second
l	=	length of cushion in millimeters
m	=	mass of load in kilograms (including piston, rod and rod end accessories)
α	=	angle to the horizontal in degrees
p	=	pressure in bar

Example

The following example shows how to calculate the energy developed by masses moving in a straight line. For non-linear motion, other calculations are required; please consult the factory. The example assumes that the bore and rod diameters are already appropriate for the application. The effects of friction on the cylinder and load have been ignored.



Selected bore/rod 160/70mm (No. 1 rod).
Cushioning at the cap end.

Pressure	=	160 bar
Mass	=	10000kg
Velocity	=	0.4m/s
Cushion length	=	41mm
α	=	45½
Sinα	=	0.70

$E = {}^1/_2mv^2 + mgl \times 10^{-3} \times \sin\alpha$

$$= \frac{10000 \times 0.4^2}{2} + 10000 \times 9.81 \times \frac{41}{10^3} \times 0.70$$

$= 800 + 2815 = 3615$ Joules

Note that velocity is greater than 0.3m/s; therefore, a derating factor of 0.75 must be applied before comparison with the curves on the cushioning charts. Applying this factor to the calculated energy figure of 3615 Joules gives a corrected energy figure of:

$$\frac{3615}{0.75} = 4820 \text{ Joules}$$

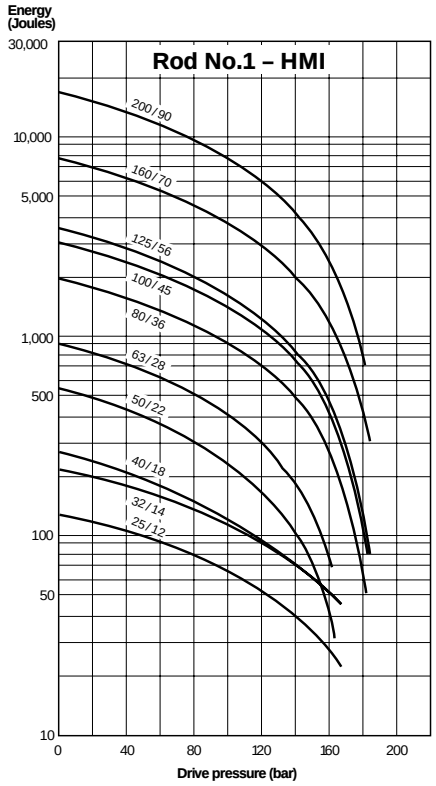
Comparison with the curve shows that the standard cushion can safely decelerate this load. If the calculated energy exceed that indicated by the curve, select a larger bore cylinder and re-calculate.

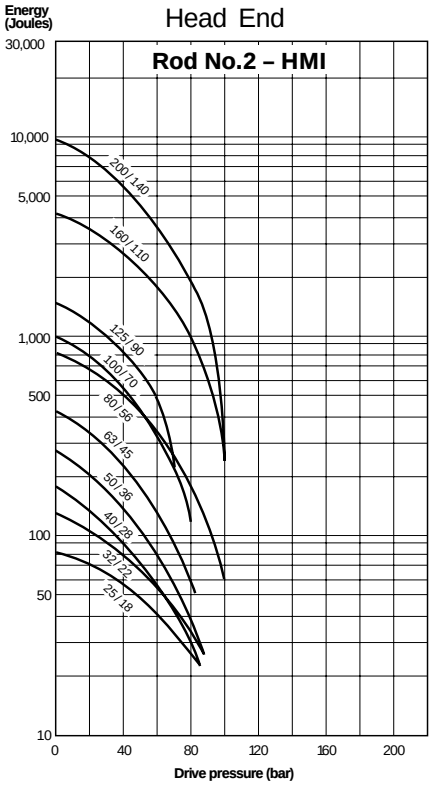
C

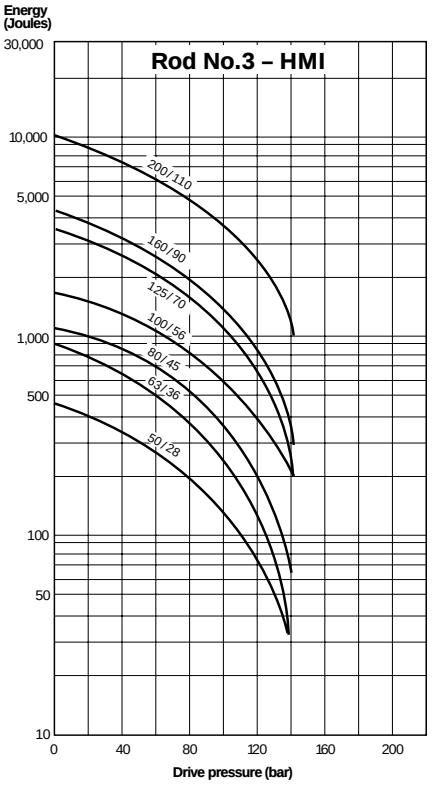
Cushion Energy Absorption Capacity Data

The cushion energy absorption capacity data shown below is based on the maximum fatigue-free pressure developed in the tube. For applications with a life cycle of less than 10^6 cycles, greater energy absorption figures can be applied. Please consult the factory if further information is required.

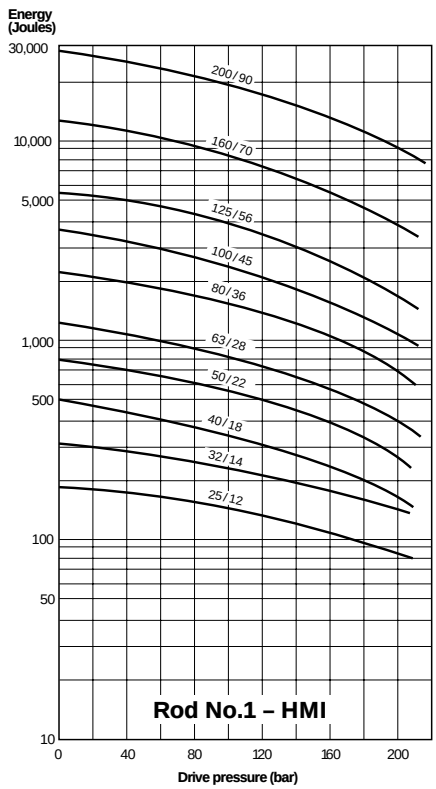
Head End

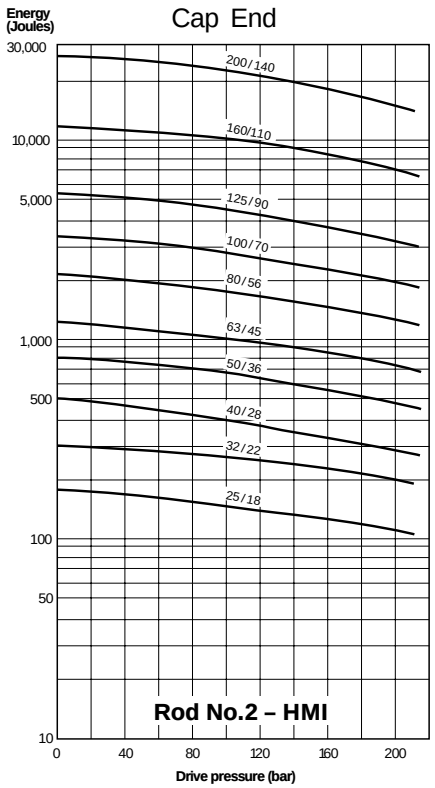


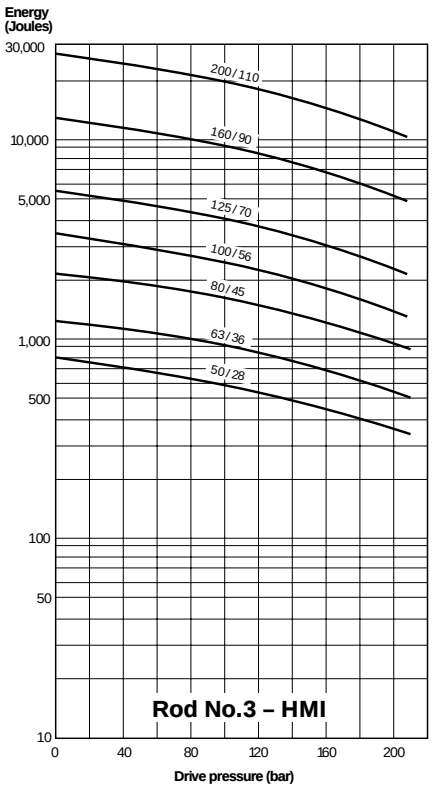




Cap End







Cushion Length, Piston and Rod Mass

Bore ϕ	Rod No.	Rod ϕ	Cushion Length - ISO				ISO		Piston & Rod Zero Stroke kg	Rod Only per 10mm Stroke kg
			Rod No. 1		Rod No. 2		Rod No. 3			
			Head	Cap	Head	Cap	Head	Cap		
25	1	12	22	20	24	20	–	–	0.12	0.01
	2	18							0.16	0.02
32	1	14	24	20	24	20	–	–	0.23	0.01
	2	22							0.30	0.03
40	1	18	29	29	29	30	–	–	0.44	0.02
	2	28							0.60	0.05
50	1	22	29	29	29	29	29	29	0.70	0.03
	2	36							0.80	0.05
	3	28							0.95	0.08
63	1	28	29	29	29	29	29	29	1.20	0.05
	2	45							1.35	0.08
	3	36							1.60	0.12
80	1	36	35	32	27	32	35	32	2.30	0.08
	2	56							2.50	0.12
	3	45							2.90	0.19
100	1	45	35	32	26	32	29	32	4.00	0.12
	2	70							4.40	0.19
	3	56							5.10	0.30
125	1	56	28	32	27	32	27	32	7.10	0.19
	2	90							8.00	0.30
	3	70							9.40	0.50
160	1	70	34	41	34	41	34	41	13.70	0.30
	2	110							15.30	0.50
	3	90							17.20	0.75
200	1	90	46	56	49	56	50	56	27.00	0.50
	2	140							30.00	0.75
	3	110							34.00	1.23

Pressure Limitations – Introduction

The pressure limitations of a hydraulic cylinder must be reviewed when considering its application. To assist the designer in obtaining the optimum performance from a cylinder, the information which follows highlights the recommended minimum and maximum pressures according to application. If in doubt, please consult the factory.

Minimum Pressure

Due to factors such as seal friction, the minimum operating pressure for HMI cylinders is 5 bar. Below this pressure, low friction seals should be specified. If in doubt, please consult the factory.

Maximum Pressure

HMI cylinders are designed to the mounting dimensions specified in ISO 6020/2 for 160 bar cylinders but, due to the selection of materials, they can be used at higher pressures depending on the application and the choice of rod size and rod end style. As a result, the majority of these cylinders can be operated at 210 bar.

All dimensions are in millimeters unless otherwise state.

Cylinder Body (Pressure Envelope)

In many applications, the pressure developed within a cylinder may be greater than the working pressure, due to pressure intensification across the piston and cushioning. In most cases, this intensification does not affect the cylinder mountings or piston rod threads in the form of increased loading. It may, however, affect the cylinder body and induce fatigue failure or cause premature seal wear. It is important, therefore, that the pressure due to cushioning or intensification does not exceed the 340 bar fatigue limit of the cylinder body. The cushion energy absorption data on the previous page is based on this maximum induced pressure. If in doubt, please consult the factory.

C

Standard Ports

Series HMI cylinders are supplied with BSP parallel threaded ports, of a size suitable for normal speed applications – see table opposite. HMI cylinders are also available with a variety of optional ports

Oversize Ports

For higher speed applications. Series HMI cylinders are available with oversize BSP or metric ports to the sizes shown in the table opposite, or with extra ports in head or cap faces that are not used for mountings or cushion screws. On 25 mm and 32 mm bore cylinders, 20mm high port bosses are necessary to provide the full thread length at the cap end – see rod end dimensions for increased height at the head end. Note that Y and PJ dimensions may vary slightly to accommodate oversize ports – please contact the factory where these dimensions are critical.

Port Size and Piston Speed

One of the factors which influences the speed of a hydraulic cylinder is fluid flow in the connecting lines. Due to piston rod displacement, the flow at the cap end port will be greater than that at the head end, at the same piston speed. Fluid velocity in connecting lines should be limited to 5m/s to minimize fluid turbulence, pressure loss and hydraulic shock. The tables opposite are a guide for use when determining whether cylinder ports are adequate for the application. Data shown gives piston speeds for standard and oversize ports and connecting lines where the velocity of the fluid is 5m/s.

If the desired piston speed results in a fluid flow in excess of 5 m/s in connecting lines, larger lines with two ports per cap should be considered. Parker recommends that a flow rate of 12 m/s in connecting lines should not be exceeded.

Speed Limitations

Where large masses are involved, or piston speeds exceed 0.1m/s and the piston will make a full stroke, cushions are recommended – see cushion information. For cylinders with oversize ports and with a flow exceeding 8m/s into the cap end, a 'non-floating cushion' should be specified. Please consult the factory.

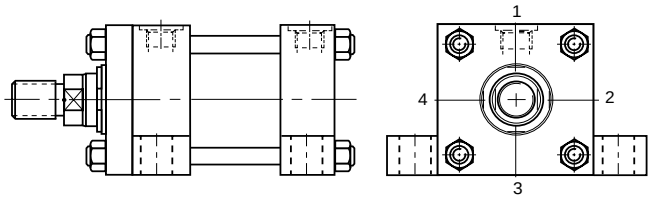
Ports, Air Bleeds and Cushion Adjustment Location

The table below shows standard positions for ports, and cushion adjusting screws where fitted. Air bleeds (see optional features) may be fitted in unoccupied faces of the head or cap, depending on mounting.

Bore ϕ	Standard Cylinder Ports				
	Port Size BSP/G Inches	Port Size Metric[1]	Bore of Connecting Lines	Cap End Flow in l/min @ 5m/s	Piston Speed m/s
25	1/4	M14x1.5	7	11.5	0.39
32	1/4	M14x1.5	7	11.5	0.24
40	3/8	M18x1.5	10	23.5	0.31
50	1/2	M22x1.5	13	40	0.34
63	1/2	M22x1.5	13	40	0.21
80	3/4	M27x2	15	53	0.18
100	3/4	M27x2	15	53	0.11
125	1	M33x2	19	85	0.12
160	1	M33x2	19	85	0.07
200	1 1/4	M42x2	24	136	0.07

Bore ϕ	Oversize Cylinder Ports (Not to DIN)				
	Port Size BSP/G Inches	Port Size Metric[1]	Bore of Connecting Lines	Cap End Flow in l/min @ 5m/s	Piston Speed m/s
25	3/8[2]	M18x1.5[2]	10	23.5	0.80
32	3/8[2]	M18x1.5[2]	10	23.5	0.48
40	1/2	M22x1.5	13	40	0.53
50	3/4	M27x2	15	53	0.45
63	3/4	M27x2	15	53	0.28
80[3]	1	M33x2	19	85	0.28
100[3]	1	M33x2	19	85	0.18
125[3]	1 1/4	M42x2	24	136	0.18
160[3]	1 1/4	M42x2	24	136	0.11
200[3]	1 1/2	M48x2		212	0.11

[1]Not to DIN 24 554
[2]20mm high port bosses fitted at cap end
[3]Consult factory – available on certain bore sizes only
Not recommended for JJ mountings at pressures above 100 bar



Positions of Ports and Cushion Screws in Head and Cap		Mounting Styles – ISO																															
		TB, TC and TD				JJ				HH				C	B and BB				SB				D				DB				DD			
Head	Port	1	2	3	4	1	2	3	4	1	2	3	4	1	1	2	3	4	1	2	3	4	1		3		1	2	3	4	1	2	3	4
	Cushion	2	3	4	1	3	3	1	1	3	4	1	2	2	2	3	4	1	2	3	4	1	3		1		3	4	1	2	3	4	1	2
Cap	Port	1	2	3	4	1	2	3	4	1	2	3	4	1	1	2	3	4	1	2	3	4	1	2	3	4	1		3		1	2	3	4
	Cushion	2	3	4	1	3	4	1	2	3	3	1	1	2	2	3	4	1	2	3	4	1	3	4	1	2	3		1		3	4	1	2

All dimensions are in millimeters unless otherwise stated.

For additional information – call your local Parker Cylinder Distributor.

Cylinder Port Options

Option "T" SAE Straight Thread O-Ring Port. Recommended for most hydraulic applications.

Option "U" Conventional NPTF Ports (Dry-Seal Pipe Threads). Recommended for pneumatic applications only.

Option "R" BSPP Port (British Parallel Thread). ISO 228 port commonly used in Europe. See Figure R-G below.

Option "P" SAE Flange Ports Code 61 (3000 psi). Recommended for hydraulic applications requiring larger port sizes.

Option "B" BSPT (British Tapered Thread).

Option "M" Metric Straight Thread Port similar to Option "R" with metric thread. Popular in some European applications. See Figure R-G below.

Option "Y" ISO-6149-1 Metric Straight Thread Port. Recommended for all hydraulic applications designed per ISO standards. See Figure Y below.

Bore	"T" SAE	"U" NPTF Pipe Thread	"R" BSPP Parallel Thread (Standard)	"P" SAE 4-Bolt Flange Nom. Size	"B" BSPT Taper Thread	"M" Metric Straight Thread	"Y" ISO-6149-1 Metric Straight Thread
25	#6	1/4	1/4	N/A	1/4	M14 x 1.5	M14 x 1.5
32	#6	1/4	1/4	N/A	1/4	M14 x 1.5	M14 x 1.5
40	#6	3/8	3/8	N/A	3/8	M18 x 1.5	M18 x 1.5
50	#10	1/2	1/2	N/A	1/2	M22 x 1.5	M22 x 1.5
63	#10	1/2	1/2	1/2	1/2	M22 x 1.5	M22 x 1.5
80	#12	3/4	3/4	3/4	3/4	M27 x 2	M27 x 2
100	#12	3/4	3/4	3/4	3/4	M27 x 2	M27 x 2
125	#16	1	1	1	1	M33 x 2	M33 x 2
160	#16	1	1	1	1	M33 x 2	M33 x 2
200	#20	1 1/4	1 1/4	1 1/4	1 1/4	M42 x 2	M42 x 2

C

BSPP Port for Series HMI

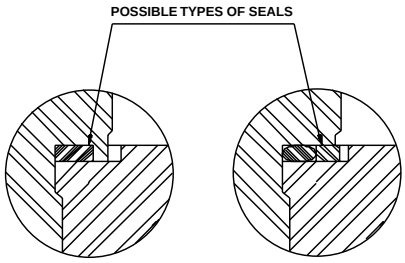
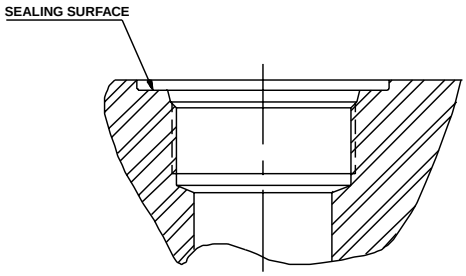


Figure R-G



ISO 6149-1 Port for Series HMI

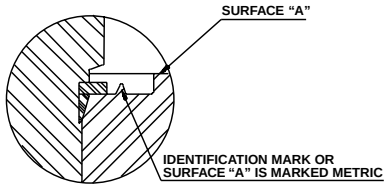
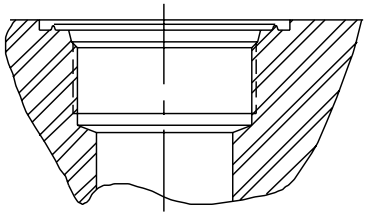


Figure Y



Seals and Fluid Data

Group	Seal Materials – a combination of:	Fluid Medium to ISO 6743/4-1982	Temperature Range
1	Nitrile (NBR), PTFE, enhanced polyurethane (AU)	Mineral oil HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 oil, nitrogen	-20½C to +80½C
5	Fluorocarbon elastomer (FPM) Viton*, PTFE	Fire resistant fluids based on phosphate esters (HFD-R) Also suitable for hydraulic oil at high temperatures/environments. **Not suitable for use with Skydrol.** See fluid manufacturer's recommendations.	-20½C to +150½C

*Viton is a registered trademark of Dupont

Operating Medium

Sealing materials used in the standard cylinder are suitable for use with most petroleum-based hydraulic fluids.

Special seals are available for use with water-glycol or water-in-oil emulsions, and with fluids such as fire-resistant synthetic phosphate ester and phosphate ester-based fluids.

If there is any doubt regarding seal compatibility with the operating medium, please consult the factory.

The table above is a guide to the sealing compounds and operating parameters of the materials used for standard and optional rod gland, piston and body seals

Temperature

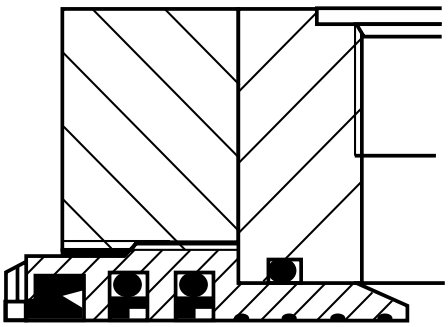
Standard seals can be operated at temperatures between -20½C and +80½C. Where operating conditions result in temperatures which exceed these limits, special seal compounds may be required to ensure satisfactory service life – please consult the factory.

Special Seals

Group 1 seals are fitted as standard to HMI cylinders. For other duties, the optional seal group 5 is available – please see the cylinder order code for HMI (ISO) cylinders. Special seals, in addition to those shown in the table above, can also be supplied. Please insert an S (Special) in the order code and specify fluid medium when ordering.

Low Friction Seals

For applications where very low friction and an absence of stick-slip are important, the option of low friction seals is available. Please consult the factory.



All dimensions are in millimeters unless otherwise stated.

Water Service

Special cylinders are available for use with water as the fluid medium. Modifications include a stainless steel piston rod with lipseal piston, and plating of internal surfaces. When ordering, please specify the maximum operating pressure or load/speed conditions.

Warranty

Parker Hannifin warrants cylinders modified for use with water or water base fluids to be free of defects in materials and workmanship, but cannot accept responsibility for premature failure caused by corrosion, electrolysis or mineral deposits in the cylinder.

Weights – Series HMI Cylinders

Bore ϕ	Rod ϕ	Mounting Styles – Weight at Zero Stroke						Weight per 10mm Stroke kg
		TB, TC TD kg	C kg	JJ, HH kg	B,BB, SB kg	D, DB kg	DD kg	
25	12	1.2	1.4	1.5	1.4	1.3	1.5	0.05
	18						1.6	0.06
32	14	1.6	1.9	2.0	1.9	1.7	2.0	0.06
	22	1.7						0.08
40	18	3.7	4.0	4.7	4.2	3.9	4.6	0.09
	28	3.8	4.1	4.8	4.3	4.0	4.7	0.12
50	22	5.9	6.5	7.2	7.0	6.3	7.9	0.14
	28	6.0	6.6	7.3	7.1		8.0	0.16
	36				7.2	6.4		0.18
63	28	8.5	9.7	10.1	10.1	8.9	10.6	0.19
	36	8.6	9.8	10.2	10.2	9.0	10.7	0.22
	45	8.7	9.9	10.3	10.4	9.1	10.9	0.27
80	36	16.0	17.3	18.9	19.5	16.5	20.5	0.27
	45	16.1	17.4	19.0	19.6	16.6		0.32
	56	16.3	17.7	19.2	19.8	16.8	20.7	0.39
100	45	22.0	24.0	25.0	28.0	22.7	26.0	0.40
	56			26.0			27.0	0.47
	70	23.0	25.0		29.0	23.2		0.58
125	56	42.0	44.0	48.0	53.0	43.0	48.0	0.65
	70		45.0		54.0		49.0	0.76
	90	43.0		49.0		44.0	50.0	0.95
160	70	69.0	73.0	78.0	90.0	71.0	84.0	1.00
	90				91.0	72.0	85.0	1.20
	110	70.0	74.0	79.0	92.0			1.40
200	90	122.0	129.0	138.0	157.0	127.0	153.0	1.50
	110	123.0	130.0		158.0	128.0		1.80
	140	124.0	131.0	140.0	160.0	129.0	155.0	2.30

Air Bleeds

The option of bleed screws is available at either or both ends of the cylinder, at any position except in the port face. The selected positions should be shown in the order code. Cylinders with bore sizes up to 40mm are fitted with M5 bleed screws; for bore sizes of 50mm and above, M8 bleed screws are fitted. Note that, for cylinders of 50mm bore and above, where it is essential to have the air bleed in the port face, bosses can be welded to the cylinder tube. Please contact the factory for details.

Gland Drains

The tendency of hydraulic fluid to adhere to the piston rod can result in an accumulation of fluid in the cavity behind the gland wiperseal under certain operating conditions. This may occur with long stroke cylinders; where there is a constant back pressure as in differential circuitry, or where the ratio of the extend speed to the retract speed is greater than 2 to 1.

A gland drain port can be provided in the retainer on all mounting styles except JJ – 25, 32 and 40mm bores with no.1 rod, and style D – 100 to 200mm bores, where it is mounted in the head. Where the gland is provided in the retainer, the thickness of the retainer is increased by 6mm on 32 and 40mm bore cylinders with no. 2 rod, and by 4mm on 63mm bore cylinders with no. 2 rod. Note that, on style JJ cylinders, drain ports cannot normally be positioned in the same face as ports or cushion valves – please consult the factory.

Gland drain ports will be the same type as the ports specified on the cylinder assembly except for non "JJ" mounts on bore sizes 25, 32, 40 and 50 mm. In these cases they will be 1/8 NPTF.

The size of the gland drain ports are as shown on the adjacent table.

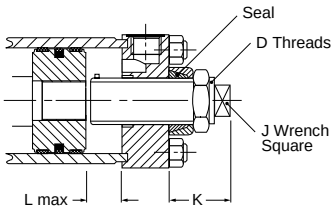
Gland drains should be piped back to the fluid reservoir, which should be located below the level of the cylinder.

Port Type	Port Size
R (BSPP)	1/8 BSPP
T (SAE)	#4 (SAE)
U (Pipe Thread)	1/8 NPTF
M (Metric Straight)	M10 x 1
Y (ISO 6149-1)	M10 x 1
B (BSPT)	1/8 BSPT
P (SAE 4 Bolt Flange)	1/8 BSPP

Stroke Adjusters

Where absolute precision in stroke length is required, a screwed adjustable stop can be supplied. Several types are available – the illustration shows a design suitable for infrequent adjustment at the uncushioned cap end of a cylinder. Please contact the factory, specifying details of the application and the adjustment required.

Bore ϕ	D	J	K min	L max
40	M12x1.25	7	75	130
50	M20x1.5	12	75	200
63	M27x2	16	75	230
80	M33x2	20	85	230
100	M42x2	26	70	450
125	M48x2	30	70	500
160	M64x3	40	75	500
200	M80x3	50	80	500



Spring-Returned, Single-Acting Cylinders

Series HMI single-acting cylinders can be supplied with an internal spring to return the piston after the pressure stroke. Please supply details of load conditions and friction factors, and advise whether the spring is required to advance or return the piston rod.

On spring-returned cylinders, tie rod extensions will be supplied to allow the spring to be 'backed off' until compression is relieved. Tie rod nuts will be welded to the tie rods at the opposite end of the cylinder, to further assure safe disassembly. Please contact the factory when ordering spring-returned cylinders.

Duplex and Tandem Cylinders

A tandem cylinder is made up of two cylinders mounted in line with pistons connected by a common piston rod and rod seals installed between the cylinders to permit double acting operation of each. Tandem cylinders allow increased output force when mounting width or height are restricted.

A duplex cylinder is made up of two cylinders mounted in line with pistons not connected with rod seals installed between the cylinders to permit double acting operation of each. Cylinders may be mounted with piston rod to piston or back to back and are generally used to provide three position operation.

Rod End Bellows

Unprotected piston rod surfaces which are exposed to contaminants with air hardening properties can be protected by rod end bellows. Longer rod extensions are required to accommodate the collapsed length of the bellows. Please consult the factory for further information.

Metallic Rod Wipers

Metallic rod wipers replace the standard wiper seal, and are recommended where dust or splashings might damage the wiper seal material. Metallic rod wipers do not affect cylinder dimensions.

Proximity Sensors

EPS proximity switches can be fitted to give reliable end of stroke signals.

Position Feedback

Linear position transducers of various types are available for Series HMI cylinders. Please contact the factory for further details.

C

All dimensions are in millimeters unless otherwise stated.

Series 3H Large Bore
High Pressure Hydraulic Cylinders

Application Data

The proper application of a fluid power cylinder requires consideration of the operating pressure, the fluid medium, the mounting style, the length of stroke, the type of piston rod connection to the load, thrust or tension loading on the rod, mounting attitude, the speed of stroke, and how the load in motion will be stopped. The information given here provides data to evaluate average applications for Series "3H" Hydraulic Cylinders, and will assist you in proper cylinder selection.

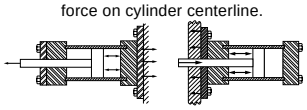
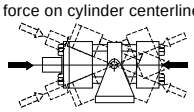
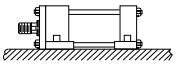
Mounting Classes

Standard mountings for series "3H" power cylinders fall into two basic classes and three groups. The two classes can be summarized as follows:

Class 1 – Straight Line Force Transfer (Groups 1 and 3).

Class 2 – Pivot Force Transfer (Group 2). Pivot mountings permit a cylinder to change it alignment in one plane.

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

	Class 1 — Group 1	Class 2 — Group 2	Class 1— Group 3
Heavy-Duty Service	FIXED MOUNTS which absorb force on cylinder centerline. 	PIVOT MOUNTS which absorb force on cylinder centerline. 	FIXED MOUNTS which do not absorb force on centerline. 
For Thrust Loads	Mtg. Styles HH, HB, E	Mtg. Styles DD, D, DB, BB	Mtg. Style C
For Tension Loads	Mtg. Styles JJ, JB, E	Mtg. Styles BB, DD, D, DB	Mtg. Style C

Rod End Data

Rod end dimension symbols as shown comply with the National Fluid Power Association dimensional code. The following chart indicates the symbols used in this catalog.

Description	Symbol
Thread diameter and pitch	KK
Length of thread	A
Length of Rod Extension from face of head to end of retracted rod	LAF (Male Thread) WF (Female Thread)

Two rod ends for Series 3H cylinders are offered as shown on the dimension pages of this catalog. They are Parker styles 4 and 9 and are optional without price penalty. If a rod end style is not specified, the Parker style 4 (N.F.P.A. Style SM) will be supplied.

International Rod End Threads

Piston rod threads to meet international requirements are available at extra cost. Parker cylinders can be supplied with British standard fine (W) or metric (M). To order, specify in model number. For dimensions, consult factory.

Special Rod Ends

If a rod end configuration other than the standard styles 4 and 9 is required, such special rod ends can be provided. The designation "Style 3" is assigned to such specials and is incorporated in the cylinder model number. To order, specify "Style 3" and give desired dimensions for KK, A, or LAF, or WF if female end. If otherwise special, send a dimensioned sketch.

Rod End Boots

Are available on request: Consult factory for details.

Special Assemblies From Standard Parts

Each dimensioned drawing in this catalog has position numbers shown on the end view to identify the four sides of the cylinder. These aid in communications and simplify the writing of specifications that cover changes in port positions, etc. Following are several suggested special assemblies that can be made up from standard parts.

a) By calling out the position numbers for the desired locations for head and cap ports, some mounting styles can be assembled with ports located at 90½ or 180½ from standard. In such special assemblies, the cushion needle and check valves are also repositioned since their relation with the port position does not change.

b) Standard mountings in different combinations can be provided: for example, Style JJ mounting on head end with Style C on the cap end. This would be made up from standard parts and would be designated Model JJC-3H14.

Single-Acting Cylinders

Maximum Pressure Rating

Bore	Rod Dia.	4:1 Design Factor (Tensile)	Heavy-Duty Service
Inches	Inches	PSI	PSI
10	4½	2720	3000
12	5½	2580	3000
14	7	2320	3000
16	8	2750	3000
18	9	2900	3000
20	10	2640	3000

Double-acting "3H" cylinders are supplied as standard. They can also be used as single-acting cylinders where fluid force is applied to only one side of the piston, with the load or other external forces acting to "return" the piston after pressure is exhausted. It is necessary to plumb the unused port tank to collect any piston bypass.

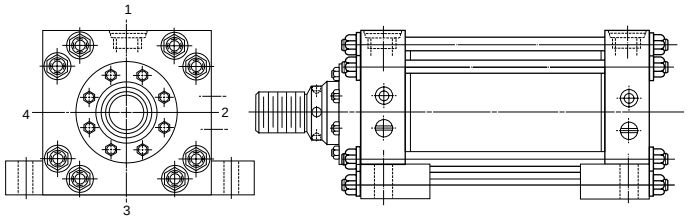
Series "3H" cylinders are recommended for pressures to 3000 p.s.i. for heavy-duty service with hydraulic oil. The 4:1 design factor ratings shown are based on tensile strength of material and are for code 1 rod dia. only. Design factors at other pressures can be calculated from this rating. In addition, mounting styles, stroke, etc., should be considered because of the limiting effect they may have on these ratings.

For additional information – call your local Parker Cylinder Distributor.

Ports

Standard Ports Series "3H" cylinders are furnished with NPTF tapered pipe threads as standard. The largest size port is provided that can be accommodated by the head and cap in any given bore size. If specified on your order, extra ports can be provided on the sides of heads or caps that are not occupied by mountings or cushion valves.

Port Locations Standard port location is position 1, as shown in Section B, pages 90 through 98. Cushion adjustment needle and check valve are at position 3 on all mounting styles except C where they will be located at position 2.



Head (Rod) End **Head** **Cap**

Mounting Style	Port Position Available	
	Head End	Cap End
T, TB, TC, TC HH, HB, JB, JJ, DD	1,2,3 or 4	1,2,3 or 4
BB, DB	1,2,3 or 4	1 or 3
D	1 or 3	1,2,3 or 4
C, E	1	1

Heads or caps which do not incorporate mounting can be rotated and assembled at no extra charge with ports 90½ or 180½ from standard position. To order other than standard port location, specify by position number shown in table above. In such assemblies, the cushion adjustment needle and check valve rotate accordingly, since their relationship with port position does not change.

Straight Thread Ports The SAE straight thread O-ring boss is recommended for hydraulic applications. Parker will furnish this port configuration on request. Consult factory for sizes available.

International Ports Other port configurations to meet international requirements are available at extra cost. Parker cylinders can be supplied with British parallel ports (BSP) or British standard port taper (BSPT) or metric (G). To order, specify in model number. For dimension, consult factory.

Air Bleeds

In most hydraulic circuits, cylinders are considered self-bleeding when cycled the full stroke. If air bleeds are required, a ⅛" NPTF port boss can be supplied at each end of the cylinder body. To order, specify Bleed port, and indicate position desired.

Water Service Modifications

Standard When requested, Parker can supply Series 3H cylinders with standard modifications that make the cylinders more nearly suitable for use with water as the fluid medium. The modifications include chrome-plated cylinder bore; a cadmium-plated, non-wearing internal surface; Viton piston rod seal and chrome-plated, stainless steel piston rod. On orders for water-service cylinders, be sure to specify the maximum operating pressure or the load and speed conditions. (These factors must be taken into account because of the lower tensile strength of stainless steels available for use in piston rods.)

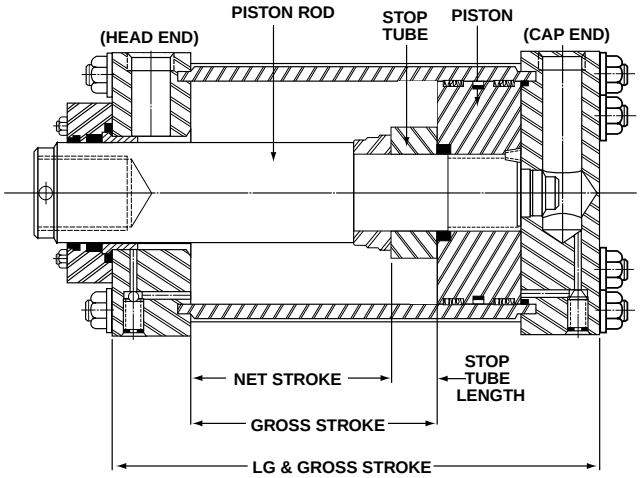
Warranty Parker will warrant Series 3H cylinders modified for water service to be free of defects in materials or workmanship. However, Parker cannot accept responsibility for premature failure of cylinder function, where failure is caused by corrosion, electrolysis or mineral deposits within the cylinder.

Fire-Resistant Fluids

See Section C, page 105 for further data and information.

Stop Tubing

Long stroke cylinders, fixed or pivot mounted, tend to jackknife or buckle on push load applications, resulting in high bearing loading at the rod gland or piston. Use of a stop tube to lengthen the distance between the gland and piston when cylinder rod is fully extended is recommended to reduce these bearing loads. The drawing below shows stop tube construction for Series 3H cylinders. Refer to Engineering Section to determine stop tube length. To order, specify gross stroke and length of stop tube.



Stroke Data

Series "3H" cylinders are available in any practical stroke length. The following information should prove helpful to you in selecting the proper stroke for your cylinder application.

Stroke Tolerances Stroke length tolerances are required due to buildup of tolerances of piston, head, cap and cylinder body. Standard production stroke tolerances run +1/32" to - 1/16".

For closer tolerances on stroke length, it is necessary to specify the required tolerance plus the operating pressure and temperature at which the cylinder will operate. Stroke tolerances smaller than .015" are not generally practical due to elasticity of cylinders

Long Strokes When considering the use of long stroke cylinders, it is necessary that the rod diameter be of such dimension so as to provide the necessary column strength. For tension (pull) loads, a correct rod size is easily selected by specifying standard cylinders with standard rod diameters, and using them at rated or lower pressures.

For compression (push) loads, the column strength must be carefully considered. This involves the stroke length, the length of the piston rod extension, the support received from the rod end connection and gland and piston bearings, the style of mounting and the mounting attitude. It is also necessary to consider the bearing loads on pistons and glands, and to keep bearing pressures within proper limits by increasing the bearing length and the distance between piston and gland bearings. This is economically accomplished by various means. Commonly, separation of the bearings is effected with a stop tube on the piston rod much like a large diameter cushion sleeve. Other designs are provided according to the application requirements. The Stroke Chart printed in Section C, page 96 of this catalog will guide you where requirements call for unusually long strokes.

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

C

Series 3H Large Bore
High Pressure Hydraulic Cylinders

Cylinder Accessories

Parker offers a complete range of cylinder accessories to assure you of greatest versatility in present or future cylinder applications.

Rod End Accessories

Accessories offered for the rod end of the cylinder include Rod Clevis, Eye Bracket, and Pivot Pin. For dimensions and ordering details consult factory.

Acceleration and Deceleration Force Determination

The uniform acceleration force factor chart and the accompanying formula can be used to rapidly determine the forces required to accelerate and decelerate a cylinder load. To determine these forces, the following factors must be known: total weight to be moved, maximum piston speed, distance available to start or stop the weight (load), direction of movement i.e. horizontal or vertical, and load friction. By use of the known factors and the "g" factor from chart, the force necessary to accelerate or decelerate a cylinder load may be found by solving the formula (as shown in chart below) application to a given set of conditions.

Nomenclature

V	=	Velocity in feet per minute
S	=	Distance in inches
F	=	Force in lbs.
W	=	Weight of load in lbs.
g	=	Force factor
f	=	Friction of load on machine ways in pounds

To determine the force factor "g" from the chart, locate the intersection of the maximum piston velocity line and the line representing the available distance. Project downward to locate "g" on the horizontal axis. To calculate the "g" factor for distances and velocities exceeding those shown on the chart, the following formula can be used:

$$g = v^2/s \times .0000517$$

Example: Horizontal motion of a free moving 25,000 lb. load is required with a distance of $^1/_2$" to a maximum speed of 120 feet per minute.

Formula (1) F = Wg should be used.

F = 25,000 pounds x 1.50 (from chart) = 37,500 lbs.

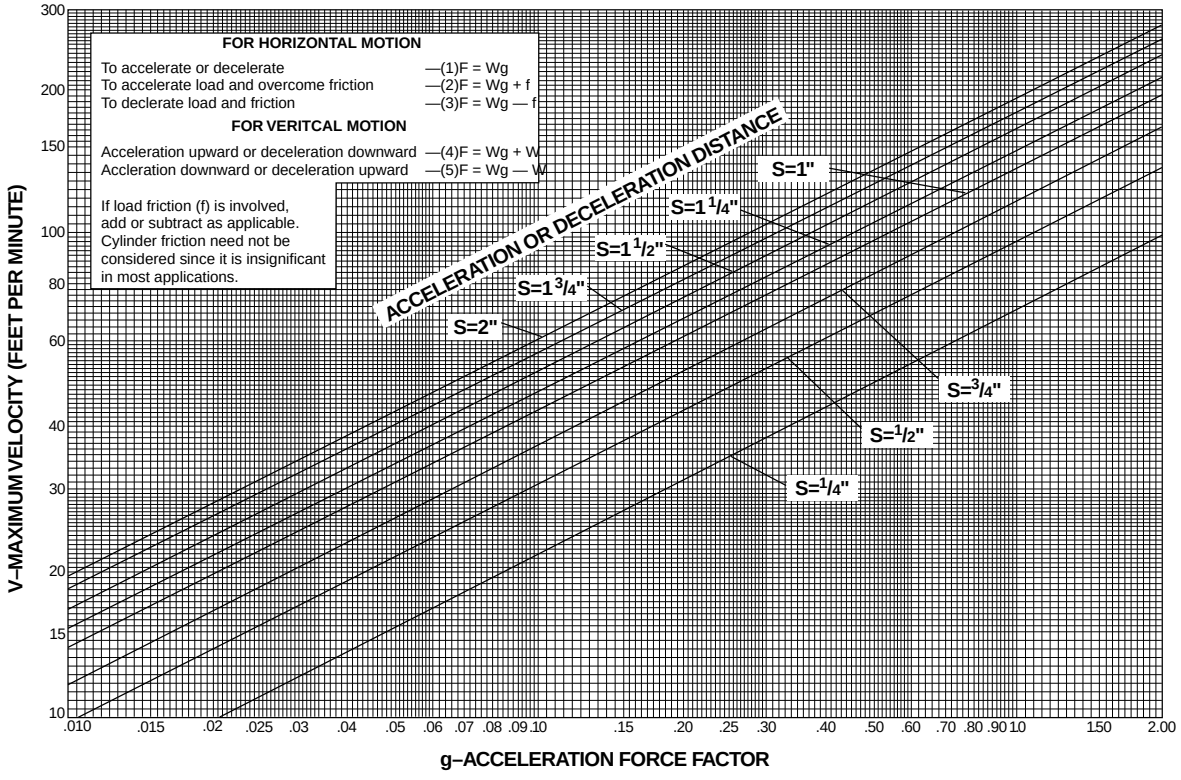
Assuming a maximum available pump pressure of 750 psi, a 10" bore cylinder should be selected, operating on push stroke at approximately 500 psi pressure at the cylinder.

Assume the same load to be sliding on ways with a coefficient of friction of 0.15. The resultant friction load would be 2,500 x 0.15 = 3,750 lbs.

Formula (2) F = Wg + f should be used.

F = 25,000 lbs. x 1.5 (from chart) + 3,750 = 41,250 lbs.

Again allowing 500 psi pressure at the cylinder, a 12" bore cylinder is indicated.



For additional information – call your local Parker Cylinder Distributor.

Theoretical Push and Pull Forces for Hydraulic Cylinders — Push Force and Displacement

Cylinder Bore Size (Inches)	Piston Area (Sq. In.)	Cylinder Push Stroke Force in Pounds at Various Pressures							Displacement Per Inch of Stroke (Gallons)
		100	250	500	1000	1500	2000	3000	
10	78.54	7854	19635	39270	78540	117810	157080	235620	.3400
12	113.10	11310	28275	56550	113100	169650	226200	339300	.4896
14	153.94	15394	38485	76970	153940	230910	307880	461820	.6664
16	201.06	20106	50265	100530	201060	301590	402120	603180	.8704
18	254.47	25447	63620	127230	254470	381700	508940	763410	1.1016
20	314.16	31416	78540	157080	314160	471240	628320	942480	1.3600

Deductions for Pull Force and Displacement

Piston Rod Diameter (Inches)	Piston Rod Area (Sq. In.)	Piston Diameter Force in Pounds at Various Pressures To determine Cylinder Pull Force or Displacement, deduct the following Force or Displacement corresponding to Rod Size, from selected Push Stroke Force or Displacement corresponding to Bore Size in table above.							Displacement Per Inch of Stroke (Gallons)
		100	250	500	1000	1500	2000	3000	
4 1/4	15.90	1590	3976	7950	15900	23860	31810	47700	.0688
5	19.63	1963	4908	9815	19630	29445	39260	58890	.0850
5 1/2	23.76	2376	5940	11880	23760	35640	47520	71280	.1028
7	38.48	3848	9620	19240	38480	57730	76970	115440	.1666
8	50.26	5026	12570	25130	50270	75400	100530	150780	.2176
9	63.62	6362	15900	31810	63620	95430	127230	190860	.2754
10	78.54	7854	19635	39270	78540	117810	157080	235620	.3400

Flow Velocity and Pressure Drop Data for Hydraulic Systems

The chart below may be used to calculate pressure loss in connecting lines at various flow velocities. The data is useful when determining hydraulic cylinder size and port size for applications where cylinder force and speed requirements are known.

S = Standard (Schedule 40) Pipe
H = Extra Strong (Schedule 80) Pipe
EH = Double Extra Strong Pipe

Tabulations based on a hydraulic oil having a viscosity of 155 SSU at 100½F — specific gravity of .87.

To determine tubing or hose losses, use I.D. closest to tubing or hose I.D.

Pressure drop does not vary with operating pressure. Avoid high pressure losses in low pressure systems. Use largest pipe size practical. Avoid flow velocities greater than 15 Ft./Sec. to reduce hydraulic line shock.

Clean Steel Pipe						Pressure Loss (Pounds Per Square Inch Per Foot Length) in Pipes at Average Flow Velocity (Feet Per Second) of														Equivalent Straight Pipe Length (Feet) for Circuit Components*					
Nominal Size		O.D.	I.D.	Wall Thickness	I.D. Area	5		7		10		15		20		25		30		Tee			Elbow		
Inches		Inches	Inches	Inch	Sq. In.	Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.				Std.	Sq.	45½
1	S	1.315	1.049	.133	.863	.10	13.45	.13	18.85	.34	26.90	.57	40.35	1.42	53.80	1.64	67.25	2.24	80.70	5.7	1.7	5.7	2.6	5.7	1.2
	H		.957	.179	.719	.11	11.21	.15	15.70	.24	22.42	.62	33.63	1.23	44.84	1.84	56.05	2.93	67.26	5.2	1.6	5.2	2.5	5.2	1.1
	EH		.599	.358	.282	.26	4.39	.37	6.16	.53	8.78	.67	13.17	2.25	17.56	3.29	21.95	3.30	26.34	3.0	1.0	3.0	1.5	3.0	.75
1 1/4	S	1.660	1.380	.140	1.496	.05	23.35	.08	31.68	.25	46.70	.39	70.05	.78	93.40	1.18	116.75	1.47	140.10	7.5	2.4	7.5	3.7	7.5	1.6
	H		1.278	.191	1.280	.07	19.95	.09	28.06	.26	39.90	.44	58.85	.85	79.80	1.27	99.75	1.80	119.70	7.0	2.1	7.0	3.5	7.0	1.5
	EH		.896	.382	.630	.13	9.83	.16	13.75	.24	19.66	.71	29.49	1.35	39.32	2.01	49.15	2.76	58.98	4.9	1.5	4.9	2.3	4.9	1.05
1 1/2	S	1.900	1.610	.145	2.036	.04	31.75	.11	44.49	.19	63.50	.33	95.25	.64	127.00	.96	158.75	1.26	190.50	9.0	2.8	9.0	4.3	9.0	2.0
	H		1.500	.200	1.767	.04	27.55	.08	38.62	.21	55.10	.36	82.65	.71	110.20	1.06	137.75	1.36	145.30	8.2	2.6	8.2	4.0	8.2	1.8
	EH		1.100	.400	.950	.09	14.81	.09	20.75	.32	29.62	.51	44.43	1.05	59.24	1.51	74.05	2.14	88.86	6.5	2.0	6.5	3.0	6.5	1.4
2	S	2.375	2.067	.154	3.355	.04	52.30	.08	73.45	.14	104.60	.24	159.20	.48	209.20	.69	261.50	.85	313.80	11.0	3.5	11.0	5.5	11.0	2.5
	H		1.939	.218	2.953	.03	46.00	.09	64.60	.15	92.00	.26	138.00	.52	184.00	.73	230.00	.98	276.00	10.8	3.4	10.8	5.0	10.8	2.4
	EH		1.503	.436	1.773	.04	27.65	.12	38.78	.21	55.30	.36	82.95	.72	110.60	1.34	138.25	1.36	165.90	8.2	2.6	8.2	4.0	8.2	1.8
2 1/2	S	2.875	2.469	.203	4.788	.03	74.75	.07	104.80	.11	149.50	.20	224.25	.37	299.00	.53	373.75	.72	448.50	14.0	4.2	14.0	6.5	14.0	3.0
	H		2.323	.276	4.238	.04	66.11	.07	92.60	.12	132.22	.21	198.33	.39	164.44	.57	330.55	.87	396.66	13.0	4.0	13.0	6.1	13.0	2.9
	EH		1.771	.552	2.464	.03	38.45	.10	53.40	.17	76.90	.30	115.35	.59	153.80	.79	192.25	1.15	230.70	10.3	3.1	10.3	4.8	10.3	2.2

*Consult valve manufacturer for pressure drops in a particular type of valve and port-to-port flow pattern.

Cylinder Weights, In Lbs., for Series 3H High Pressure Large Bore Hydraulic Cylinders

Bore Size	Rod Dia. (In.)	Rod Code	Single Rod Cylinders — Basic Wt. Zero Stroke: D, DB	DD, JJ, HH	JB, HB	BB, C, E	Add Per In. of Stroke	Double Rod Cylinders — Basic Wt. Zero Stroke Add to All Mtg. Styles	Add Per In. of Stroke
10	4 1/2	1	562	646	684	607	15	43	20
	5	3	574	656	695	619	16	50	21
	5 1/2	4	583	667	705	628	17	64	24
	7	2	620	704	742	665	21	101	32
12	51/2	1	924	1057	1136	1000	22	64	29
	7	3	961	1094	1173	1036	26	101	37
	8	2	1022	1155	1234	1097	29	162	43
14	7	1	1335	1520	1582	1485	28	101	39
	8	3	1396	1581	1643	1546	31	162	45
	10	2	1496	1681	1743	1646	39	262	61
16	Consult Factory								
18									
20									

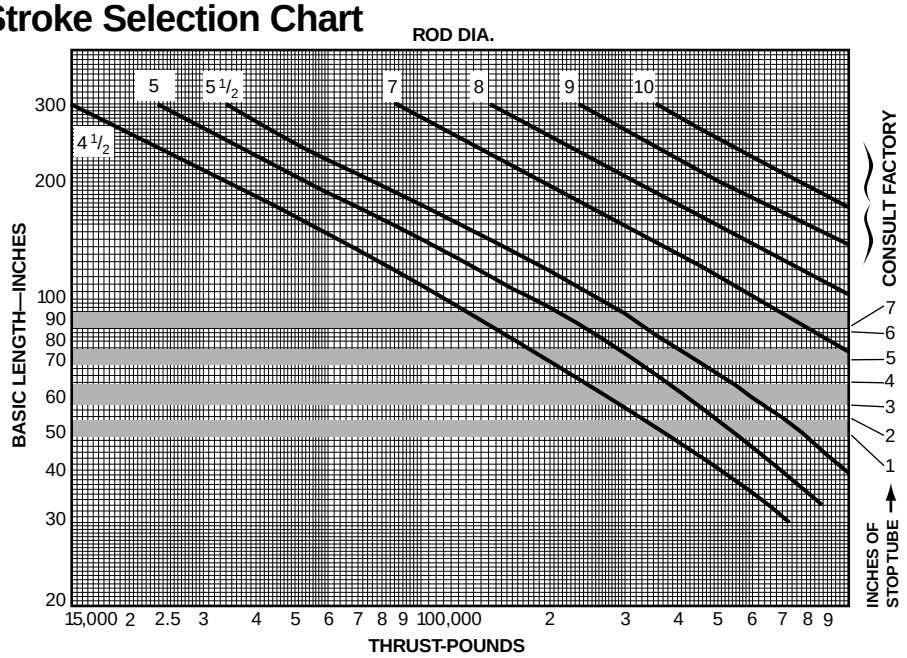
The weights shown at left are for standard Series 3H hydraulic cylinders equipped with various diameter piston rods. To determine the net weights of a cylinder, first select the proper basic weight for zero stroke, then calculate the weight of the cylinder stroke and add the result to the basic weight.

Extra weight for longer than standard rod extensions can be calculated from table below.

Rod Diameter	Weight Per Inch
41/2	4.50
5	5.56
51/2	6.72
7	10.89
8	14.22
10	22.23

For Cylinder Division Plant Locations – See Page II.

Piston Rod — Stroke Selection Chart



How to Use the Chart

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

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

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

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

3. Find the load imposed for the thrust application by multiplying the full bore area of the cylinder by the system pressure.
4. Enter the graph along the values of "basic length" and "thrust" as found above and note the point of intersection:

A) The correct piston rod size is read from the diagonally curved line labeled "Rod Diameter" next *above* the point of intersection.

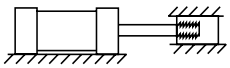
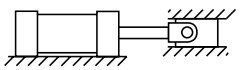
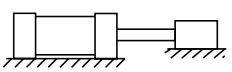
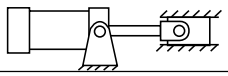
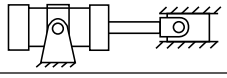
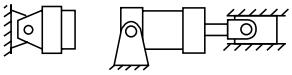
B) The required length of stop tube is read from the right of the graph by following the shaded band in which the point of intersection lies.

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

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

Warning ⚠

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

Recommended Mounting Styles for Maximum Stroke and Thrust Loads	Rod End Connection	Case	Stroke Factor
Class 1 — Groups 1 or 3 Long stroke cylinders for thrust loads should be mounted using a heavy-duty mounting style at one end, firmly fixed and aligned to take the principal force. Additional mounting should be specified at the opposite end, which should be used for alignment and support. An intermediate support may also be desirable for long stroke cylinders mounted horizontally.	Fixed and Rigidly Guided	I 	·50
	Pivoted and Rigidly Guided	II 	.70
	Supported but not Rigidly Guided	III 	2.00
Class 2 — Group 2 Heavy-Duty Style D — Trunnion on Head	Pivoted and Rigidly Guided	IV 	1.00
Heavy-Duty Style DD — Intermediate Trunnion	Pivoted and Rigidly Guided	V 	1.50
Heavy-Duty Style DB — Trunnion on Cap or Style BB — Clevis on Cap	Pivoted and Rigidly Guided	VI 	2.00

For additional information – call your local Parker Cylinder Distributor.

Storage

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

1. Store the cylinders in an indoor area which has a dry, clean and noncorrosive atmosphere. Take care to protect the cylinder from both internal corrosion and external damage.
2. Whenever possible cylinders should be stored in a vertical position (piston rod up). This will minimize corrosion due to possible condensation which could occur inside the cylinder.
3. Port protector plugs should be left in the cylinder until the time of installation.

Installation

1. Cleanliness is an important consideration, and Parker cylinders are shipped with the ports plugged to protect them from contaminants entering the ports. These plugs should not be removed until the piping is to be installed. Before making the connection to the cylinder ports, piping should be thoroughly cleaned to remove all chips or burrs which might have resulted from threading or flaring operations.
2. Cylinders operating in an environment where air drying materials are present such as fast-drying chemicals, paint, or weld splatter, or other hazardous conditions such as excessive heat, should have shields installed to prevent damage to the piston rod and piston rod seals.
3. Proper alignment of the cylinder piston rod and its mating component on the machine should be checked in both the extended and retracted positions. Improper alignment will result in excessive rod gland and/or cylinder bore wear.

Mounting Recommendations

1. The use of high tensile alloy steel socket head screws 1/16" smaller than the mounting hole size is recommended for all mounting styles.
2. Side-Mounted Cylinders – In addition to the mounting bolts, cylinders of this type should be equipped with thrust keys or dowel pins located so as to resist the major load.
3. Tie Rod Mounting – Cylinders with tie rod mountings are recommended for applications where mounting space is limited. The standard tie rod extension is shown as BB in dimension tables. Longer or shorter extensions can be supplied.
4. Flange Mount Cylinders – The controlled diameter of the rod gland extension on head end flange mount cylinders can be used as a pilot to locate the cylinders in relation to the machine. After alignment has been obtained, the flanges may be drilled for pins or dowels to prevent shifting.
5. Trunnion Mountings – Cylinders require lubricated pillow blocks with minimum bearing clearances. Pillow blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to axis of the trunnion pins.
6. Clevis Mountings – Cylinders should be pivoted at both ends with centerline of pins parallel to each other. After cylinder is mounted, be sure to check to assure that the cylinder is free to swing through its working arc without interference from other machine parts.

Cylinder Trouble Shooting

External Leakage

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

   Rod seal leakage could also be traced to gland bearing wear. If clearance is excessive, replace rod gland and seal.

   Rod seal leakage can also be traced to seal deterioration. If seals are soft or gummy, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with a seal material which is compatible with the lubricant or operating fluid. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165½F. (+74½C). Shield the cylinder from the heat source to limit temperature to 350½F. (+177½C.) and replace with Viton seals.
2. Cylinder body seal leak can generally be traced to loose tie rods. Torque the tie rods to manufacturer's recommendation for that bore size.

   Excessive pressure can also result in cylinder body seal leak. Determine maximum pressure to rated limits. Replace seals and retorque tie rods as in paragraph above.

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

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

   Soft or gummy seals are evidence of exposure to fluid with which they are not compatible. Hard seals or seals which have lost their elasticity are a symptom of exposure to excessive temperature. Replace seals as per paragraph above.

Internal Leakage

1. Piston seal leak (by-pass) 1 to 3 cubic inches per minute leakage is considered normal for piston ring construction. Virtually no leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.
2. With lipseal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal wear. Contamination in a hydraulic system can result in a scored cylinder bore, resulting in rapid seal wear. In either case, replace piston seals as required.
3. What appears to be piston seal leak, evidenced by the fact that the cylinder drifts, is not always traceable to the piston. To make sure, it is suggested that one side of the cylinder piston be pressurized and the fluid line at the opposite port be disconnected. Observe leakage. If none is evident, seek the cause of cylinder drift in other component parts in the circuit.

Cylinder Fails to Move the Load

1. Pneumatic or hydraulic pressure is too low. Check the pressure at the cylinder to make sure it is to circuit requirements.
2. Piston Seal Leak – Operate the valve to cycle the cylinder and observe fluid flow at valve exhaust ports at end of cylinder stroke. Replace piston seals if flow is excessive.
3. Cylinder is undersized for the load – Replace cylinder with one of a larger bore size.
4. Piston rod broken at piston end – Disassemble cylinder and replace piston rod.

Erratic or Chatter Operation

1. Excessive friction at gland or piston bearing due to load misalignment – Correct cylinder-to-load alignment.
2. Cylinder sized too close to load requirements – Reduce load or install larger cylinder.
3. Erratic operation could be traced to the difference between static and kinetic friction. Install speed control valves to provide a back pressure to control the stroke.

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

WARNING: ⚠ FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF CYLINDERS AND THEIR RELATED ACCESSORIES CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

Before selecting or using Parker cylinders or related accessories, it is important that you read, understand and follow the following safety information.

User Responsibility

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

- Making the final selection of the cylinders and related accessories.
- Determining if the cylinders are required to meet specific design requirements as required by the Agency(s) or industry standards covering the design of the user's equipment.
- Assuring that that the user's requirements are met and that the use presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the cylinders are used.

Seals

Part of the process of selecting a cylinder is the selection of seal compounds. Before making this selection read the Operating Fluids and Seals section in the Cylinder Application Engineering Data section of this catalogue.

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

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

Piston Rods

Possible consequences of piston rod failure or separation of the piston rod from the piston, but not limited to are:

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

Follow the recommendations of the Cylinder Stroke Chart found in the Cylinder Application Engineering Data section of this catalogue in the for piston rod diameter to avoid piston rod buckling.

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

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

On occasion cylinders are ordered with double piston rods. In some cases a stop is threaded onto one of the piston rods and used as an external stroke adjuster. The external stop will create a pinch point and the user should consider appropriate use of guards. If the external stop is not perpendicular to the contact surface it will place a bending moment on the piston rod which can lead to piston rod failure. An external stop will also negate the effect of a cushion and will subject the piston rod to impact loading. These two (2) conditions can cause piston rod failure. The use of an external stroke adjuster should be reviewed with our engineering department.

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

Port Fittings

Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at piston rod end. The rod end pressure is approximately equal to:

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

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