Industrial Cylinder Products

Hydraulic and Pneumatic Cylinders

Catalog 0106-7
(01/11)

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

PRINTED IN THE U.S.A. (06/02)

⚠WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from the Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having expertise. It is important that you analyze all aspects of your application, including consequences of any failure and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

Offer of Sale

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by provisions stated on a separate page of the document entitled ‘Offer of Sale’.

For additional information – call your local Parker Cylinder Distributor.

Wherever in the world machinery is designed, manufactured or used, Parker is there to meet your hydraulic and pneumatic application requirements – with complete component selection and total systems engineering, worldwide availability and technical assistance.

This catalog contains the information you need to order hydraulic and pneumatic cylinders and accessories. Arranged by product group, it contains complete specifications, dimensions, and ordering information, including technical data and reference material for designers, builders and users of fluid power machinery. No more shuffling through dozens of separate catalogs from dozens of separate suppliers.

And when you're ready to order, call your local Parker distributor for fast delivery and service. Or call your Parker Sales Office see listing on page VI.

Contents

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For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

Manufacturing Locations

Regional Plants

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221 Helicopter Circle
Corona, CA 92880
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Fax: (800) 869-9886

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80 Shaker Road
Enfield, CT 06082
Tel.: (860) 749-2215
Fax: (800) 323-0105

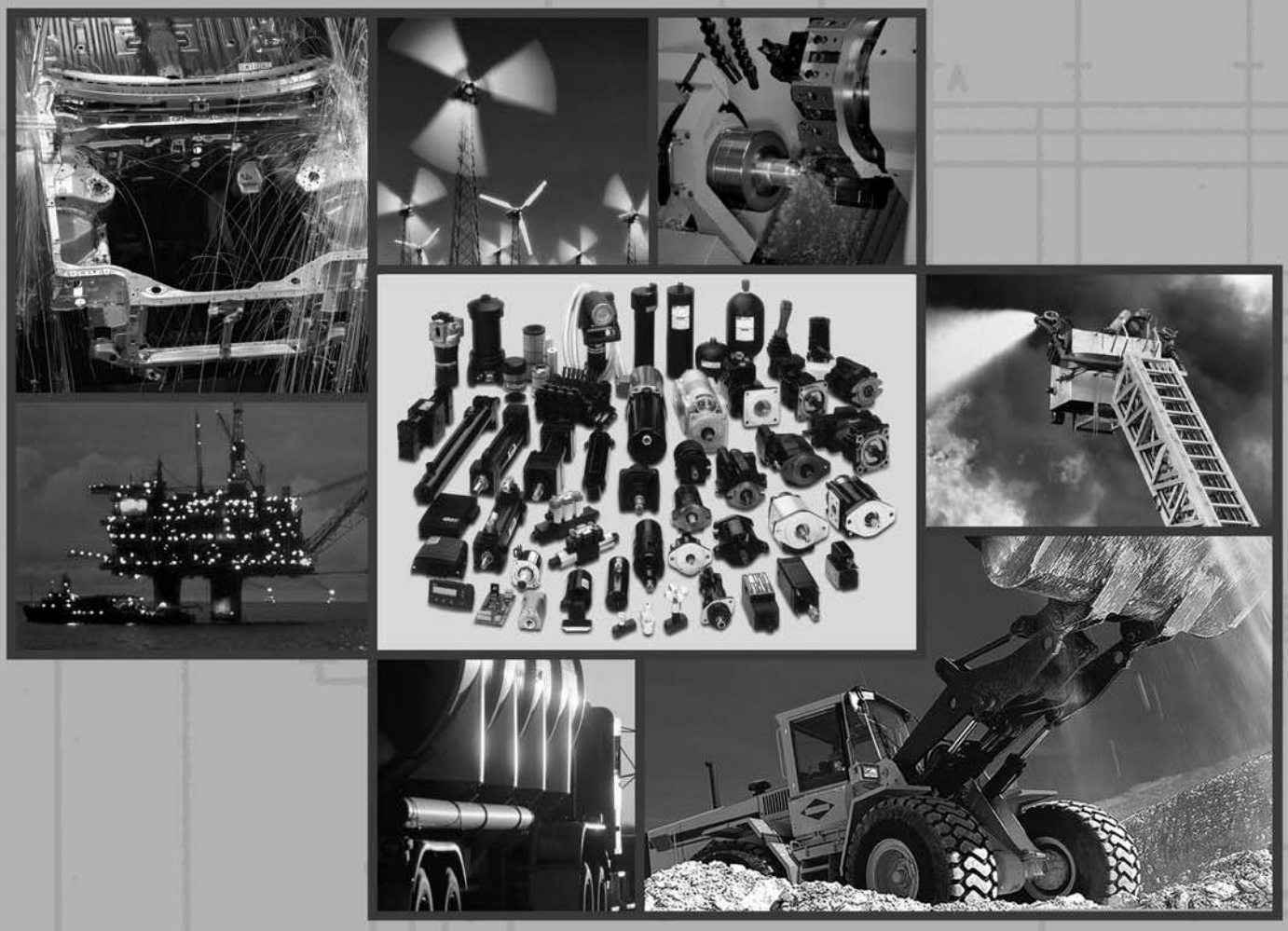
Georgia
1300 Six Flags Road
Lithia Springs, GA 30122
Tel.: (770) 819-3400
Fax: (800) 437-3498

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

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

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

For additional information – call your local Parker Cylinder Distributor.



Hydraulics

Components & System Solutions

Components and System Solutions

Parker Hannifin is a Fortune 500 corporation listed on the New York Stock Exchange as PH. Parker is the leading global manufacturer of the widest variety of components and systems designed to control motion, flow and pressure in all types of machinery and other equipment.

We offer over 1,400 product lines that control motion in 1,000 mobile, industrial and aerospace markets. Parker is the only manufacturer to offer its customers a choice of hydraulic, pneumatic, electromechanical and computer motion control solutions. And we have the largest distribution network in our field, with over 7,500 distributors serving more than 400,000 customers worldwide.

Parker products are found around the globe: in satellites orbiting the earth, machine tools, mobile equipment, oil rigs and refineries, laboratories and hospitals–any place where machines depend on motion or fluid control.

Parker offers one of the world's most extensive hydraulic product lines. From pumps and valves to motors and motion controllers, all of our products share a common heritage of advanced technology for your applications. They incorporate electronic control for precise motion, innovative new designs to reduce size, and a greater choice of functions than ever before. Parker hydraulic components and systems are designed to deliver precise, reliable control in space-saving, weight-saving packages.

Motors

Our full line of high and low speed motors provides power up to 15,000 in-lbs of torque. A complete range of sizes is offered in gear, gerotor and piston style operating configurations. Fixed and variable placement motors are available. Parker hydraulic motors deliver excellent performance with high efficiency, true wear compensation and longer service life.

Power Units

Parker offers the most complete line of standard, pre-engineered, cataloged hydraulic power units in the industry. We offer everything from five gallon vertical to 165 gallon overhead style platforms; Parker also offers custom power units that are designed and built to customer specifications. These units can be accessorized for almost any application, offering the convenience of one stop shopping in one quality unit.

Cylinders

Parker is a leading manufacturer of hydraulic cylinders for your most demanding applications. Our cylinders keep on performing like you would only expect from Parker. By offering you more power per pound and more power per dollar over millions of trouble-free cycles, Parker cylinders have proven to be the most reliable and cost effective cylinders available today.

Hydraulic Valves and Controls
We make hydraulic control valves for virtually every equipment application, from simple on/off functions to precise motion control. These include threaded cartridge valves, integrated hydraulic circuit blocks, bankable control valves, control valves, motion controllers, pressure control valves, manifold mounted directional and proportional valves.

Hydrostatic Steering Units
Parker offers a full line of hydrostatic steering units for a wide range of applications. These rugged components are designed to withstand system contaminant and engineered to handle higher oil pressure and temperatures than competitive products. A choice of sizes is offered in open center, closed center and load sense configurations.

Rotary Actuators
Parker is an industry leader in the design and manufacture of hydraulic rack and pinion, and vane style rotary actuators with torque output to 63 million in-lbs. In conjunction with our standard offering of rotary actuators, we work with customers on designs to meet specific application requirements. Rotary actuators provide smooth motion to perform a variety of actions including upending, turning, rolling over, tilting, indexing, transferring, mixing, valve operating, tensioning and clamping.

Pumps
Parker's broad line of energy-efficient hydraulic pumps includes fixed or variable displacement models in piston, vane and gear pumps. Designed to handle a wide range of applications, Parker hydraulic pumps are available with a full complement of electronic and computer controls. Like all Parker products, these pumps are manufactured with the finest materials under strict quality control. The result is a pump that delivers high efficiency and low maintenance under the toughest operating conditions.

Accumulators
Parker is the industry's most complete source for hydraulic accumulators and related products. We offer a complete range of piston, bladder and diaphragm type accumulators, as well as gas bottles, KleenVent reservoir isolators and other accessories. These reliable components improve hydraulic system efficiency by maintaining pressure, supplementing pump flow and absorbing system shocks. Sturdy construction provides years of efficient, reliable service.

Filtration
Filtration products by Parker are designed to maximize the reliability of your hydraulic systems and components with positive protection against fluid contaminants. Our comprehensive line of pressure and return line filters enhances machine life, reduces maintenance and lowers costs. High, medium and low pressure filters are offered, as well as portable filter carts and replacement elements.

Fluid Connectors
Parker has a complete line of fluid connector products and services for hydraulic systems. Products range from high-quality state-of-the-art fittings, valves and quick couplings to pressure hose that is available in a wide range of core-tube materials, reinforcement designs and outer covers. Our global distribution network and strategically located service centers ensure that you can get the products you need when and where you need them.

Your source for complete hydraulic system solutions.

Complete System Solutions
We are putting our 70 years of application engineering expertise to work for you by being the single source solution for your entire hydraulic system. Ordering a complete hydraulic system from Parker brings with it all of the benefits you have come to expect: quality, system integrity, worldwide distribution, extensive field support and premier customer service.

Sales Offices Worldwide

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6035 Parkland Boulevard
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direct (905) 693-3000
fax (905) 876-1958
www.parker.com

Parker Actuator Products

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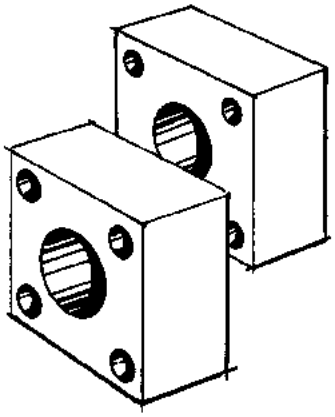
Parker Cylinder

Quality features, proven reliability
Parker cylinders…The Cylinders

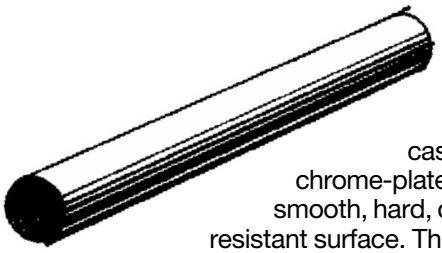
Parker cylinders have proven themselves in the only "test" that matters…the one you give it on the job.

Year after year, in all types of industrial applications, Parker Cylinders give reliability you can count on with minimum maintenance. The benefits to you are increased productivity at lower operating costs.

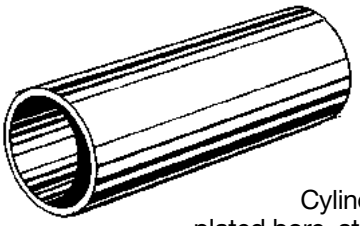
Parker offers an unmatched combination of quality features in the widest selection of industrial cylinders available. All to give you job-matched top performance and proven reliability.



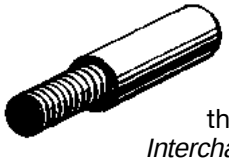
Square Steel heads and caps provide concentricity for mating parts. Both the steel head and cap are bored and grooved to assure concentricity to a common centerline for the cylinder body.



For example, the piston rod is case-hardened and chrome-plated to guarantee a smooth, hard, dent and scratch resistant surface. This increases seal and bearing life, reduces maintenance costs and assures dependable *long-life service.*

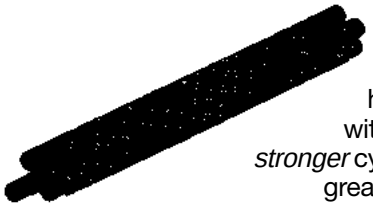


Cylinder bodies Hard chrome plated bore, steel tubing honed to a 15 micro inch finish.

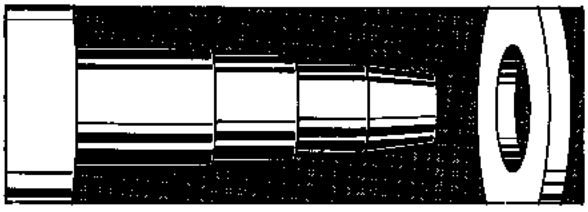


The high strength rod end stud has rolled threads providing threads reducing the possibility of fatigue failure. *Interchangeability*, easy conversion and/or repair of rod ends allow low cost modification or on-the-job repair. Anaerobic adhesive is used to permanently lock the stud to the piston rod.

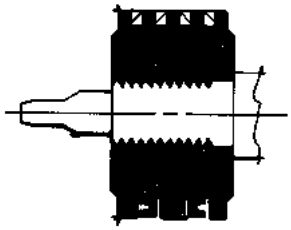
Parker cushions are the *longest* in the industry, providing the finest cushioning control available in a standard cylinder. The floating, self-centering bushing delivers high efficiency by increasing "out-stroke" speed. This all adds up to a no-compromise design that provides longer machine life, safer deceleration and greater reliability. Cushions are furnished when ordered without increasing overall cylinder length.



Tie rods are also high strength material with rolled threads for a *stronger* cylinder assembly and greater product reliability.



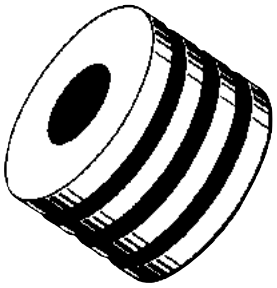
Parker's *new* adjustable, *floating stepped cushion design* is economical and flexible for even the most demanding applications. It provides superior performance in reducing hydraulic shock. Cushioning time is reduced up to 50%, permitting faster machine operating cycles for increased productivity. It reduces machine noise for less downtime and lower maintenance costs.



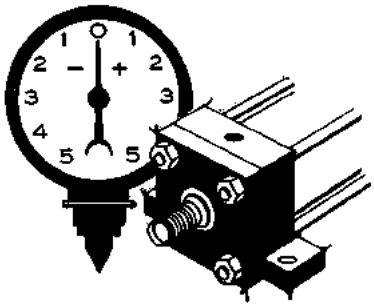
The long, full size piston-to-rod thread *connection* acts as a shock absorber and helps resist side loading. For added strength the piston-to-rod thread increases with the rod diameter thereby increasing the thread strength up to 314% for safety-assured performance in a given bore size.

For additional information – call your local Parker Cylinder Distributor.

and service are the hallmark of all Preferred Around the World.

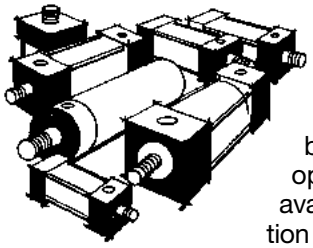


The *one-piece, wide surface*, nodular iron piston reduces bearing loads. The piston is piloted to ensure concentricity. Loctite is used to permanently lock the piston to the rod.



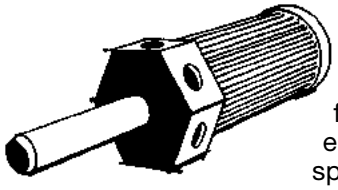
Feature after feature, the Parker story is the same. Parker cylinders are premium quality cylinders and have what it takes to give you the top performance you require. Cylinders designed and engineered for *greater production profitability* to save you unnecessary cost in downtime. To make sure every cylinder is premium quality, we subject each one, not just batch samples to tough inspection and performance tests.

Static O-ring body seals are *pressure energized*, compensating and positive sealing for less maintenance cost and downtime saving oil losses and allowing quick, easy repair.

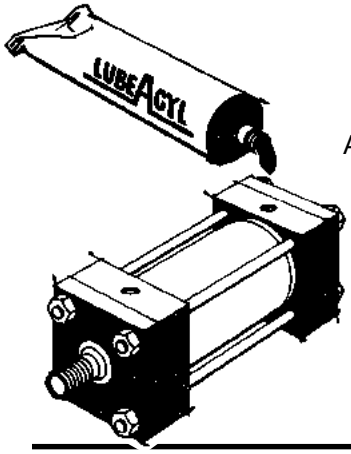


More selection and availability. Parker offers you the largest selection of sizes, bores, strokes, mountings, options, and accessories available. The kind of selection that lets you "customize" cylinders to fit your application. There are over 5 million different cylinders in our standard line alone. Parker's engineering capabilities are backed by over 60 years of manufacturing experience to meet all your cylinder requirements of today…and tomorrow.

Parker spherical bearings virtually eliminate alignment problems normally associated with the use of pivoting cylinders. Spherical bearings simplify difficulties with machine alignment. Even with misalignment of up to 4.5° performance remains satisfactory without creating any excessive cylinder wear.



Specials? Absolutely! Parker has the Sales, Engineering and Manufacturing capability and experience to provide special cylinders to meet your custom specifications and requirements. Let your imagination be your guide. We're ready to give you any technical assistance you might need. We will help turn your ideas into reality by providing special cylinder designs for you to create new machinery…solve a difficult production problem… or improve existing equipment.



Air cylinders are factory pre-lubricated with Parker Lube-A-Cyl for normal operation and provide *millions of trouble-free* cycles. This greatly reduces both operating and maintenance costs.

The best in factory-trained fluidpower technical help is available from your Parker distributor's servicemen who are as close as your phone. They receive intensive training in cylinder design, application and maintenance at Parker facilities and regional training centers. They're always ready, eager and able to service all your cylinder requirements.

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

Parker Pneumatic Check Seal Cushion

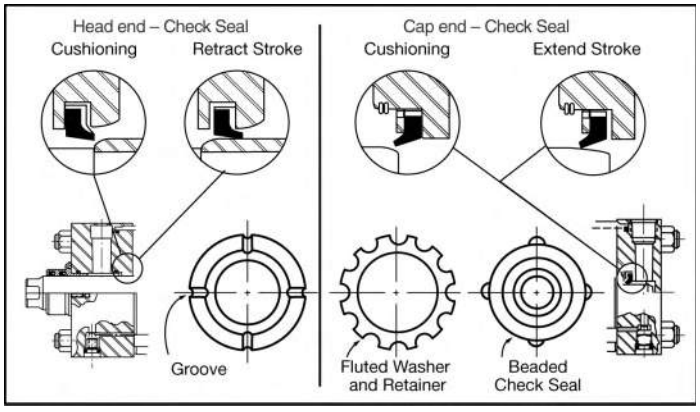
New Series MA air cylinder check seal cushions provides fast response, low wear, and low pressure drop.

Parker engineers have developed a new concept in air cylinder cushions…the "check seal". The new Parker check seal cushion combines the sealing capabilities of a lipseal for efficient capture of air for effective cushioning with check valve action for quick stroke reversal.

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

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

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



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

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

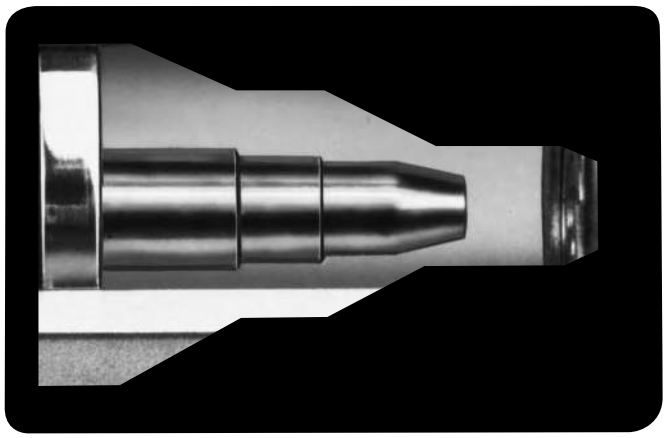
As pressure is applied to the head-end port on retraction, the air forces the seal towards the inside of the cylinder. The air then flows around the O.D. of the seal and through the flutes of the seal washer. Full-flow, quick starts with little or no pressure drop is just one of the major benefits of the design.

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

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

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

For additional information – call your local Parker Cylinder Distributor.



the Great Shape

a new cushion design that makes Parker hydraulic cylinders perform even better

- Faster cushioning time
- Reduced hydraulic shock
- Reduced machine noise
- Lower machine maintenance

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

Hydraulic Cylinder Cushioning:

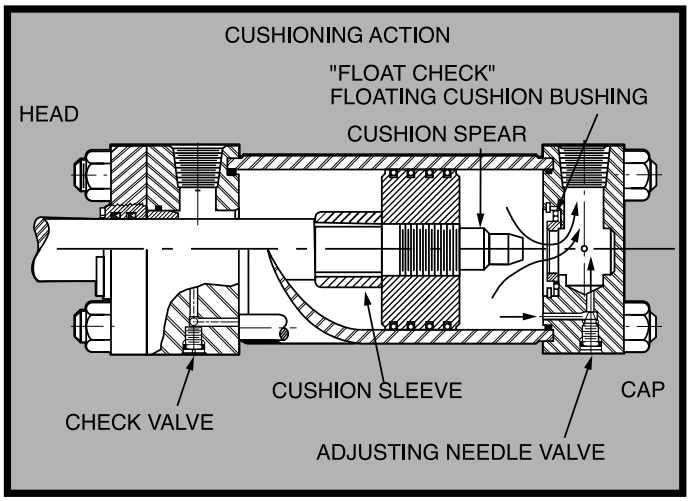
The control of kinetic energy

Moving loads faster with heavy-duty hydraulic cylinders – In today's machinery and machine tools, hydraulic cylinders are required to stop heavy loads at increasingly faster rates. Every second saved can increase productivity and reduce costs. So the machine designer must find ways to operate cylinders as fast as possible.

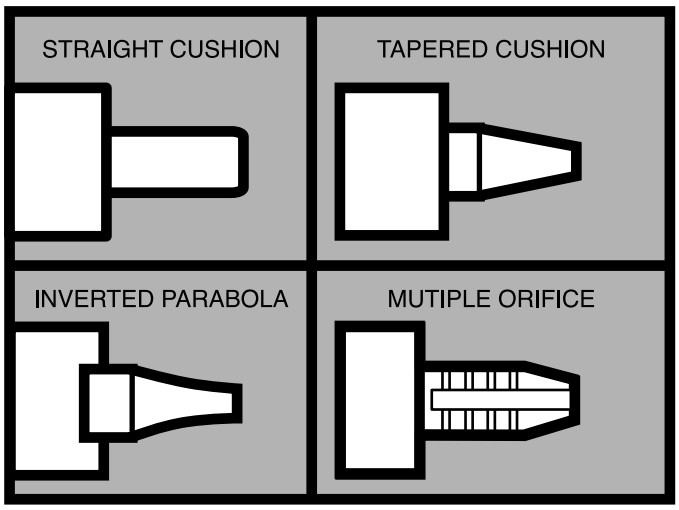
Merely speeding up a cylinder eventually leads to unacceptable hydraulic shock loads. The high inertial forces developed at the end of the stroke must be stopped without damaging the cylinder or the load.

Cushioning to control kinetic energy – One way to maintain a higher average velocity in cylinders is to incorporate cushions at the end of the stroke. These integral deceleration devices are designed to minimize excessive deceleration forces and peak hydraulic pressures which result from a sudden change of velocity.

Ideally, the cushion should achieve constant deceleration by developing constant pressure during the time of deceleration. In hydraulic cylinders, special shaping or contouring of the cushion spear or sleeve has been employed to provide programmed deceleration for the unit.



Design of Cylinder Cushions – In cushioning of hydraulic cylinders, the spear or sleeve closes the main exhaust passage in the cylinder head or cap, confining the fluid between the piston and the head or cap. The trapped fluid is metered at a somewhat controlled rate around the cushion spear and through bypass orifice that is adjusted with a needle valve. In the reverse direction, fluid bypasses the needle valve by means of check valve in the cylinder. The cushion must center itself properly regardless of the piston and bore clearance situation. To facilitate mechanical engagement with the mating orifice, a short taper is used on the leading portion of the cushion spear or sleeve. In addition, the clearance annulus must be concentric so the fluid flow characteristics remain consistent from one stroke to the next. Parker cylinders use floating bushings and floating cushion sleeves to assure concentricity of the flow annuli. Some designs, however, do not provide the floating feature, thereby increasing the chances of eccentricity of mating cushion parts. When cushion parts do not mate concentrically on each cycle, undercushioning or erratic cushioning results.



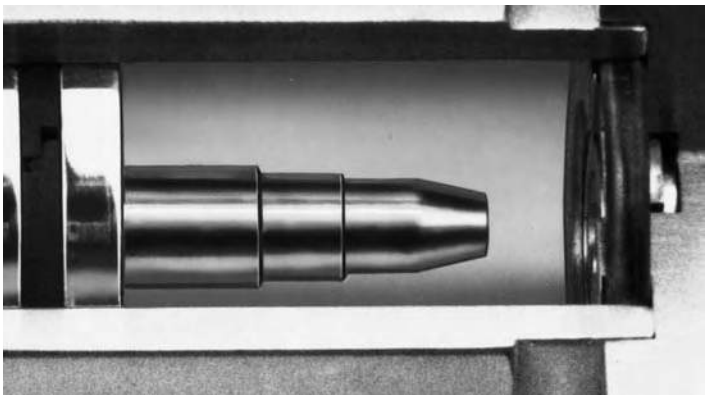
The most common cushion design is a straight spear or sleeve with a fixed clearance. The straight cushion has been used in a broad range of cylinder applications. It is economical to produce, but provides cushioning in a relatively narrow combination of loads and speeds.

Another common cushion design is the tapered configuration. Most often, it consists of a 1/2 degree taper for 2/3 the length of the cushion stroke, followed by a straight diameter for the last 1/3 of the stroke. Although economical to produce, the tapered cushion normally requires a series of multiple tapers to achieve the desired performance.

In conventional hydraulic cylinders, the theoretical shape for a constant deceleration cushion is an inverted parabola properly sized for the cylinder. This design is extremely expensive to machine, so cannot be economically used on a broad range of products.

Another design, using a series of orifice holes in the cushion sleeve or spear, can also achieve constant deceleration. This multiple orifice or piccolo type cushion is also very expensive to machine and control. As a result, it is only used on specially engineered cylinders.

For additional information – call your local Parker Cylinder Distributor.



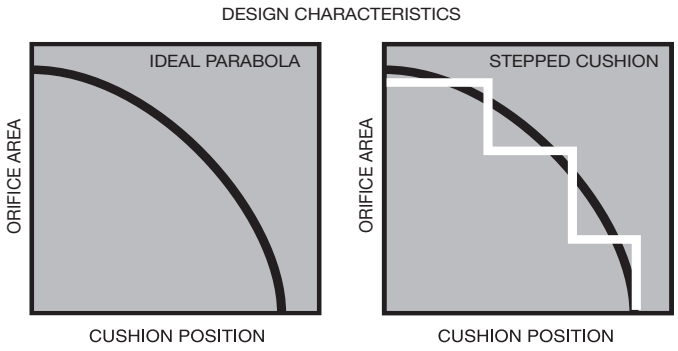
The Stepped Cushion

A new shape with great performance advantages

Stepped cushions combine the best features of known cushion technology – The stepped cushion is a totally new approach in cushioning of hydraulic cylinders. By engineering a new design configuration, Parker has developed a cushion that increases performance over conventional straight and tapered cushions used in heavy duty cylinders.

Advantages of hydraulic cylinders equipped with the Parker stepped cushion include:

- Faster cushioning time
- Reduced internal and external shock
- Reduced machine noise
- Lower machine maintenance

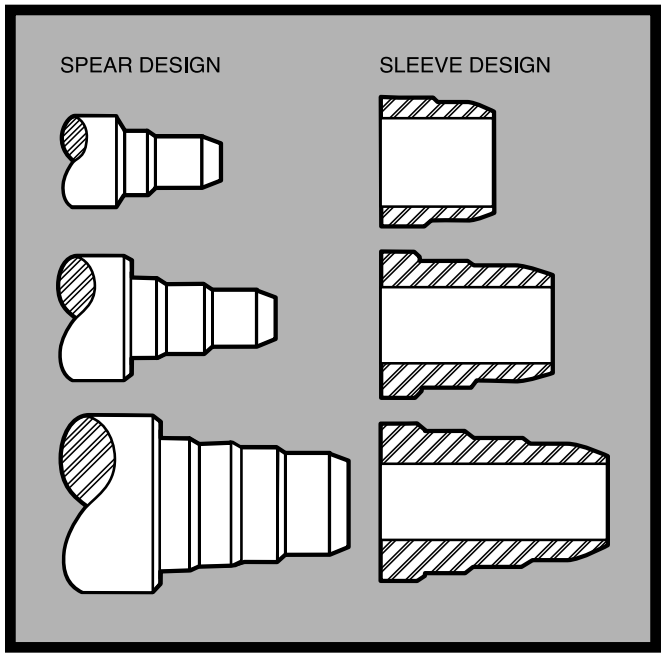


Success of the new design lies in a stepped spear or sleeve which for specific load and velocity conditions, achieves deceleration curves that come very close to the ideal performance curve. The ideal cushioning curve is one which is developed through the use of an inverted parabola cushion which achieves rapid reduction of orifice area near the end of the cushion stroke. With the stepped cushion, a series of steps are calculated to approximate the theoretical orifice area curve. The shape of the cushion allows kinetic energy to be absorbed gradually and smoothly over the entire cushioning stroke.

New standard option in Parker heavy duty hydraulic cylinders – The stepped cushion replaces the straight cushion as a standard option on Parker Series 2H heavy duty hydraulic cylinders. And they're available at the same price as the previous straight cushions.

The new cushions can be supplied at the head end, cap end or on both ends. The cushion spear or sleeve is machined to close tolerances, assuring that the steps provide the proper deceleration characteristics.

Three types of spear and sleeve designs are employed on Series 2H cylinders. They are required, because in analyzing bore sizes to maximize performance, tests showed that more steps were needed for the higher energy absorption common to larger bore cylinders.



Specify the Stepped Cushion to meet demanding performance requirements – Evaluate all the facts about the new stepped cushion from Parker. And consider its performance advantages when you specify heavy duty hydraulic cylinders.

More details are available in the Parker Series 2H Catalog.

For Cylinder Division Plant Locations – See Page II.

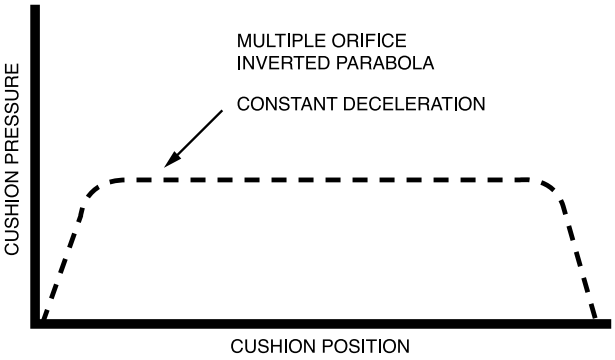
Parker Cylinder

Cushion Performance:

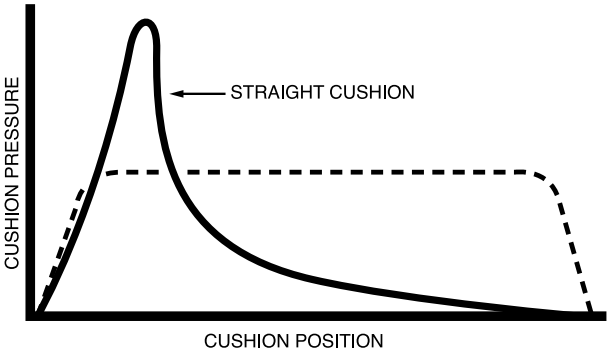
Designing for effective deceleration

Performance of the various cushion designs can be measured by the pressure changes that occur as the cushion stroke takes place. Since cushion pressure is a measure of the retarding force, it shows the resulting deceleration forces.

Pressure curves developed by the various cushion designs demonstrate cushioning performance. The theoretically ideal pressure-stroke curve is a straight line, showing that cushion action had constant pressure characteristics. The total area under the curve represents the kinetic energy absorbed. This constant deceleration curve can be produced with the ideal inverted parabola and multiple orifice cushion designs. However, neither of these designs are economical for most hydraulic cylinder applications in industry today.

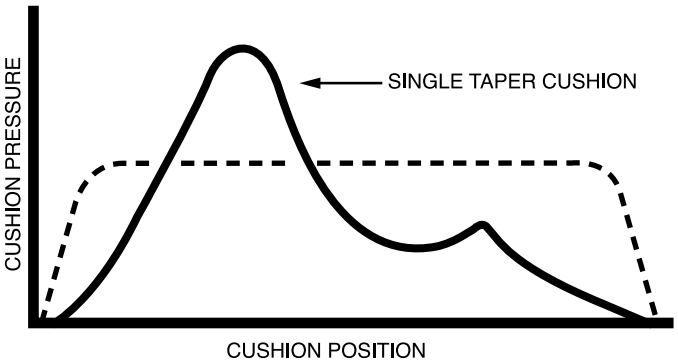


The straight cushion typically develops a very high initial pressure peak. Then, it degrades gradually as the stroke continues with fluid being metered through the fixed clearance annulus. As a result of high peak pressure, the straight cushion produces high shock levels, contributing to machine vibration, noise, and wear.

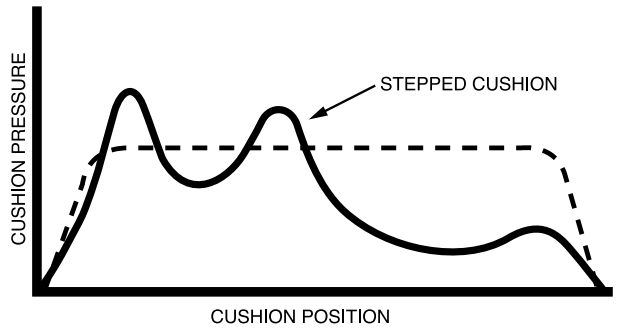


A single taper cushion develops lower initial shock than the straight design, but often delays pressure development, resulting in under cushioning.

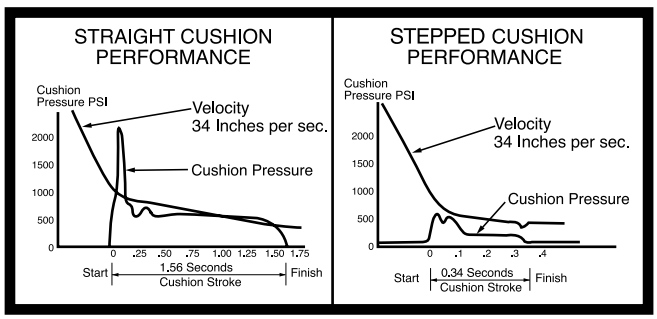
The new Parker stepped cushion design (with a three-step spear) develops three pressure pulses which more closely



approximate the constant deceleration curve. Pressure peaks are lower than those of both the straight and tapered cushions, resulting in significantly lower hydraulic shock.



A comparison of actual pressure traces produced by a stepped cushion versus a straight cushion under the same conditions further demonstrates advantages of the new design. The stepped cushion not only reduces internal and external shock, it also saves time during the cushion stroke. It can reduce shock up to 90% and reduce cushioning time up to 50% — a dramatic performance improvement. As a result, faster machine operating cycles are possible. And lower shock reduces machine noise and maintenance.

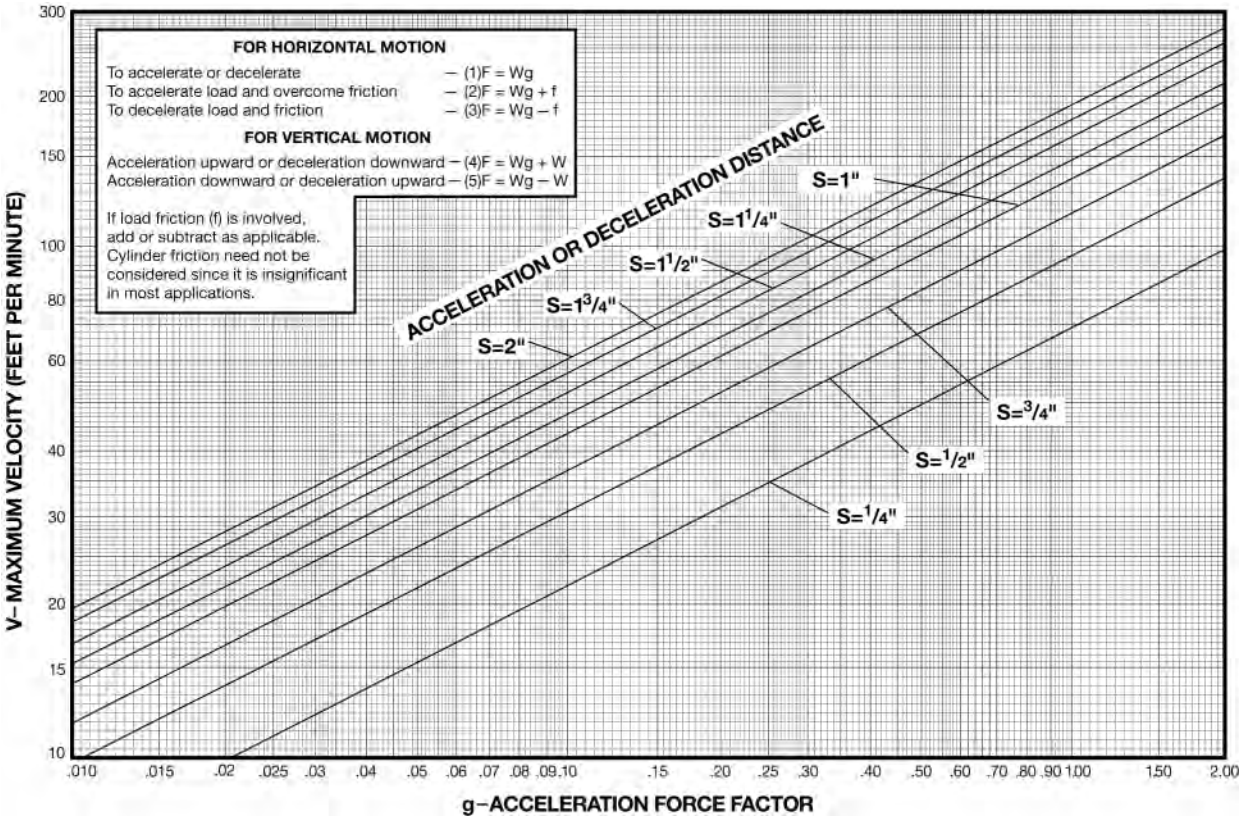


For additional information – call your local Parker Cylinder Distributor.

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 the chart, the force necessary to accelerate or decelerate a cylinder load may be found by solving the formula (as shown in chart below) applicable to a given set of conditions.

The chart represents ideal conditions and makes no allowance for losses. Possible losses due to leakage past the cushion fits or through the adjustable needle valve result in a .85 efficiency factor for deceleration in cushioning.



Nomenclature

- V = Velocity in feet per minute
- S = Distance in inches
- F = Force in pounds
- 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:

$$g = \frac{v^2}{s} \times .0000517$$

EXAMPLE: Horizontal motion of a free moving 6,000 pound 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 pounds 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 pounds 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 6,000 pound load is required by using a 1" long cushion in a 5" bore cylinder having a 2" diameter piston rod. Cylinder bore area (19.64 Sq. In.) minus the rod area (3.14 Sq. In.) results in a minor area of 16.5 Sq. In. at head end of cylinder. A 1,000 p.s.i. pump delivering 750 p.s.i. at the cylinder is being used to push the load at 120 feet per minute. Friction coefficient is 0.15 or 900 lbs.

In this example, the total deceleration force is the sum of the force needed to decelerate the 6,000 pound load, and the force required to counteract the thrust produced by the pump.

- W = Load in pounds = 6,000
- S = Deceleration distance in inches = 1"
- V = Maximum piston speed in feet per minute = 120
- g = .74 (from chart)
- f = 900 pounds

Use formula (3) F = Wg -f

(F = Wg – f) = (F = 6,000 x .74 – 900) = 3,540 Pounds

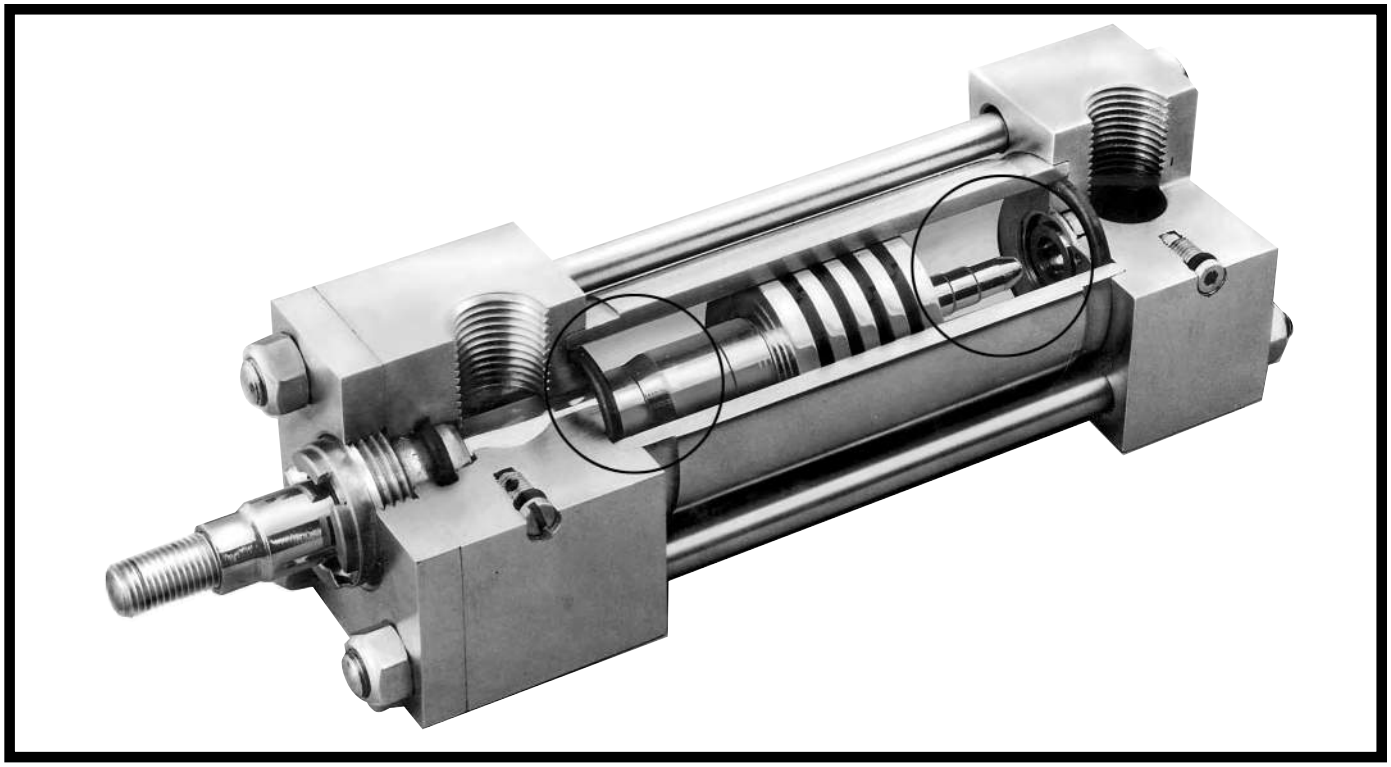
The pump is delivering 750 p.s.i. acting on the 19.64 Sq. In. piston area producing a force (F_2) of 14,730 pounds. This force must be included in our calculations. Thus F + F_2 = 3,540 + 14,730 = 18,270 pounds total force to be decelerated. Correct for cushion delivery of .85 or 18,270 ÷ .85 = 21,495.

The total deceleration force is developed by the fluid trapped between the piston and the head. The fluid pressure is equal to the force (21,495 pounds) divided by the minor area (16.5 Sq. In.) equals 1303 p.s.i. This pressure should not exceed the non-shock rating of the cylinder.

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

For Cylinder Division Plant Locations – See Page II.

Specify The Parker Stepped Cushion



For
- reduced shock up to 90%
- less noise
- less maintenance
- cushioning time reduced up to 50%

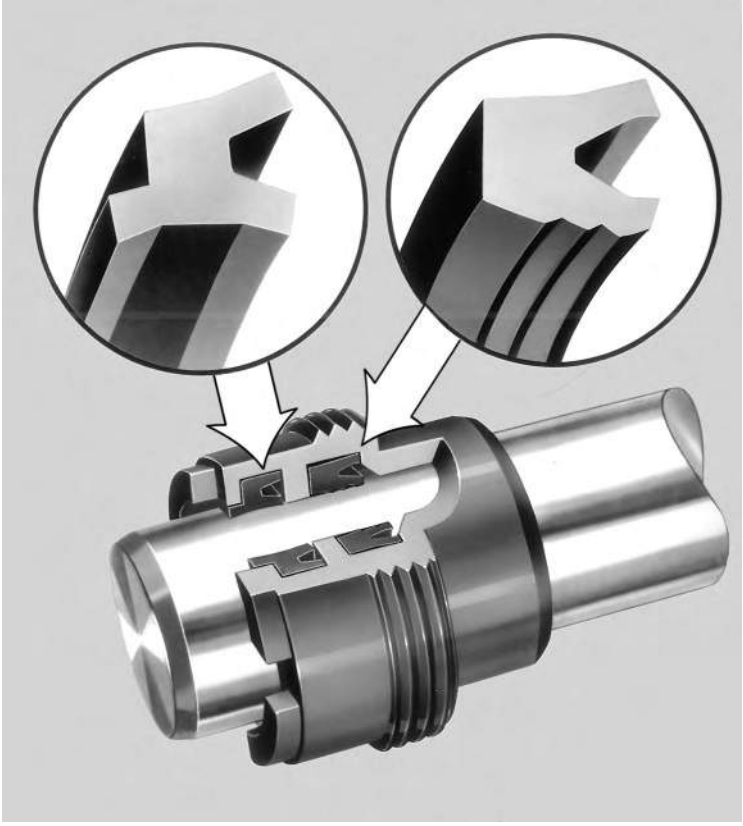
We're In Great Shape To Serve You!

For additional information – call your local Parker Cylinder Distributor.

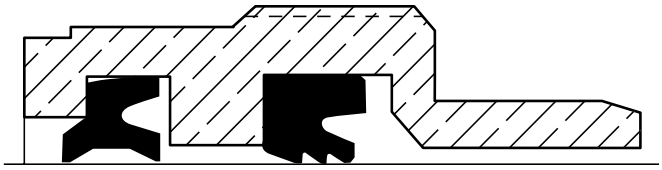
The "Jewel" Gland
An exclusive feature of Parker cylinders

Now with Parker Cylinder's Exclusive TS-2000 Rod Sealing System

• What Is It? • Why Is It Required? • How Does It Work?



What Is It?



The Parker “Jewel” gland cartridge is a combination of elements designed exclusively for sealing fluids when used in conjunction with reciprocating shafts.

Why Is It Required?

Throughout the history of fluid power, the one seemingly insurmountable problem faced by the user of reciprocating hydraulic equipment was a “wet rod”. The problem had been lived with for so many years that the sight of a puddle of oil under the rod end of the cylinder was almost characteristic, and no one seemed to be doing anything about it. With the increase in demand for the advantages of fluid power in such industries as food, medical instruments, etc, plus the increasing costs of maintenance, it became obvious that the old, previously accepted standards were no longer acceptable.

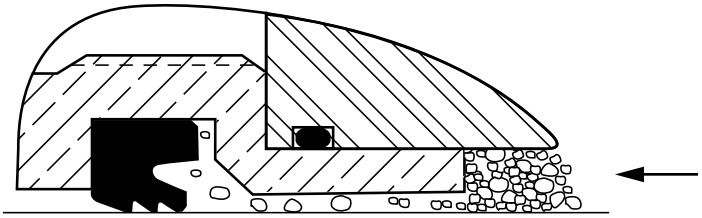
How Does It Work?

The “Jewel” gland assembly consists of the cartridge gland, serrated TS-2000 rod seal, and Wiperseal. Each has a multiple job to perform.

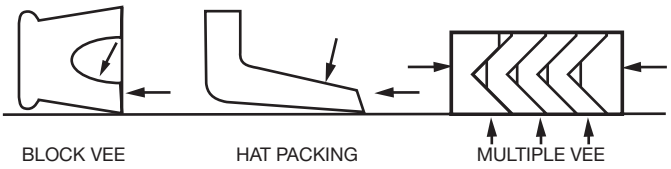
Let’s start from the beginning. The fluid approaches the rod end of the cylinder and tends to follow the rod out. The fluid has a natural tendency to grip the rod (adhesion) with a force depending upon the viscosity (among other factors) of the fluid. Now note that the gland bearing is inboard of the sealing members. This not only keeps the bearing lubricated, which is in itself an important feature, but it also results in an initial shearing of the viscous fluid which occurs as the rod passes through the bearing.

This leading edge of the bearing also acts as a pressure snubber when subjected to high hydraulic shocks from the system, and it tends to tame the pressure variations felt by the TS-2000 rod seal.

The serrated TS-2000 rod seal is a truly pressure compensating *unitary* rod seal. Look for a moment at the conventional seals.

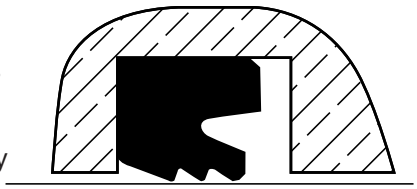


The block vee and hat packing are both low friction type seals and depend upon fine line contact with the rod to effect the seal at a minimum friction value. By scientific optical methods, investigation has indicated this “theory” is short lived as pressure increases. As the pressure increases, the critical edge lifts from the rod, or you might say the line of contact moves away from the pressure.



Essentially, what you now have is an O-ring type contact. The critical shearing edge is gone.

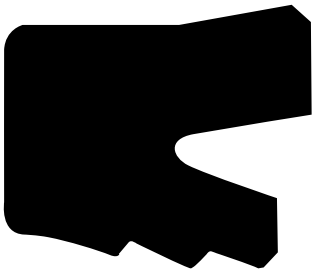
As an example of this, hold a tablet of paper with one edge on the desk. A single sheet of paper will not pass under. Roll the edge of the tablet up and the single sheet easily passes under.



In the compression type packing, (multiple vee) the natural inclination of the maintenance man is to increase the compressive force on the seal gland in an effort to seal off the leak, but this only makes matters worse. The additional friction adds to the wear and the seals quickly wear out and have to be replaced. Multiple vee’s tend to wedge open and throw the point of maximum contact pressure of the seal against the rod, away from the theoretical sealing edge.

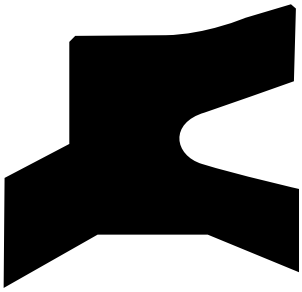
For additional information – call your local Parker Cylinder Distributor.

The serrated TS-2000 rod seal, on the other hand, has three shearing edges on a common lip. As the pressure increases and the line contact moves forward, a “new” shearing edge takes over. The increase in friction with increase in pressure is held to a minimum, yet the sealing qualities of the unitary seal are constant throughout the pressure range.

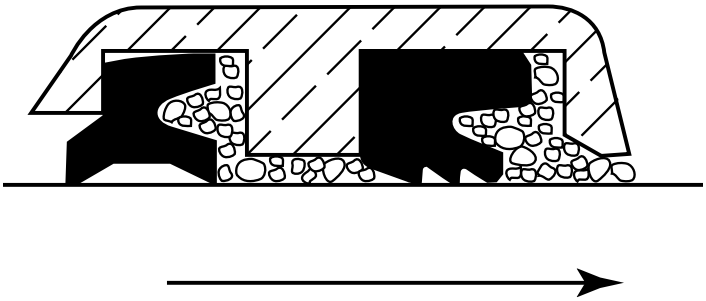


The only fluid adhering to the rod at this point is that very thin layer which is usually “scraped” off the rod on the return stroke by the rugged rod wiper. The solution to this is relatively simple. Don’t let it get out.

We can accomplish this with the Parker developed double-lip Wiperseal. Note the sturdy inner lip. This, in essence, is a scraper. It removes the “last” layer of oil that clings to the bitter end, and traps it between the Wiperseal and TS-2000 rod seal. The rod emerges from the cylinder dry. (Note: “Dry” is a relative term. In our usage, we mean that there is not enough excess oil left on the rod to be scraped off and “collar”. In reality, due to the mirro-structure of the ground, polished and plated surface of the rod, some lubrication remains, which cannot be wiped off.) There is nothing left to be removed by the wiper lip on the return stroke except the dirt and grit which it is designed to remove.



Let’s look at the return stroke now. What happens to the fluid trapped between the Wiperseal and TS-2000 rod seal? (Note the general configuration of the TS-2000 rod seal.)



With the rod extending, the seal is rigid, digging in, resisting the motion of the rod. Now look at it from the other direction, with the rod retracting. It is flexible, able to move out of the way and ride over the oil clinging to the rod on the way back. It acts like a built-in check valve. The fluid trapped in the chamber between the seal is thus carried back into the cylinder on the return stroke. In addition to the oil “carried” back, if sufficient oil gets past the TS-2000 on the way out to build up a pressure between the seals, the pressure “pops” the oil back at the end of the stroke in normal applications when pressure in the head end of the cylinder drops to a low value during reversal.

Now, let’s look at the gland in general. The O-ring seal provided for the O.D. of the gland also serves as a prevailing torque locking device, to prevent rotation of the gland when in service.

Realizing that the gland and seal combination is subject to normal wear and will eventually need attention, the gland has been designed to minimize down time and maintenance costs. The threaded design is far superior for several reasons. The snap ring retained type always has some end play. This results in wipeage of the hydraulic fluid past the O.D. sealing ring. The totally retained type requires the cylinder tie rod nuts to be removed and, in reality, the cylinder almost disassembled. With the threaded design, the gland assembly can be removed without disturbing the rest of the cylinder, and yet is securely held during service.

Why Is The Parker "Jewel" The Best Gland On The Market?

Because it is designed with superior oil and water resisting seals of the fully dynamic type. The TS-2000 Rod Seal compensates automatically for pressure, temperature and wear conditions. This feature, coupled with our method of retaining these seals in the gland, results in a practically tamper-proof seal.

Look at a cross-section of the "JEWEL." As the rod strokes out from the seal, the rod motion and its friction tend to dynamically flex the inner edge of the TS-2000 rod seal in contact with the rod. This provides a cutting action to shear the oil from the rod, allowing the rod to pass out of the TS-2000 rod seal practically dry. Imagine that some oil wipes past the TS-2000 rod seal as the piston rod strokes out. It won't get far for it is stopped by the inner lip of the Wiperseal and is held between it and the TS-2000 rod seal. As the rod returns, any dirt or foreign matter which has collected on the rod is wiped off by the leading edge, or outer lip of the Wiperseal.

At the same time, any oil which may be trapped between the Wiperseal and the TS-2000 rod seal tends to adhere to the rod; and because of the rod motion, a dynamic flexing action of the TS-2000 rod seal occurs which causes the oil to be returned past the TS-2000 rod seal into the cylinder proper. In other words, we have an automatic check valve that prevents any appreciable amount of oil to leak past the seals, and then returns any that has managed to wipe by the TS-2000 rod seal.

The location of the bearing area of this remarkable gland is unique. Note that the major bearing surface is on the *cylinder* side of the seals. This assures optimum lubrication and cooling of this vital surface by the fluid used in the cylinder.

The O-ring seal on the O.D. of the gland also serves as a prevailing torque locking device to prevent rotation of the gland when in service.

Realizing that even the best gland and seal combination will eventually need attention, Parker-Hannifin engineers have designed the gland to minimize down time and maintenance costs. A threaded gland is more expensive to make than a snap ring retained type. However, we feel that the threaded design is far superior for at least two reasons. First, the snap ring retained type always has some end play. This results in wipeage of the hydraulic fluid past the O.D. sealing ring. Second, the threaded construction is preferred by hydraulic maintenance men. They prefer to unscrew a part rather than to "fish it out" (providing they have managed to locate the tools to remove a snap ring.)

Almost every hydraulic engineer to whom we have shown the "Jewel" has exclaimed…"This makes SENSE!"

For additional information – call your local Parker Cylinder Distributor.

Pneumatic Cylinders Index…

A

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

Parker Series 2A Air Cylinder

When the job calls for reliable, heavy-duty performance, specify Series 2A. A 100,000 psi yield strength chrome-plated, case-hardened piston rod. A 125,000 psi yield strength rod-end stud with rolled threads. 100,000 psi yield strength tie rods. With construction like this, the Parker Series 2A is rated for air service to 250 psi. This is one heavy-duty air cylinder that's really heavy duty.

They're truly premium quality cylinders, factory prelubricated for millions of maintenance-free cycles. And to make sure every cylinder is premium quality, we subject each and every one – not just batch samples – to tough inspection and performance tests. See pages 18 and 19 for the inside story on all the features that make Series 2A the high performance, long lasting choice for all your heavy-duty air applications.

For additional information – call your local Parker Cylinder Distributor.

Standard Specifications

- Heavy Duty Service – ANSI/(NFPA) T3.6.7R2-1996 Specifications and Mounting Dimension Standards
- Standard Construction – Square Head – Tie Rod Design
- Nominal Pressure – Up to 250 PSI Air Service
- Standard Fluid – Filtered Air
- Standard Temperature – -10°F. to +165°F.
- Bore Sizes – 1" through 14" (Larger sizes available)

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

- Piston Rod Diameter – 1/2" through 5 1/2"
- Mounting Styles – 17 standard styles at various application ratings
- Strokes – Available in any practical stroke length
- Cushions – Optional at either end or both ends of stroke. "Float Check" at cap end.
- Rod Ends – Three Standard Choices – Specials to Order

*See section C, "Operating Fluids and Temperature Range" for higher temperature service.

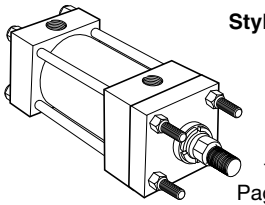
Note: Series 2A Air Cylinders fully meet ANSI/(NFPA) T3.6.7R2-1996 Specifications and Mounting Dimension Standards for Square Head Industrial Fluid Power Cylinders. Parker Style TB, JB, HB, C, DB, and BB are available in 7" bore size, see page 32.

A

Available Mounting Styles

Tie Rods Extended Head End

Style TB



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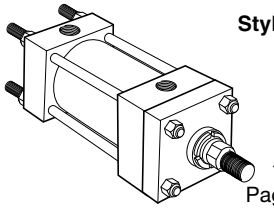
Tie Rods Extended Cap End

Style TC



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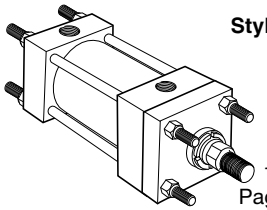
Tie Rods Extended Both Ends

Style TD



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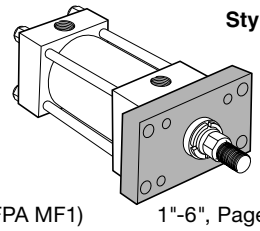
Head Rectangular Flange

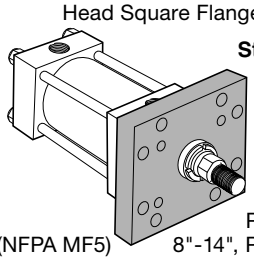
Style J



(NFPA MF1) 1"-6", Page 20

Head Square Flange

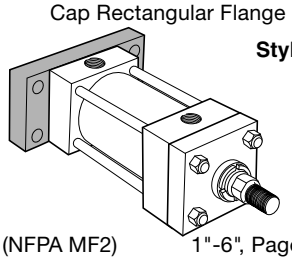
Style JB



1"-6", Page 22
(NFPA MF5) 8"-14", Page 34

Cap Rectangular Flange

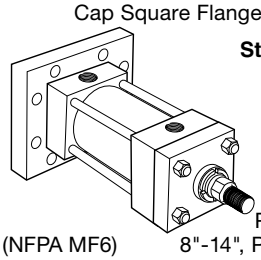
Style H



(NFPA MF2) 1"-6", Page 20

Cap Square Flange

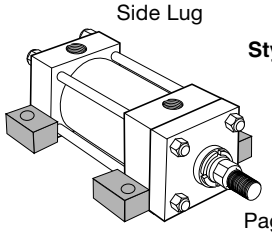
Style HB



1"-6", Page 22
(NFPA MF6) 8"-14", Page 34

Side Lug

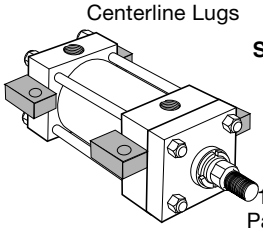
Style C



1"-6", Page 24
(NFPA MS2) 8"-14", Page 36

Centerline Lugs

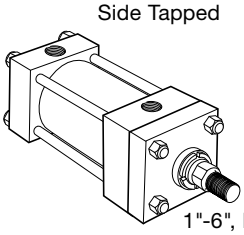
Style E



1 1/2"-6", Page 24
(NFPA MS3) 8"-14", Page 36

Side Tapped

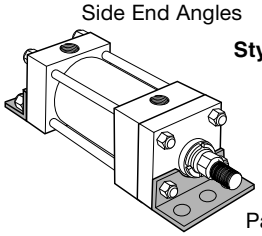
Style F



1"-6", Page 24
(NFPA MS4) 8"-14", Page 38

Side End Angles

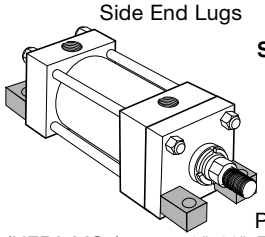
Style CB



1"-6", Page 26
(NFPA MS1) 8"-14", Page 40

Side End Lugs

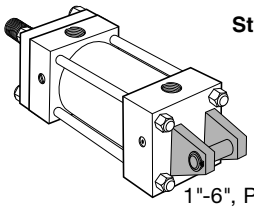
Style G



1"-6", Page 26
(NFPA MS7) 8"-14", Page 38

Cap Fixed Clevis

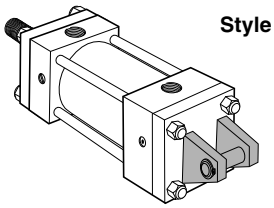
Style BB



1"-6", Page 30
(NFPA MP1) 8"-14", Page 40

Cap Detachable Clevis

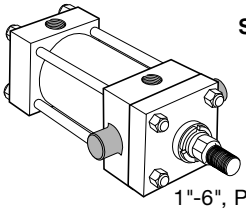
Style BC



(NFPA MP2) 1"-6", Page 30

Head Trunnion

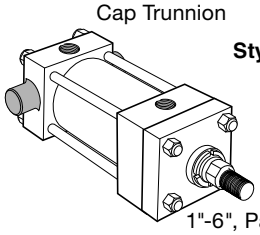
Style D



1"-6", Page 28
(NFPA MT1) 8"-14", Page 42

Cap Trunnion

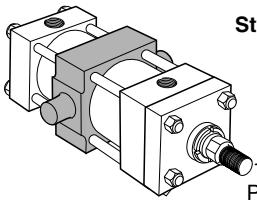
Style DB



1"-6", Page 28
(NFPA MT2) 8"-14", Page 42

Intermediate Fixed Trunnion

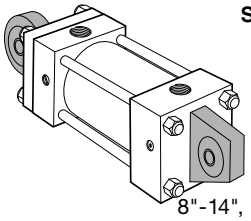
Style DD



1 1/2"-6", Page 28
(NFPA MT4) 8"-14", Page 42

Spherical Bearing

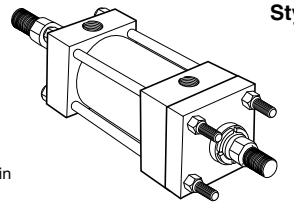
Style SB



1 1/2"-6", Page 44
8"-14", Page 45

Double Rod Cylinders

Style KTB Shown



Most of the above illustrated mounting styles are available in double rod cylinders. See Catalog Page 46.

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

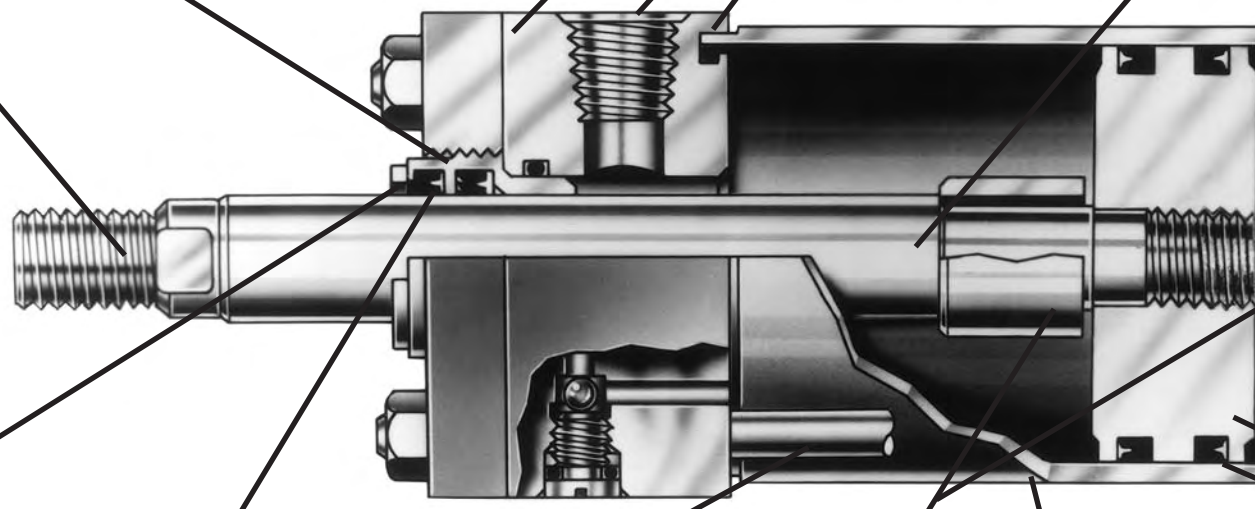
The inside story on why Series 2A is your best choice in heavy duty pneumatic cylinders

Steel Head – Bored and grooved to provide concentricity for mating parts.

Ports – NPTF ports are standard.

End Seals – Pressure-actuated cylinder body-to-head and cap "O" rings.

Primary Seal – Unique Serrated Lipseal™ is a proven leakproof design, completely self-compensating and self-relieving to withstand variations and conform to mechanical deflection that may occur.



Piston Rod Stud – Furnished on 2" diameter rods and smaller when standard style #4 rod end threads are required or on 1 3/8" diameter rods and smaller when style #8 threads are required. Also available in 2 times the catalog "A" dimension length. Studs have rolled threads and are made from high strength steel. Anaerobic adhesive is used to permanently lock the stud to the piston rod.

"Jewel" Rod Gland Assembly – Externally removable without cylinder disassembly. Long bearing surface is inboard of the seals, assuring positive lubrication from within the cylinder. An "O" ring is used as a seal between gland and head, and also serves as a prevailing torque-type lock.

Secondary Seal – Double-Service Wiperseal™ – acts as a secondary pressure seal on the extend stroke and cleans the rod on the return stroke.

High Strength Tie Rods – Made from 100,000 psi minimum yield steel with rolled threads for added strength.

Adjustable Floating Cushions – Cushions are optional and can be supplied at head end, cap end, or both ends without change in envelope or mounting dimensions.

The Cylinder Body – Hard chrome-plated bore, steel tubing honed to a 15 micro inch finish on 1 1/2" through 14" bore sizes. 1" bore size is aluminum with hard-coated bore.

Adjustable floating cushions

Cushions are optional, and can be supplied at head end, cap end, or both ends without change in envelope or mounting dimensions. All Parker cushions are adjustable.

The Series 2A cylinder design incorporates the longest cushion sleeve and cushion spear that can be provided in the standard envelope without decreasing the rod bearing and piston bearing lengths.

(1) When a cushion is specified at the head end:

a. A self-centering sleeve is furnished on the piston rod assembly.

b. A needle valve is provided that is flush with the side of the head when wide open. It may be identified by the fact that it is socket-keyed. It is located on side number 2, in all mounting styles except D, DB, DD, and E. In these styles it is located on side number 3.

c. A springless check valve is provided that is also flush with the side of the head and is mounted adjacent to the needle valve except on certain bores of mounting style C where it is mounted opposite the needle valve. It may be identified by the fact that it is slotted.

d. The check and needle valves are interchangeable in the head.

(2) When a cushion is specified at the cap end:

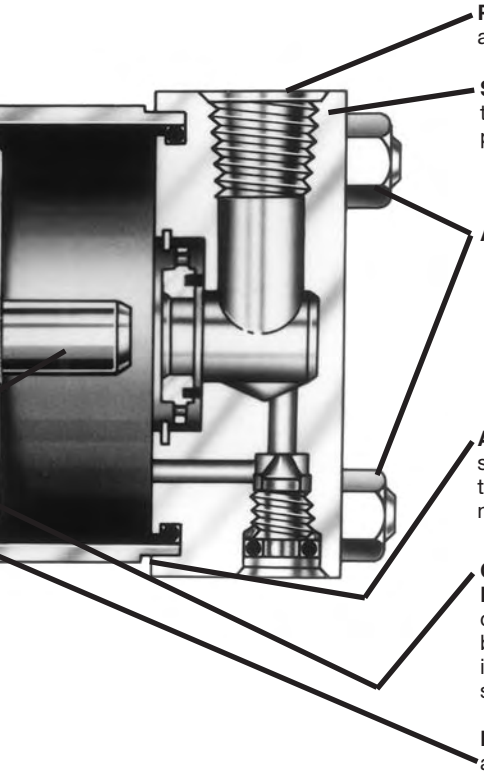
a. A cushion spear is provided on the piston rod assembly.

b. A "float check" self-centering bushing is provided which incorporates a large flow check valve for fast "out-stroke" action.

c. A socket-keyed needle valve is provided that is flush with the side of the cap when wide open. It is located on side number 2 in all mounting styles except D, DB, DD, and E. In these styles it is located on side number 3.

For additional information – call your local Parker Cylinder Distributor.

Piston Rod – Medium carbon steel, induction case-hardened, hard chrome-plated and polished to 10 RMS finish. Piston rods are made from 90,000 to 100,000 psi minimum yield material in 1/2" through 4" diameters. Larger diameters vary between 57,000 and 90,000 psi minimum material, depending on rod diameter. The piston thread equals the catalog style #4 rod end thread for each rod diameter to assure proper piston-to-rod thread strength. Two wrench flats are provided for rod end attachment.



Ports – NPTF ports are standard.

Steel Cap – Bored and grooved to provide concentricity for mating parts.

Alloy Steel Tie Rod Nuts

Align-A-Groove – A 3/16" wide surface machined at each end of the cylinder body. Makes precise mounting quick and easy.

One-Piece Nodular Iron Piston – The wide piston surface contacting cylinder bore reduces bearing loads. Anaerobic adhesive is used to permanently lock and seal the piston to the rod.

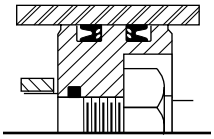
Piston Lipseal – Fully dynamic and self-compensating for variations in pressure, mechanical deflections and wear.

The exclusive "Jewel" gland gives you longer cylinder life, better performance and lower costs.

An extra-long inboard bearing surface insures lubrication from within the cylinder. Outboard of the bearing surface are two leakproof seals – The Lipseal and Wiperseal. The serrated Lipseal (primary seal) is completely self-compensating and self-relieving. It adjusts to mechanical deflections or any pressure variation from near-zero to rated operating pressure. The result is positive, no-leak sealing – regardless of conditions.

The Wiperseal does double duty. On the advance stroke, it acts as a secondary pressure seal. On the return, it wipes away any dirt on the rod. This means less wear on bearing surfaces and internal parts. Longer life for working parts. And, less loss of fluid. Plus, you can replace a "Jewel" gland without removing the tie rods or the retainer. Just a few twists with a spanner wrench does the job.

Prelubricated Wearing Surfaces
Parker Series 2A Air Cylinders are factory prelubricated. Lube-A-Cyl applied to seals, piston, cylinder bore, piston rod and gland surfaces provides lubrication for normal operation. Lube-A-Cyl has been field and laboratory tested, and is recommended by Parker for air cylinders where lubricant should remain in the cylinder and not be expelled into the atmosphere.



Piston with Retainer Nut – Optional at extra charge.

A

Cushion Length

Cylinder Bore (Inches)	Rod Diameter* (Inches)	Rod Number	Cushion Length (Inches)	
			Head*	Cap
1 1/2	5/8	1	7/8	13/16
	1	2	7/8	13/16
2	5/8	1	7/8	13/16
	1 3/8	2	7/8	13/16
2 1/2	5/8	1	7/8	13/16
	1 3/4	2	7/8	13/16
3 1/4	1	1	1 1/8	1
	2	2	13/16	1
4	1	1	1 1/8	1
	2 1/2	2	13/16	1
5	1	1	1 1/8	1
	3 1/2	2	13/16	1

Cylinder Bore (Inches)	Rod Diameter* (Inches)	Rod Number	Cushion Length (Inches)	
			Head*	Cap
6	1 3/8	1	1 3/8	1 1/4
	4	2	1 1/16	1 1/4
7	1 3/8	1	1 1/16	1 1/4
	2	4	1 1/16	1 1/4
8	1 3/8	1	1 1/16	1 1/4
	5 1/2	2	15/16	1 1/4
10	1 3/4	1	1 5/16	1 3/4
	5 1/2	0	1 3/16	1 3/4
12	2	1	1 5/16	1 3/4
	5 1/2	9	1 3/16	1 3/4
14	2 1/2	1	1 3/4	2
	5 1/2	8	1 11/16	2

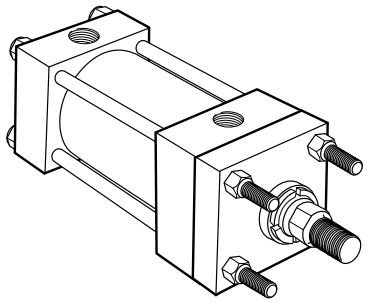
*Head end cushions for rod diameters not listed have cushion lengths with the limits shown.
For cushion selection and sizing see Section C.

For Cylinder Division Plant Locations – See Page II.

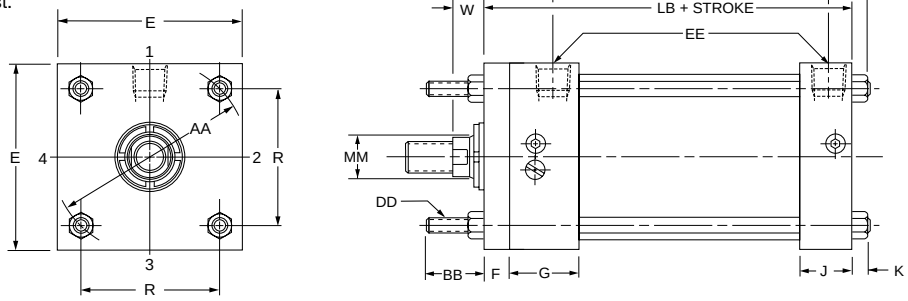
Parker Cylinder

Tie Rods Extended

Style TB
(NFPA Style MX3)



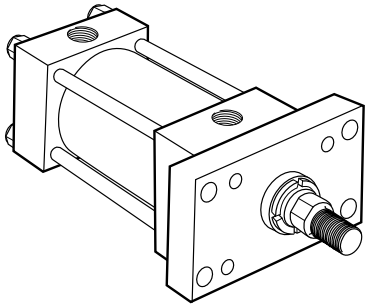
Basic Mounting (T) —
NFPA MX0 — no tie rods extended can be supplied upon request.

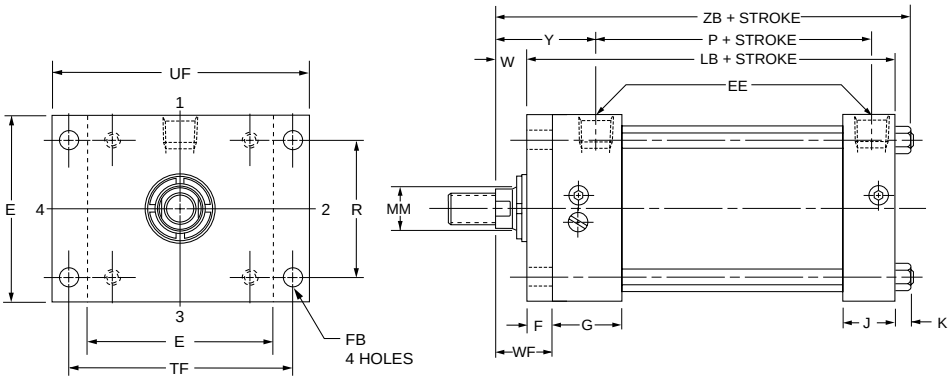


Style TB (NFPA MX3). Head Tie Rods Extended, illustrated: Style TC (NFPA MX2), Cap Tie Rods Extended; and Style TD (NFPA MX1), Both Ends Tie Rods Extended are also available. All "T" styles can be dimensioned from Style TB drawing at right.

Head Rectangular Flange

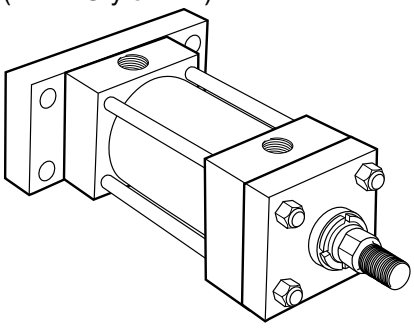
Style J
(NFPA Style MF1)

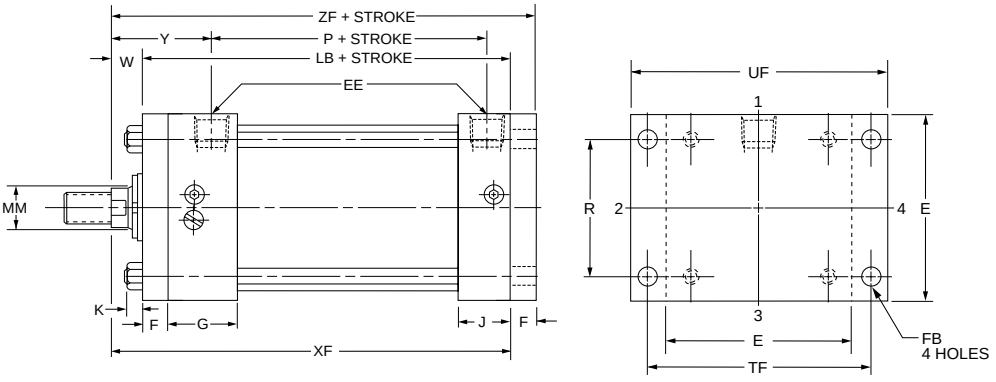




Cap Rectangular Flange

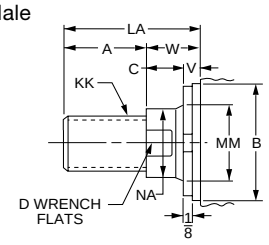
Style H
(NFPA Style MF2)



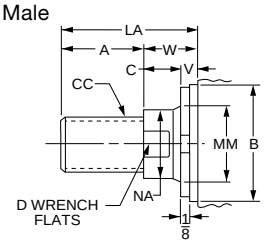


Rod End Dimensions — see table 2

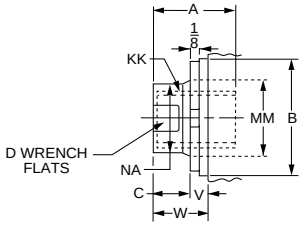
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	AA	BB	DD	E	EE NPTF	F	FB	G	J	K	R	TF	UF	Add Stroke LB	Add Stroke P
1*	1.53	3/4	10-24	■	1/4	3/8	1/4	1 1/2	1	3/16	1.08	2	2 1/2	3 7/8	2 1/8
1 1/2	2.02	1	1/4-28	2	3/8**	3/8	5/16	1 1/2	1	1/4	1.43	2 3/4	3 3/8	4	2 1/4
2	2.6	1 1/8	5/16-24	2 1/2	3/8**	3/8	3/8	1 1/2	1	5/16	1.84	3 3/8	4 1/8	4	2 1/4
2 1/2	3.1	1 1/8	5/16-24	3	3/8**	3/8	3/8	1 1/2	1	5/16	2.19	3 7/8	4 5/8	4 1/8	2 3/8
3 1/4	3.9	1 3/8	3/8-24	3 3/4	1/2	5/8	7/16	1 3/4	1 1/4	3/8	2.76	4 11/16	5 1/2	4 7/8	2 5/8
4	4.7	1 3/8	3/8-24	4 1/2	1/2	5/8	7/16	1 3/4	1 1/4	3/8	3.32	5 7/16	6 1/4	4 7/8	2 5/8
5	5.8	1 13/16	1/2-20	5 1/2	1/2	5/8	9/16	1 3/4	1 1/4	7/16	4.10	6 5/8	7 5/8	5 1/8	2 7/8
6	6.9	1 13/16	1/2-20	6 1/2	3/4	3/4	9/16	2	1 1/2	7/16	4.88	7 5/8	8 5/8	5 3/4	3 1/8

* Cushions not available on 1" bore.
** On 1", 1 1/2", 2" and 2 1/2" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with No. 2 rods. Minimum of three full threads available.
■ 1" bore head dimension is 1 3/4" x 1 1/2". See page B20.

Table 2—Rod Dimensions

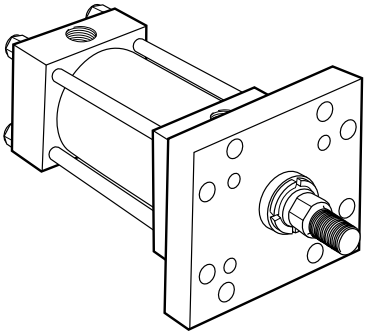
Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W
1	1(Std.)	1/2	7/16-20	5/16-24	5/8	.999	3/8	3/8	1 1/4	7/16	1/4	5/8
	2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
1 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
2 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
	4	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4
3 1/4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
5	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5 1/8	3 3/8	5/8	1 5/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
	6	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8
	7	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5 1/8	2 7/8	5/8	1 5/8
6	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8
	2	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2

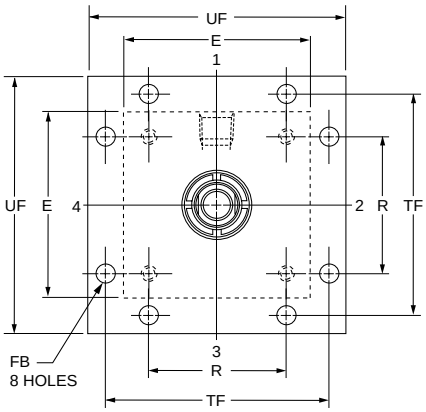
Table 3 — Envelope and Mounting Dimensions

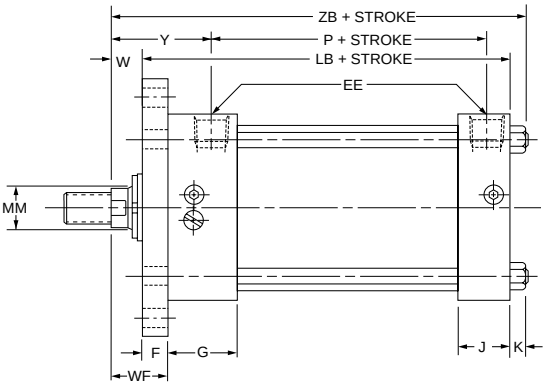
Bore	WF	Y	Add Stroke XF	Add Stroke ZB	Add Stroke ZF
1	1	1 15/16	4 1/2	4 11/16	4 7/8
	1	1 15/16	4 1/2	4 11/16	4 7/8
1 1/2	1	1 15/16	4 5/8	4 7/8	5
	1 3/8	2 5/16	5	5 1/4	5 3/8
2	1	1 15/16	4 5/8	4 15/16	5
	1 5/8	2 9/16	5 1/4	5 9/16	5 5/8
	1 3/8	2 5/16	5	5 5/16	5 3/8
2 1/2	1	1 15/16	4 3/4	5 1/16	5 1/8
	1 7/8	2 13/16	5 5/8	5 15/16	6
	1 3/8	2 5/16	5 1/8	5 7/16	5 1/2
	1 5/8	2 9/16	5 3/8	5 11/16	5 3/4
3 1/4	1 3/8	2 7/16	5 5/8	6	6 1/4
	2	3 1/16	6 1/4	6 5/8	6 7/8
	1 5/8	2 11/16	5 7/8	6 1/4	6 1/2
	1 7/8	2 15/16	6 1/8	6 1/2	6 3/4
4	1 3/8	2 7/16	5 5/8	6	6 1/4
	2 1/4	3 5/16	6 1/2	6 7/8	7 1/8
	1 5/8	2 11/16	5 7/8	6 1/4	6 1/2
	1 7/8	2 15/16	6 1/8	6 1/2	6 3/4
	2	3 1/16	6 1/4	6 5/8	6 7/8
5	1 3/8	2 7/16	5 7/8	6 5/16	6 1/2
	2 1/4	3 5/16	6 3/4	7 3/16	7 3/8
	1 5/8	2 11/16	6 1/8	6 9/16	6 3/4
	1 7/8	2 15/16	6 3/8	6 13/16	7
	2	3 1/16	6 1/2	6 15/16	7 1/8
	2 1/4	3 5/16	6 3/4	7 3/16	7 3/8
	2 1/4	3 5/16	6 3/4	7 3/16	7 3/8
6	1 5/8	2 13/16	6 5/8	7 1/16	7 3/8
	2 1/4	3 7/16	7 1/4	7 11/16	8
	1 7/8	3 1/16	6 7/8	7 5/16	7 5/8
	2	3 3/16	7	7 7/16	7 3/4
	2 1/4	3 7/16	7 1/4	7 11/16	8
	2 1/4	3 7/16	7 1/4	7 11/16	8
	2 1/4	3 7/16	7 1/4	7 11/16	8

Head Square Flange

Style JB
(NFPA Style MF5)

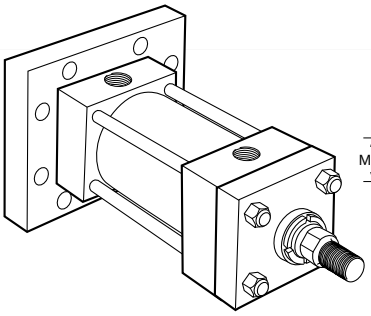


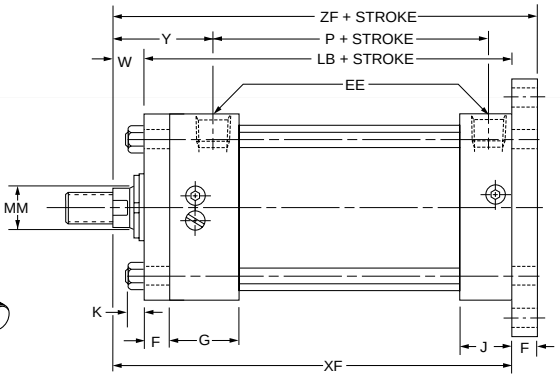


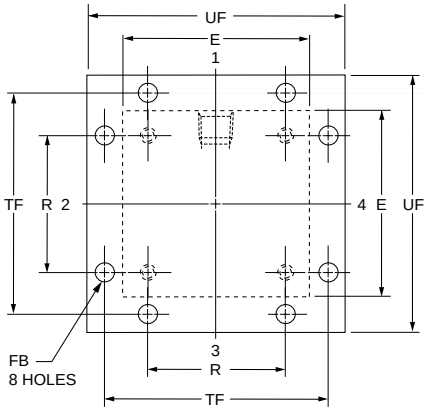


Cap Square Flange

Style HB
(NFPA Style MF6)

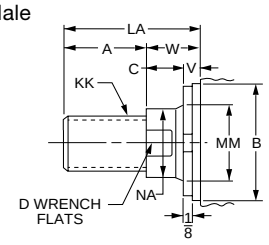




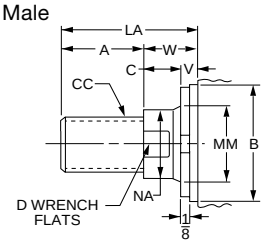


Rod End Dimensions — see table 2

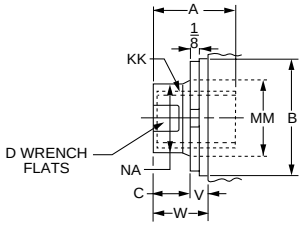
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	E	EE NPTF	F	FB	G	J	K	R	TF	UF	Add Stroke LB	Add Stroke P
1*	■	1/4	3/8	1/4	1 1/2	1	3/16	1.08	2	2 1/2	3 7/8	2 1/8
1 1/2	2	3/8**	3/8	5/16	1 1/2	1	1/4	1.43	2 3/4	3 3/8	4	2 1/4
2	2 1/2	3/8**	3/8	3/8	1 1/2	1	5/16	1.84	3 3/8	4 1/8	4	2 1/4
2 1/2	3	3/8**	3/8	3/8	1 1/2	1	5/16	2.19	3 7/8	4 5/8	4 1/8	2 3/8
3 1/4	3 3/4	1/2	5/8	7/16	1 3/4	1 1/4	3/8	2.76	4 11/16	5 1/2	4 7/8	2 5/8
4	4 1/2	1/2	5/8	7/16	1 3/4	1 1/4	3/8	3.32	5 7/16	6 1/4	4 7/8	2 5/8
5	5 1/2	1/2	5/8	9/16	1 3/4	1 1/4	7/16	4.10	6 5/8	7 5/8	5 1/8	2 7/8
6	6 1/2	3/4	3/4	9/16	2	1 1/2	7/16	4.88	7 5/8	8 5/8	5 3/4	3 1/8

* Cushions not available on 1" bore.
** On 1", 1 1/2", 2" and 2 1/2" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with No. 2 rods. Minimum of three full threads available.
■ 1" bore head dimension is 1 3/4" x 1 1/2". See page B20.

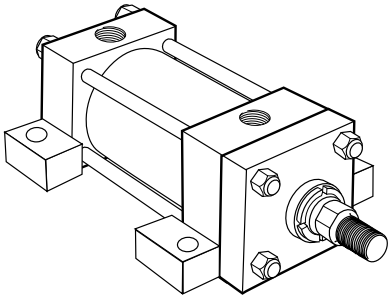
Table 2—Rod Dimensions

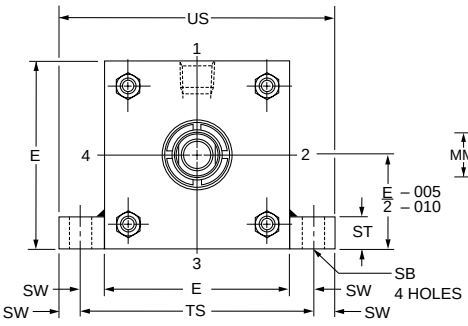
Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W
1	1(Std.)	1/2	7/16-20	5/16-24	5/8	.999	3/8	3/8	1 1/4	7/16	1/4	5/8
	2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
1 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
2 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
	4	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4
3 1/4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
5	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5 1/8	3 3/8	5/8	1 5/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
	6	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8
	7	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5 1/8	2 7/8	5/8	1 5/8
6	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8
	2	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2

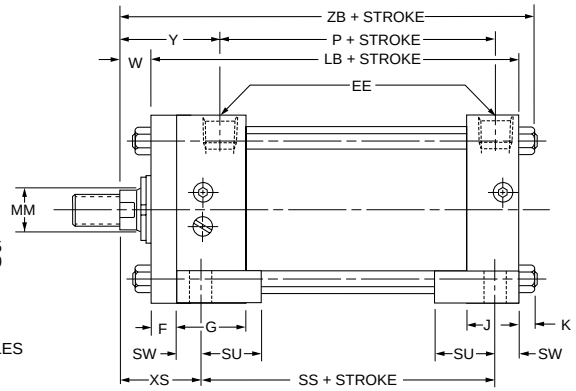
Table 3 — Envelope and Mounting Dimensions

Bore	WF	Y	Add Stroke XF	Add Stroke ZB	Add Stroke ZF
1	1	1 15/16	4 1/2	4 11/16	4 7/8
	1	1 15/16	4 1/2	4 11/16	4 7/8
1 1/2	1	1 15/16	4 5/8	4 7/8	5
	1 3/8	2 5/16	5	5 1/4	5 3/8
2	1	1 15/16	4 5/8	4 15/16	5
	1 5/8	2 9/16	5 1/4	5 9/16	5 5/8
	1 3/8	2 5/16	5	5 5/16	5 3/8
2 1/2	1	1 15/16	4 3/4	5 1/16	5 1/8
	1 7/8	2 13/16	5 5/8	5 15/16	6
	1 3/8	2 5/16	5 1/8	5 7/16	5 1/2
	1 5/8	2 9/16	5 3/8	5 11/16	5 3/4
3 1/4	1 3/8	2 7/16	5 5/8	6	6 1/4
	2	3 1/16	6 1/4	6 5/8	6 7/8
	1 5/8	2 11/16	5 7/8	6 1/4	6 1/2
	1 7/8	2 15/16	6 1/8	6 1/2	6 3/4
4	1 3/8	2 7/16	5 5/8	6	6 1/4
	2 1/4	3 5/16	6 1/2	6 7/8	7 1/8
	1 5/8	2 11/16	5 7/8	6 1/4	6 1/2
	1 7/8	2 15/16	6 1/8	6 1/2	6 3/4
	2	3 1/16	6 1/4	6 5/8	6 7/8
5	1 3/8	2 7/16	5 7/8	6 5/16	6 1/2
	1 3/8	2 5/16	6 3/4	7 3/16	7 3/8
	1 5/8	2 11/16	6 1/8	6 9/16	6 3/4
	1 7/8	2 15/16	6 3/8	6 13/16	7
	2	3 1/16	6 1/2	6 15/16	7 1/8
	2 1/4	3 5/16	6 3/4	7 3/16	7 3/8
	2 1/4	3 5/16	6 3/4	7 3/16	7 3/8
6	1 5/8	2 13/16	6 5/8	7 1/16	7 3/8
	2 1/4	3 7/16	7 1/4	7 11/16	8
	1 7/8	3 1/16	6 7/8	7 5/16	7 5/8
	2	3 3/16	7	7 7/16	7 3/4
	2 1/4	3 7/16	7 1/4	7 11/16	8
	2 1/4	3 7/16	7 1/4	7 11/16	8
	2 1/4	3 7/16	7 1/4	7 11/16	8

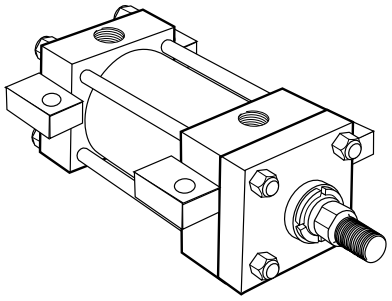
Side Lug
Style C
(NFPA Style MS2)

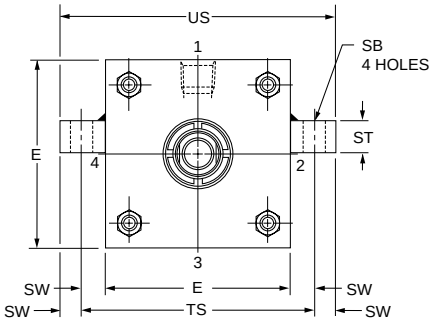


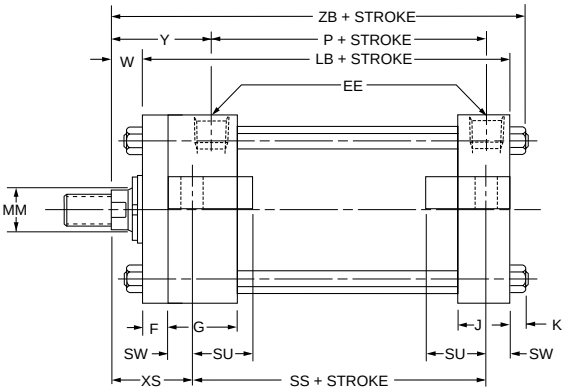




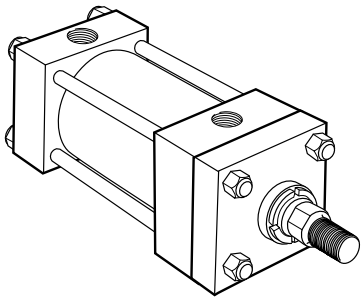
Centerline Lugs
Style E
(NFPA Style MS3)

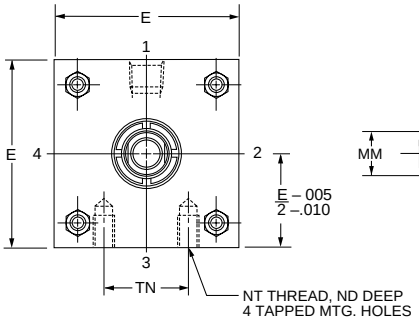


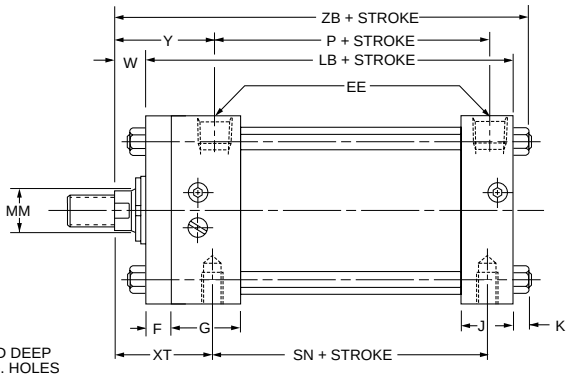




Side Tapped
Style F
(NFPA Style MS4)

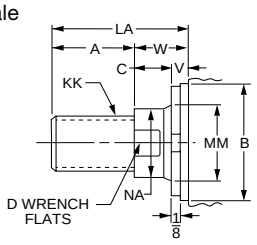




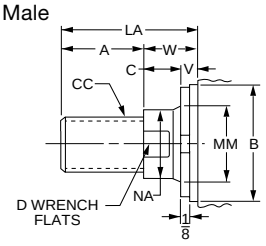


Rod End Dimensions — see table 2

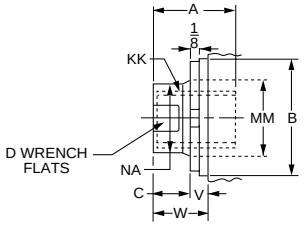
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3
Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	E	EE NPTF	F	G	J	K	NT	SB•	ST	SU	SW	TN	TS	US	Add Stroke LB	P	SN	SS
1*	■	1/4	3/8	1 1/2	1	3/16	10-24	9/32†	5/16†	3/4†	5/16†	9/16	2 1/8†	2 3/4†	3 7/8	2 1/8	2 1/8	2 7/8†
1 1/2	2	3/8**	3/8	1 1/2	1	1/4	1/4-20	7/16	1/2	15/16	3/8	5/8	2 3/4	3 1/2	4	2 1/4	2 1/4	2 7/8
2	2 1/2	3/8**	3/8	1 1/2	1	5/16	5/16-18	7/16	1/2	15/16	3/8	7/8	3 1/4	4	4	2 1/4	2 1/4	2 7/8
2 1/2	3	3/8**	3/8	1 1/2	1	5/16	3/8-16	7/16	1/2	15/16	3/8	1 1/4	3 3/4	4 1/2	4 1/8	2 3/8	2 3/8	3
3 1/4	3 3/4	1/2	5/8	1 3/4	1 1/4	3/8	1/2-13	9/16	3/4	1 1/4	1/2	1 1/2	4 3/4	5 3/4	4 7/8	2 5/8	2 5/8	3 1/4
4	4 1/2	1/2	5/8	1 3/4	1 1/4	3/8	1/2-13	9/16	3/4	1 1/4	1/2	2 1/16	5 1/2	6 1/2	4 7/8	2 5/8	2 5/8	3 1/4
5	5 1/2	1/2	5/8	1 3/4	1 1/4	7/16	5/8-11	13/16	1	1 9/16	11/16	2 11/16	6 7/8	8 1/4	5 1/8	2 7/8	2 7/8	3 1/8
6	6 1/2	3/4	3/4	2	1 1/2	7/16	3/4-10	13/16	1	1 9/16	11/16	3 1/4	7 7/8	9 1/4	5 3/4	3 1/8	3 1/8	3 5/8

* Cushions not available on 1" bore.
** On 1", 1 1/2", 2" and 2 1/2" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with No. 2 rods. Minimum of three full threads available.
• Upper surface spot-faced for socket head screws.
† Mounting style E not available in 1" bore. ■ 1" bore head dimension is 1 3/4" x 1 1/2". See page B20.

Table 2—Rod Dimensions

Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W
1	1(Std.)	1/2	7/16-20	5/16-24	5/8	.999	3/8	3/8	1 1/4	7/16	1/4	5/8
	2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
1 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
2 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
	4	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4
3 1/4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
5	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5 1/8	3 3/8	5/8	1 5/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
	6	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8
	7	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5 1/8	2 7/8	5/8	1 5/8
6	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8
	2	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2

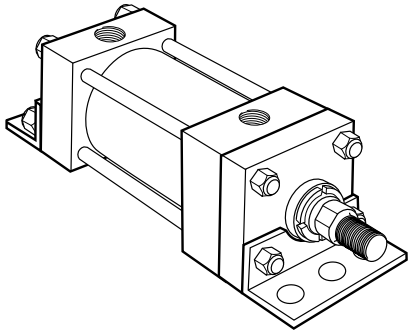
* Mounting style E not available in 1" bore.

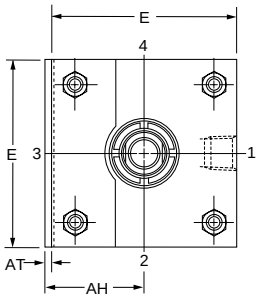
Table 3 — Envelope and Mounting Dimensions

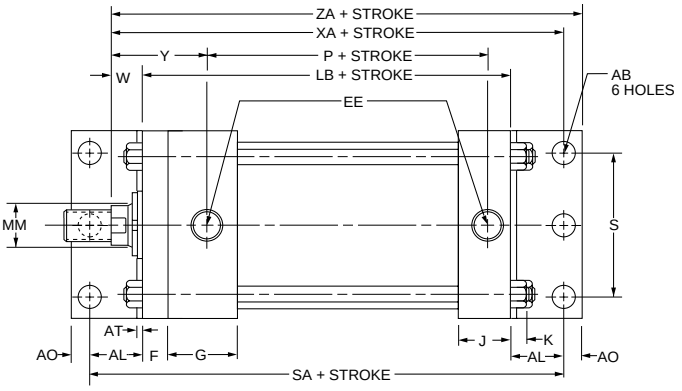
Bore	ND	XS	XT	Y	Add Stroke ZB
1	1/4	1 15/16*	1 15/16	1 15/16	4 11/16
	1/4	1 15/16*	1 15/16	1 15/16	4 11/16
1 1/2	5/16	1 3/8	1 15/16	1 15/16	4 7/8
	5/16	1 3/4	2 5/16	2 5/16	5 1/4
2	11/32	1 3/8	1 15/16	1 15/16	4 15/16
	11/32	2	2 9/16	2 9/16	5 9/16
	11/32	1 3/4	2 5/16	2 5/16	5 5/16
2 1/2	7/16	1 3/8	1 15/16	1 15/16	5 1/16
	7/16	2 1/4	2 13/16	2 13/16	5 15/16
	7/16	1 3/4	2 5/16	2 5/16	5 7/16
	7/16	2	2 9/16	2 9/16	5 11/16
3 1/4	1/2	1 7/8	2 7/16	2 7/16	6
	1/2	2 1/2	3 1/16	3 1/16	6 5/8
	1/2	2 1/8	2 11/16	2 11/16	6 1/4
	1/2	2 3/8	2 15/16	2 15/16	6 1/2
4	5/8	1 7/8	2 7/16	2 7/16	6
	5/8	2 3/4	3 5/16	3 5/16	6 7/8
	5/8	2 1/8	2 11/16	2 11/16	6 1/4
	5/8	2 3/8	2 15/16	2 15/16	6 1/2
	5/8	2 1/2	3 1/16	3 1/16	6 5/8
5	3/4	2 1/16	2 7/16	2 7/16	6 5/16
	3/4	2 15/16	3 5/16	3 5/16	7 3/16
	3/4	2 5/16	2 11/16	2 11/16	6 9/16
	3/4	2 9/16	2 15/16	2 15/16	6 13/16
	3/4	2 11/16	3 1/16	3 1/16	6 15/16
	3/4	2 15/16	3 5/16	3 5/16	7 3/16
	3/4	2 15/16	3 5/16	3 5/16	7 3/16
6	7/8	2 5/16	2 13/16	2 13/16	7 1/16
	7/8	2 15/16	3 7/16	3 7/16	7 11/16
	7/8	2 9/16	3 1/16	3 1/16	7 5/16
	7/8	2 11/16	3 3/16	3 3/16	7 7/16
	7/8	2 15/16	3 7/16	3 7/16	7 11/16
	7/8	2 15/16	3 7/16	3 7/16	7 11/16
	7/8	2 15/16	3 7/16	3 7/16	7 11/16

Side End Angles

Style CB
(NFPA Style MS1)

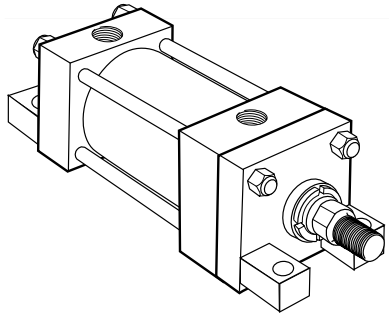


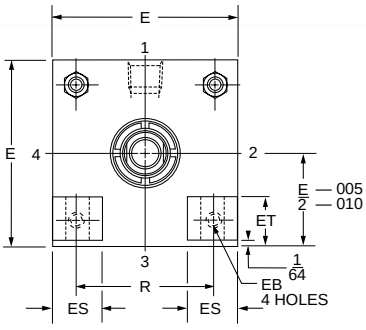


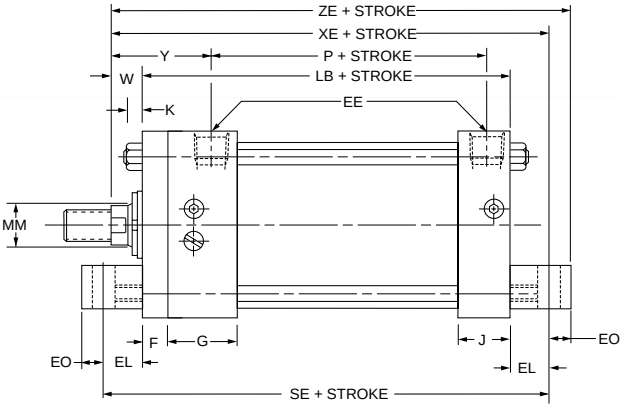


Side End Lugs

Style G
(NFPA Style MS7)

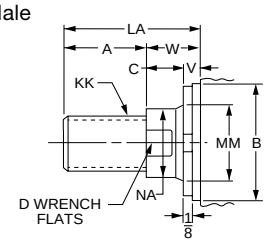




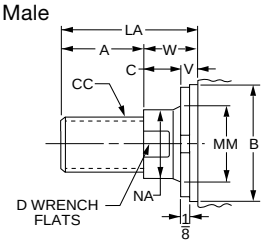


Rod End Dimensions — see table 2

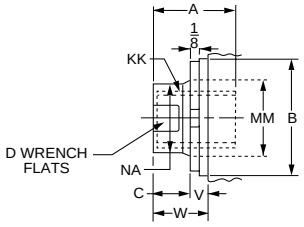
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	AB	AH	AL	AO	AT	E	EB	EE NPTF	EL	EO	ES	ET	F	G	J	K	R	S	Add Stroke LB	P	SA	SE
1*	3/8†‡	1†	13/16†	5/16†	1/8†	■	•	1/4	•	•	•	•	3/8	1 1/2	1	3/16	1.08•	15/16†	3 7/8	2 1/8	5 1/2†	•
1 1/2	7/16	1 3/16	1	3/8	1/8	2	5/16	3/8**	3/4	1/4	9/16	17/32	3/8	1 1/2	1	1/4	1.43	1 1/4	4	2 1/4	6	5 1/2
2	7/16	1 7/16	1	3/8	1/8	2 1/2	3/8	3/8**	15/16	5/16	5/8	5/8	3/8	1 1/2	1	5/16	1.84	1 3/4	4	2 1/4	6	5 7/8
2 1/2	7/16	1 5/8	1	3/8	1/8	3	3/8	3/8**	1 1/16	5/16	13/16	25/32	3/8	1 1/2	1	5/16	2.19	2 1/4	4 1/8	2 3/8	6 1/8	6 1/4
3 1/4	9/16	1 15/16	1 1/4	1/2	1/8	3 3/4	7/16	1/2	7/8	3/8	1	15/16	5/8	1 3/4	1 1/4	3/8	2.76	2 3/4	4 7/8	2 5/8	7 3/8	6 5/8
4	9/16	2 1/4	1 1/4	1/2	1/8	4 1/2	7/16	1/2	1	3/8	1 1/4	1 15/32	5/8	1 3/4	1 1/4	3/8	3.32	3 1/2	4 7/8	2 5/8	7 3/8	6 7/8
5	11/16	2 3/4	1 3/8	5/8	3/16	5 1/2	9/16	1/2	1 1/16	1/2	1 3/8	1 3/8	5/8	1 3/4	1 1/4	7/16	4.10	4 1/4	5 1/8	2 7/8	7 7/8	7 1/4
6	13/16	3 1/4	1 3/8	5/8	3/16	6 1/2	9/16	3/4	1	1/2	1 3/4	1 19/32	3/4	2	1 1/2	7/16	4.88	5 1/4	5 3/4	3 1/8	8 1/2	7 3/4

* Cushions not available on 1" bore.
** On 1", 1 1/2", 2" and 2 1/2" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with No. 2 rods. Minimum of three full threads available.
† Mounting style CB available in 1" bore for rod No. 1 only.
‡ Mounting style CB for 1" bore only is furnished with four mounting holes (two each end). Center holes omitted.
■ 1" bore head dimension is 1 3/4" x 1 1/2". See page B20.
• Mounting style G not available in 1" bore.

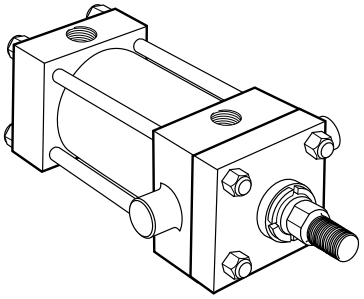
Table 2—Rod Dimensions

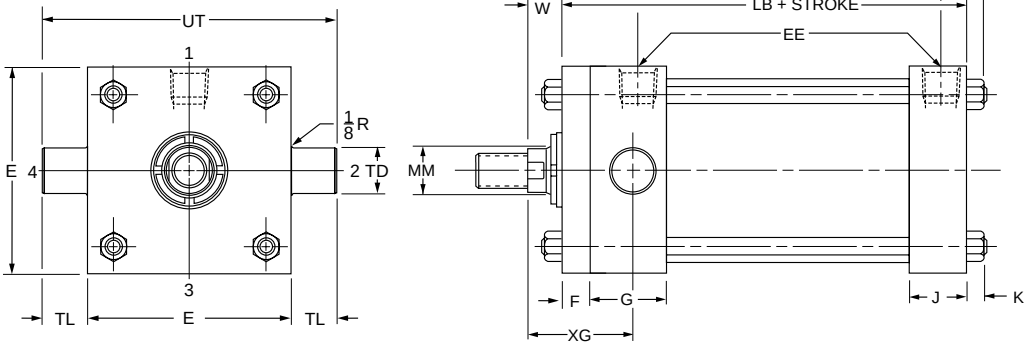
Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W	Y	Add Stroke XA	XE	ZA	ZE
1	1(Std.)	1/2	7/16-20	5/16-24	5/8	.999	3/8	3/8	1 1/4	7/16	1/4	5/8	1 15/16	5 5/16*	•	5 5/8*	•
	2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	*	•	*	•
1 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	5 5/8	5 3/8	6	5 5/8
	2	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	6	5 3/4	6 3/8	6
2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	5 5/8	5 9/16	6	5 7/8
	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16	6 1/4	6 3/16	6 5/8	6 1/2
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	6	5 15/16	6 3/8	6 1/4
2 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16	5 3/4	5 13/16	6 1/8	6 1/8
	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2	2 13/16	6 5/8	6 11/16	7	7
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16	6 1/8	6 3/16	6 1/2	6 1/2
	4	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16	6 3/8	6 7/16	6 3/4	6 3/4
3 1/4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	1 5/16	1/4	3/4	2 7/16	6 7/8	6 1/2	7 3/8	6 7/8
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	7 1/2	7 1/8	8	7 1/2
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	7 1/8	6 3/4	7 5/8	7 1/8
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	7 3/8	7	7 7/8	7 3/8
4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	1 5/16	1/4	3/4	2 7/16	6 7/8	6 5/8	7 3/8	7
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8	3 5/16	7 3/4	7 1/2	8 1/4	7 7/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	7 1/8	6 7/8	7 5/8	7 1/4
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	7 3/8	7 1/8	7 7/8	7 1/2
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	7 1/2	7 1/4	8	7 5/8
5	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	1 5/16	1/4	3/4	2 7/16	7 1/4	6 15/16	7 7/8	7 7/16
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5 1/8	3 3/8	5/8	1 5/8	3 5/16	8 1/8	7 13/16	8 3/4	8 5/16
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16	7 1/2	7 3/16	8 1/8	7 11/16
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16	7 3/4	7 7/16	8 3/8	7 15/16
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16	7 7/8	7 9/16	8 1/2	8 1/16
	6	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8	3 5/16	8 1/8	7 13/16	8 3/4	8 5/16
	7	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5 1/8	2 7/8	5/8	1 5/8	3 5/16	8 1/8	7 13/16	8 3/4	8 5/16
6	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	2 13/16	8	7 5/8	8 5/8	8 1/8
	2	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	3 7/16	8 5/8	8 1/4	9 1/4	8 3/4
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	3 1/16	8 1/4	7 7/8	8 7/8	8 3/8
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	3 3/16	8 3/8	8	9	8 1/2
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	3 7/16	8 5/8	8 1/4	9 1/4	8 3/4
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	3 7/16	8 5/8	8 1/4	9 1/4	8 3/4
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	3 7/16	8 5/8	8 1/4	9 1/4	8 3/4

Table 3 — Envelope and Mounting Dimensions

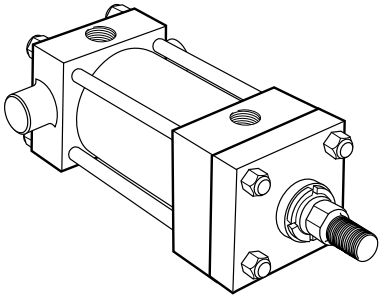
* Mounting style CB available in 1" bore for rod No. 1 only.
• Mounting style G not available in 1" bore.
Caution: When using mounting styles CB and G, check clearance between mounting members and rod attachment or accessory. If necessary, specify longer rod extension to avoid interference with mounting members.

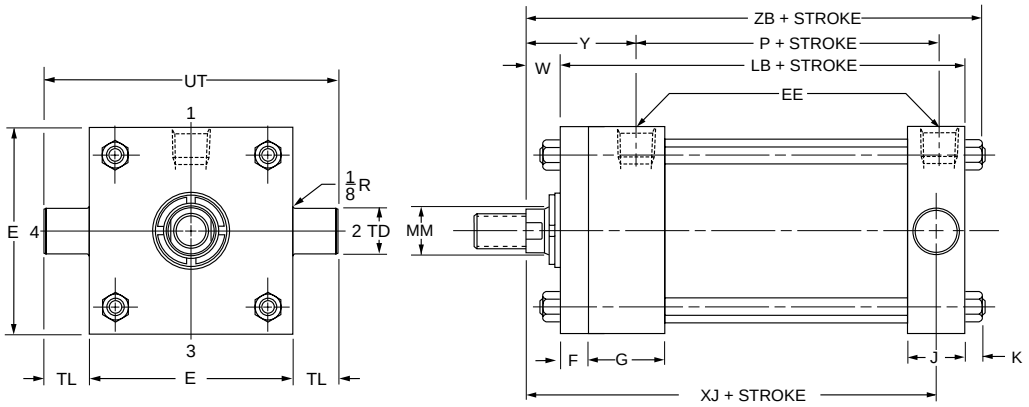
Head Trunnion
Style D
(NFPA Style MT1)



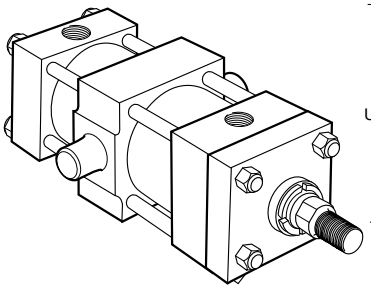


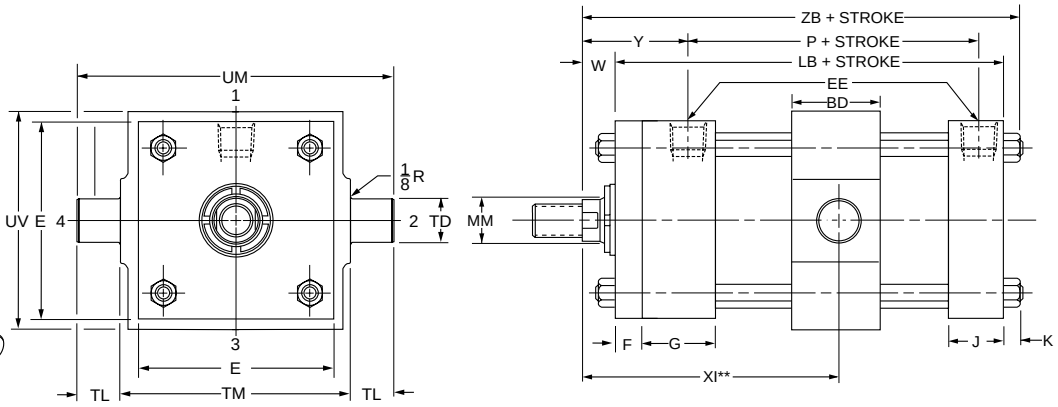
Cap Trunnion
Style DB
(NFPA Style MT2)





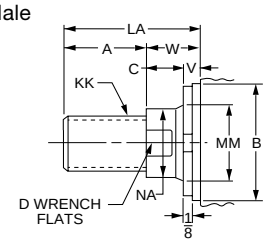
Intermediate Fixed Trunnion
Style DD
(NFPA Style MT4)



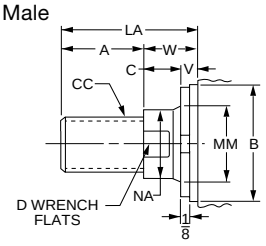


Rod End Dimensions — see table 2

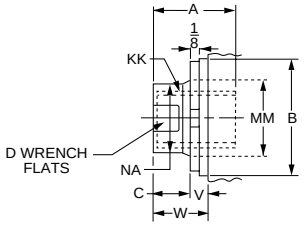
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3
Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	BD	E	EE NPTF	F	G	J	K	+.000 TD -.001	TL	TM	UM	UT	UV	Add Stroke LB	Add Stroke P	Style DD Min. Stroke
1*	•	■	1/4	3/8	1 1/2	1	3/16	.750•	3/4•	•	•	3	•	3 7/8	2 1/8	•
1 1/2	1 1/4	2	3/8**	3/8	1 1/2	1	1/4	1.000	1	2 1/2	4 1/2	4	2 1/2	4	2 1/4	1/4
2	1 1/2	2 1/2	3/8**	3/8	1 1/2	1	5/16	1.000	1	3	5	4 1/2	3	4	2 1/4	1/2
2 1/2	1 1/2	3	3/8**	3/8	1 1/2	1	5/16	1.000	1	3 1/2	5 1/2	5	3 1/2	4 1/8	2 3/8	3/8
3 1/4	2	3 3/4	1/2	5/8	1 3/4	1 1/4	3/8	1.000	1	4 1/2	6 1/2	5 3/4	4 1/4	4 7/8	2 5/8	7/8
4	2	4 1/2	1/2	5/8	1 3/4	1 1/4	3/8	1.000	1	5 1/4	7 1/4	6 1/2	5	4 7/8	2 5/8	7/8
5	2	5 1/2	1/2	5/8	1 3/4	1 1/4	7/16	1.000	1	6 1/4	8 1/4	7 1/2	6	5 1/8	2 7/8	5/8
6	2 1/2	6 1/2	3/4	3/4	2	1 1/2	7/16	1.375	1 3/8	7 5/8	10 3/8	9 1/4	7	5 3/4	3 1/8	1 1/8

* Cushions not available on 1" bore.
** On 1", 1 1/2", 2" and 2 1/2" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with No. 2 rods. Minimum of three full threads available.
• Mounting style not available in 1" bore.
■1" bore head dimension is 1 3/4" x 1 1/2". See page B20.

Table 2—Rod Dimensions

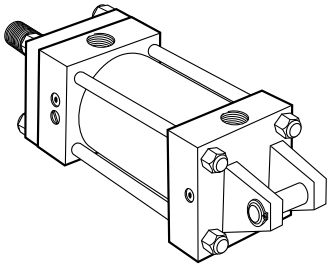
Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W
1	1(Std.)	1/2	7/16-20	5/16-24	5/8	.999	3/8	3/8	1 1/4	7/16	1/4	5/8
	2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
1 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
2 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8
	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1
	4	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4
3 1/4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
5	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5 1/8	3 3/8	5/8	1 5/8
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8
	6	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8
	7	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5 1/8	2 7/8	5/8	1 5/8
6	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	15/16	1/4	7/8
	2	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2

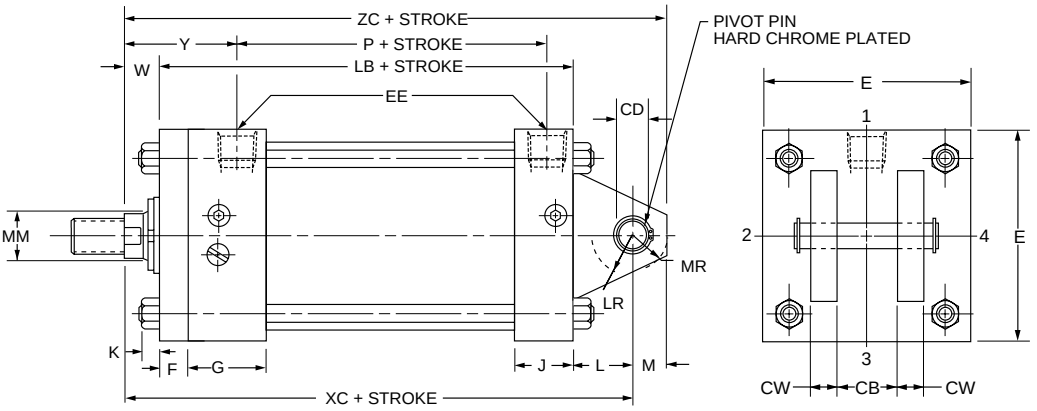
Table 3 — Envelope and Mounting Dimensions

Bore	XG	Min.** XI	Y	Add Stroke XJ	Add Stroke ZB
1	1 3/4	*	1 15/16	4	4 11/16
	1 3/4	*	1 15/16	4	4 11/16
1 1/2	1 3/4	3 3/16	1 15/16	4 1/8	4 7/8
	2 1/8	3 9/16	2 5/16	4 1/2	5 1/4
2	1 3/4	3 5/16	1 15/16	4 1/8	4 15/16
	2 3/8	3 15/16	2 9/16	4 3/4	5 9/16
	2 1/8	3 11/16	2 5/16	4 1/2	5 5/16
2 1/2	1 3/4	3 5/16	1 15/16	4 1/4	5 1/16
	2 5/8	4 3/16	2 13/16	5 1/8	5 15/16
	2 1/8	3 11/16	2 5/16	4 5/8	5 7/16
	2 3/8	3 15/16	2 9/16	4 7/8	5 11/16
3 1/4	2 1/4	4 3/16	2 7/16	5	6
	2 7/8	4 13/16	3 1/16	5 5/8	6 5/8
	2 1/2	4 7/16	2 11/16	5 1/4	6 1/4
	2 3/4	4 11/16	2 15/16	5 1/2	6 1/2
4	2 1/4	4 3/16	2 7/16	5	6
	3 1/8	5 1/16	3 5/16	5 7/8	6 7/8
	2 1/2	4 7/16	2 11/16	5 1/4	6 1/4
	2 3/4	4 11/16	2 15/16	5 1/2	6 1/2
	2 7/8	4 13/16	3 1/16	5 5/8	6 5/8
5	2 1/4	4 5/16	2 7/16	5 1/4	6 5/16
	3 1/8	5 1/16	3 5/16	6 1/8	7 3/16
	2 1/2	4 7/16	2 11/16	5 1/2	6 9/16
	2 3/4	4 11/16	2 15/16	5 3/4	6 13/16
	2 7/8	4 13/16	3 1/16	5 7/8	6 15/16
	3 1/8	5 1/16	3 5/16	6 1/8	7 3/16
	3 1/8	5 1/16	3 5/16	6 1/8	7 3/16
6	2 5/8	4 15/16	2 13/16	5 7/8	7 1/16
	3 1/4	5 9/16	3 7/16	6 1/2	7 11/16
	2 7/8	5 3/16	3 1/16	6 1/8	7 5/16
	3	5 5/16	3 3/16	6 1/4	7 7/16
	3 1/4	5 9/16	3 7/16	6 1/2	7 11/16
	3 1/4	5 9/16	3 7/16	6 1/2	7 11/16
	3 1/4	5 9/16	3 7/16	6 1/2	7 11/16

* Mounting style DD not available in 1" bore.
**Dimension XI to be specified by customer.

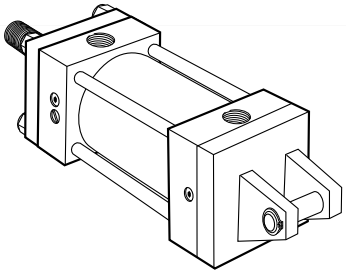
Cap Fixed Clevis
Style BB
(NFPA Style MP1)

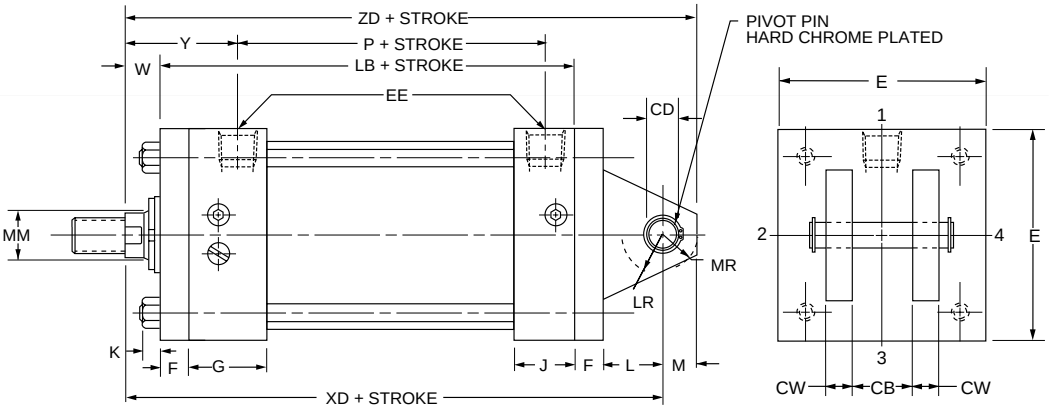




The 1", 4", 5" and 6" bore sizes have tie rod nuts at both ends as shown. Tie rods thread into cap on all other bore sizes.

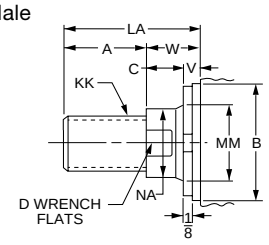
Cap Detachable Clevis
Style BC
(NFPA Style MP2)



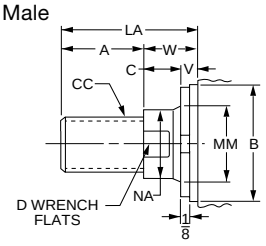


Rod End Dimensions — see table 2

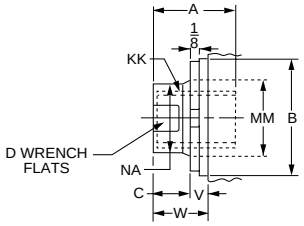
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3
Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	CB	+.000 CD• -.002	CW	E	EE NPTF	F	G	J	K	L	LR	M	MR	Add Stroke LB	Add Stroke P
1*	†	.441†	†	■	1/4	3/8	1 1/2	1	3/16	1/2†	1/2†	7/16†	1/2†	3 7/8	2 1/8
1 1/2	3/4	.501	1/2	2	3/8**	3/8	1 1/2	1	1/4	3/4	3/4	1/2	5/8	4	2 1/4
2	3/4	.501	1/2	2 1/2	3/8**	3/8	1 1/2	1	5/16	3/4	3/4	1/2	5/8	4	2 1/4
2 1/2	3/4	.501	1/2	3	3/8**	3/8	1 1/2	1	5/16	3/4	3/4	1/2	5/8	4 1/8	2 3/8
3 1/4	1 1/4	.751	5/8	3 3/4	1/2	5/8	1 3/4	1 1/4	3/8	1 1/4	1	3/4	15/16	4 7/8	2 5/8
4	1 1/4	.751	5/8	4 1/2	1/2	5/8	1 3/4	1 1/4	3/8	1 1/4	1	3/4	15/16	4 7/8	2 5/8
5	1 1/4	.751	5/8	5 1/2	1/2	5/8	1 3/4	1 1/4	7/16	1 1/4	1	3/4	15/16	5 1/8	2 7/8
6	1 1/2	1.001	3/4	6 1/2	3/4	3/4	2	1 1/2	7/16	1 1/2	1 1/4	1	1 3/16	5 3/4	3 1/8

* Cushions not available on 1" bore.
** On 1", 1 1/2", 2" and 2 1/2" bore sizes, the head-end (only) pipe thread is not full depth on cylinders with No. 2 rods. Minimum of three full threads available.
† In 1" bore size model only, a single eye mounting, 7/16" thick, is used. Dimension CD (.441") is hole diameter – pin not supplied.
• Dimension CD is pin diameter except in 1" bore. ■1" bore head dimension is 1 3/4" x 1 1/2". See page B20.

Table 2—Rod Dimensions

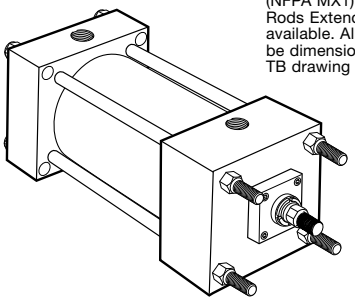
Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W	Y
1	1(Std.)	1/2	7/16-20	5/16-24	5/8	.999	3/8	3/8	1 1/4	7/16	1/4	5/8	1 15/16
	2	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16
1 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16
	2	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16
2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16
	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16
2 1/2	1(Std.)	5/8	1/2-20	7/16-20	3/4	1.124	3/8	1/2	1 3/8	9/16	1/4	5/8	1 15/16
	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/2	1 11/16	3/4	1 1/2	2 13/16
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	15/16	1/2	1	2 5/16
	4	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 7/8	1 5/16	5/8	1 1/4	2 9/16
3 1/4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16
4	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8	3 5/16
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16
5	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	2 7/16
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5 1/8	3 3/8	5/8	1 5/8	3 5/16
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 11/16
	4	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 15/16
	5	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 5/8	1 15/16	1/2	1 3/8	3 1/16
	6	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 5/8	2 3/8	5/8	1 5/8	3 5/16
	7	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5 1/8	2 7/8	5/8	1 5/8	3 5/16
6	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	2 13/16
	2	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	3 7/16
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	3 1/16
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	3 3/16
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	3 7/16
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	3 7/16
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	3 7/16

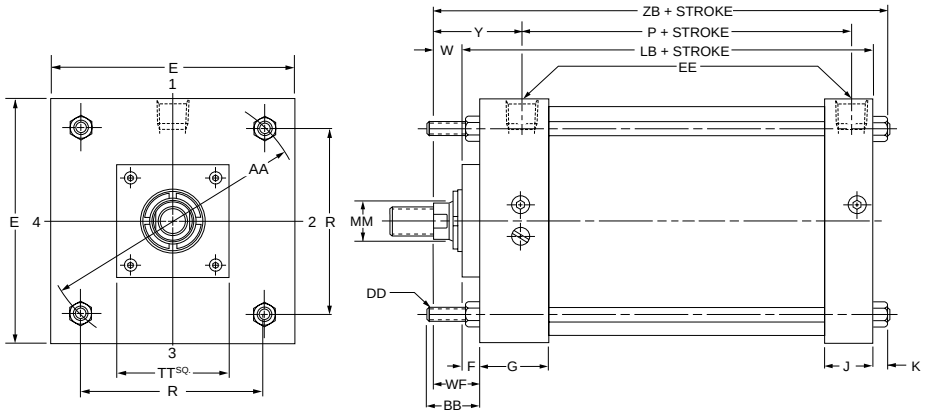
Table 3 — Envelope and Mounting Dimensions

Bore	Add Stroke XC	Add Stroke XD	Add Stroke ZC	Add Stroke ZD
1	5	5 3/8	5 7/16	5 13/16
	5	5 3/8	5 7/16	5 13/16
1 1/2	5 3/8	5 3/4	5 7/8	6 1/4
	6 3/4	6 1/8	6 1/4	6 5/8
2	5 3/8	5 3/4	5 7/8	6 1/4
	6	6 3/8	6 1/2	6 7/8
	6 3/4	6 1/8	6 1/4	6 5/8
2 1/2	5 1/2	5 7/8	6	6 3/8
	6 3/8	6 3/4	6 7/8	7 1/4
	5 7/8	6 1/4	6 3/8	6 3/4
	6 1/8	6 1/2	6 5/8	7
3 1/4	6 7/8	7 1/2	7 5/8	8 1/4
	7 1/2	8 1/8	8 1/4	8 7/8
	7 1/8	7 3/4	7 7/8	8 1/2
	7 3/8	8	8 1/8	8 3/4
4	6 7/8	7 1/2	7 5/8	8 1/4
	7 3/4	8 3/8	8 1/2	9 1/8
	7 1/8	7 3/4	7 7/8	8 1/2
	7 3/8	8	8 1/8	8 3/4
	7 1/2	8 1/8	8 1/4	8 7/8
5	7 1/8	7 3/4	7 7/8	8 1/2
	8	8 5/8	8 3/4	9 3/8
	7 3/8	8	8 1/8	8 3/4
	7 5/8	8 1/4	8 3/8	9
	7 3/4	8 3/8	8 1/2	9 1/8
	8	8 5/8	8 3/4	9 3/8
	8	8 5/8	8 3/4	9 3/8
6	8 1/8	8 7/8	9 1/8	9 7/8
	8 3/4	9 1/2	9 3/4	10 1/2
	8 3/8	9 1/8	9 3/8	10 1/8
	8 1/2	9 1/4	9 1/2	10 1/4
	8 3/4	9 1/2	9 3/4	10 1/2
	8 3/4	9 1/2	9 3/4	10 1/2
	8 3/4	9 1/2	9 3/4	10 1/2

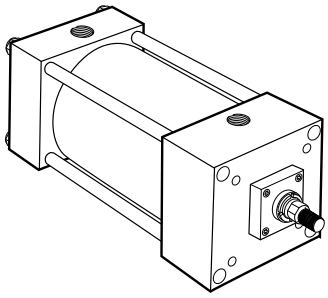
Tie Rods Extended
Style TB
(NFPA Style MX3)

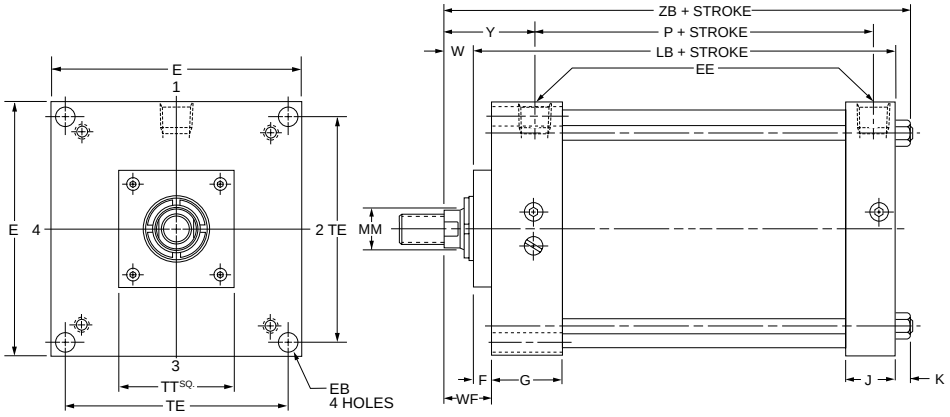
Style TB (NFPA MX3) Head Tie Rods Extended, illustrated: Style TC (NFPA MX2), Cap Tie Rods Extended; and Style TD (NFPA MX1), Both Ends Tie Rods Extended are also available. All "T" styles can be dimensioned from Style TB drawing at right.



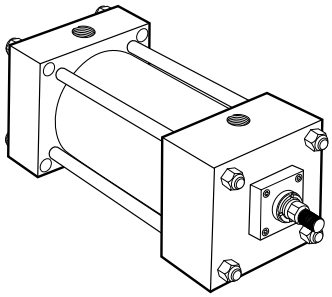


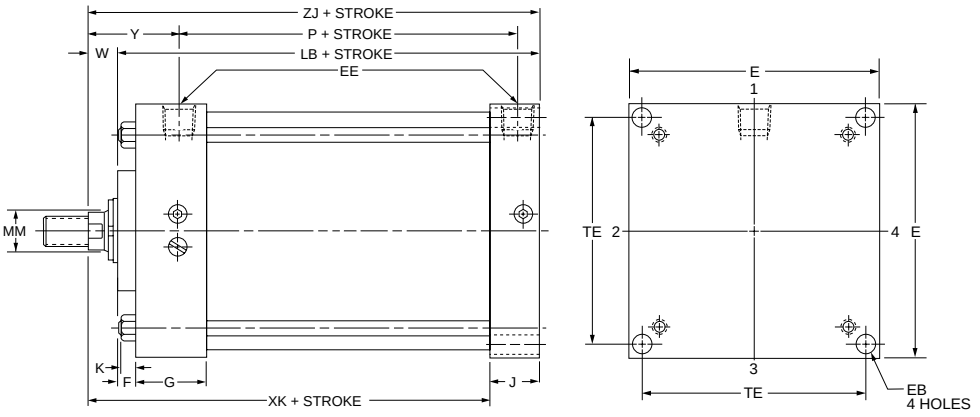
Head Square Flange
Style JB
(NFPA Style ME3)





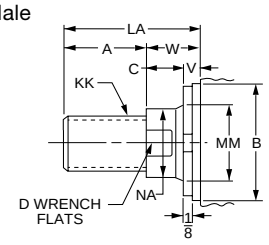
Cap Square Flange
Style HB
(NFPA Style ME4)



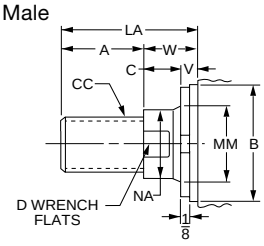


Rod End Dimensions — see table 2

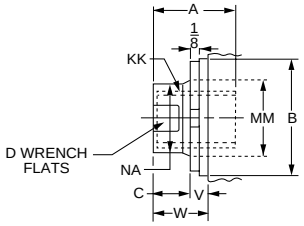
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

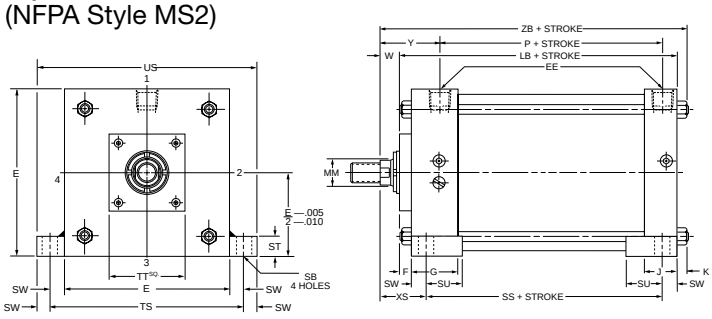
"Special" Thread Style 3
Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensional sketch.

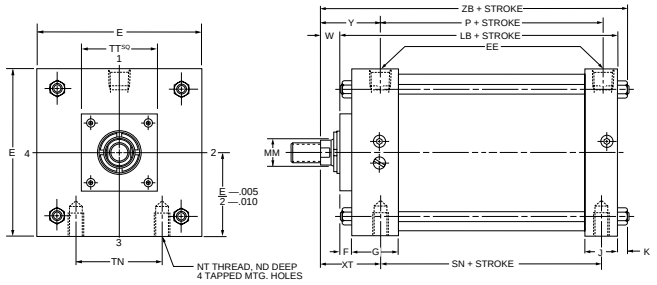
For additional information – call your local Parker Cylinder Distributor.

A

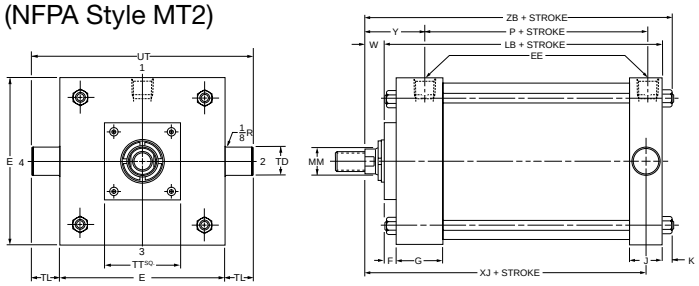
Side Lug
Style C
(NFPA Style MS2)



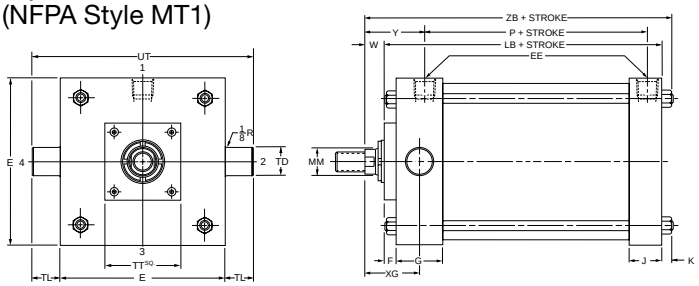
Side Tapped
Style F
(NFPA Style MS4)



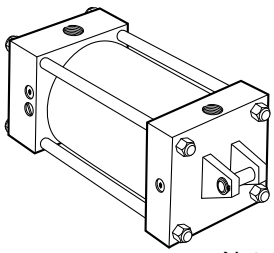
Cap Trunnion
Style DB
(NFPA Style MT2)

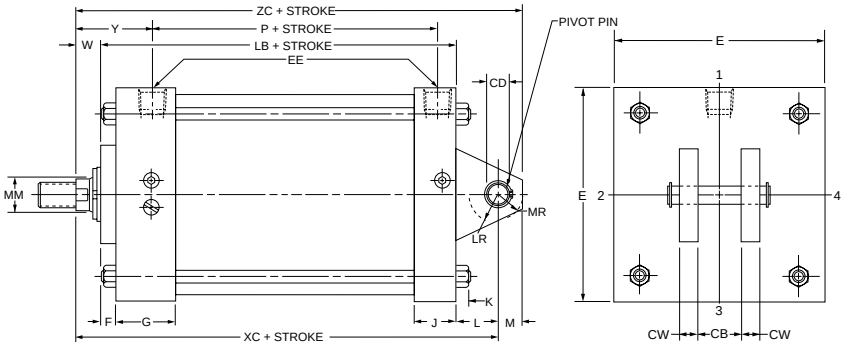


Head Trunnion
Style D
(NFPA Style MT1)



Cap Fixed Clevis
Style BB
(NFPA Style MP1)





Note: Other mounting styles and double rod end cylinders are available on request. Consult factory for details.

Table 1—Envelope and Mounting Dimensions

Bore	AA	BB	CB	+.000 CD -.002	CW	DD	E	EB	EE	F	G	J	K	L	LR	M	MR	ND	NT	R	SB	ST	SU	SW	+.000 TD -.001	TE	TL	TN	TS	US	UT	Add Stroke LB	P	SN	SS
7	8.1	2 5/16	1 1/2	1.001	3/4	5/8-18	7 1/2	9/16	3/4	3/4	2	1 1/2	9/16	1 1/2	1 1/4	1	1 3/16	1 1/8	3/4-10	5.73	13/16	1	1 9/16	11/16	1.375	6 3/4	1 3/8	3 1/2	8 7/8	10 1/4	10 1/4	5 7/8	3 1/4	3 1/4	3 3/4

Table 2—Rod Dimensions

Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W	WF	Y
7	1	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	1 5/8	2 13/16
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	1 7/8	3 1/16
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	2	3 3/16

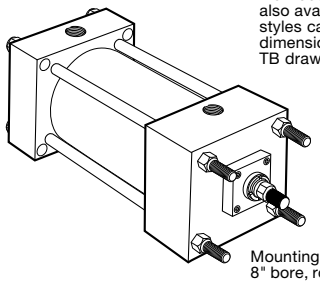
Table 3 — Envelope and Mounting Dimensions

Bore	TT	XG	XS	XT	Add Stroke XC	XJ	XK	ZB	ZC	ZJ
7	4	2 5/8	2 5/16	2 13/16	8 1/4	6	5 1/4	7 5/16	9 1/4	6 3/4
	4	2 7/8	2 9/16	3 1/16	8 1/2	6 1/4	5 1/2	7 9/16	9 1/2	7
	4	3	2 11/16	3 3/16	8 5/8	6 3/8	5 5/8	7 11/16	9 5/8	7 1/8

For Cylinder Division Plant Locations – See Page II.

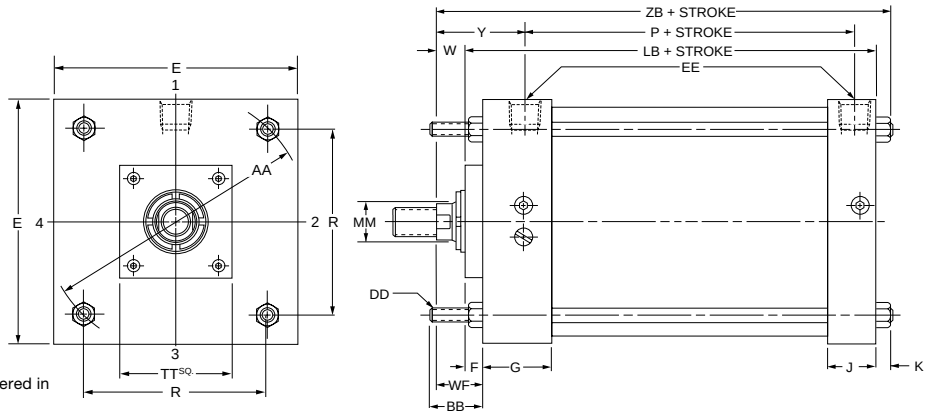
Parker Cylinder

Tie Rods Extended
Style TB
(NFPA Style MX3)

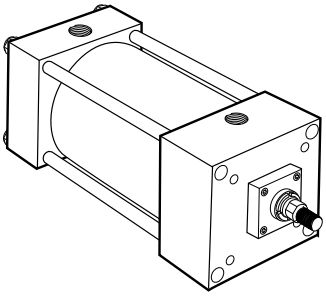


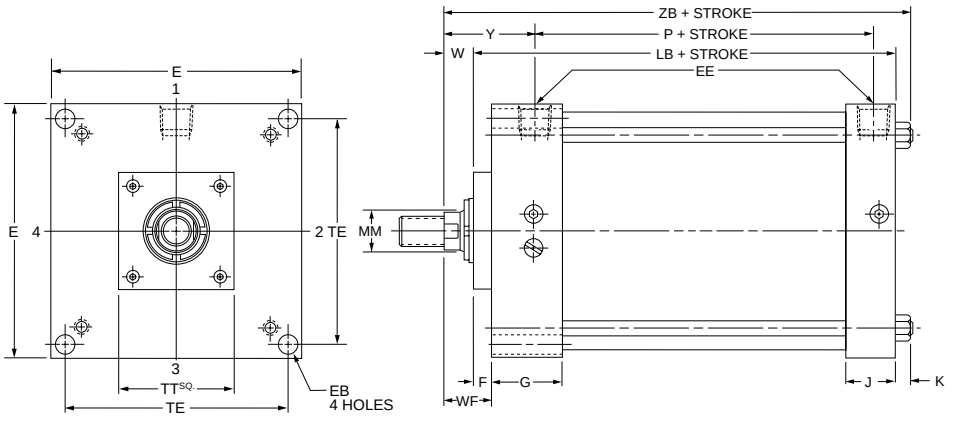
Style TB (NFPA MX3) Head Tie Rods Extended, illustrated: Style TC (NFPA MX2), Cap Tie Rods Extended; and Style TD (NFPA MX1), Both Ends Tie Rods Extended are also available. All "T" styles can be dimensioned from Style TB drawing at right.

Mounting styles TB & TD not offered in 8" bore, rod codes #2, 9 and 0.

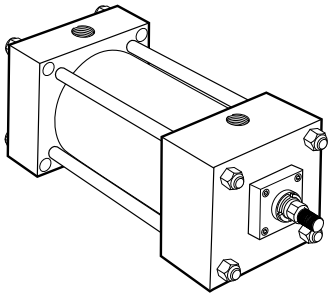


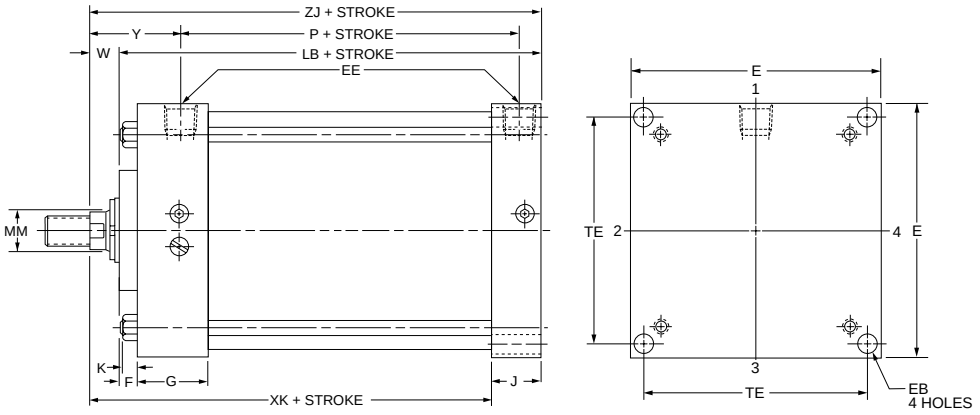
Head Square Flange
Style JB
(NFPA Style ME3)





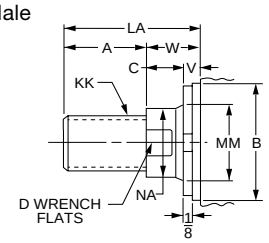
Cap Square Flange
Style HB
(NFPA Style ME4)



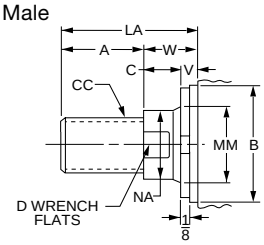


Rod End Dimensions — see table 2

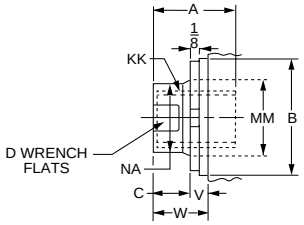
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensional sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	AA	BB	DD	E	EB	EE NPTF	F	G	J	K	R	TE	Add Stroke LB	Add Stroke P
8	9.1	2 5/16	5/8-18	8 1/2	11/16	3/4	3/4	2	1 1/2	9/16	6.44	7.57	5 7/8	3 1/4
10	11.2	2 11/16	3/4-16	10 5/8	13/16	1	3/4	2 1/4	2	11/16	7.92	9.40	7 1/8	4 1/8
12	13.3	2 11/16	3/4-16	12 3/4	13/16	1	3/4	2 1/4	2	11/16	9.40	11.10	7 5/8	4 5/8
14	15.4	3 3/16	7/8-14	14 3/4	15/16	1 1/4	3/4	2 3/4	2 1/4	3/4	10.90	12.87	8 7/8	5 1/2

Table 2—Rod Dimensions

Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W
8	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8
	2	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2
	8	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	9	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2
	0	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2
10	1(Std.)	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	4	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	5	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	6	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2
	7	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	8	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2
	9	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2
	0	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2
12	1(Std.)	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	5	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2
	6	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	7	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2
	8	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2
	9	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2
14	1(Std.)	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	3	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	4	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2
	5	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	6	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2
	7	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2
	8	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2

Table 3 — Envelope and Mounting Dimensions

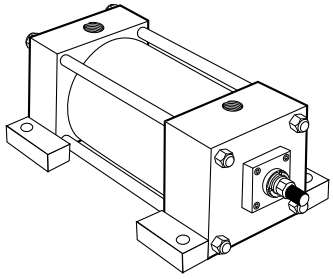
Bore	Rod No.	TT	WF	Y	Add Stroke XK	Add Stroke ZB	Add Stroke ZJ
8	1(Std.)	4	1 5/8	2 13/16	5 1/4	7 5/16	6 3/4
	2	7	2 1/4	3 7/16	5 7/8	7 15/16	7 3/8
	3	4	1 7/8	3 1/16	5 1/2	7 9/16	7
	4	4	2	3 3/16	5 5/8	7 11/16	7 1/8
	5	4	2 1/4	3 7/16	5 7/8	7 15/16	7 3/8
	6	5 1/2	2 1/4	3 7/16	5 7/8	7 15/16	7 3/8
	7	5 1/2	2 1/4	3 7/16	5 7/8	7 15/16	7 3/8
	8	5 1/2	2 1/4	3 7/16	5 7/8	7 15/16	7 3/8
	9	7	2 1/4	3 7/16	5 7/8	7 15/16	7 3/8
	0	7	2 1/4	3 7/16	5 7/8	7 15/16	7 3/8
10	1(Std.)	4	1 7/8	3 1/8	6 1/4	8 15/16	8 1/4
	3	4	2	3 1/4	6 3/8	9 1/16	8 3/8
	4	4	2 1/4	3 1/2	6 5/8	9 5/16	8 5/8
	5	5 1/2	2 1/4	3 1/2	6 5/8	9 5/16	8 5/8
	6	5 1/2	2 1/4	3 1/2	6 5/8	9 5/16	8 5/8
	7	5 1/2	2 1/4	3 1/2	6 5/8	9 5/16	8 5/8
	8	7	2 1/4	3 1/2	6 5/8	9 5/16	8 5/8
	9	7	2 1/4	3 1/2	6 5/8	9 5/16	8 5/8
	0	7	2 1/4	3 1/2	6 5/8	9 5/16	8 5/8
12	1(Std.)	4	2	3 1/4	6 7/8	9 9/16	8 7/8
	3	4	2 1/4	3 1/2	7 1/8	9 13/16	9 1/8
	4	5 1/2	2 1/4	3 1/2	7 1/8	9 13/16	9 1/8
	5	5 1/2	2 1/4	3 1/2	7 1/8	9 13/16	9 1/8
	6	5 1/2	2 1/4	3 1/2	7 1/8	9 13/16	9 1/8
	7	7	2 1/4	3 1/2	7 1/8	9 13/16	9 1/8
	8	7	2 1/4	3 1/2	7 1/8	9 13/16	9 1/8
	9	7	2 1/4	3 1/2	7 1/8	9 13/16	9 1/8
14	1(Std.)	4	2 1/4	3 13/16	8 1/8	11 1/8	10 3/8
	3	5 1/2	2 1/4	3 13/16	8 1/8	11 1/8	10 3/8
	4	5 1/2	2 1/4	3 13/16	8 1/8	11 1/8	10 3/8
	5	5 1/2	2 1/4	3 13/16	8 1/8	11 1/8	10 3/8
	6	7	2 1/4	3 13/16	8 1/8	11 1/8	10 3/8
	7	7	2 1/4	3 13/16	8 1/8	11 1/8	10 3/8
	8	7	2 1/4	3 13/16	8 1/8	11 1/8	10 3/8

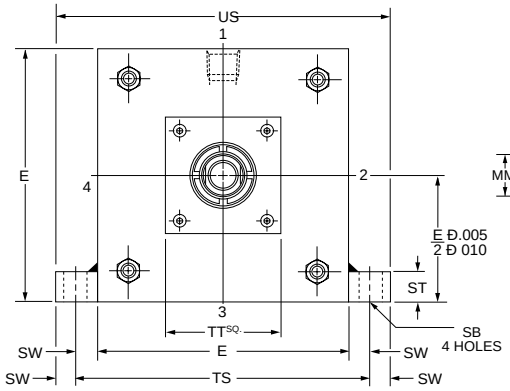
For Cylinder Division Plant Locations – See Page II.

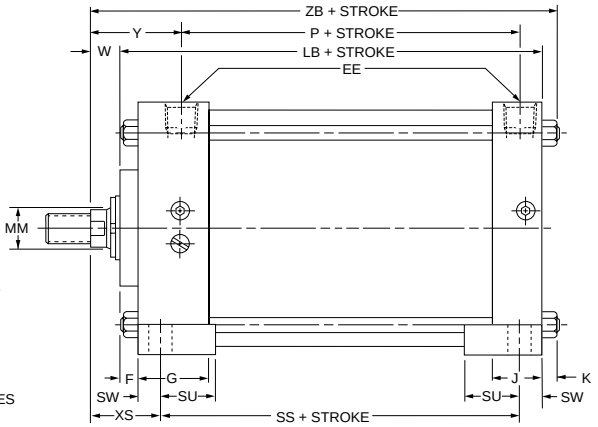
Parker Cylinder

Side Lug

Style C
(NFPA Style MS2)

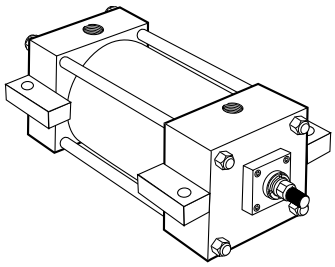


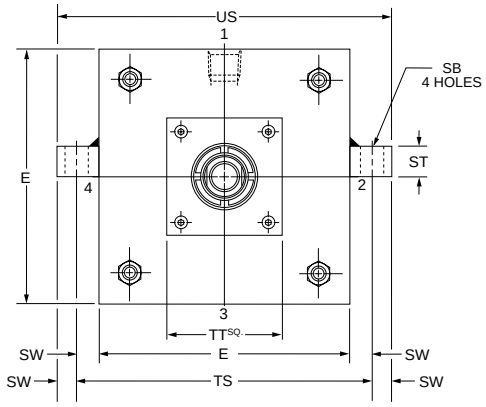


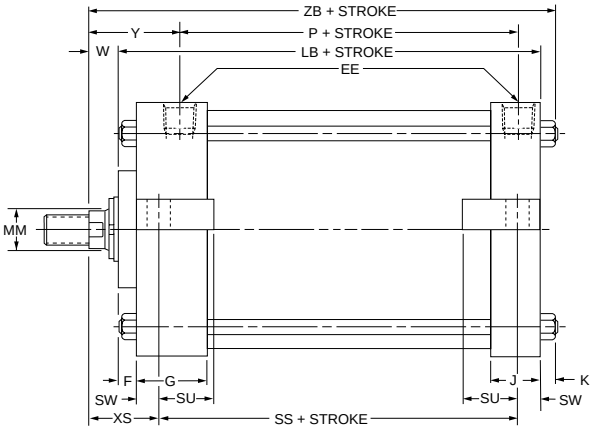


Centerline Lugs

Style E
(NFPA Style MS3)

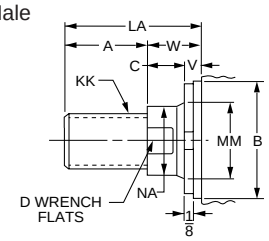




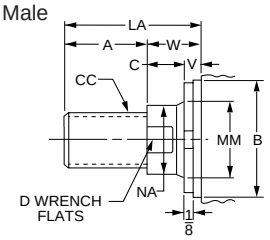


Rod End Dimensions — see table 2

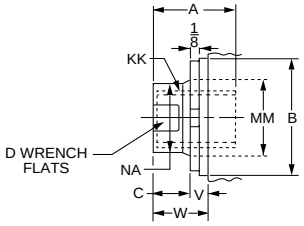
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensional sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	E	EE NPTF	F	G	J	K	SB*	ST	SU	SW	TS	US	Add Stroke LB	Add Stroke P	Add Stroke SS
8	8 1/2	3/4	3/4	2	1 1/2	9/16	13/16	1	1 9/16	11/16	9 7/8	11 1/4	5 7/8	3 1/4	3 3/4
10	10 5/8	1	3/4	2 1/4	2	11/16	1 1/16	1 1/4	2	7/8	12 3/8	14 1/8	7 1/8	4 1/8	4 5/8
12	12 3/4	1	3/4	2 1/4	2	11/16	1 1/16	1 1/4	2	7/8	14 1/2	16 1/4	7 5/8	4 5/8	5 1/8
14	14 3/4	1 1/4	3/4	2 3/4	2 1/4	3/4	1 5/16	1 1/2	2 1/2	1 1/8	17	19 1/4	8 7/8	5 1/2	5 7/8

* Upper surface spotfaced for socket head screws.

A

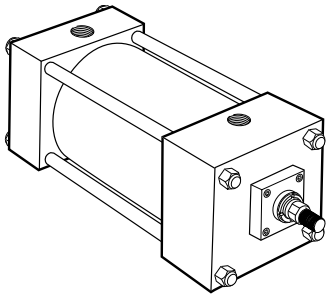
Table 2—Rod Dimensions

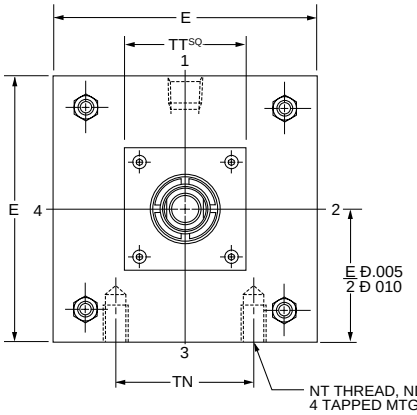
Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W	TT	XS	Y	Add Stroke ZB
8	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	4	2 5/16	2 13/16	7 5/16
	2	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	2 15/16	3 7/16	7 15/16
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	4	2 9/16	3 1/16	7 9/16
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4	2 11/16	3 3/16	7 11/16
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	2 15/16	3 7/16	7 15/16
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	2 15/16	3 7/16	7 15/16
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	2 15/16	3 7/16	7 15/16
	8	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	2 15/16	3 7/16	7 15/16
	9	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	2 15/16	3 7/16	7 15/16
	0	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	2 15/16	3 7/16	7 15/16
10	1(Std.)	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	4	2 3/4	3 1/8	8 15/16
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4	2 7/8	3 1/4	9 1/16
	4	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 1/8	3 1/2	9 5/16
	5	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 1/8	3 1/2	9 5/16
	6	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 1/8	3 1/2	9 5/16
	7	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 1/8	3 1/2	9 5/16
	8	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 1/8	3 1/2	9 5/16
	9	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 1/8	3 1/2	9 5/16
	0	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 1/8	3 1/2	9 5/16
12	1(Std.)	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4	2 7/8	3 1/4	9 9/16
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 1/8	3 1/2	9 13/16
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 1/8	3 1/2	9 13/16
	5	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 1/8	3 1/2	9 13/16
	6	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 1/8	3 1/2	9 13/16
	7	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 1/8	3 1/2	9 13/16
	8	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 1/8	3 1/2	9 13/16
	9	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 1/8	3 1/2	9 13/16
14	1(Std.)	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 3/8	3 13/16	11 1/8
	3	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 3/8	3 13/16	11 1/8
	4	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 3/8	3 13/16	11 1/8
	5	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 3/8	3 13/16	11 1/8
	6	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 3/8	3 13/16	11 1/8
	7	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 3/8	3 13/16	11 1/8
	8	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 3/8	3 13/16	11 1/8

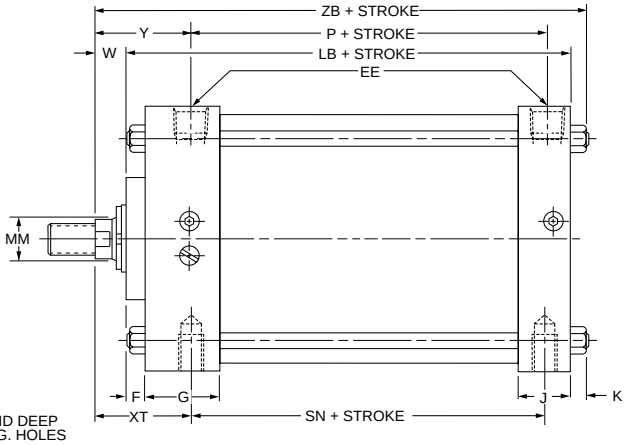
Table 3 — Envelope and Mounting Dimensions

Side Tapped

Style F
(NFPA Style MS4)



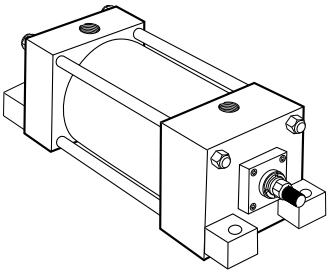


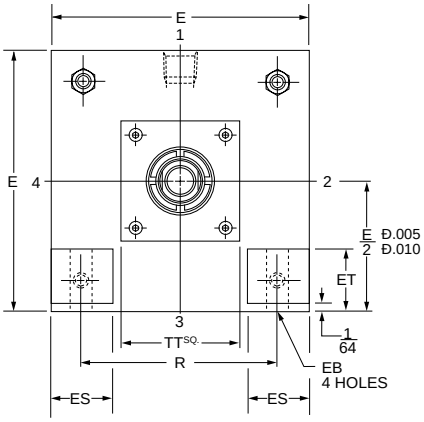


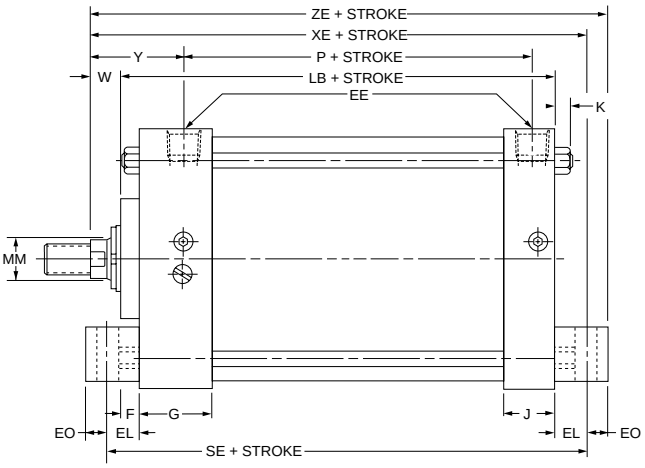
Side End Lugs

Style G
(NFPA Style MS7)

Cylinders with this mounting style are mounted on the precision ground surfaces of the head and cap. There must be a minimum gap of at least 1/64 of an inch between the bottom of the lug and the mounting surface before the mounting bolts are tightened.



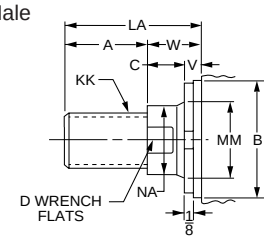




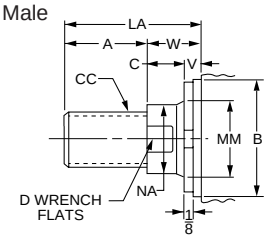
Not offered in the following sizes: 8" bore, rod codes #2, 6, 7, 8, 9 and 0; 10" bore, rod codes #8, 9 and 0; and 12" bore, rod codes #7, 8 and 9.

Rod End Dimensions — see table 2

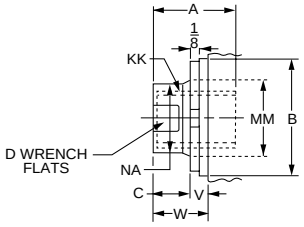
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

Special Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensional sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	E	EB	EE NPTF	EL	EO	ES	ET	F	G	J	K	ND	NT	R	TN	Add Stroke LB	P	SE	SN
8	8 1/2	11/16	3/4	1 1/8	5/8	2 1/4	2 1/32	3/4	2	1 1/2	9/16	1 1/8	3/4-10	6.44	4 1/2	5 7/8	3 1/4	7 3/8	3 1/4
10	10 5/8	13/16	1	1 5/16	5/8	2 3/4	2 11/16	3/4	2 1/4	2	11/16	1 1/2	1-8	7.92	5 1/2	7 1/8	4 1/8	9	4 1/8
12	12 3/4	13/16	1	1 5/16	5/8	3 1/2	3 5/16	3/4	2 1/4	2	11/16	1 1/2	1-8	9.40	7 1/4	7 5/8	4 5/8	9 1/2	4 5/8
14	14 3/4	15/16	1 1/4	1 1/2	3/4	4	3 13/16	3/4	2 3/4	2 1/4	3/4	1 7/8	1 1/4-7	10.90	8 3/8	8 7/8	5 1/2	11 1/8	5 1/2

Table 2—Rod Dimensions

Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W	TT	XT	Y	Add Stroke XE	ZB	ZE
8	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	4	2 13/16	2 13/16	7 7/8	7 5/16	8 1/2
	2	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 7/16	3 7/16	*	7 15/16	*
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	4	3 1/16	3 1/16	8 1/8	7 9/16	8 3/4
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4	3 3/16	3 3/16	8 1/4	7 11/16	8 7/8
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 7/16	3 7/16	8 1/2	7 15/16	9 1/8
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 7/16	3 7/16	*	7 15/16	*
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 7/16	3 7/16	*	7 15/16	*
	8	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 7/16	3 7/16	*	7 15/16	*
	9	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 7/16	3 7/16	*	7 15/16	*
	0	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 7/16	3 7/16	*	7 15/16	*
10	1(Std.)	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	4	3 1/8	3 1/8	9 9/16	8 15/16	10 3/16
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4	3 1/4	3 1/4	9 11/16	9 1/16	10 5/16
	4	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 1/2	3 1/2	9 15/16	9 5/16	10 9/16
	5	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 1/2	3 1/2	9 15/16	9 5/16	10 9/16
	6	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 1/2	3 1/2	9 15/16	9 5/16	10 9/16
	7	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 1/2	3 1/2	9 15/16	9 5/16	10 9/16
	8	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 1/2	3 1/2	*	9 5/16	*
	9	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 1/2	3 1/2	*	9 5/16	*
	0	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 1/2	3 1/2	*	9 5/16	*
12	1(Std.)	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4	3 1/4	3 1/4	10 3/16	9 9/16	10 13/16
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 1/2	3 1/2	10 7/16	9 13/16	11 1/16
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 1/2	3 1/2	10 7/16	9 13/16	11 1/16
	5	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 1/2	3 1/2	10 7/16	9 13/16	11 1/16
	6	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 1/2	3 1/2	10 7/16	9 13/16	11 1/16
	7	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 1/2	3 1/2	*	9 13/16	*
	8	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 1/2	3 1/2	*	9 13/16	*
	9	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 1/2	3 1/2	*	9 13/16	*
14	1(Std.)	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 13/16	3 13/16	11 7/8	11 1/8	12 5/8
	3	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 13/16	3 13/16	11 7/8	11 1/8	12 5/8
	4	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 13/16	3 13/16	11 7/8	11 1/8	12 5/8
	5	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 13/16	3 13/16	11 7/8	11 1/8	12 5/8
	6	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 13/16	3 13/16	11 7/8	11 1/8	12 5/8
	7	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 13/16	3 13/16	11 7/8	11 1/8	12 5/8
	8	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 13/16	3 13/16	11 7/8	11 1/8	12 5/8

Table 3 — Envelope and Mounting Dimensions

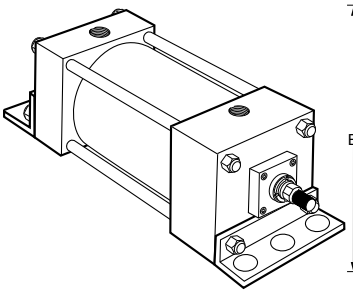
* Mounting style G not offered in this rod size.

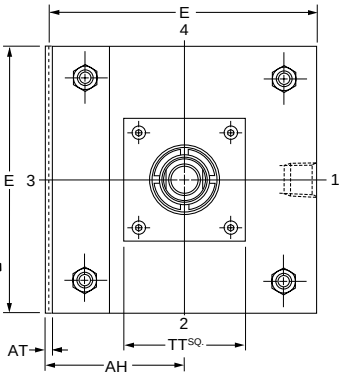
Caution: When using mounting style G, check clearance between mounting members and rod attachment or accessory. If necessary, specify longer rod extension to avoid interference with mounting members.

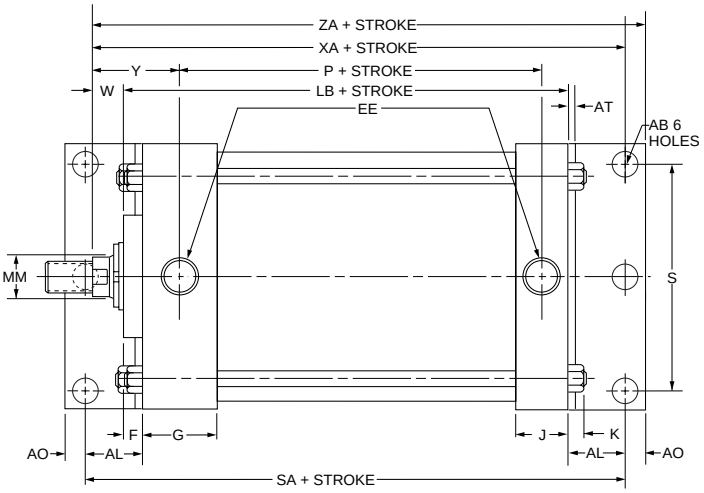
For Cylinder Division Plant Locations – See Page II.

Side End Angles

Style CB
(NFPA Style MS1)



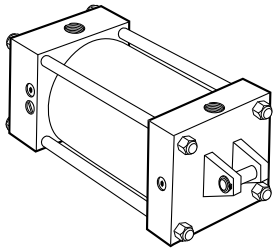


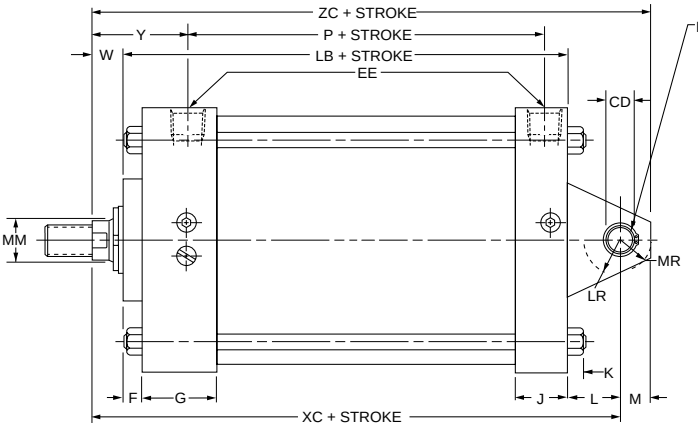


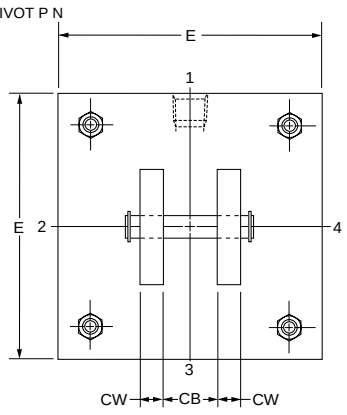
Not offered in the following sizes: 8" bore, rod codes #2, 6, 7, 8, 9 and 0; 10" bore, rod codes #8, 9 and 0.

Cap Fixed Clevis

Style BB
(NFPA Style MP1)

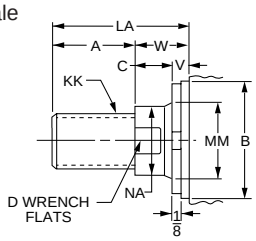




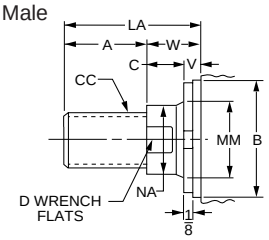


Rod End Dimensions — see table 2

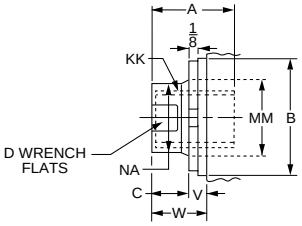
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensional sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	AB	AH	AL	AO	AT	CB	+.000 CD* -.002	CW	E	EE NPTF	F	G	J	K	L	LR	M	MR	S	Add Stroke LB	Add Stroke P	Add Stroke SA
8	13/16	4 1/4	1 13/16	11/16	1/4	1 1/2	1.001	3/4	8 1/2	3/4	3/4	2	1 1/2	9/16	1 1/2	1 1/4	1	1 3/16	7 1/8	5 7/8	3 1/4	8 3/4
10	1 1/16	5 5/16	2 1/8	7/8	1/4	2	1.376	1	10 5/8	1	3/4	2 1/4	2	11/16	2 1/8	1 7/8	1 3/8	1 5/8	8 7/8	7 1/8	4 1/8	10 5/8
12	1 1/16	6 3/8	2 1/8	7/8	3/8	2 1/2	1.751	1 1/4	12 3/4	1	3/4	2 1/4	2	11/16	2 1/4	2 1/8	1 3/4	2 1/8	11	7 5/8	4 5/8	11 1/8
14	1 5/16	7 3/8	2 7/16	1 1/16	3/8	2 1/2	2.001	1 1/4	14 3/4	1 1/4	3/4	2 3/4	2 1/4	3/4	2 1/2	2 3/8	2	2 3/8	12 5/8	8 7/8	5 1/2	13

* CD is pin diameter.

A

Table 2—Rod Dimensions

Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W	TT	Y	Add Stroke XA	Add Stroke XC	Add Stroke ZA	Add Stroke ZC
8	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	4	2 13/16	8 9/16	8 1/4	9 1/4	9 1/4
	2	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 7/16	*	8 7/8	*	9 7/8
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	4	3 1/16	8 13/16	8 1/2	9 1/2	9 1/2
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4	3 3/16	8 15/16	8 5/8	9 5/8	9 5/8
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 7/16	9 3/16	8 7/8	9 7/8	9 7/8
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 7/16	*	8 7/8	*	9 7/8
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 7/16	*	8 7/8	*	9 7/8
	8	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 7/16	*	8 7/8	*	9 7/8
	9	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 7/16	*	8 7/8	*	9 7/8
	0	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 7/16	*	8 7/8	*	9 7/8
10	1(Std.)	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	4	3 1/8	10 3/8	10 3/8	11 1/4	11 3/4
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4	3 1/4	10 1/2	10 1/2	11 3/8	11 7/8
	4	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 1/2	10 3/4	10 3/4	11 5/8	12 1/8
	5	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 1/2	10 3/4	10 3/4	11 5/8	12 1/8
	6	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 1/2	10 3/4	10 3/4	11 5/8	12 1/8
	7	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 1/2	10 3/4	10 3/4	11 5/8	12 1/8
	8	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 1/2	*	10 3/4	*	12 1/8
	9	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 1/2	*	10 3/4	*	12 1/8
	0	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 1/2	*	10 3/4	*	12 1/8
12	1(Std.)	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4	3 1/4	11	11 1/8	11 7/8	12 7/8
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 1/2	11 1/4	11 3/8	12 1/8	13 1/8
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 1/2	11 1/4	11 3/8	12 1/8	13 1/8
	5	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 1/2	11 1/4	11 3/8	12 1/8	13 1/8
	6	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 1/2	11 1/4	11 3/8	12 1/8	13 1/8
	7	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 1/2	11 1/4	11 3/8	12 1/8	13 1/8
	8	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 1/2	11 1/4	11 3/8	12 1/8	13 1/8
	9	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 1/2	11 1/4	11 3/8	12 1/8	13 1/8
14	1(Std.)	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2	4	3 13/16	12 13/16	12 7/8	13 7/8	14 7/8
	3	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2	5 1/2	3 13/16	12 13/16	12 7/8	13 7/8	14 7/8
	4	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2	5 1/2	3 13/16	12 13/16	12 7/8	13 7/8	14 7/8
	5	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2	5 1/2	3 13/16	12 13/16	12 7/8	13 7/8	14 7/8
	6	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2	7	3 13/16	12 13/16	12 7/8	13 7/8	14 7/8
	7	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2	7	3 13/16	12 13/16	12 7/8	13 7/8	14 7/8
	8	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2	7	3 13/16	12 13/16	12 7/8	13 7/8	14 7/8

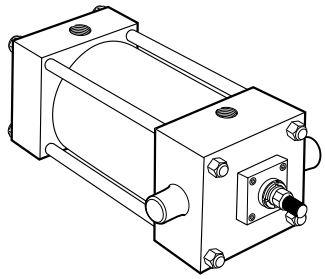
* Mounting style G not offered in this rod size.

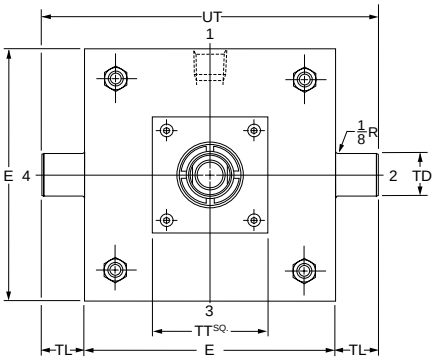
Caution: When using mounting style G, check clearance between mounting members and rod attachment or accessory. If necessary, specify longer rod extension to avoid interference with mounting members.

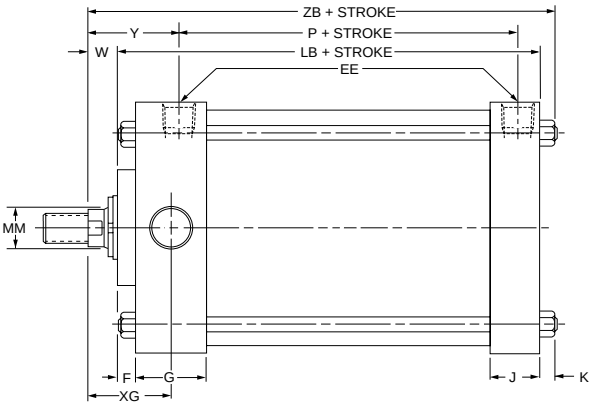
Table 3 — Envelope and Mounting Dimensions

For Cylinder Division Plant Locations – See Page II.

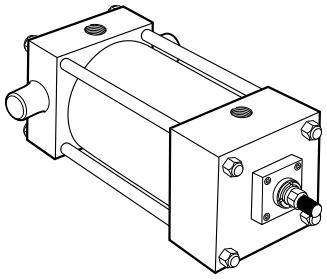
Head Trunnion
Style D
(NFPA Style MT1)

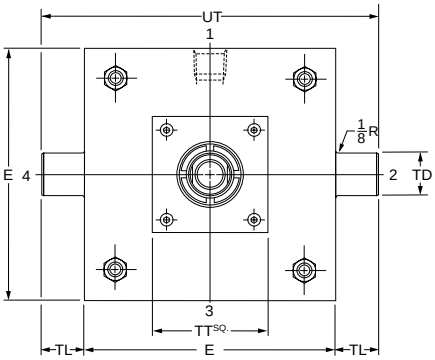


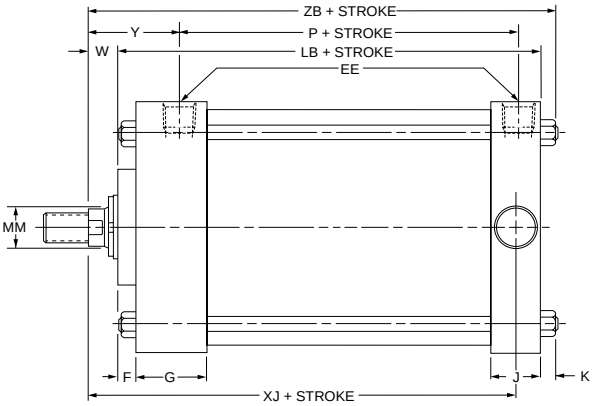




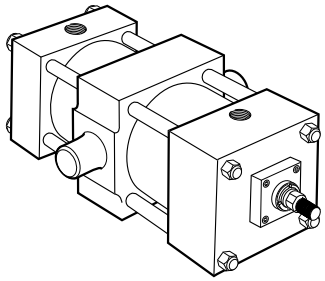
Cap Trunnion
Style DB
(NFPA Style MT2)

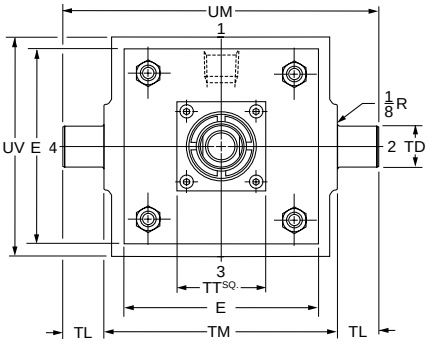


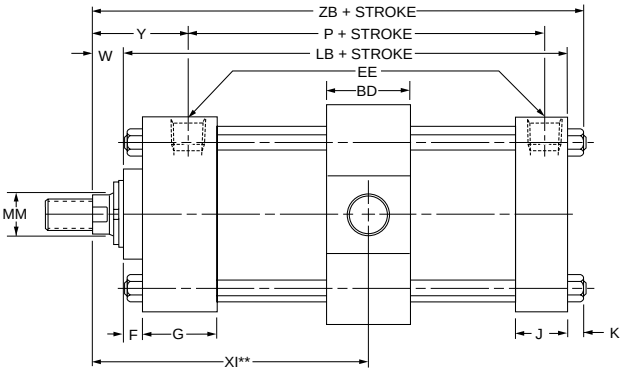




Intermediate Fixed Trunnion
Style DD
(NFPA Style MT4)

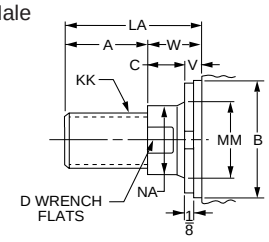




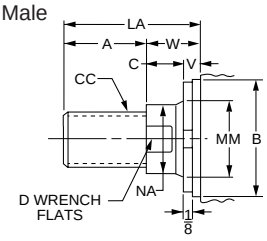


Rod End Dimensions — see table 2

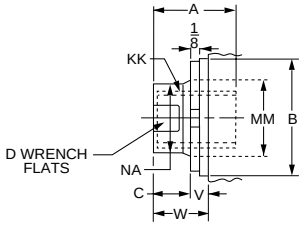
Thread Style 4
(NFPA Style SM)
Small Male



Thread Style 8
(NFPA Style IM)
Intermediate Male



Thread Style 9
(NFPA Style SF)
Small Female



A high strength rod end stud is supplied on thread style 4 through 2" diameter rods and on thread style 8 through 1 3/8" diameter rods. Larger sizes or special rod ends are cut threads. Style 4 rod ends are recommended where the workpiece is secured against the rod shoulder. When the workpiece is not shouldered, style 4 rod ends are recommended through 2" piston rod diameters and style 8 rod ends are recommended on larger diameters. Use style 9 for applications where female rod end threads are required. If rod end is not specified, style 4 will be supplied.

"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensional sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1—Envelope and Mounting Dimensions

Bore	BD	E	EE NPTF	F	G	J	K	+.000 TD -.001	TL	TM	UM	UT	UV	Add Stroke LB	Add Stroke P	Style DD Min. Stroke
8	2 1/2	8 1/2	3/4	3/4	2	1 1/2	9/16	1.375	1 3/8	9 3/4	12 1/2	11 1/4	9 1/2	5 7/8	3 1/4	7/8
10	3	10 5/8	1	3/4	2 1/4	2	11/16	1.750	1 3/4	12	15 1/2	14 1/8	11 3/4	7 1/8	4 1/8	7/8
12	3	12 3/4	1	3/4	2 1/4	2	11/16	1.750	1 3/4	14	17 1/2	16 1/4	13 3/4	7 5/8	4 5/8	3/8
14	3 1/2	14 3/4	1 1/4	3/4	2 3/4	2 1/4	3/4	2.000	2	16 1/4	20 1/4	18 3/4	16	8 7/8	5 1/2	3/8

A

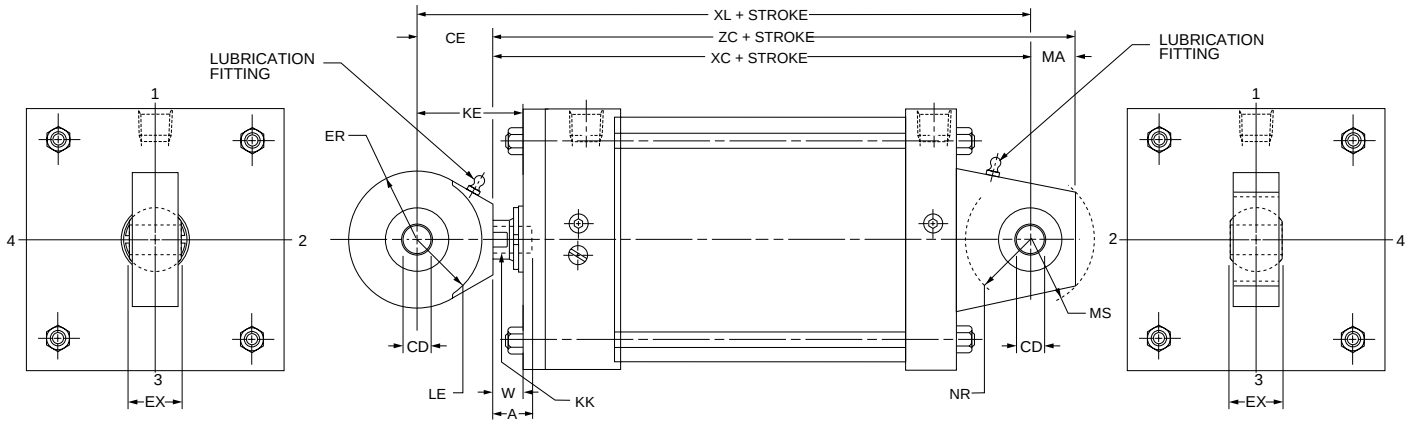
Table 2—Rod Dimensions

Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	Rod Extensions and Pilot Dimensions A	+.000 -.002 B	C	D	LA	NA	V	W
8	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8
	2	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/8	1 1/2	3 1/8	1 11/16	3/8	1 1/8
	4	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	5	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	6	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	7	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2
	8	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	9	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2
	0	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2
10	1(Std.)	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	4	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	5	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	6	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2
	7	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	8	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2
	9	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2
	0	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2
12	1(Std.)	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	5	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2
	6	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	7	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2
	8	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2
	9	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2
14	1(Std.)	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/2	2 3/8	1/2	1 1/2
	3	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	5	2 7/8	1/2	1 1/2
	4	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	5	3 3/8	1/2	1 1/2
	5	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/2	3 7/8	1/2	1 1/2
	6	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	6	4 3/8	1/2	1 1/2
	7	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/2	4 7/8	1/2	1 1/2
	8	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	7	5 3/8	1/2	1 1/2

**Dimension XI to be specified by customer.

Table 3 — Envelope and Mounting Dimensions

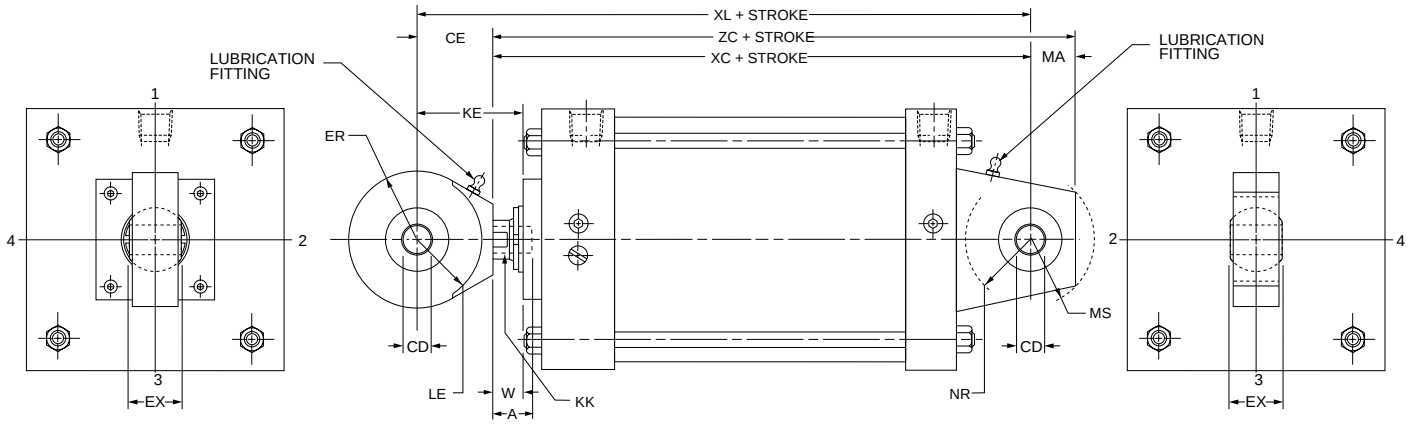
Bore	Rod No.	TT	XG	Min.** XI	Y	Add Stroke XJ	Add Stroke ZB
8	1(Std.)	4	2 5/8	4 15/16	2 13/16	6	7 5/16
	2	7	3 1/4	5 9/16	3 7/16	6 5/8	7 15/16
	3	4	2 7/8	5 3/16	3 1/16	6 1/4	7 9/16
	4	4	3	5 5/16	3 3/16	6 3/8	7 11/16
	5	4	3 1/4	5 9/16	3 7/16	6 5/8	7 15/16
	6	5 1/2	3 1/4	5 3/16	3 7/16	6 5/8	7 15/16
	7	5 1/2	3 1/4	5 9/16	3 7/16	6 5/8	7 15/16
	8	5 1/2	3 1/4	5 9/16	3 7/16	6 5/8	7 15/16
	9	7	3 1/4	5 9/16	3 7/16	6 5/8	7 15/16
	0	7	3 1/4	5 9/16	3 7/16	6 5/8	7 15/16
10	1(Std.)	4	3	5 11/16	3 1/8	7 1/4	8 15/16
	3	4	3 1/8	5 13/16	3 1/4	7 3/8	9 1/16
	4	4	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16
	5	5 1/2	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16
	6	5 1/2	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16
	7	5 1/2	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16
	8	7	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16
	9	7	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16
	0	7	3 3/8	6 1/16	3 1/2	7 5/8	9 5/16
12	1(Std.)	4	3 1/8	5 13/16	3 1/4	7 7/8	9 9/16
	3	4	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16
	4	5 1/2	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16
	5	5 1/2	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16
	6	5 1/2	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16
	7	7	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16
	8	7	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16
	9	7	3 3/8	6 1/16	3 1/2	8 1/8	9 13/16
14	1(Std.)	4	3 5/8	6 13/16	3 13/16	9 1/4	11 1/8
	3	5 1/2	3 5/8	6 13/16	3 13/16	9 1/4	11 1/8
	4	5 1/2	3 5/8	6 13/16	3 13/16	9 1/4	11 1/8
	5	5 1/2	3 5/8	6 13/16	3 13/16	9 1/4	11 1/8
	6	7	3 5/8	6 13/16	3 13/16	9 1/4	11 1/8
	7	7	3 5/8	6 13/16	3 13/16	9 1/4	11 1/8
	8	7	3 5/8	6 13/16	3 13/16	9 1/4	11 1/8



Bore	Rod No.	Rod Dia. MM	Thread Style 9 KK	Thread Style 7 KK	A	W	Add Stroke XC	Add Stroke XL	Add Stroke ZC	KE	CD*	CE	ER	EX	LE	MA	MS	NR	Max. Oper. PSI 2A
1½	1(Std.)	⅝	7/16-20	—	¾	⅝	5⅜	6¼	6⅛	1½	-.0005 .5000	⅞	13/16	7/16	¾	¾	15/16	⅝	250
	2	1	**	7/16-20	¾	1	5¾	6⅝	6½	1⅞									
2	1(Std.)	⅝	7/16-20	—	¾	⅝	5⅜	6¼	6⅛	1½	-.0005 .5000	⅞	13/16	7/16	¾	¾	15/16	⅝	250
	2	1⅜	**	7/16-20	¾	1¼	6	6⅞	6¾	2⅛									
	3	1	**	7/16-20	¾	1	5¾	6⅝	6½	1⅞									
2½	1(Std.)	⅝	7/16-20	—	¾	⅝	5½	6⅜	6¼	1½	-.0005 .5000	⅞	13/16	7/16	¾	¾	15/16	⅝	250
	2	1¾	**	7/16-20	¾	1½	6⅜	7¼	7⅛	2⅜									
	3	1	**	7/16-20	¾	1	5⅞	6¾	6⅝	1⅞									
	4	1⅜	**	7/16-20	¾	1¼	6⅛	7	6⅞	2⅛									
3¼	1(Std.)	1	¾-16	—	1⅛	¾	6⅞	8⅛	7⅞	2	-.0005 .7500	1¼	1⅛	21/32	1 1/16	1	1⅜	1	250
	2	2	**	¾-16	1⅛	1⅜	7½	8¾	8½	2⅝									
	3	1⅜	**	¾-16	1⅛	1	7⅛	8⅜	8⅛	2¼									
	4	1¾	**	¾-16	1⅛	1¼	7⅜	8⅝	8⅜	2½									
4	1(Std.)	1	¾-16	—	1⅛	¾	6⅞	8⅛	7⅞	2	-.0005 .7500	1¼	1⅛	21/32	1 1/16	1	1⅜	1	250
	2	2½	**	¾-16	1⅛	1⅝	7¾	9	8¾	2⅞									
	3	1⅜	**	¾-16	1⅛	1	7⅛	8⅜	8⅛	2¼									
	4	1¾	**	¾-16	1⅛	1¼	7⅜	8⅝	8⅜	2½									
	5	2	**	¾-16	1⅛	1⅜	7½	8¾	8½	2⅝									
5	1(Std.)	1	¾-16	—	1⅛	¾	7⅛	8⅜	8⅛	2	-.0005 .7500	1¼	1⅛	21/32	1 1/16	1	1⅜	1	250
	2	3½	**	¾-16	1⅛	1⅝	8	9¼	9	2⅞									
	3	1⅜	**	¾-16	1⅛	1	7⅜	8⅝	8⅜	2¼									
	4	1¾	**	¾-16	1⅛	1¼	7⅝	8⅞	8⅝	2½									
	5	2	**	¾-16	1⅛	1⅜	7¾	9	8¾	2⅝									
	6	2½	**	¾-16	1⅛	1⅝	8	9¼	9	2⅞									
	7	3	**	¾-16	1⅛	1⅝	8	9¼	9	2⅞									
6	1(Std.)	1⅜	1-14	—	1⅝	⅞	8⅛	10	9⅜	2¾	-.0005 10000	1⅞	1¼	⅞	1 7/16	1¼	1 11/16	1¼	250
	2	4	**	1-14	1⅝	1½	8¾	10⅝	10	3⅜									
	3	1¾	**	1-14	1⅝	1⅛	8⅜	10¼	9⅝	3									
	4	2	**	1-14	1⅝	1¼	8½	10⅜	9¾	3⅛									
	5	2½	**	1-14	1⅝	1½	8¾	10⅝	10	3⅜									
	6	3	**	1-14	1⅝	1½	8¾	10⅝	10	3⅜									
	7	3½	**	1-14	1⅝	1½	8¾	10⅝	10	3⅜									

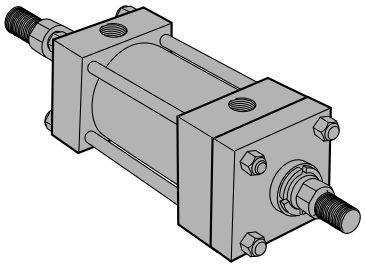
Maximum operating pressure at 4:1 design factor is based on tensile strength of material. Pressure ratings are based on standard commercial bearing ratings.
Note: For additional dimensions see Series 2A, page 30.
* Dimension CD is hole diameter.
** Corresponding rod eye pin diameter may not match pin diameter of cap.
Rod No. 1 is standard.

For additional information – call your local Parker Cylinder Distributor.



Bore	Rod No.	Rod Dia. MM	Thread Style 9 KK	Thread Style 7 KK	A	W	Add Stroke XC	Add Stroke XL	Add Stroke ZC	KE	CD*	CE	ER	EX	LE	MA	MS	NR	Max. Oper. PSI 2A
8	1(Std.)	1 3/8	1-14	–	1 5/8	7/8	8 1/4	10 1/8	9 1/2	2 3/4	-.0005 1.0000	1 7/8	1 1/4	7/8	1 7/16	1 1/4	1 11/16	1 1/4	250
	2	5 1/2	**	1-14	1 5/8	1 1/2	8 7/8	10 3/4	10 1/8	3 3/8									
	3	1 3/4	**	1-14	1 5/8	1 1/8	8 1/2	10 3/8	9 3/4	3									
	4	2	**	1-14	1 5/8	1 1/4	8 5/8	10 1/2	9 7/8	3 1/8									
	5	2 1/2	**	1-14	1 5/8	1 1/2	8 7/8	10 3/4	10 1/8	3 3/8									
	6	3	**	1-14	1 5/8	1 1/2	8 7/8	10 3/4	10 1/8	3 3/8									
	7	3 1/2	**	1-14	1 5/8	1 1/2	8 7/8	10 3/4	10 1/8	3 3/8									
	8	4	**	1-14	1 5/8	1 1/2	8 7/8	10 3/4	10 1/8	3 3/8									
	9	4 1/2	**	1-14	1 5/8	1 1/2	8 7/8	10 3/4	10 1/8	3 3/8									
	0	5	**	1-14	1 5/8	1 1/2	8 7/8	10 3/4	10 1/8	3 3/8									
10	1(Std.)	1 3/4	1 1/4-12	–	2	1 1/8	10 3/8	12 1/2	12 1/4	3 1/4	-.0005 1.3750	2 1/8	1 11/16	1 3/16	1 7/8	1 7/8	2 7/16	1 5/8	250
	3	2	**	1 1/4-12	2	1 1/4	10 1/2	12 5/8	12 3/8	3 3/8									
	4	2 1/2	**	1 1/4-12	2	1 1/2	10 3/4	12 7/8	12 5/8	3 5/8									
	5	3	**	1 1/4-12	2	1 1/2	10 3/4	12 7/8	12 5/8	3 5/8									
	6	3 1/2	**	1 1/4-12	2	1 1/2	10 3/4	12 7/8	12 5/8	3 5/8									
	7	4	**	1 1/4-12	2	1 1/2	10 3/4	12 7/8	12 5/8	3 5/8									
	8	4 1/2	**	1 1/4-12	2	1 1/2	10 3/4	12 7/8	12 5/8	3 5/8									
	9	5	**	1 1/4-12	2	1 1/2	10 3/4	12 7/8	12 5/8	3 5/8									
	0	5 1/2	**	1 1/4-12	2	1 1/2	10 3/4	12 7/8	12 5/8	3 5/8									
12	1(Std.)	2	1 1/2-12	–	2 1/4	1 1/4	11 1/8	13 5/8	13 5/8	3 3/4	-.0005 1.7500	2 1/2	2 1/16	1 17/32	2 1/8	2 1/2	2 7/8	2 1/16	250
	3	2 1/2	**	1 1/2-12	2 1/4	1 1/2	11 3/8	13 7/8	13 7/8	4									
	4	3	**	1 1/2-12	2 1/4	1 1/2	11 3/8	13 7/8	13 7/8	4									
	5	3 1/2	**	1 1/2-12	2 1/4	1 1/2	11 3/8	13 7/8	13 7/8	4									
	6	4	**	1 1/2-12	2 1/4	1 1/2	11 3/8	13 7/8	13 7/8	4									
	7	4 1/2	**	1 1/2-12	2 1/4	1 1/2	11 3/8	13 7/8	13 7/8	4									
	8	5	**	1 1/2-12	2 1/4	1 1/2	11 3/8	13 7/8	13 7/8	4									
	9	5 1/2	**	1 1/2-12	2 1/4	1 1/2	11 3/8	13 7/8	13 7/8	4									
14	1(Std.)	2 1/2	1 7/8-12	–	3	1 1/2	12 7/8	15 5/8	15 3/8	4 1/4	-.0005 2.0000	2 3/4	2 1/2	1 3/4	2 1/2	2 1/2	3 5/16	2 3/8	250
	3	3	**	1 7/8-12	3	1 1/2	12 7/8	15 5/8	15 3/8	4 1/4									
	4	3 1/2	**	1 7/8-12	3	1 1/2	12 7/8	15 5/8	15 3/8	4 1/4									
	5	4	**	1 7/8-12	3	1 1/2	12 7/8	15 5/8	15 3/8	4 1/4									
	6	4 1/2	**	1 7/8-12	3	1 1/2	12 7/8	15 5/8	15 3/8	4 1/4									
	7	5	**	1 7/8-12	3	1 1/2	12 7/8	15 5/8	15 3/8	4 1/4									
	8	5 1/2	**	1 7/8-12	3	1 1/2	12 7/8	15 5/8	15 3/8	4 1/4									

Maximum operating pressure at 4:1 design factor is based on tensile strength of material. Pressure ratings are based on standard commercial bearing ratings.
Note: For additional dimensions see Series 2A, page 40.
* Dimension CD is hole diameter.
** Corresponding rod eye pin diameter may not match pin diameter of cap. Rod No. 1 is standard.



Mounting Styles for Single Rod Models	Mounting Styles for Corresponding Double Rod Models*	Dimensions Shown on This Page Supplement Dimensions on Pages Listed Below	
		1"-6" Bores Page No.	8"-14" Bores Page No.
T	KT	20	34
TB**	KTB	20	34
TD	KTD	20	34
J	KJ	20	—
JB**	KJB	22	34
C**	KC	24	36
E	KE	24	36
F	KF	24	38
CB	KCB	26	40
G	KC	26	38
D	KD	28	42
DD	KDD†	28	42

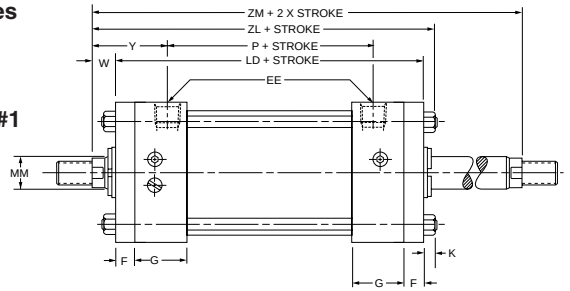
*If only one end of these Double Rod Cylinders is to be cushioned, be sure to specify clearly which end this will be.

**Available in 7" bore, page 32.

†Specify XI dimension from rod end #1.

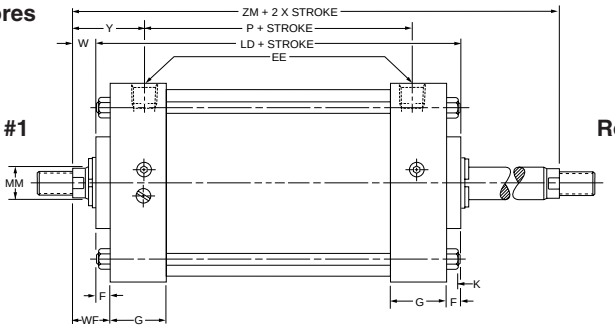
How to Use Double Rod Cylinder Dimensioned Drawings

1"- 6" Bores



Rod End #1 **Rod End #2**

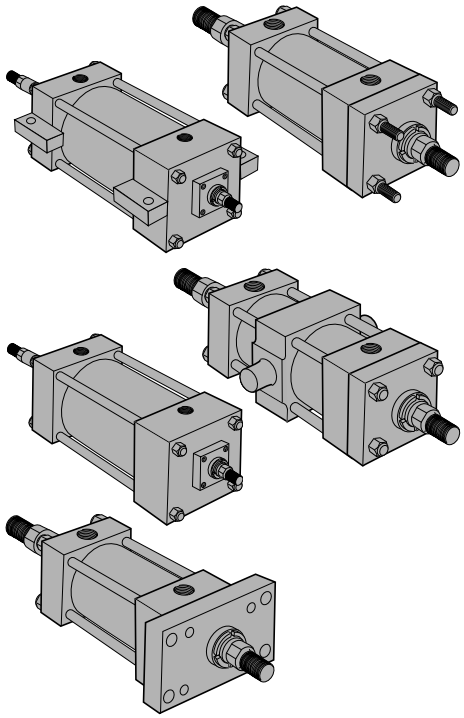
7"- 14" Bores



Rod End #1 **Rod End #2**

To determine dimensions for a double rod cylinder, first refer to the desired single rod mounting style cylinder shown on preceding pages of this catalog. (See table at left.) After selecting necessary dimensions from that drawing, return to this page supplement the single rod dimensions with those shown on drawings at right and dimension table below. Note that double rod cylinders have a head (Dim. G) at both ends and that dimension LD replace LB and ZL replaces ZB, etc. The double rod dimensions differ from, or are in addition to those for single rod cylinders shown on preceding pages and provide the information needed to completely dimension a double rod cylinder.

On a double rod cylinder where the two rod ends are different, be sure to clearly state which rod end is to be assembled at which end. Port position 1 is standard. If other than standard, specify pos. 2, 3 or 4 when viewed from rod end #1 only. See port position information in Section C.



All dimensions are in inches and apply to Code 1 rod sizes only. For alternate rod sizes, determine all envelope dimensions (within LD dim.) as described above and then use appropriate rod end dimensions for proper rod size from single rod cylinder.

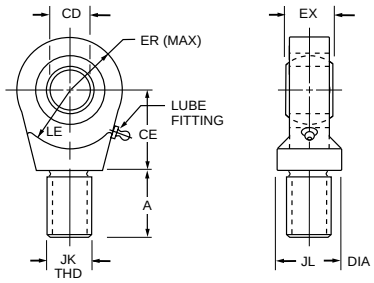
Bore	Rod No.	Rod Dia. MM	Add Stroke										Add 2X Stroke
			LD	ZL	SAK	XAK	ZAK	SSK	SNK	SEK	XEK	ZEK	ZM
1	1	1/2	4 3/4	5 1/2	6 3/8	6 3/16	6 1/2	3 3/8*	2 1/8	*	*	*	6
1 1/2	1	5/8	4 7/8	5 3/4	6 7/8	6 1/2	6 7/8	3 3/8	2 1/4	6 3/8	6 1/4	6 1/2	6 1/8
2	1	5/8	4 7/8	5 13/16	6 7/8	6 1/2	6 7/8	3 3/8	2 1/4	6 3/4	6 7/16	6 3/4	6 1/8
2 1/2	1	5/8	5	5 15/16	7	6 5/8	7	3 1/2	2 3/8	7 1/8	6 11/16	7	6 1/4
3 1/4	1	1	6	7 1/8	8 1/2	8	8 1/2	3 3/4	2 5/8	7 3/4	7 5/8	8	7 1/2
4	1	1	6	7 1/8	8 1/2	8	8 1/2	3 3/4	2 5/8	8	7 3/4	8 1/8	7 1/2
5	1	1	6 1/4	7 7/16	9	8 3/8	9	3 5/8	2 7/8	8 3/8	8 1/16	8 9/16	7 3/4
6	1	1 3/8	7	8 5/16	9 3/4	9 1/4	9 7/8	4 1/8	3 1/8	9	8 7/8	9 3/8	8 3/4
7	1	1 3/8	7 1/8	—	—	—	—	4 1/4	3 1/4	—	—	—	8 7/8
8	1	1 3/8	7 1/8	—	9 1/4	9 1/16	9 3/4	4 1/4	3 1/4	7 7/8	8 3/8	9	8 7/8
10	1	1 3/4	8 1/8	—	10 7/8	10 5/8	11 1/2	4 7/8	4 1/8	9 1/4	9 13/16	10 7/16	10 3/8
12	1	2	8 5/8	—	11 3/8	11 1/4	12 1/8	5 3/8	4 5/8	9 3/4	10 7/16	11 1/16	11 1/8
14	1	2 1/2	10 1/8	—	13 1/2	13 5/16	14 3/8	6 3/8	5 1/2	11 5/8	12 3/8	13 1/8	13 1/8
Replaces: On single rod mounting styles:			LB	ZB	SA	XA	ZA	SS	SN	SE	XE	ZE	—
			All Mtg. Styles		CB			C,E	F	G			All Mtgs.

* Mounting styles KE, KG and KDD not available in 1" and 7" bore sizes.

For additional information – call your local Parker Cylinder Distributor.

Parker offers a complete range of Cylinder Accessories to assure you of the greatest versatility in present or future cylinder applications. Accessories offered for the respective cylinder include the Rod Eye, Pivot Pin and Clevis Bracket. To select the proper part number for any desired accessory refer to the charts below.

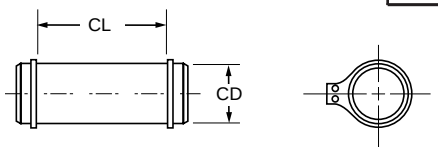
Spherical Rod Eye



Order to fit Piston Rod Thread Size.

Bore Sizes	Series 2A	1 1/2, 2 & 2 1/2	3 1/4, 4 & 5	6 & 8	10	12	14
Rod Eye	Part No.	132290	132291	132292	132293	132294	132295
	CD	.5000 -.0005	.7500 -.0005	1.0000 -.0005	1.3750 -.0005	1.7500 -.0005	2.0000 -.0005
	A	11/16	1	1 1/2	2	2 1/8	2 7/8
	CE	7/8	1 1/4	1 7/8	2 1/8	2 1/2	2 3/4
	EX	7/16	21/32	7/8	1 3/16	1 17/32	1 3/4
	ER	13/16	1 1/8	1 1/4	1 11/16	2 1/16	2 1/2
	LE	3/4	1 1/16	1 7/16	1 7/8	2 1/8	2 1/2
	JK	7/16-20	3/4-16	1-14	1 1/4-12	1 1/2-12	1 7/8-12
	JL	7/8	1 5/16	1 1/2	2	2 1/4	2 3/4
	LOAD CAPACITY LBS.	2644	9441	16860	28562	43005	70193

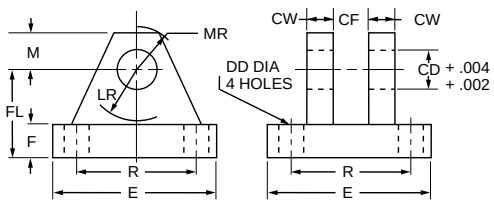
Pivot Pin



Pivot Pins are furnished with (2) Retainer Rings.

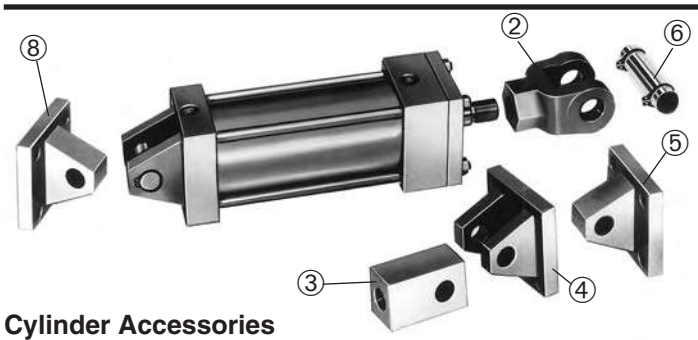
Bore Sizes	Series 2A	1 1/2, 2 & 2 1/2	3 1/4, 4 & 5	6 & 8	10	12	14
Pivot Pin	Part No.	83962	83963	83964	83965	83966	83967
	CD	.4997 -.0004	.7497 -.0005	.9997 -.0005	1.3746 -.0006	1.7496 -.0006	1.9996 -.0007
	CL	1 9/16	2 1/32	2 1/2	3 5/16	4 7/32	4 15/16
	LOAD CAPACITY LBS.	8600	19300	34300	65000	105200	137400

Clevis Bracket



Order to fit Mounting Plate or Rod Eye.

Bore Sizes	Series 2A	1 1/2, 2 & 2 1/2	3 1/4, 4 & 5	6 & 8	10	12	14
Clevis Bracket	Part No.	83947	83948	83949	83950	83951	83952
	CD	1/2	3/4	1	1 3/8	1 3/4	2
	CF	7/16	21/32	7/8	1 3/16	1 17/32	1 3/4
	CW	1/2	5/8	3/4	1	1 1/4	1 1/2
	DD	13/32	17/32	17/32	21/32	29/32	29/32
	E	3	3 3/4	5 1/2	6 1/2	8 1/2	10 5/8
	F	1/2	5/8	3/4	7/8	1 1/4	1 1/2
	FL	1 1/2	2	2 1/2	3 1/2	4 1/2	5
	LR	15/16	1 3/8	1 11/16	2 7/16	2 7/8	3 5/16
	M	1/2	7/8	1	1 3/8	1 3/4	2
	MR	5/8	1	1 3/16	1 5/8	2 1/16	2 3/8
	R	2.05	2.76	4.10	4.95	6.58	7.92
	LOAD CAPACITY LBS.	5770	9450	14300	20322	37800	50375



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, Knuckle, Clevis Bracket and Pivot Pin. To select the proper part number for any desired accessory, refer to Chart A below and look opposite the thread size of the rod end as indicated in the first column. The Pivot Pins, Eye Brackets and Clevis Brackets are listed opposite the thread size which their mating Knuckles or Clevises fit.

Chart A

Thread Size	Mating Parts			Mating Parts			Alignment Coupler
	Rod Clevis	Eye Bracket	Pin	Knuckle	Clevis Bracket	Pin	
5/16-24	51221	74077	—	74075	74076	74078	134757 0031
7/16-20	50940	69195	68368	69089	69205	68368	134757 0044
1/2-20	50941	69195	68368	69090	69205	68368	134757 0050
3/4-16	50942	69196	68369	69091	69206†	68369	134757 0075
3/4-16	133284	69196	68369	69091	69206	68369	134757 0075
7/8-14	50943	*85361	68370	69092	69207	68370	134757 0088
1-14	50944	*85361	68370	69093	69207	68370	134757 0100
1-14	133285	*85361	68370	69093	69207	68370	134757 0100
1 1/4-12	50945	69198	68371	69094	69208	68371	134757 0125
1 1/4-12	133286	69198	68371	69094	69208	68371	134757 0125
1 1/2-12	50946	*85362	68372	69095	69209	68372	133739 0150
1 3/4-12	50947	*85363	68373	69096	69210	69215	133739 0175
1 7/8-12	50948	*85363	68373	69097	69210	69215	133739 0188
2 1/4-12	50949	*85364	68374	69098	69211	68374	Consult Factory
2 1/2-12	50950	*85365	68375	69099	69212	68375	
2 3/4-12	50951	*85365	68375	69100	69213	69216	
3 1/4-12	50952	73538	73545	73536	73542	73545	
3 1/2-12	50953	73539	73547	73437	73542	73545	
4-12	50954	73539	73547	73438	73543	82181	
4 1/2-12	–	–	–	73439	73544	73547	

†For alignment coupler dimensions, see Section C.

*Cylinder accessory dimensions conform to NFPA recommended standard NFPA/T3.6.8 R1-1984, NFPA recommended standard fluid power systems — cylinder — dimensions for accessories for cataloged square head industrial types. Parker adopted this standard in April, 1985. Eye Brackets or Mounting Plates shipped before this date may have different dimensions and will not necessarily interchange with the NFPA standard. For dimensional information on older style Eye Brackets or Mounting Plates consult Drawing #144805 or previous issues of this catalog.

NOTE: For economical accessory selection, it is recommended that rod end style 4 be specified on your cylinder order.

Accessory Load Capacity

The various accessories on Pages 48 and 49 have been load rated for your convenience. The load capacity in bs. shown on page 49, is the recommended maximum load for that accessory based on a 4:1 design factor in tensions. (Pivot Pin is rated in shear.) Before specifying, compare the actual load or the tension (pull) force at maximum operating pressure of the cylinder with the load capacity of the accessory you plan to use. If load or pull force of cylinder exceeds load capacity of accessory, consult factory.

Mounting Plates

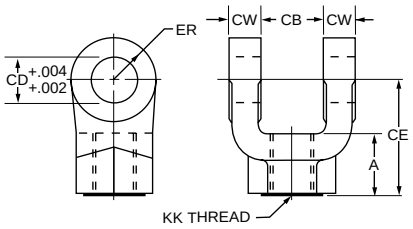
Mounting Plates for Style BB and Style BC (Clevis mounted) cylinders are offered. To select proper part number for your application, refer to Chart B, above right.

Chart B

Mtg. Plate Part No.	Series 2A Bore Size
74076‡	1"
69195	1 1/2", 2", 2 1/2"
69196	3 1/4", 4", 5"
*85361	6", 7", 8"
69198	10"
*85362	12"
*85363	14"

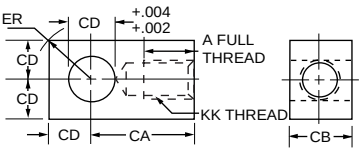
‡Mounting plate for 1" bore single lug BC & BB cylinder mounting style is Clevis Bracket P/N 74076.

② Female Rod Clevis



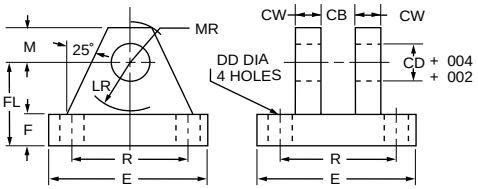
Order to fit thread size.

③ Knuckle (Female Rod Eye)



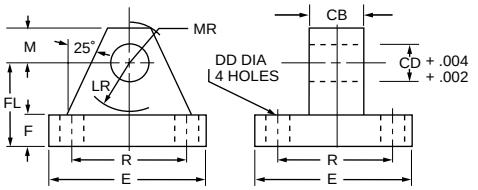
Order to fit thread size.

④ Clevis Bracket for Knuckle



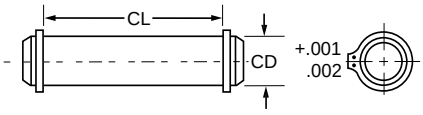
Order to fit Knuckle.

⑧ Mounting Plate or ⑤ Eye Bracket



1. When used to mate with the Rod Clevis, select from Chart A.
2. When used to mount the Style BB or BC cylinders, select from the Mounting Plate Selection Table. See Chart B at lower left.

⑥ Pivot Pin



1. Pivot Pins are furnished with Clevis Mounted Cylinders as standard.
2. Pivot Pins are furnished with (2) Retainer Rings.
3. Pivot Pins must be ordered as a separate item if to be used with Knuckles, Rod Clevises, or Clevis Brackets.

For additional information – call your local Parker Cylinder Distributor.

	Female Rod Clevis Part Number																		
	51221†	50940	50941	50942	133284	50943	50944	133285	50945	133286	50946	50947	50948	50949	50950	50951	50952	50953	50954
A	13/16	3/4	3/4	1 1/8	1 1/8	1 5/8	1 5/8	1 5/8	1 7/8	2	2 1/4	3	3	3 1/2	3 1/2	3 1/2	3 1/2‡	4‡	4‡
CB	11/32	3/4	3/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	2	2	2 1/2	2 1/2	2 1/2	3	3	3	4	4 1/2	4 1/2
CD	5/16	1/2	1/2	3/4	3/4	1	1	1	1 3/8	1 3/8	1 3/4	2	2	2 1/2	3	3	3 1/2	4	4
CE	2 1/4	1 1/2	1 1/2	2 1/8	2 3/8	2 15/16	2 15/16	3 1/8	3 3/4	4 1/8	4 1/2	5 1/2	5 1/2	6 1/2	6 3/4	6 3/4	7 3/4	8 13/16	8 13/16
CW	13/64	1/2	1/2	5/8	5/8	3/4	3/4	3/4	1	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	2	2 1/4	2 1/4
ER	19/64	1/2	1/2	3/4	3/4	1	1	1	1 3/8	1 3/8	1 3/4	2	2	2 1/2	2 3/4	2 3/4	3 1/2	4	4
KK	5/16-24	7/16-20	1/2-20	3/4-16	3/4-16	7/8-14	1-14	1-14	1 1/4-12	1 1/4-12	1 1/2-12	1 3/4-12	1 7/8-12	2 1/4-12	2 1/2-12	2 3/4-12	3 1/4-12	3 1/2-12	4-12
Load Capacity Lbs. ⊖	2600	4250	4900	11200	11200	18800	19500	19500	33500	33500	45600	65600	65600	98200	98200	98200	156700	193200	221200

	Knuckle Part Number																
	74075	69089	69090	69091	69092	69093	69094	69095	69096	69097	69098	69099	69100	73536	73437	73438	73439
A	3/4	3/4	3/4	1 1/8	1 1/8	1 5/8	2	2 1/4	2 1/4	3	3 1/2	3 1/2	3 5/8	4 1/2	5	5 1/2	5 1/2
CA	1 1/2	1 1/2	1 1/2	2 1/16	2 3/8	2 13/16	3 7/16	4	4 3/8	5	5 13/16	6 1/8	6 1/2	7 5/8	7 5/8	9 1/8	9 1/8
CB	7/16	3/4	3/4	1 1/4	1 1/2	1 1/2	2	2 1/2	2 1/2	2 1/2	3	3	3 1/2	4	4	4 1/2	5
CD	7/16	1/2	1/2	3/4	1	1	1 3/8	1 3/4	2	2	2 1/2	3	3	3 1/2	3 1/2	4	4
ER	19/32	23/32	23/32	1 1/16	1 7/16	1 7/16	1 31/32	2 1/2	2 27/32	2 27/32	3 9/16	4 1/4	4 1/4	4 31/32	4 31/32	5 11/16	5 11/16
KK	5/16-24	7/16-20	1/2-20	3/4-16	7/8-14	1-14	1 1/4-12	1 1/2-12	1 3/4-12	1 7/8-12	2 1/4-12	2 1/2-12	2 3/4-12	3 1/4-12	3 1/2-12	4-12	4 1/2-12
Load Capacity Lbs.⊖	3300	5000	5700	12100	13000	21700	33500	45000	53500	75000	98700	110000	123300	161300	217300	273800	308500

	Clevis Bracket for Knuckle Part Number												
	74076	69205	69206	69207	69208	69209	69210	69211	69212	69213	73542	73543	73544
CB	15/32	3/4	1 1/4	1 1/2	2	2 1/2	2 1/2	3	3	3 1/2	4	4 1/2	5
CD	7/16	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3	3 1/2	4	4
CW	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2
DD	17/64	13/32	17/32	21/32	21/32	29/32	1 1/16	1 3/16	1 5/16	1 5/16	1 13/16	2 1/16	2 1/16
E	2 1/4	3 1/2	5	6 1/2	7 1/2	9 1/2	12 3/4	12 3/4	12 3/4	12 3/4	15 1/2	17 1/2	17 1/2
F	3/8	1/2	5/8	3/4	7/8	7/8	1	1	1	1	1 11/16	1 15/16	1 15/16
FL	1	1 1/2	1 7/8	2 1/4	3	3 5/8	4 1/4	4 1/2	6	6	6 11/16	7 11/16	7 11/16
LR	5/8	3/4	1 3/16	1 1/2	2	2 3/4	3 3/16	3 1/2	4 1/4	4 1/4	5	5 3/4	5 3/4
M	3/8	1/2	3/4	1	1 3/8	1 3/4	2 1/4	2 1/2	3	3	3 1/2	4	4
MR	1/2	5/8	29/32	1 1/4	1 21/32	2 7/32	2 25/32	3 1/8	3 19/32	3 19/32	4 1/8	4 7/8	4 7/8
R	1.75	2.55	3.82	4.95	5.73	7.50	9.40	9.40	9.40	9.40	12.00	13.75	13.75
Load Capacity Lbs.⊖	3600	7300	14000	19200	36900	34000	33000	34900	33800	36900	83500	102600	108400

	Eye Bracket and Mounting Plate Part Number										
	74077	69195	69196	85361*	69198	85362*	85363*	85364*	85365*	73538	73539
CB	5/16	3/4	1 1/4	1 1/2	2	2 1/2	2 1/2	3	3	4	4 1/2
CD	5/16	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4
DD	17/64	13/32	17/32	21/32	21/32	29/32	1 1/16	1 3/16	1 5/16	1 13/16	2 1/16
E	2 1/4	2 1/2	3 1/2	4 1/2	5	6 1/2	7 1/2	8 1/2	9 1/2	12 5/8	14 7/8
F	3/8	3/8	5/8	7/8	7/8	1 1/8	1 1/2	1 3/4	2	1 11/16	1 15/16
FL	1	1 1/8	1 7/8	2 3/8	3	3 3/8	4	4 3/4	5 1/4	5 11/16	6 7/16
LR	5/8	3/4	1 1/4	1 1/2	2 1/8	2 1/4	2 1/2	3	3 1/4	4	4 1/2
M	3/8	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	2 3/4	3 1/2	4
MR	1/2	9/16	7/8	1 1/4	1 5/8	2 1/8	2 7/16	3	3 1/4	4 1/8	5 1/4
R	1.75	1.63	2.55	3.25	3.82	4.95	5.73	6.58	7.50	9.62	11.45
Load Capacity Lbs.⊖	1700	4100	10500	20400	21200	49480	70000	94200	121900	57400	75000

	Pivot Pin Part Number													
	74078	68368	68369	68370	68371	68372	68373	69215	68374	68375	69216	73545	82181	73547•
CD	7/16	1/2	3/4	1	1 3/8	1 3/4	2	2	2 1/2	3	3	3 1/2	4	4
CL	1 5/16	1 7/8	2 5/8	3 1/8	4 1/8	5 3/16	5 3/16	5 11/16	6 3/16	6 1/4	6 3/4	8 1/4	8 5/8	9
Shear Capacity Lbs.⊖	6600	8600	19300	34300	65000	105200	137400	137400	214700	309200	309200	420900	565800	565800

*Cylinder accessory dimensions conform to NFPA recommended standard NFPA/T3.6 8 R1-1984, NFPA recommended standard fluid power systems — cylinder — dimensions foraccessories for cataloged square head industrial types. Parker adopted this standard in April, 1985. Eye Brackets or Mounting Plates shipped before this date may have different dimensions and will not necessarily interchange with the NFPA standard. For dimensional information on older style Eye Brackets or Mounting Plates consult Drawing #144805 or previous issues of this catalog.

⊖ See Accessory Load Capacity note on page 48.

•These sizes supplied with cotter pins.

†Includes Pivot Pin.

‡Consult appropriate cylinder rod end dimensions for compatibility.

For Cylinder Division Plant Locations – See Page II.

How to Order Series "2A" Cylinders

When ordering Series 2A cylinders, please review the following:

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

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

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

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

Fluid Medium: Series 2A hydraulic cylinders are equipped with seals for use with lubricated air.

Class 1 Seals

Class 1 seals are the seals provided as standard in a cylinder assembly unless otherwise specified. For further information on fluid compat bility or operating limitations of all components, see section C.

For the 2A series cylinders the following make-up Class 1 Seals:

Primary Piston Rod Seal – Nitrile with PTFE back-up washers
Piston Rod Wiper – Nitrile
Piston Seals – Nitrile with polymyte back-up washers
O-Rings – Nitrile

Combination Mountings

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

Example: 4.00 CCBB2ALTS14AC x 10.000

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

Double Rod End In general, the model number is read left to right corresponding to the cylinder as viewed from left to right with the primary end at rod end #1. See Double Rod Models information page in this section. For this option the piston rod number, piston rod end, and piston rod threads are to be specified for both ends. The simplest are for symmetric cylinders such as: TD, C, E, F, G, and CB mounts. All other mounting styless, the description of the first rod end will be at the mounting end. In the case of multiple mounts, the description of the first rod end will be at the primary mounting end. For "DD" mounts, the description of the first rod end will be the same location as the "XI" dimension.

Example: 4.00 KDD2ALT24A/18A x 10.000 XI=8

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

Style 3 Rod End

A style 3 rod end indicates a special rod end configuration. All special piston rod dimensions must have **all three:** KK; A; W/WF or LA/LAF specified with the rod fully retracted. A sketch or drawing should be submitted for rod ends requiring special machining such as snap ring grooves, keyways, tapers, multiple diameters, etc. It is good design practice to have this machining done on a diameter at least 0.065 inches smaller than the piston rod diameter. This allows the piston rod to have a chamfer preventing rod seal damage during assembly or maintenance. Standard style 55 rod ends with a longer than standard WG dimension should call out a style 3 rod end and the note: **same as 55 except WG=____**. A drawing should be submitted for special 55 rod ends that have specific tolerances or special radii. Special rod ends that have smaller than standard male threads, larger than standard female threads, or style 55 rod ends with smaller than standard AF or AE dimensions are to be reviewed by Engineering for proper strength at operating pressure.

Service Policy

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

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

Certified Dimensions

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

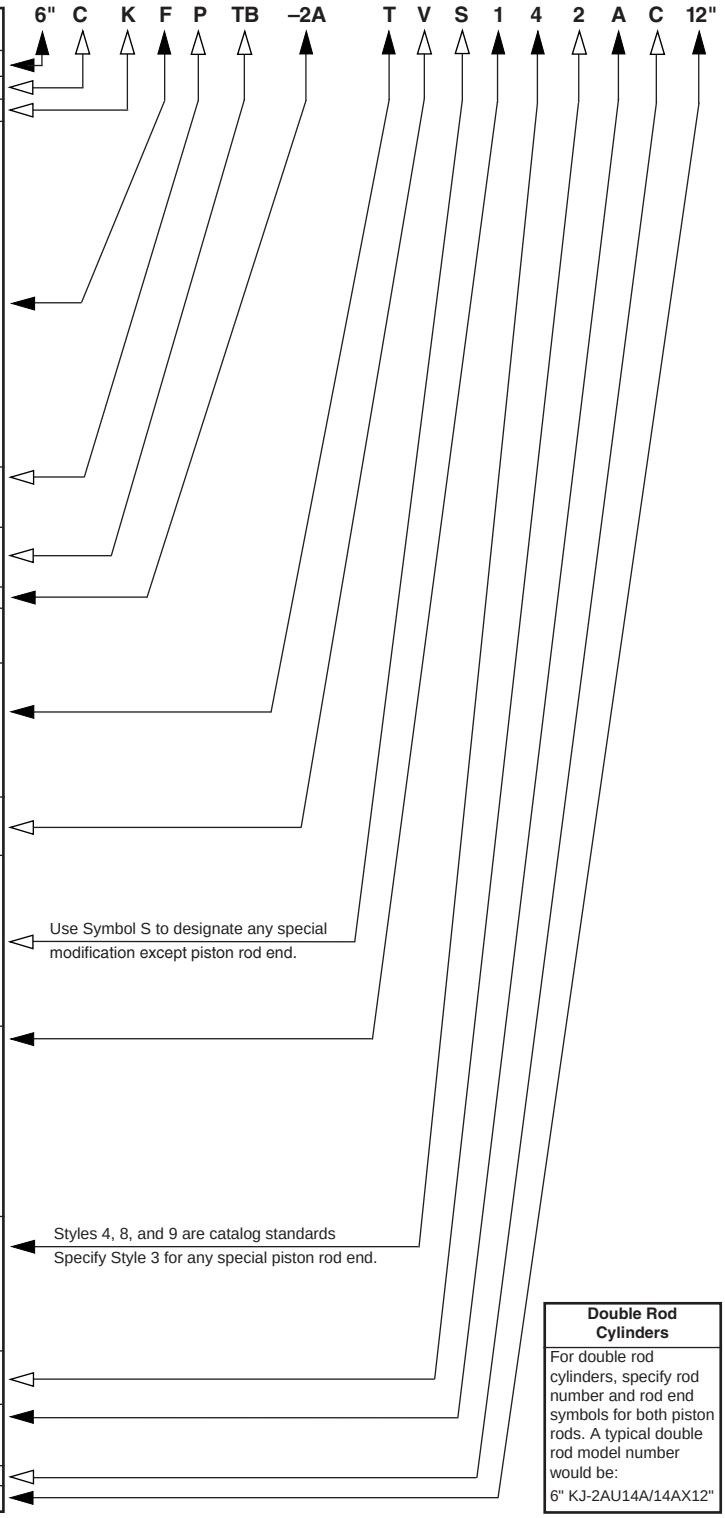
For additional information – call your local Parker Cylinder Distributor.

Series 2A Model Numbers – How to Develop Them – How to "Decode" Them

Parker Series 2A cylinders can be completely and accurately described by a model number consisting of coded symbols. To develop a model number, select only those symbols that represent the cylinder required, and place them in the sequence indicated below.

Note: Page numbers with a letter prefix, ie: C77, are located in section C of this catalog.

Feature	Description	Page No.	Symbol
Bore*	Specify in inches	—	—
Cushion-Head	Used **only** if cushion required	C101-103	C
Double-Rod	Used **only** if double-rod cylinder is required	A46	K
Mounting* Style	Head Tie Rods Extended	20 & 34	TB
	Cap Tie Rods Extended	20 & 34	TC
	Both End Tie Rods Extended	20 & 34	TD
	Head Rectangular Flange	20	J
	Cap Rectangular Flange	20	H
	Head Square Flange	22 & 34	JB
	Cap Square Flange	22 & 34	HB
	Side Lugs	24 & 36	C
	Centerline Lugs	24 & 36	E
	Side Tapped	24 & 38	F
	Side End Angles	26 & 40	CB
	Side End Lugs	26 & 38	G
	Cap Fixed Clevis	30 & 40	BB
	Head Trunnion	28 & 42	D
	Cap Trunnion	28 & 42	DB
	Intermediate Fixed Trunnion ‡	28 & 42	DD
	Cap Detachable Clevis	30	BC
	Spherical Bearing	44 & 45	SB
Mounting Modifications	Thrust Key (Styles C,F,G, & CB **only**)	C93	P
	Manifold Port O-Ring Seal (Style C **only**)	C89-91	M
	Removable Trunnions	C88	R
Combination Mounting Style	Any Practical Mounting Style	–	As
	Listed Above	–	listed
		–	above
Series*	Used in **all** 2A Model Numbers	–	–2A
Piston	Lipseal™ Piston standard. No need for symbol in model number.	–	–
	Piston Bumper Seals	C20	4
Ports*	NPTF (Dry Seal Pipe Thread) is standard. Used **only** for SAE Straight Thread O-Ring Port	C89-91	U
		C89-91	T
	Used **only** for BSP (Parallel Thread SO 228)	C89-91	R
	Used **only** for BSPT (Taper Thread ISO 7-Rc)	C89-91	B
	Used **only** for Metric Thread	C89-91	G
	Used **only** for Metric Thread per SO 6149	C89-91	Y
Common Modifications	Nut Retained Piston	A19	F
	Fluorocarbon Seals	C83	V
	Water Service	C83	W
Special Modifications	Used **only** if special Modifications are required: Oversize Ports	C89-91	
	Port Position Change	C89-91	
	Rod End Bellows	C104	
	Special Seals	C83	S
	Stop Tube†	C95	
	Stroke Adjuster	C93	
	Tie Rod Supports	C93	
	Water Service Modification	C83	
Piston Rod* Number	For Single Rod Cylinders, select one only. Refer to Rod number listing, Table 2, Pages 20 through 43. Note: Check chart in Section C, page 96 for minimum piston rod diameter	–	1
		–	2
		–	3
		–	4
		–	5
		–	6
		–	7
		–	8
		–	9
		–	0
Piston* Rod End	Select:		
	Style 4 Small Male	C92	4
	Style 7 Female Thread for Spherical Rod Eye	A44, 45	7
	Style 8 Intermediate Male	C92	8
	Style 9 Short Female	C92	9
	Style 55 Rod End for Flange Coupling	C19	55
	Style 3 Special (Specify)	C92	3
Piston Rod Alternate Thread	Used **only** for stud two times longer than standard.	C92	2
Piston Rod* Threads	UNF Standard	C92	A
	BSF (British Fine)	C92	W
	Metric	C101-C103	M
Cushion-Cap	Used **only** if cushion required	C93	C
Stroke*†	Specify in inches		–



Double Rod Cylinders

For double rod cylinders, specify rod number and rod end symbols for both piston rods. A typical double rod model number would be:

6" KJ-2AU14A/14AX12"

*Required for Basic Cylinder Model Number

Dark Arrows Indicate Basic Minimum Model Number

‡Specify XI dimension

†In case of Stop Tube, call out gross stroke length.

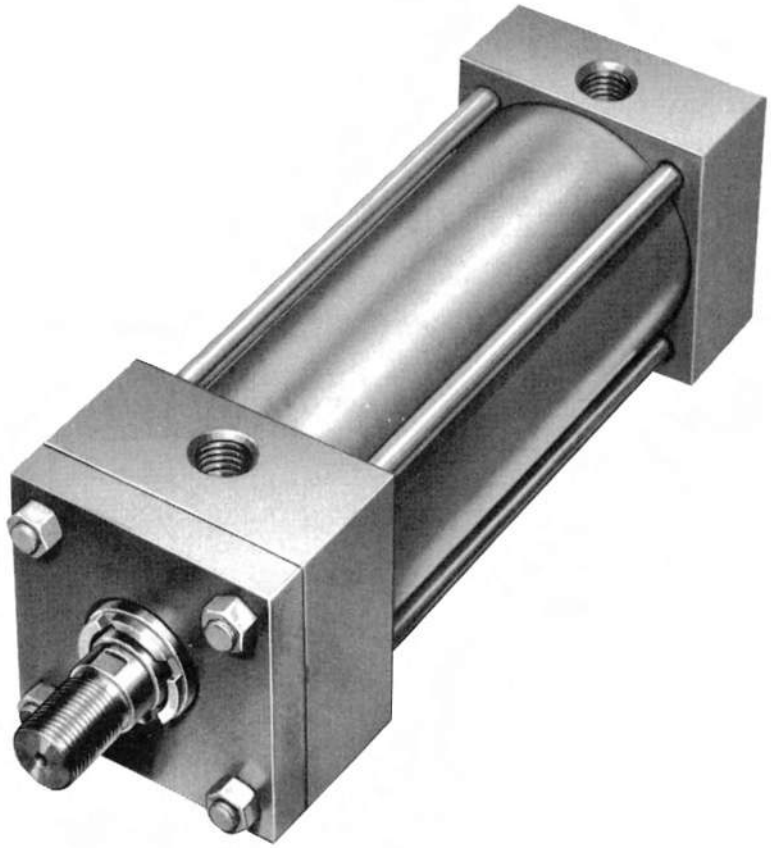
Cylinder serial numbers are factory production record numbers and are assigned to each cylinder, in addition to the model number.

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

Parker
Non-Lube Heavy Duty
Air Cylinders

Series 2AN



For millions of trouble free cycles

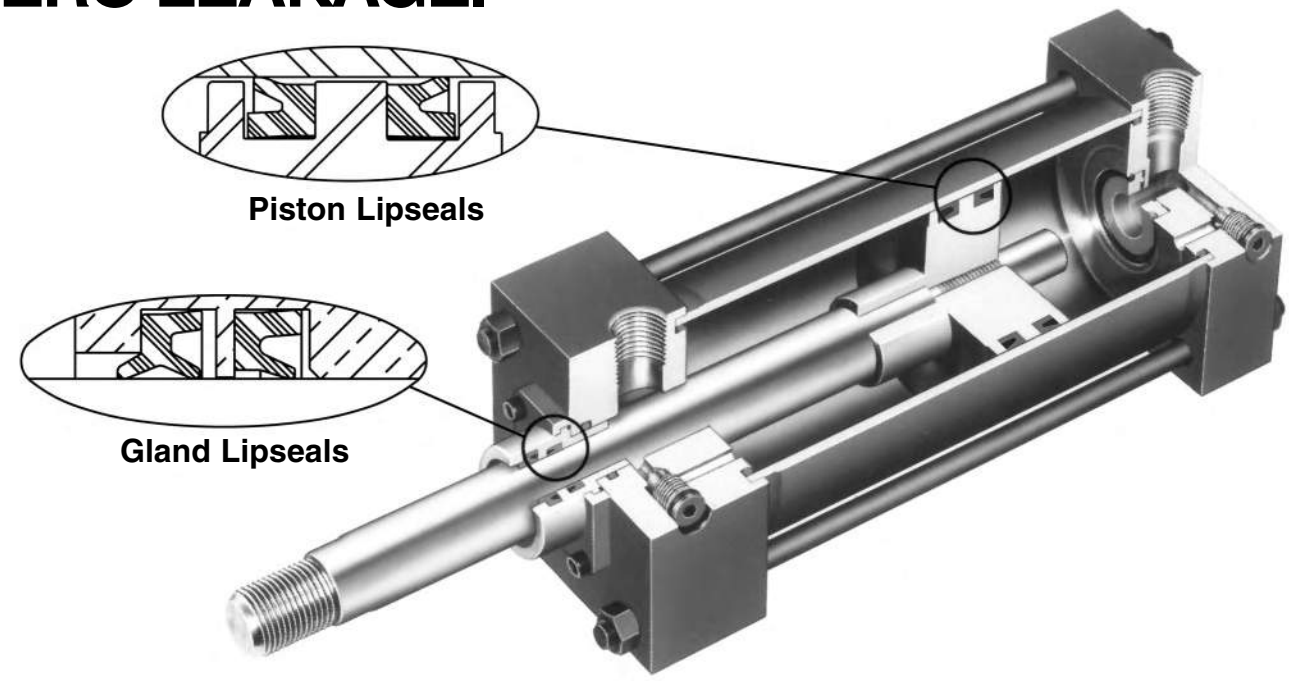
- Nominal Pressure – 250 PSI – Air Service
- Standard Bore Sizes 1½" through 14"
- Piston Rod Diameters – ⅝" through 5½"
- 17 Standard Mounting Styles
- N.F.P.A. Interchangeable
- Exceeds Automotive Specifications

For additional information – call your local Parker Cylinder Distributor.

Another Parker Cylinder Innovation…

The SERIES 2AN Non-Lube Air Cylinder with Proven Performance.

Over 21 million trouble free cycles with… ZERO LEAKAGE.



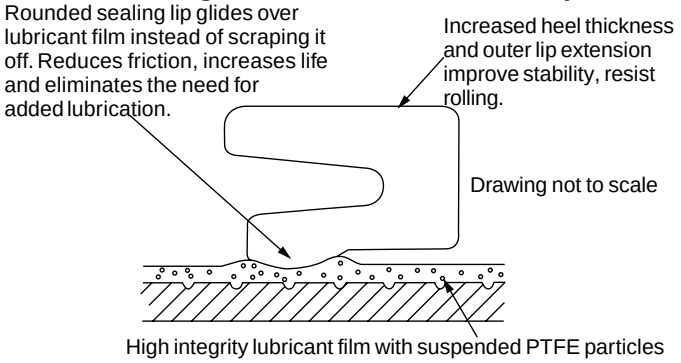
Design Data
In 1971 Parker experimented with the use of specially designed composite materials in the piston and gland of their cylinders. Their use of storing lubricating oil met with good results. Through extensive testing it was learned that the outside diameter of the material in the piston and the inside diameter on the material in the gland showed signs of wear and ultimately would lose contact with the surface of the cylinder body bore or piston rod. As a result, the cylinders lost their self lubricating capacity.

Today's industrial market demands more from a pneumatic cylinder. Cylinders are still required to handle tough, heavy-duty applications. But, more and more, these cylinders operate in environments or circumstances where it is not possible or advantageous to add lubrication to the compressed air entering the cylinder. Certain packaging and assembly operations, food environments, and microprocessor chip manufacturing are typical examples of areas where the exhausting of oil into the environment is not desirable. In many other situations, "non-lube" systems are used when proper air line lubrication is not present because of the time and expense of keeping lubricators filled and operating correctly.

Increased market demand and continuous research and testing efforts inspired the development of the Series 2AN Non-Lubricated Air Cylinder. In bore sizes to 12" diameter and rod diameters to 2-1/2", the Parker Series 2AN air cylinder features rounded lip rod and piston seals. These seals glide over the PTFE based lubricant that is provided at the time of manufacture. The Parker Series 2AN Non Lubricated Air Cylinder maintains the lubricant film where it belongs; on the seals bearing surfaces, piston rod and cylinder bore.

Benefits include… long seal and bearing life. No oil needs to be added through the use of lubricators. As the cylinder strokes, no oil is expelled into the atmosphere with the exhaust air.

Anatomy of Series 2AN
Sealing and Lubricant Retention Systems



For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

In the Series 2AN you get all the cost saving benefits and features of the popular heavy duty Series 2A air cylinder including…

- **The Jewel Rod Gland Assembly for positive no leak sealing**
- **Piston rod, hard chrome plated and case hardened steel**
- **High strength rolled thread Piston Rod Stud**
- **Steel tube cylinder body with chrome-plated micro finish bore…**

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

Standard Specifications

- Heavy Duty Service—ANSI/(NFPA) T3.6.7R2-1996 Specifications and Mounting Dimension Standards.
- Standard Construction—Square Head —Tie Rod Design.
- Standard Temperature— -10°F. to +165°F.
- Standard Fluid—Filtered Dry Air.
- Strokes—Available in any Practical Stroke Length.
- Cushions—Optional at either end or both ends of stroke. "Float Check" at cap end.

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

Available Bore and Rod Sizes*

Bore Sizes Available	1 1/2"	2"	2 1/2"	3 1/4"	4"	5"	6"	8"	10"	12"	14"

Rod Sizes Available	5/8"	1"	1 3/8"	1 3/4"	2"	2 1/2"	3"	3 1/2"	4"	4 1/2"	5"	5 1/2"

*For specific cylinder bore size/piston rod availabilities and dimensions, see Series 2A Cylinder.

For additional information – call your local Parker Cylinder Distributor.

How to order Series "2AN" Non-Lube Air Cylinders

Data Required on all 2AN Cylinder Orders

When ordering Series "2AN" cylinders, be sure to specify each of the following requirements:

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

a) Bore Size

b) Mounting Style
Specify your choice of mounting style — as shown and dimensioned in Series 2A. If double rod is wanted, specify "with double rod".

c) Series Designation ("2AN")

d) Length of Stroke

e) Piston Rod Diameter
Specify rod diameter or rod code number. In Series "2AN" cylinders, standard rod diameters (code No. 1) will be furnished if not otherwise specified, unless length of stroke makes the application questionable.

f) Piston Rod End Thread Style
Give thread style number or specify dimensions. Thread style number 4 will be supplied if not otherwise specified.

g) Cushions (if required)
Specify "Cushion-head end", "Cushion-cap end" or "Cushion-both ends" as required. If cylinder is to have a double rod and only one cushion is required, be sure to specify clearly which end of the cylinder is to be cushioned.

A

Note: Parker Series 2AN cylinders can be completely and accurately described by a model number consisting of coded symbols. To develop a model number select only those symbols that represent the cylinder required and place them in the sequence as shown in the chart below.

Series 2AN Model Numbers – How to Develop Them – How to Decode Them.

	BORE SIZE	CUSHION HEAD END	DOUBLE ROD	MOUNTING STYLE	MOUNTING MOD.	COMBINATION MOUNTING STYLE	SERIES	PORT	SPECIAL FEATURES	ROD NO.	ROD END THREAD STYLE NO.	THREAD TYPE	CUSHION CAP END	STROKE
	3 1/4"	**C**	**K**	**F**	**P**	**TB**	**2AN**	**U**	**S**	**1**	**4**	**A**	**C**	**X12**
EXAMPLE	Specify 1 1/2" thru 14"	Specify only if cushion head end is required	Use only if Double Rod Cylinder is required	Specify–Mounting Style BB, BC, C, CB, D, DB, DD, E, F, G, H, HB, J, JB, T, TB, TC, TD	Specify: P–for Thrust Key–Mtg. Style C, F, G & CB only M–for Manifold Ports Style C only R–for Removable Trunnion Mtg. Style D & DB only	Specify any practical Mounting Style available	Specify Series 2AN	Specify–Port Type required: U = NPTF T = S.A.E. R = BSP B = BSPT G = METRIC	Specify: Only if special modification is required Note: 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.	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 stroke length.

Modifications: All modifications that apply to the Series 2A Air Cylinder also apply to the Series 2AN *except* the use of Fluorocarbon seals. The maximum temperature of the Series 2AN is +165°F. Consult factory for higher temperature applications.

Warranty

Seller warrants the goods sold hereunder to be free from defects in material and workmanship. This warranty shall terminate eighteen months after date of shipment from Seller's plant and claims not made in writing within such period are waived.

The above warranty does not extend to goods damaged after date of shipment from Seller's plant where the damage is not directly due to a defect in material or workmanship, nor does it apply to goods altered or repaired by anyone other than Seller's authorized employees, nor to goods furnished by Buyer or acquired at Buyer's request and/or to Buyer's specifications.

If the goods are in accordance with or in reference to an engineering drawing specified by or furnished to the customer, the specifications and information on the drawing shall be applicable in determining such correct use, operation and application.

When claiming a breach of warranty, Buyer must notify Seller promptly whereupon Seller will either examine the goods at their site, or issue shipping instructions for return to Seller (transportation costs prepaid by Buyer). When any goods sold hereunder are proved not as warranted, Seller's sole obligation under this warranty shall be to repair or replace the goods, at its option, without charge to Buyer.

The above warranty comprises Seller's sole and entire warranty obligation and liability to Buyer, its customers and assigns in connection with goods sold hereunder. All other warranties, express or implied, including but not limited to, warranties of merchantability and fitness, are expressly excluded.

For Cylinder Division Plant Locations – See Page II.

Series MA

The No-Compromise Design N.F.P.A. Air Cylinder from Parker

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

Exclusive with the New Parker Check Seal Cushions:

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

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

For additional information – call your local Parker Cylinder Distributor.

Parker Series MA

N.F.P.A. Industrial Air Cylinders

Parker Series MA air cylinders meet or exceed N.F.P.A. Pneumatic Standards and except for Tie Rod Mount Styles conform to ANSI Standard B93.15-1981 for mounting dimensions of Square Head Industrial Fluid Power Cylinders.

For heavy-duty applications see Parker Series 2A cylinder page 17.

A

Standard Specifications

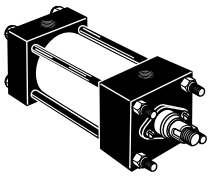
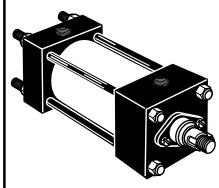
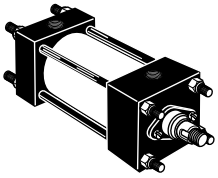
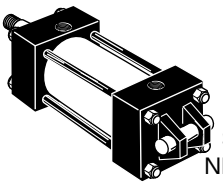
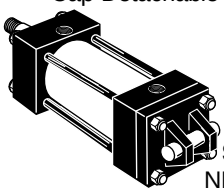
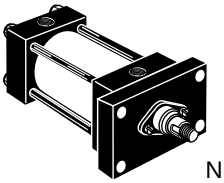
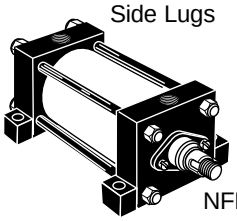
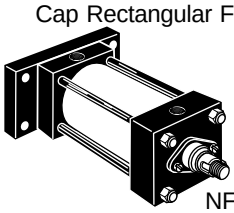
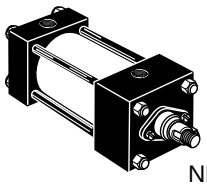
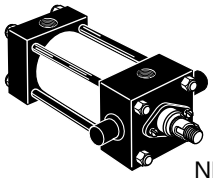
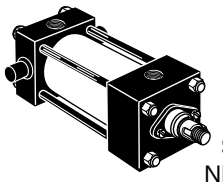
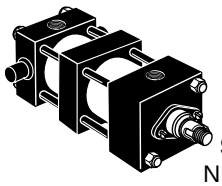
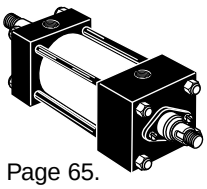
- Seven bore sizes – $1^1/_2$" through 6"
- Three rod diameters – $^5/_8$", 1" and $1^3/_8$"
- Twelve mounting styles
- Choice of three rod end styles
- Cushions at head, cap or both ends
- Double rod models in six mounting styles
- JIC interchangeable
- Temperature Range – 10° F. to 165° F.*

*See Section C for higher temperature service, operating fluids, and temperature range.

For complete ordering information, see Page 69.

AVAILABLE MOUNTINGS

For Single Rod Styles, see Pages 60 through 63.

Tie Rods Extended Head End  **Style TB**	Tie Rods Extended Cap End  **Style TC** NFPA MX2	Tie Rods Extended Both Ends  **Style TD**	Cap Fixed Clevis  **Style BB** NFPA MP1
Cap Detachable Clevis  **Style BC** NFPA MP2	Head Rectangular Flange  **Style J** NFPA MF1	Side Lugs  **Style C** NFPA MS2	Cap Rectangular Flange  **Style H** NFPA MF2
Side Tapped  **Style F** NFPA MS4	Head Trunnion  **Style D** NFPA MT1	Cap Trunnion  **Style DB** NFPA MT2	Intermediate Trunnion  **Style DD** NFPA MT4
	Double Rod Cylinders  **Style KTB** For Double Rod Styles, see Page 65.		

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

Parker Series MA

N.F.P.A. Industrial Air Cylinders

The inside story on the no-compromise design

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

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

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

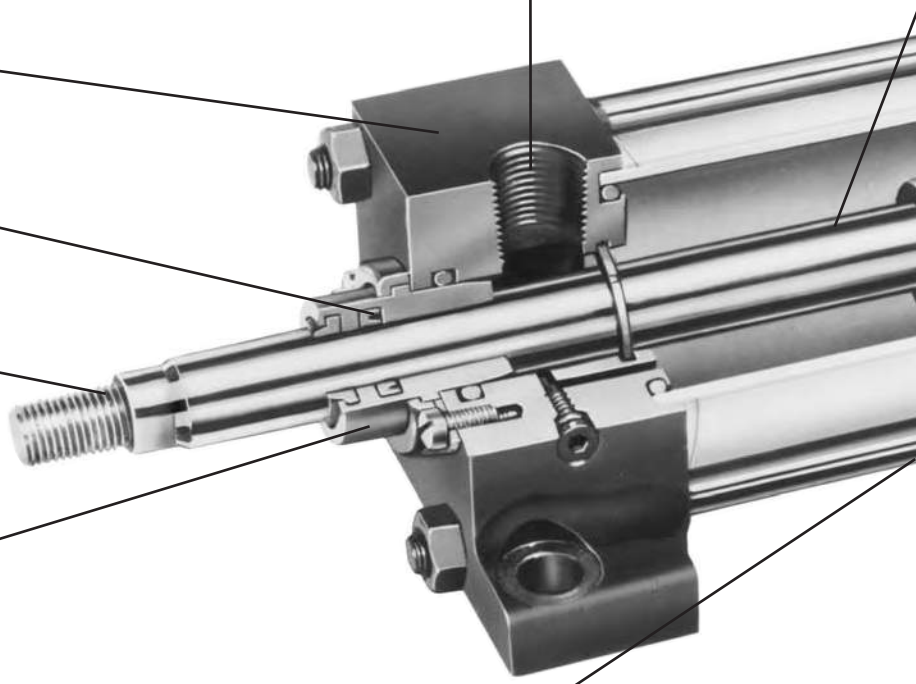
Piston rod lipseal/wiper combination is completely self-compensating for zero leakage at all pressures. Keeps pressure in, contamination out.

High strength piston rod end stud (125,000 psi minimum yield steel) with rolled threads for 52% greater strength at this critical fatigue point. Choice of male or female thread at no extra cost. Anaerobic adhesive is used to permanently lock the stud to the rod.

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

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

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



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

Parker's New Exclusive Check Seal Cushions

For Increased Productivity and Maximum Performance

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

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

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

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

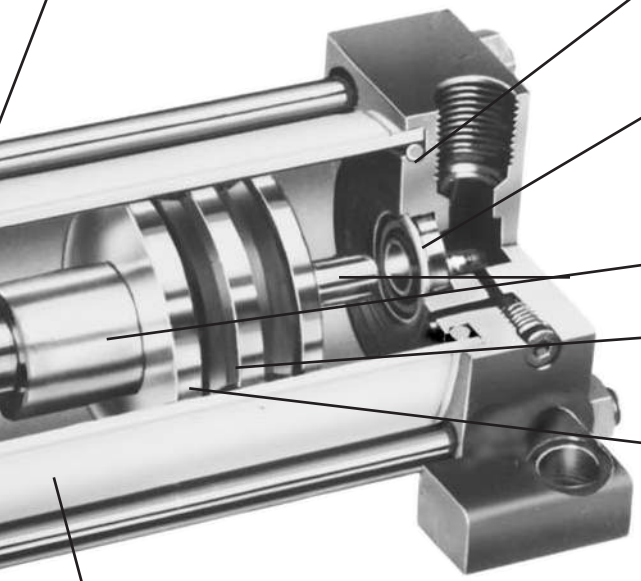
At the **head end** of the cylinder, the check seal is assembled into a groove in the central bore of the head, with the groove being slightly wider and larger in diameter than the check seal, so that it floats laterally and radially within predetermined limits. The check seal has four grooves molded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

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

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

For additional information – call your local Parker Cylinder Distributor.

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



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

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

Longest standard cushions in the industry for maximum cushioning capability.

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

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

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

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

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

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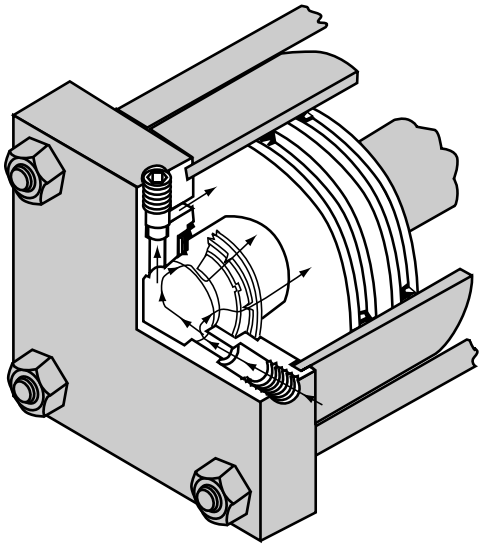
then flows around the OD of the seal and through the flutes of the seal washer. Full-flow, quick starts with little or no pressure drop is just one of the major benefits of the design.

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

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

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



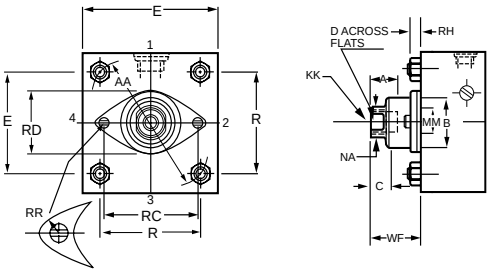
For Cylinder Division Plant Locations – See Page II.

Basic Cylinder Style T (NFPA Style MX0)

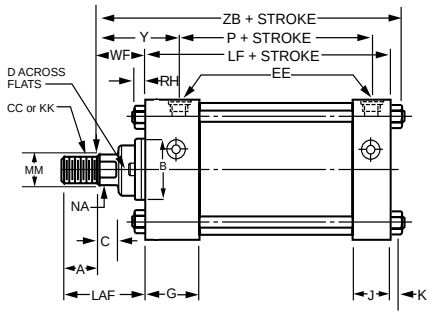
Rod end Style 4 is standard per dimension KK. Styles 8 or 9 are optional at no extra charge. A high strength rod end stud is standard on Styles 4 and 8 for all rod sizes.

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

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



Style 9 Rod End
NFPA SF

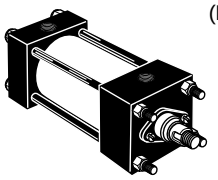


Style 4 & 8 Rod End
NFPA SM & IM

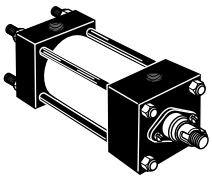
Rod End Dimensions – Styles 9 (NFPA SF), 4 (NFPA SM) and 8 (NFPA IM)																			Basic Envelope and Mounting Dimensions								
			Thread																					Add Stroke		
Bore	Rod No.	Rod Dia. MM	Style 8 CC	Style 4 & 9 KK	A	+.000 -.002 B	C	D	LA	LAF	NA	RC	RD	RH	RR	V	W	WF	Y	AA	E	(NPTF) EE	G	J	K	LF	P	ZB
1 1/2	1	5/8	1/2-20	7/16-20	3/4	.999	3/8	1/2	1 3/8	1 3/4	9/16	1 11/16	1 5/16	3/16	11/64	1/4	5/8	1	1 15/16	2.02	2	3/8	1 1/2	1	1/4	3 5/8	2 1/4	4 7/8
2	1	5/8	1/2-20	7/16-20	3/4	.999	3/8	1/2	1 3/8	1 3/4	9/16	1 11/16	1 5/16	3/16	11/64	1/4	5/8	1	1 15/16	2.6	2 1/2	3/8	1 1/2	1	5/16	3 5/8	2 1/4	4 15/16
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	2 1/2	15/16	2 3/16	1 13/16	3/16	11/64	1/2	1	1 3/8	2 5/16									5 5/16
2 1/2	1	5/8	1/2-20	7/16-20	3/4	.999	3/8	1/2	1 3/8	1 3/4	9/16	1 11/16	1 5/16	3/16	11/64	1/4	5/8	1	1 15/16	3.1	3	3/8	1 1/2	1	5/16	3 3/4	2 3/8	5 1/16
	3	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	2 1/8	2 1/2	15/16	2 3/16	1 13/16	3/16	11/64	1/2	1	1 3/8	2 5/16									5 7/16
3 1/4	1	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	2 1/2	15/16	2 3/16	1 13/16	3/16	11/64	1/4	3/4	1 3/8	2 7/16	3.9	3 3/4	1/2	1 3/4	1 1/4	3/8	4 1/4	2 5/8	6
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.874	5/8	1 1/8	2 5/8	3 1/4	15/16	2 11/16	2 15/64	7/32	13/64	3/8	1	1 5/8	2 11/16									6 1/4
4	1	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	2 1/2	15/16	2 3/16	1 13/16	3/16	11/64	1/4	3/4	1 3/8	2 7/16	4.7	4 1/2	1/2	1 3/4	1 1/4	3/8	4 1/4	2 5/8	6
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.874	5/8	1 1/8	2 5/8	3 1/4	15/16	2 11/16	2 15/64	7/32	13/64	3/8	1	1 5/8	2 11/16									6 1/4
5	1	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	2 1/2	15/16	2 3/16	1 13/16	3/16	11/64	1/4	3/4	1 3/8	2 7/16	5.8	5 1/2	1/2	1 3/4	1 1/4	7/16	4 1/2	2 7/8	6 5/16
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.874	5/8	1 1/8	2 5/8	3 1/4	15/16	2 11/16	2 15/64	7/32	13/64	3/8	1	1 5/8	2 11/16									6 9/16

Tie Rod Mounted Styles TB, TC, TD

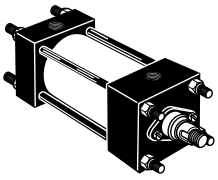
Style TB



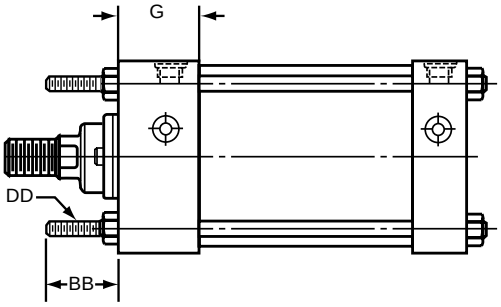
Style TC
NFPA
(MX2)



Style TD



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



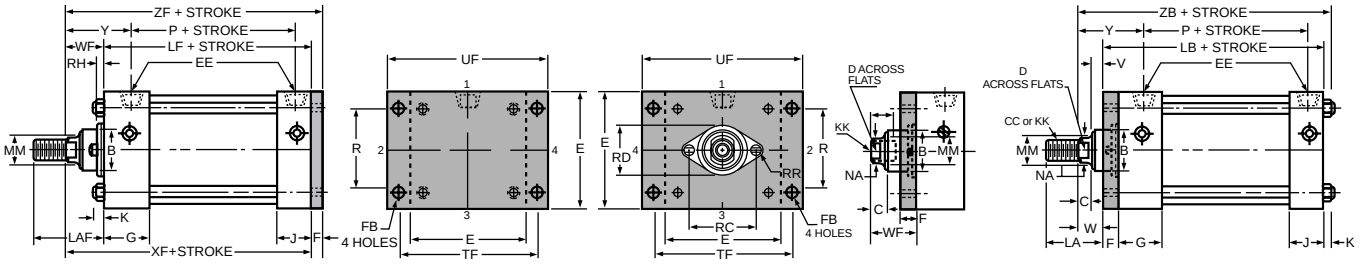
Dimensions for Specific Series MA Mounting Styles H, J, C, F, BB and BC

Bore	Rod No.	Rod Dia. MM	BB	CB	+.000 -.002 CD	CW	DD	F	FB	L	LR	M	MR	ND	NT	R	SB*
1 1/2	1	5/8	1	3/4	.501	1/2	1/4-28	3/8	5/16	3/4	3/4	1/2	5/8	5/16	1/4-20	1.43	7/16
2	1	5/8	1 1/8	3/4	.501	1/2	5/16-24	3/8	3/8	3/4	3/4	1/2	5/8	11/32	5/16-18	1.84	7/16
	3	1															
2 1/2	1	5/8	1 1/8	3/4	.501	1/2	5/16-24	3/8	3/8	3/4	3/4	1/2	5/8	7/16	3/8-16	2.19	7/16
	3	1															
3 1/4	1	1	1 3/8	1 1/4	.751	5/8	3/8-24	5/8	7/16	1 1/4	1	3/4	15/16	1/2	1/2-13	2.76	9/16
	3	1 3/8															
4	1	1	1 3/8	1 1/4	.751	5/8	3/8-24	5/8	7/16	1 1/4	1	3/4	15/16	5/8	1/2-13	3.32	9/16
	3	1 3/8															
5	1	1	1 13/16	1 1/4	.751	5/8	1/2-20	5/8	9/16	1 1/4	1	3/4	15/16	3/4	5/8-11	4.10	13/16
	3	1 3/8															

*Upper surface spotfaced for socket head screws.

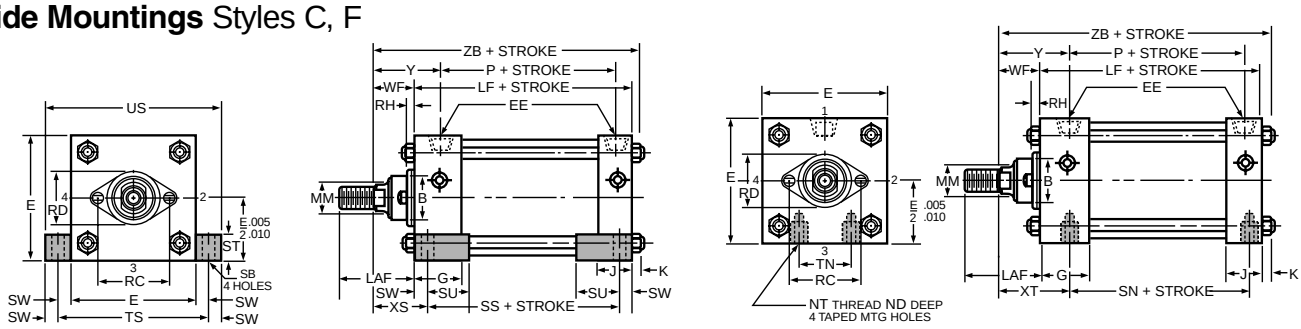
For additional information – call your local Parker Cylinder Distributor.

Flange Mountings Styles H, J



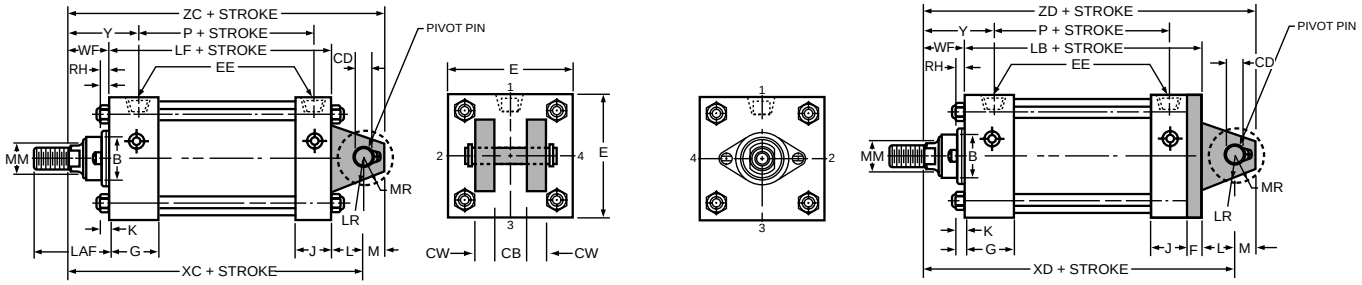
Style H (NFPA MF2) **Style 9 Rod End** J Mount Only **Style J** (NFPA MF1)

Side Mountings Styles C, F



Style C (NFPA MS2) **Style F** (NFPA MS4)

Pivot Mountings Styles BB, BC



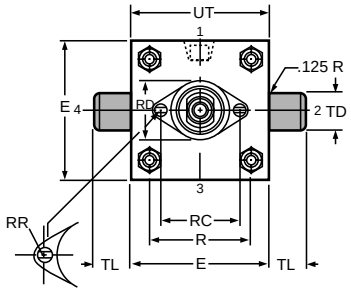
Style BB (NFPA MP1) **Style BC** (NFPA MP2)

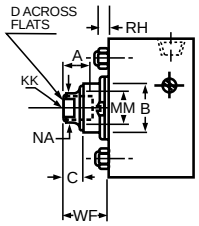
Tie Rods thread into Cap on 1 1/2", 2", 2 1/2" & 3 1/4" bore sizes as shown. Larger sizes have Tie Rod Nuts at both ends.

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

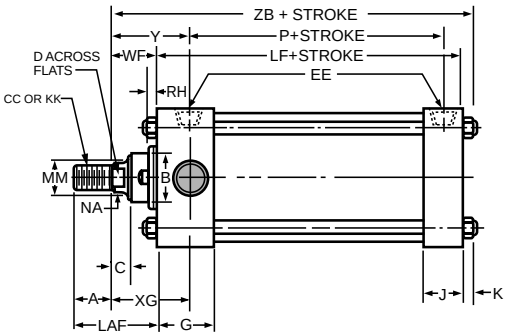
For Cylinder Division Plant Locations – See Page II.

Head Trunnion Mounting Style D (NFPA Style MT1)



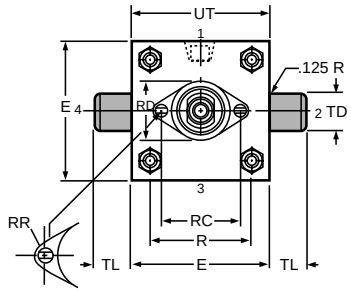


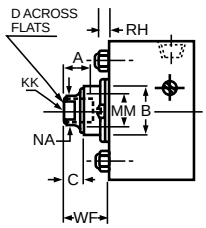
Style 9 Rod End
(NFPA SF)



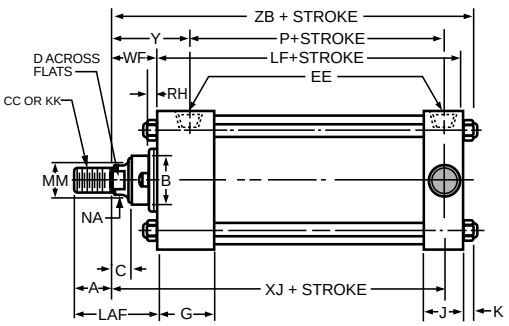
Style 4 & 8 Rod End
(NFPA SM & IM)

Cap Trunnion Mounting Style DB (NFPA Style MT2)



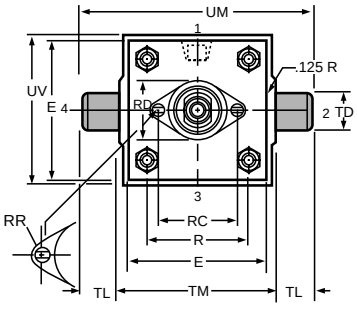


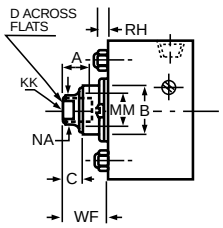
Style 9 Rod End
(NFPA SF)



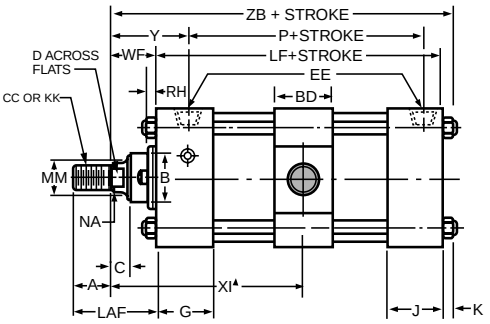
Style 4 & 8 Rod End
(NFPA SM & IM)

Intermediate Fixed Trunnion Mounting Style DD (NFPA Style MT4)





Style 9 Rod End
(NFPA SF)



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

Note: For Rod End Dimensions See Page 60.			Basic Envelope and Mounting Dimensions																			
			Thread																	Add Stroke			
Bore	Rod No.	Rod Dia. MM	Style 8 CC	Style 4 & 9 KK	BD	E	(NPTF) EE	G	J	K	+.000 TD -.001	TL	TM	UM	UT	UV	XG	Min. XI▲	LF	P	XJ	ZB
1 1/2	1	5/8	1/2-20	7/16-20	1 1/4	2	3/8	1 1/2	1	1/4	1.000	1	2 1/2	4 1/2	4	2 1/2	1 3/4	3 3/16	3 5/8	2 1/4	4 1/8	4 7/8
2	1 3	5/8 1	1/2-20 7/8-14	7/16-20 3/4-16	1 1/2	2 1/2	3/8	1 1/2	1	5/16	1.000	1	3	5	4 1/2	3	1 3/4 2 1/8	3 5/16 3 11/16	3 5/8	2 1/4	4 1/8 4 1/2	4 15/16 5 5/16
2 1/2	1 3	5/8 1	1/2-20 7/8-14	7/16-20 3/4-16	1 1/2	3	3/8	1 1/2	1	5/16	1.000	1	3 1/2	5 1/2	5	3 1/2	1 3/4 2 1/8	3 5/16 3 11/16	3 3/4	2 3/8	4 1/4 4 5/8	5 1/16 5 7/16
3 1/4	1 3	1 1 3/8	7/8-14 1 1/4-12	3/4-16 1-14	2	3 3/4	1/2	1 3/4	1 1/4	3/8	1.000	1	4 1/2	6 1/2	5 3/4	4 1/4	2 1/4 2 1/2	4 3/16 4 7/16	4 1/4	2 5/8	5 5 1/4	6 6 1/4
4	1 3	1 1 3/8	7/8-14 1 1/4-12	3/4-16 1-14	2	4 1/2	1/2	1 3/4	1 1/4	3/8	1.000	1	5 1/4	7 1/4	6 1/2	5	2 1/4 2 1/2	4 3/16 4 7/16	4 1/4	2 5/8	5 5 1/4	6 6 1/4
5	1 3	1 1 3/8	7/8-14 1 1/4-12	3/4-16 1-14	2	5 1/2	1/2	1 3/4	1 1/4	7/16	1.000	1	6 1/4	8 1/4	7 1/2	6	2 1/4 2 1/2	4 3/16 4 7/16	4 1/2	2 7/8	5 1/4 5 1/2	6 5/16 6 9/16

▲ Dimension XI to be specified by customer

For additional information – call your local Parker Cylinder Distributor.

A

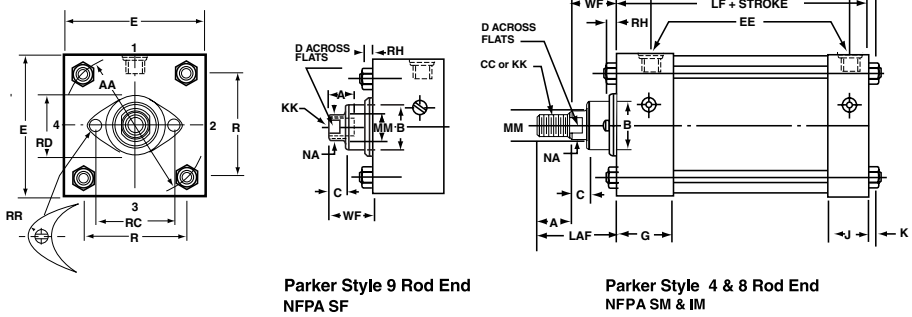
Basic Cylinder Style T (NFPA Style MX0)

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

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

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

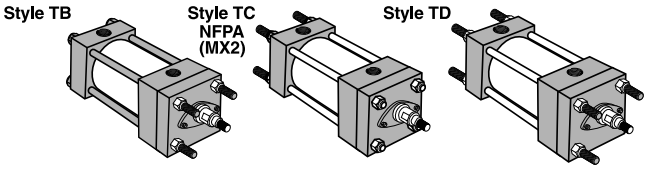
See Table 3 for rod end dimensions.

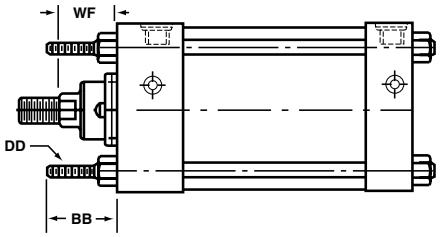


Parker Style 9 Rod End
NFPA SF

Parker Style 4 & 8 Rod End
NFPA SM & IM

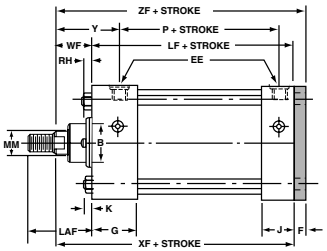
Tie Rod Mounted Styles, TB, TC, TD

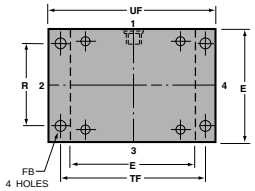


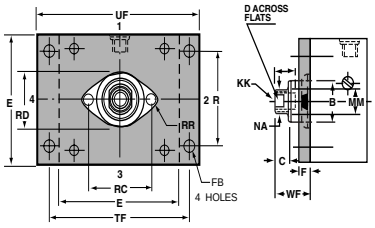


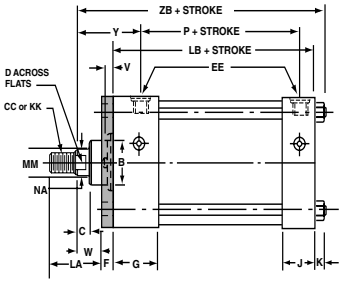
Style TB, Tie Rods Extended, is illustrated at right. Style TC, Cap Tie Rods Extended, and Style TD, Both Ends Tie Rods Extended, can be dimensioned from Style TB drawing.

Flange Mountings Styles H, J







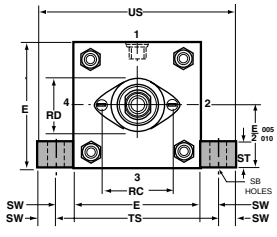


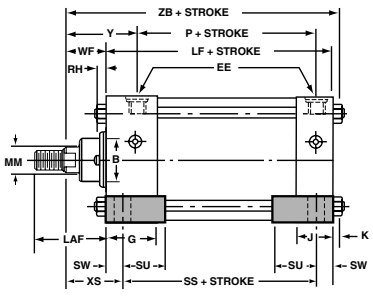
Style H (NFPA MF2)

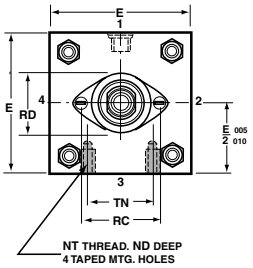
Style 9 Rod End (NFPA SF)

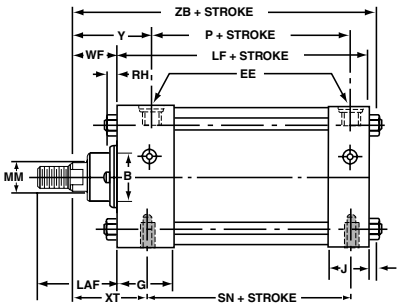
Style J (NFPA MF1)

Side Mountings Styles C, F









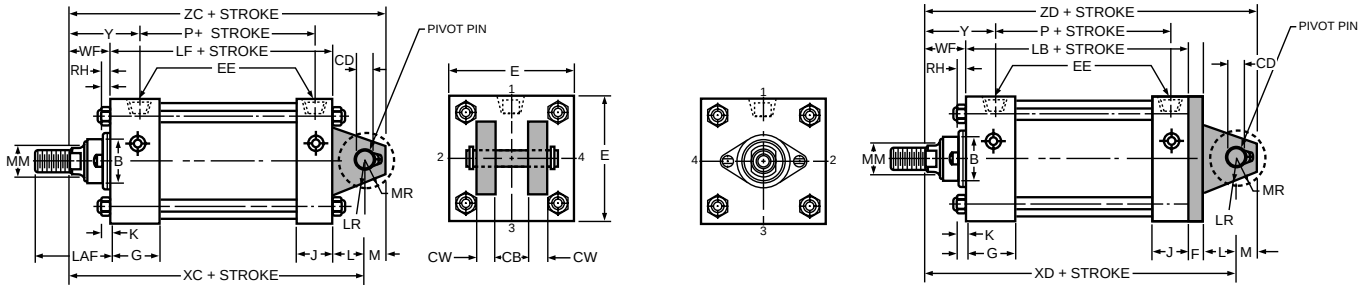
Style C (NFPA MS2)

Style F (NFPA MS4)

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

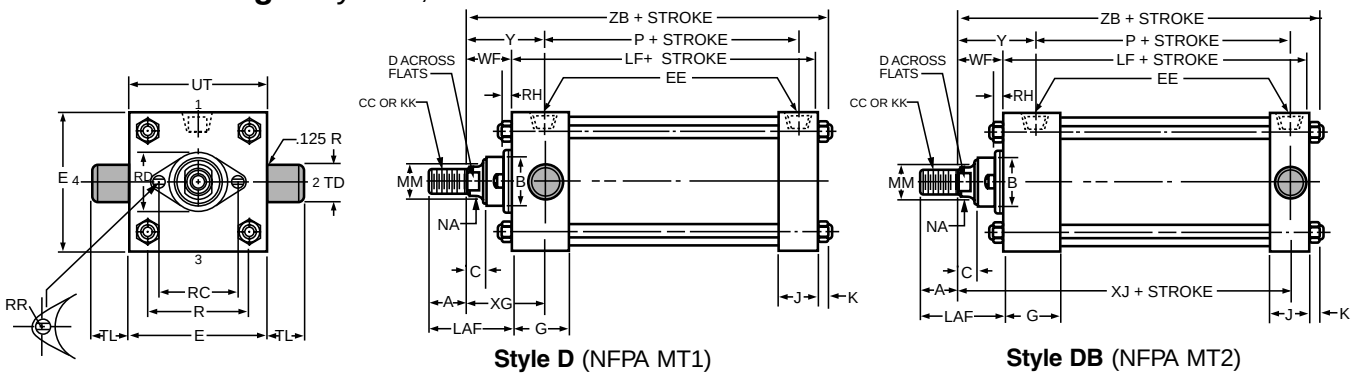
Pivot Mountings Styles BB, BC



Style BB (NFPA MP1)

Style BC (NFPA MP2)

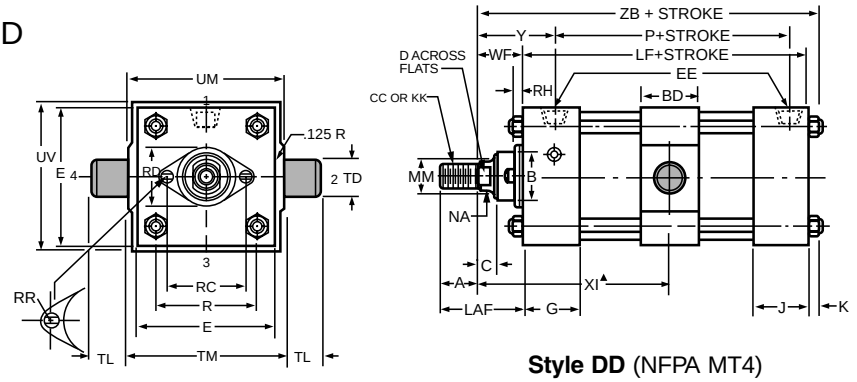
Trunnion Mountings Styles D, DB



Style D (NFPA MT1)

Style DB (NFPA MT2)

Trunnion Mounting Style DD



Style DD (NFPA MT4)

Table 3 Rod End Dimensions—Styles 9 (NFPA SF), 4 (NFPA SM) and 8 (NFPA IM)

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

Table 4 Basic Envelope and Mounting Dimensions

Bore	Rod No.	Rod Dia. MM	AA	BB	BD	CB	+.000 -.002 CD	CW	DD	E	(NPTF) EE	F	FB	G	J	K	L	LR	M	MR	ND	NT	R	SB•	ST	SU	SW
6	1	1 3/8	6.9	1 13/16	2 1/2	1 1/2	1.001	3/4	1/2-20	6 1/2	3/4	3/4	9/16	2	1 1/2	7/16	1 1/2	1 1/4	1	1 3/16	7/8	3/4-10	4.88	13/16	1	1 9/16	11/16

Basic Envelope and Mounting Dimensions (cont.)

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

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

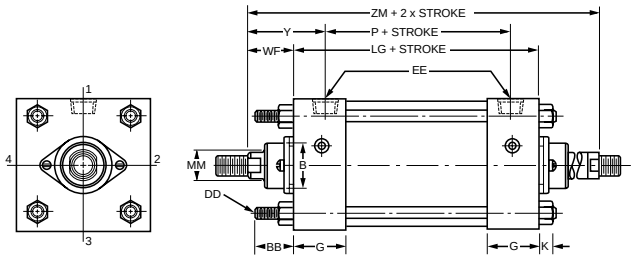
For additional information – call your local Parker Cylinder Distributor.

To dimension double rod cylinders, select the desired mounting style and refer to corresponding single rod model on pages 60-64. After obtaining necessary dimensions from that drawing, supplement those with the drawings and tables below.

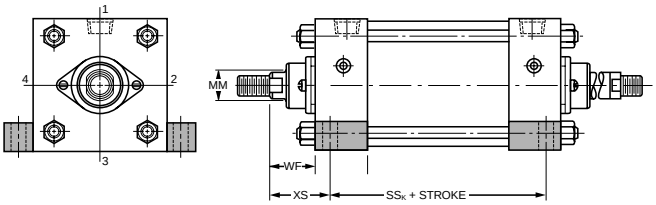
Tie Rods Extended
Parker Style KT

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

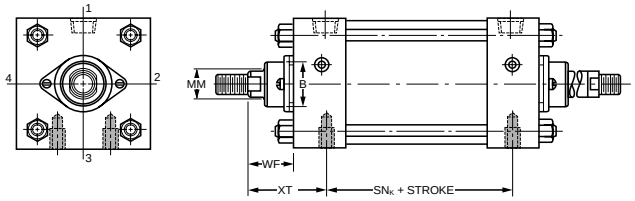
Tie Rods Extended Both Ends, Style **KTD.**



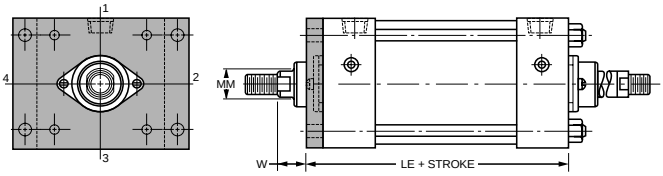
Side Lug Mounting
Parker Style KC



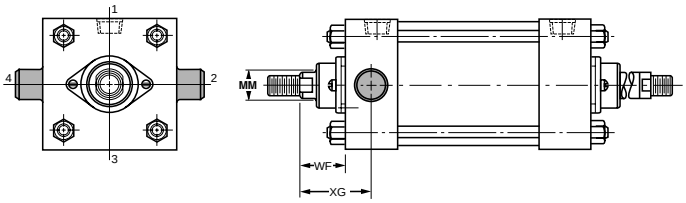
Side Tapped Mounting
Parker Style KF



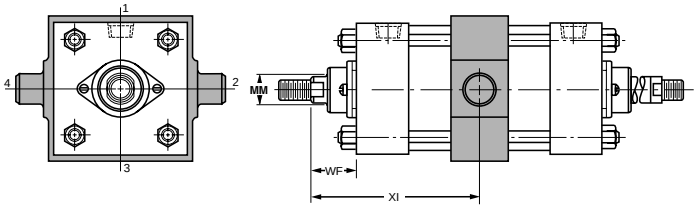
Rectangular Flange Mounting
Parker Style KJ



Head Trunnion Mounting
Parker Style KD



Intermediate Fixed Trunnion Mounting
Parker Style KDD



Double Rod Cylinder Dimensions

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

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

NOTE: For Rod End Dimensions, see pages 60 and 64.

For Cylinder Division Plant Locations – See Page II.

Cylinder Accessories

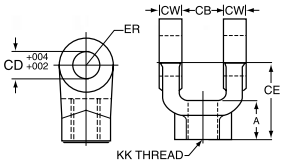
Parker offers a range of heavy-duty cylinder accessories for convenient mounting of pivot mount cylinders or for use at rod end of fixed mount types. All are load capacity rated for use at 4:1 design factor in tension or compression (pivot pin is rated in shear) when used on bore sizes recommended in tables below. Select rod clevises or knuckles by bore and thread size along with mating parts shown. Pivot pin must be ordered as separate item, if needed.

Mounting Plate

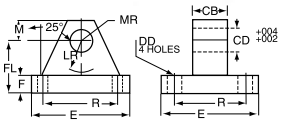
Mounting Plates

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

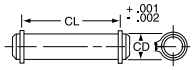
Mounting Plate	Series "MA"
Part No.	Bore Size
69195	1 1/2", 2", 2 1/2"
69196	3 1/4", 4", 5"
▲85361	6"



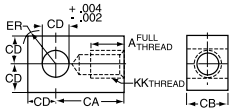
FEMALE ROD CLEVIS
(Order to fit thread size)



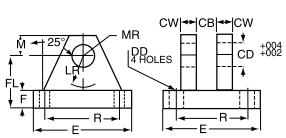
MOUNTING PLATE
OR EYE BRACKET



PIVOT PIN



ROD KNUCKLE
(Order to fit thread size)



CLEVIS BRACKET
FOR KNUCKLE

Dimensions for Rod Clevis and Mating Parts

Bore Size	Rod Dia.	KK Thread Size	Rod Clevis	Eye Brkt.	Pivot Pin	A	CB	CD	CE	CL	CW	DD	E	ER	F	FL	LR	M	MR	R
1 1/2	5/8	7/16-20	50940	69195	68368	3/4	3/4	1/2	1 1/2	1 7/8	1/2	13/32	2 1/2	1/2	3/8	1 1/8	3/4	1/2	9/16	1.63
2	5/8	7/16-20	50940	69195	68368	3/4	3/4	1/2	1 1/2	1 7/8	1/2	13/32	2 1/2	1/2	3/8	1 1/8	3/4	1/2	9/16	1.63
	1	3/4-16	50942 133284	69196	68369	1 1/8	1 1/4	3/4	2 1/8 2 3/8	2 5/8	5/8	17/32	3 1/2	3/4	5/8	1 7/8	1 1/4	3/4	7/8	2.55
2 1/2	5/8	7/16-20	50940	69195	68368	3/4	3/4	1/2	1 1/2	1 7/8	1/2	13/32	2 1/2	1/2	3/8	1 1/8	3/4	1/2	9/16	1.63
	1	3/4-16	50942 133284	69196	68369	1 1/8	1 1/4	3/4	2 1/8 2 3/8	2 5/8	5/8	17/32	3 1/2	3/4	5/8	1 7/8	1 1/4	3/4	7/8	2.55
3 1/4	1	3/4-16	50942 133284	69196	68369	1 1/8	1 1/4	3/4	2 1/8 2 3/8	2 5/8	5/8	17/32	3 1/2	3/4	5/8	1 7/8	1 1/4	3/4	7/8	2.55
	1 3/8	1-14	50944 133285	85361▲	68370	1 5/8	1 1/2	1	2 15/16 3 1/8	3 1/8	3/4	21/32	4 1/2	1	7/8	2 3/8	1 1/2	1	1 1/4	3.25
4 & 5	1	3/4-16	50942 133284	69196	68369	1 1/8	1 1/4	3/4	2 1/8 2 3/8	2 5/8	5/8	17/32	3 1/2	3/4	5/8	1 7/8	1 1/4	3/4	7/8	2.55
	1 3/8	1-14	50944 133285	85361▲	68370	1 5/8	1 1/2	1	2 15/16 3 1/8	3 1/8	3/4	21/32	4 1/2	1	7/8	2 3/8	1 1/2	1	1 1/4	3.25
-	1 3/8	1-14	50944 133285	85361▲	68370	1 5/8	1 1/2	1	2 15/16 3 1/8	3 1/8	3/4	21/32	4 1/2	1	7/8	2 3/8	1 1/2	1	1 1/4	3.25

Dimensions for Rod Knuckle and Mating Parts

Bore Size	Rod Dia.	KK Thread Size	Knuckle	Clevis Brkt.	Pivot Pin	A	CA	CB	CD	CL	CW	DD	E	ER	F	FL	LR	M	MR	R
1 1/2	5/8	7/16-20	69089	69205	68368	3/4	1 1/2	3/4	1/2	1 7/8	1/2	13/32	3 1/2	23/32	1/2	1 1/2	3/4	1/2	5/8	2.55
2	5/8	7/16-20	69089	69205	68368	3/4	1 1/2	3/4	1/2	1 7/8	1/2	13/32	3 1/2	23/32	1/2	1 1/2	3/4	1/2	5/8	2.55
	1	3/4-16	69091	69206	68369	1 1/8	2 1/16	1 1/4	3/4	2 5/8	5/8	17/32	5	1 1/16	5/8	1 7/8	1 3/16	3/4	29/32	3.82
2 1/2	5/8	7/16-20	69089	69205	68368	3/4	1 1/2	3/4	1/2	1 7/8	1/2	13/32	3 1/2	23/32	1/2	1 1/2	3/4	1/2	5/8	2.55
	1	3/4-16	69091	69206	68369	1 1/8	2 1/16	1 1/4	3/4	2 5/8	5/8	17/32	5	1 1/16	5/8	1 7/8	1 3/16	3/4	29/32	3.82
3 1/4	1	3/4-16	69091	69206	68369	1 1/8	2 1/16	1 1/4	3/4	2 5/8	5/8	17/32	5	1 1/16	5/8	1 7/8	1 3/16	3/4	29/32	3.82
	1 3/8	1-14	69093	69207	68370	1 5/8	2 13/16	1 1/2	1	3 1/8	3/4	21/32	6 1/2	1 7/16	3/4	2 1/4	1 1/2	1	1 1/4	4.95
4 & 5	1	3/4-16	69091	69206	68369	1 1/8	2 1/16	1 1/4	3/4	2 5/8	5/8	17/32	5	1 1/16	5/8	1 7/8	1 3/16	3/4	29/32	3.82
	1 3/8	1-14	69093	69207	68370	1 5/8	2 13/16	1 1/2	1	3 1/8	3/4	21/32	6 1/2	1 7/16	3/4	2 1/4	1 1/2	1	1 1/4	4.95
6	1 3/8	1-14	69093	69207	68370	1 5/8	2 13/16	1 1/2	1	3 1/8	3/4	21/32	6 1/2	1 7/16	3/4	2 1/4	1 1/2	1	1 1/4	4.95

▲Cylinder accessory dimensions conform to NFPA recommended standard NFPA/T3.6.8 R1-1984, NFPA recommended standard fluid power systems – cylinder – dimensions for accessories for cataloged square head industrial types. Parker adopted his standard in April, 1985. Eye brackets or mounting plates shipped before this date may have different dimensions and will not necessarily interchange with the NFPA standard. For dimensional information on older style eye brackets or mounting plates consult Drawing #144805.

For additional information – call your local Parker Cylinder Distributor.

NOTES

How to Order Series "MA" Cylinders

When ordering Series MA cylinders, please review the following:

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

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

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

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

Fluid Medium: Series MA hydraulic cylinders are equipped with seals for use with lubricated air.

Class 1 Seals

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

For the MA series cylinders the following make-up Class 1 Seals:

Primary Piston Rod Seal – Nitrile with PTFE back-up washers
Piston Rod Wiper – Nitrile
Piston Seals – Nitrile with polymyte back-up washers
O-Rings – Nitrile

Combination Mountings

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

Example: 4.00 CCBBMALTS14AC x 10.000

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

Double Rod End In general, the model number is read left to right corresponding to the cylinder as viewed from left to right with the primary end at rod end #1. See Double Rod Models information page in this section. For this option the piston rod number, piston rod end, and piston rod threads are to be specified for both ends. The simplest are for symmetric cylinders such as: TD, C, E, F, G, and CB mounts. All other mounting styless, the description of the first rod end will be at the mounting end. In the case of multiple mounts, the description of the first rod end will be at the primary mounting end. For "DD" mounts, the description of the first rod end will be the same location as the "XI" dimension.

Example: 4.00 KDDMALT24A/18A x 10.000 XI=8

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

Style 3 Rod End

A style 3 rod end indicates a special rod end configuration. All special piston rod dimensions must have **all three:** KK; A; W/WF or LA/LAF specified with the rod fully retracted. A sketch or drawing should be submitted for rod ends requiring special machining such as snap ring grooves, keyways, tapers, multiple diameters, etc. It is good design practice to have this machining done on a diameter at least 0.065 inches smaller than the piston rod diameter. This allows the piston rod to have a chamfer preventing rod seal damage during assembly or maintenance. Standard style 55 rod ends with a longer than standard WG dimension should call out a style 3 rod end and the note: **same as 55 except WG=____**. A drawing should be submitted for special 55 rod ends that have specific tolerances or special radii. Special rod ends that have smaller than standard male threads, larger than standard female threads, or style 55 rod ends with smaller than standard AF or AE dimensions are to be reviewed by Engineering for proper strength at operating pressure.

Service Policy

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

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

Certified Dimensions

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

For additional information – call your local Parker Cylinder Distributor.

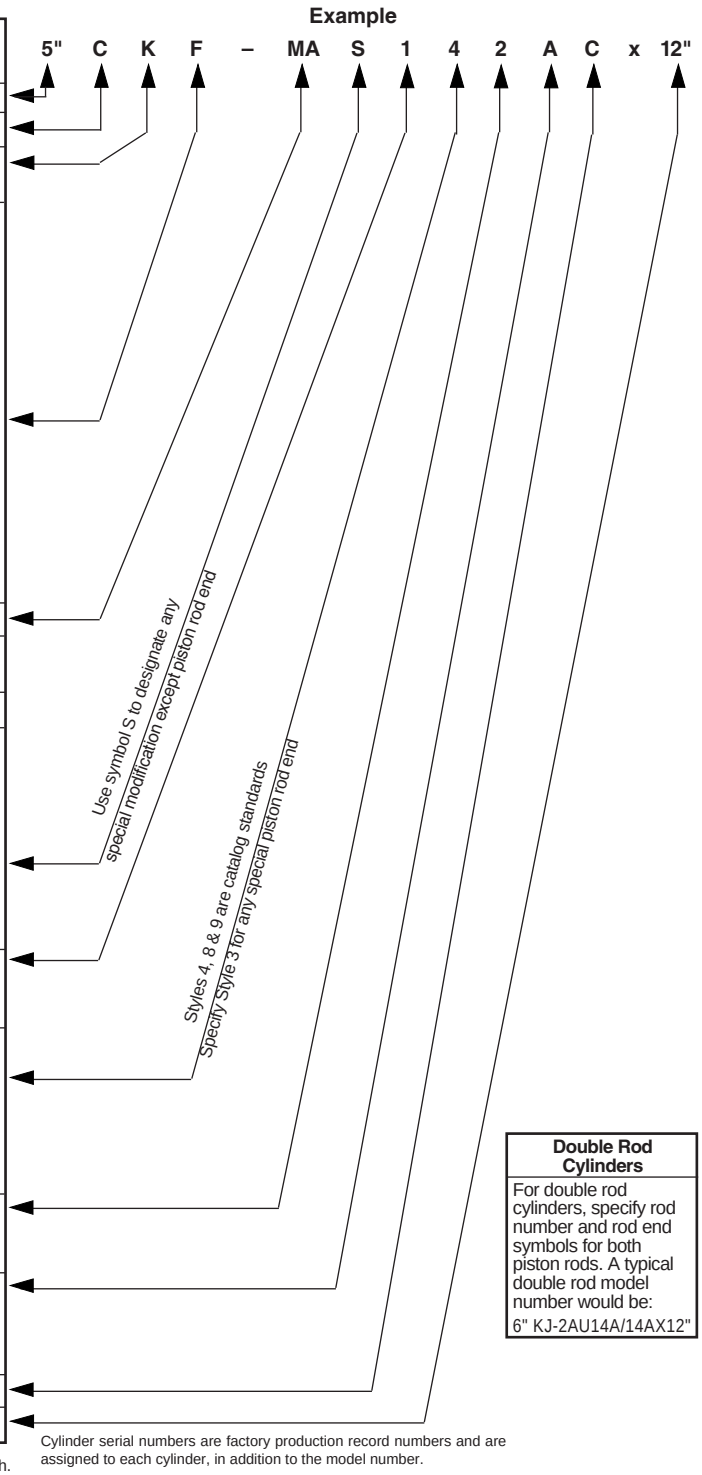
Series MA Model Numbers – How to Develop Them – How to "Decode" Them

Parker Series MA cylinders can be completely and accurately described by a model number consisting of coded symbols. To develop a model number, select only those symbols that represent the cylinder required, and place them in the sequence indicated below.

Note: Page numbers with a letter prefix, ie: C77, are located in section C of this catalog.

Feature	Description	Page No.	Symbol
Bore	Specify in inches	—	—
Cushion Head	Used **only** if cushion head is required	58	C
Double Rod	Used **only** if double rod cylinder is required	65	K
Mounting Style	Head Tie Rods Extended		T B
	Cap Tie Rods Extended		T C
	Both End Tie Rods Extended		T D
	Head Rectangular Flange		J
	Cap Rectangular Flange	60, 61	H
	Side Lug	62, 63,	C
	Side Tapped	64 & 65	F
	Cap Fixed Clevis		B B
	Cap Detachable Clevis		B C
	Head Trunnion		D
	Cap Trunnion		D B
	Intermediate Fixed Trunnion		D D
Series	Used in all MA Model Numbers	–	M A
Piston	Lipseal™ Piston standard. No need for symbol in model number.	–	–
Ports	NPTF (Dry Seal) Ports are standard.	C89-91	–
Special Modifications	Used **only** if special modifications are required:		
	Oversize Ports	C89-91	
	Port Position Change	C89-91	
	Stop Tube•	C95	S
	Stroke Adjuster	C93	
	Fluorocarbon Seals	C83	
Piston Rod Number	For Single Rod Cylinders, Select only one. Check chart on Page C96 for minimum piston rod diameter.	60 & 65	1 3
Piston Rod End	Select:		
	Style 4 Small Male		4
	Style 8 Intermediate Male	60, 62, 64, 65	8
	Style 9 Short Female		9
	Style 3 Special (Specify)		3
Piston Rod Alternate Threads	Used **only** for two times longer than standard.	C92	2
Piston Rod Threads	UNF Standard		A
	BSF (British Fine)	C92	W
	Metric		M
Cushion Cap	Used **only** if cushion cap is required	58	C
Stroke•	Specify in inches	C93	–

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



Double Rod Cylinders

For double rod cylinders, specify rod number and rod end symbols for both piston rods. A typical double rod model number would be:
6" KJ-2AU14A/14AX12"

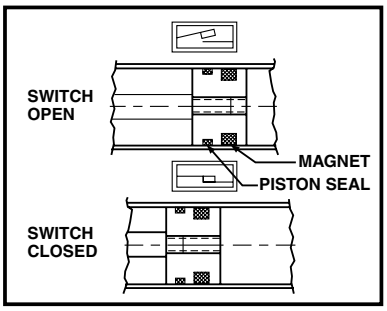
Cylinder serial numbers are factory production record numbers and are assigned to each cylinder, in addition to the model number.

For Cylinder Division Plant Locations – See Page II.

Magnetically Actuated Switches

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

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



Switch Specifications

	Reed Switch Assembly MAR-2 L074480000	Solid State Switch Assembly MAS-3 PNP Sourcing L074490000 MAS-4 NPN Sinking L074500000
Switching Logic	Normally Open, SPST	NPN or PNP
Supply Voltage Range	5 to 125 V AC/DC	5 TO 30 VDC
Max. Switching Power	10 Watts (Resistive) 5 Watts (Inductive)	6 Watts
Max. Switching Current	300 mA (Resistive) 150 mA (Inductive)	200 mA at 24 VDC
Circuit Current Consumption	–	Max 14 mA at 24 VDC
Short Circuit Interruption Current	–	370 mA
Leakage Current	–	10 µA Maximum
Residual Voltage	Maximum 3 V	1.5 V Maximum
"On" State Voltage Drop	1.7V Maximum	See Below
Response	1000 Hz Maximum	1000 Hz Maximum
Shock Resistance	30G Non-Repeated Shock	30G Non-Repeated Shock
Degree Of Protection	IEC IP 67	IEC IP 67

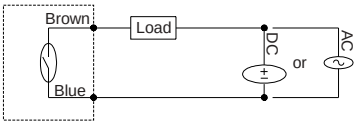
	Reed Switch Assembly MAR-2 L074480000	Solid State Switch Assembly MAS-3 PNP Sourcing L074490000 MAS-4 NPN Sinking L074500000
Operating Temperature	14° to 140°F (-10° to 60°C)	14° to 158°F (-10° to 70°C)
Storage Temperature	-4° to 158°F (-20° to 70°C)	-4° to 176°F (-20° to 80°C)
LED Indicator	Red, Target Present When On	Red, Target Present When On
Minimum Current To Light LED	18 mA	1 mA
Lead Wire Lengths	39 Inches, 1 Meter	39 Inches, 1 Meter

[1]Polarity is restricted to DC operation: (+) to Brown (-) to Blue
If these connections are reversed the contacts will close, but the LED will not light.
Note: For switches with connectors and cordsets, see Section C.

Circuits

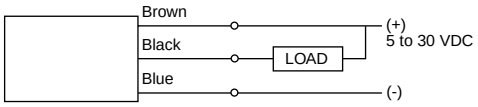
Reed Switch (MAS-2)

Part No. L074480000
NOTE: Polarity must be observed for DC operation only.



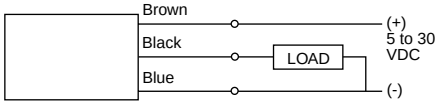
NPN Sinking Output (MAS-4)

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



PNP Sourcing Output (MAS-3)

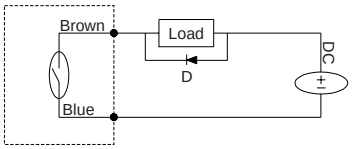
Part No. L074490000
Color of Cable ..... Gray
"On" State Voltage Drop ..... 0.2V Maximum



Circuit for Switching Contact Protection (Inductive Loads)

(Required for proper operation 24V DC)

Put Diode parallel to loads following polarity as shown below.

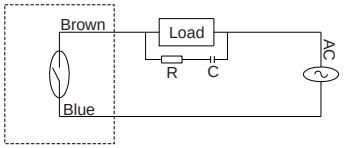


D: Diode: select a Diode with the breakdown voltage and current rating according to the load.

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

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

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



⚠ Caution

– Use an ampmeter to test reed switch current. Testing devices such as incandescent light bulbs may subject the reed switch to high in-rush loads.

– **NOTE:** When checking an unpowered reed switch for continuity with a digital ohmmeter the resistance reading will change from infinity to a very large resistance (2 M ohm) when the switch is activated. This is due to the presence of a diode in the reed switch.

– Anti-magnetic shielding is recommended for reed switches exposed to high external RF or magnetic fields.

– The magnetic field strength of the piston magnet is designed to operate with our switches. Other manufacturers' switches or sensors may not operate correctly in conjunction with these magnets.

– Current capabilities are relative to operational temperatures.

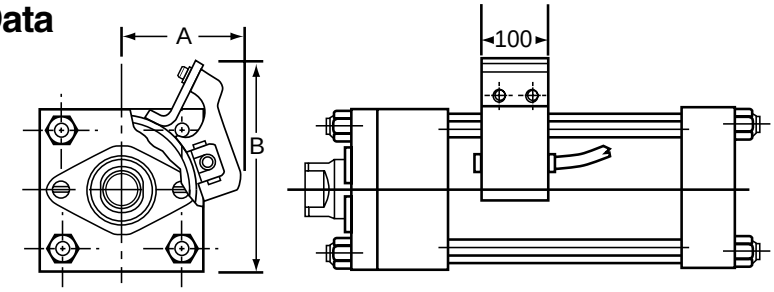
– Use relay coils for reed switch contact protection.

– The operation of some 120 VAC PLC's (especially some older Allen-Bradley PLC's) can overload the reed switch. The switch may fail to release after the piston magnet has passed. This problem may be corrected by the placement of a 700 to 1K OHM resistor between the switch and the PLC input terminal. Consult the manufacturer of the PLC for appropriate circuit.

– Switches with long wire leads (greater than 15 feet) can cause capacitance build-up and sticking will result. Attach a resistor in series with the reed switch (the resistor should be installed as close as possible to the switch). The resistor should be selected such that R (ohms) >E/0.3.

For additional information – call your local Parker Cylinder Distributor.

MA Switch Mounting Data



Bore	A	B	PISTON TRAVEL AT MIDSTROKE (SWITCH ON) (±.01)	MINIMUM ACTIVATION DISTANCE FROM END OF STROKE	
				Head	Cap
1½	1.90	2.71	.37	.20	.20
2	2.10	3.25	.37	.20	.20
2½*	2.20	3.60	.37	.13	.13
3¼*	2.70	4.25	.37	.13	.13
4*	2.90	4.90	.37	.13	.13
5*†	3.20	5.85	.37	0	0
6*†	3.82	6.70	.37	0	0

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

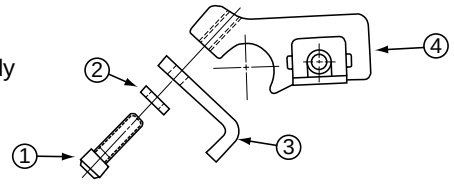
† On 5.0" and 6.0" bore cylinders, end of stroke activation will occur without the switch physically touching the head or cap.

A

Standard MA Switch Assembly

Consists of:

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



How to Order:

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

1. Derive a proper model number as shown in the table below.
2. Place an "S" in the special features column.
3. Underneath the model number specify:
   1) Cylinder prepared for MA switch.
4. As a separate item specify the number of switch assemblies required.

	BORE SIZE	CUSHION HEAD END	DOUBLE ROD	MOUNTING STYLE	SERIES	SPECIAL FEATURES	PISTON ROD NO.	PISTON ROD END	PISTON ROD ALTERNATE THREADS	THREAD TYPE	CUSHION CAP END	STROKE
	6	C	K	J	MA	S	1	4	2	A	C	X12
EXAMPLE	Specify 1½" thru 6"	Specify only if cushion head end is required	Use only if Double Rod Cylinder is required	Specify Mounting Style: T, TB, TC, TD, J, H, C, F, BB, BC, D, DB or DD	Specify Series MA	Specify for cylinder prepared for switches and/or other 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, LAF, W, WF Dim.	Use only for 2x longer than standard rod end thread	Specify: A = UNF W = BSF M = METRIC	Specify only if Cushion Cap End is required	Specify in inches. Show Symbol "X" just ahead of stroke length

Example: To order a 2½" x 10" MA cylinder with MA switches to sense the end of stroke at both the head and cap end specify:

Item	Qty.	Description
A	(1)	2.50 C J MAS 14A C x 10.000 (1) Cylinder prepared for MA Switch
B	(2)	(*) Switch Assemblies

* #L074480000 – MAR-2
#L074490000 – MAS-3
#L074500000 – MAS-4

For Cylinder Division Plant Locations – See Page II.

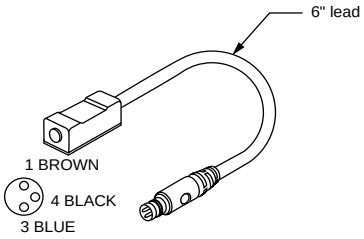
Magnet Actuated Switches with Quick Connect

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)

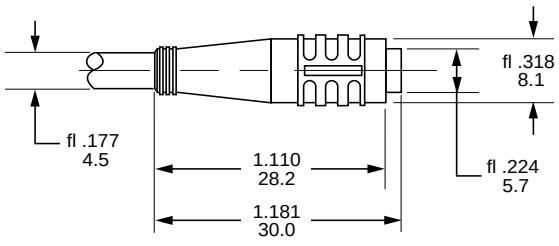
A female connector is available for all switches with the male quick connect option. The male plug will accept a snap-on or threaded connector. Cylinder Division cordset part numbers and other manufacturer's part numbers are listed below:

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

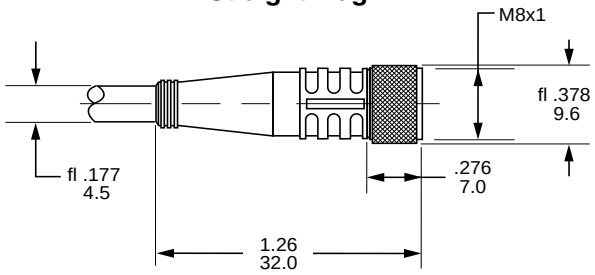
Cordset Specifications:

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

Snap-On Straight Plug



Threaded Straight Plug



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.

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

THE UPDATED VERSION 1.5 NOW ON CD

During any portion of the program, reference material can be accessed or printed for future use.

The ***inPHorm*** cylinders sizing, selection and parametric CAD software is designed around the user to assist in the design process and minimize the time required to specify, draw and file your favorite Parker Cylinder product. By working with the Parker ***inPHorm* for Cylinders** software, the design, selection and specification of Parker cylinders becomes easier and faster for the most effective use of your valuable time.

System Highlights

- **Cylinder Sizing and Selection**
- **Parametric Drawing Creation**
- **Windows-based**
- **Input Formats:**
  - **Direct Part Number Entry**
  - **Systematic Design**
- **Available Information Outputs:**
  - **HPGL CAD Drawing**
  - **CAD File (*.dxf)**
  - **Selection Summary Printout**
  - **RFQ/Order Sheet Printout**

For further details, or to purchase your copy of ***inPHorm* for Cylinders**, call your local Parker distributor or 1-800-C-Parker (272-7537). To try ***inPHorm*** visit our web site at www.Parker.com/cylinder.

Worldclass Quality Products and Service

Parker Cylinder

Hydraulic Cylinders
Index…

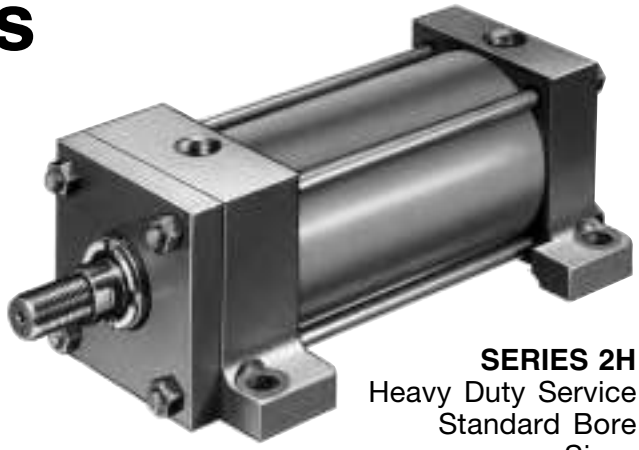
B

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

Hydraulic Cylinders

SERIES HMI
Heavy Duty Service
ISO Bore Sizes 25mm-200mm

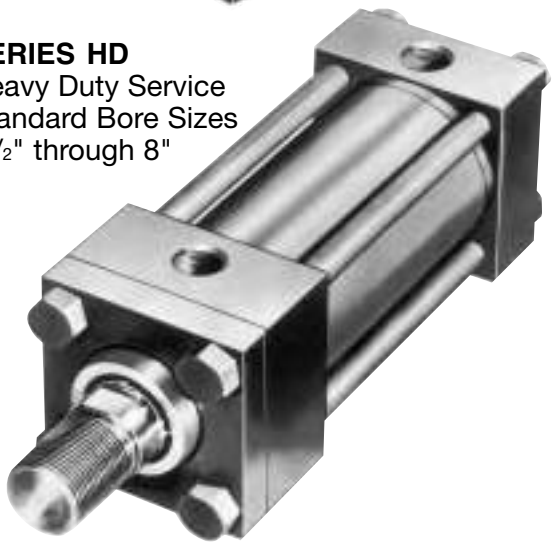


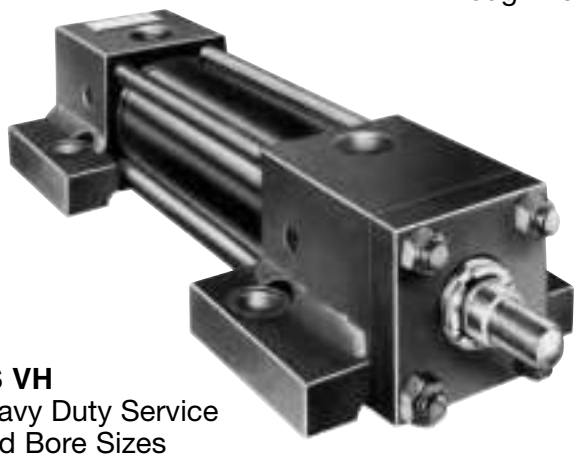
SERIES 2H
Heavy Duty Service
Standard Bore
Sizes
1 1/2" through 6"

SERIES 3L
Medium Duty Service
Standard Bore Sizes
1" through 8"

SERIES 3H
Heavy Duty Service
Bore Sizes
7" through 20"

SERIES HD
Heavy Duty Service
Standard Bore Sizes
1 1/2" through 8"





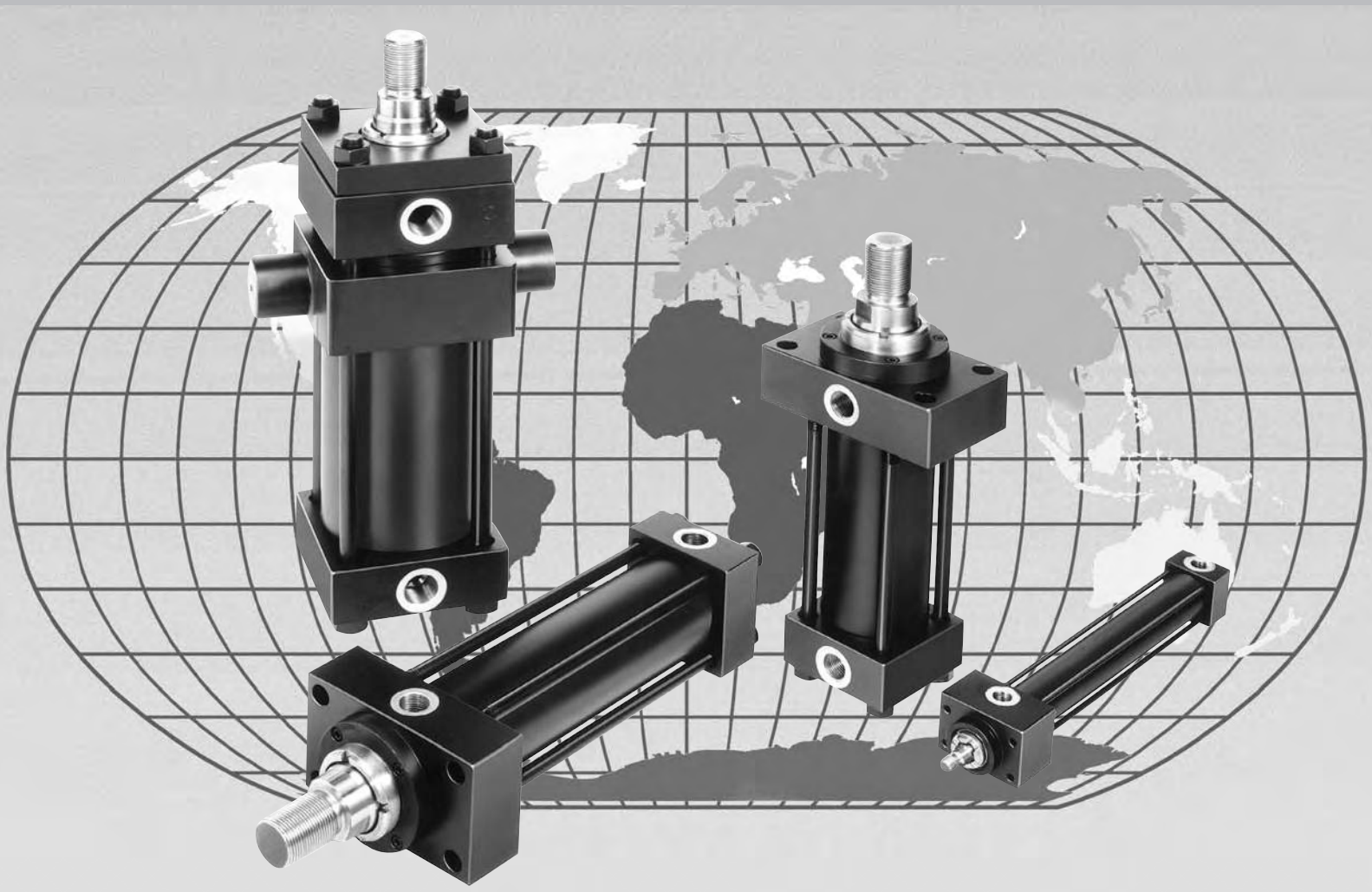
SERIES VH
Very Heavy Duty Service
Standard Bore Sizes
2 1/2" through 8"

For additional information – call your local Parker Cylinder Distributor.

Parker
Cylinder

Metric Hydraulic Cylinders
Series HMI

Conforms to ISO 6020/2 (1991)
For working pressures up to 210 bar



Vital Technologies for Motion and Control

For Cylinder Division Plant Locations – See Page II.

Parker
Cylinder

Parker Series HMI
Metric Hydraulic Cylinders

As the world leader in the design and manufacture of tie-rod cylinders, Parker Cylinder Division introduces the Parker Series HMI *metric* hydraulic cylinder. Parker's HMI Series cylinders are designed to meet the requirements of ISO 6020/2 (1991), 160 Bar Compact Series. HMI Series cylinders may be used for working pressures up to 210 Bar.

Parker HMI Series cylinders are the true *world standard*, available all over the globe from Parker's worldwide manufacturing facilities. Whether you or your machine are in Europe, Asia, South America, Canada, Mexico, or the United States, you can rely on the engineering expertise, manufacturing experience, and commitment to quality that you've come to expect from the Parker Cylinder Division.

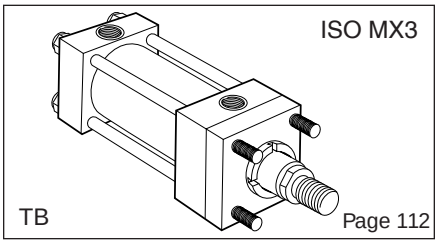
For additional information – call your local Parker Cylinder Distributor.

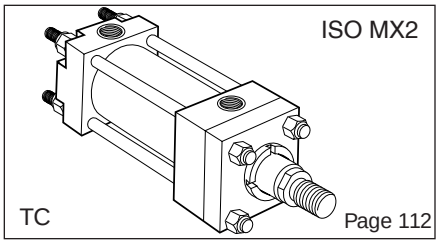
Series HMI Standard Features and Specifications

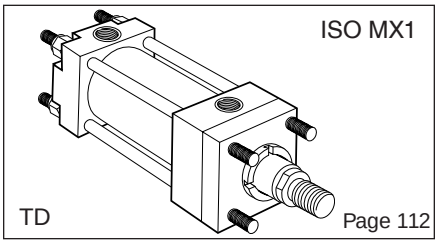
- ISO 6020/2 mounting interchangeable
- 12 standard mounting styles
- Up to 3 rod sizes per bore
- Wide range of mounting accessories
- Up to 3 male and 3 female rod end threads per bore
- Bore sizes – 25mm to 200mm
- Strokes – available in any practical stroke length
- Working pressure up to 210 bar
- Piston rods – 12mm to 140mm
- Single and Double rod designs
- Cushions available at either end
- Temperature Range – -20°C to 150°C depending on seal type
- Seal types to suit a wide variety of operating environments

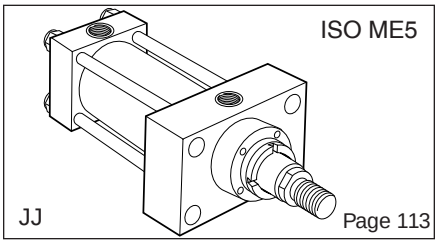
In line with our policy of continuing product improvement, specifications in this catalog are subject to change.

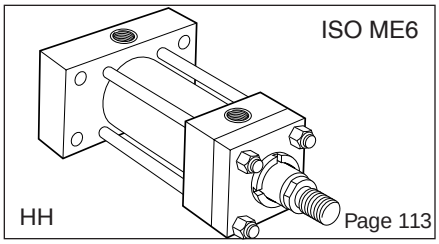
Available Mountings and Where To Find Them

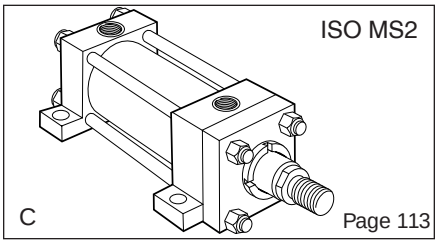


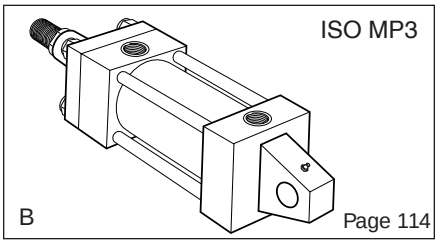


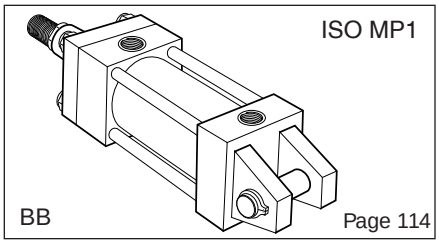


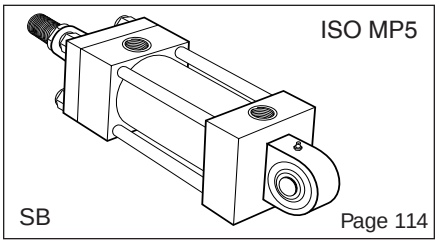


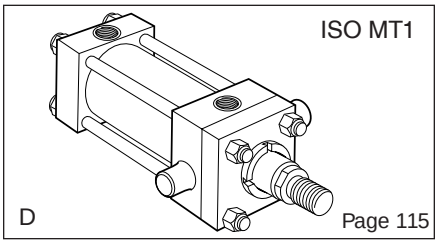


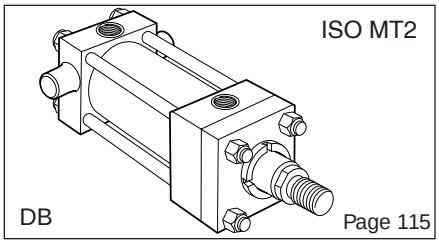


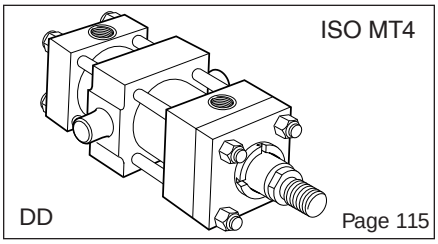












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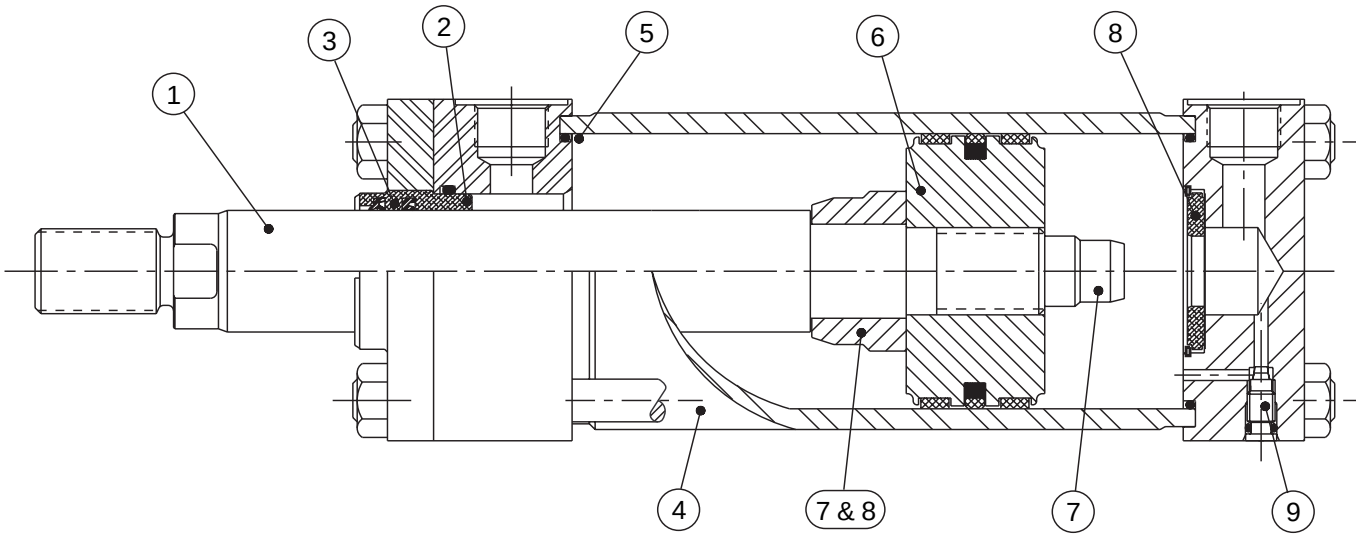
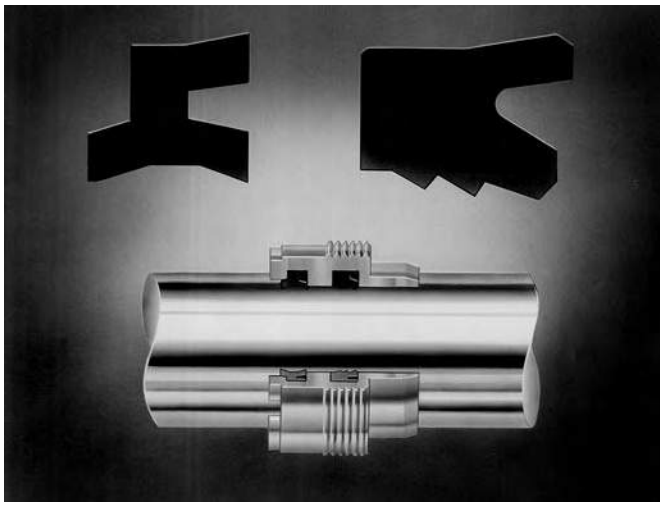


1 Piston Rod

Gland seal life is maximized by manufacturing piston rods from precision ground, high tensile carbon alloy steel, hard chrome plated and polished to 0.2µm max.

2 Parker's 'Jewel' Gland

Continuous lubrication, and therefore longer gland life, are provided by the long bearing surface inboard of the primary seal. The Jewel gland, complete with rod seals, can easily



be removed without dismantling the cylinder, so servicing is quicker – and therefore more economical.

3 Rod Seals

The TS-2000 primary seal has a series of sealing edges which take over successively as pressure increases, providing efficient sealing under all operating conditions. On the return stroke the serrations act as a check valve, allowing the oil adhering to the rod to pass back into the cylinder.

The double lip wiperseal acts as a secondary seal, trapping excess lubricating film in the chamber between the wiper and lip seals. Its outer lip prevents the ingress of dirt into the cylinder, extending the life of gland and seals.

The TS-2000 is manufactured from an enhanced polyurethane, giving efficient retention of pressurized fluid and long service life.

4 Cylinder Body

Strict quality control standards and precision manufacture ensure that all tubes meet rigid standards of straightness, roundness and surface finish. The steel tubing is surface finished to minimize internal friction and prolong seal life.

5 Cylinder Body Seals

To make sure that the cylinder body remains leaktight, even under pressure shock conditions, Parker utilizes pressure-energized body seals.

6 One-Piece Piston

Side loading is resisted by the wide bearing surfaces of the pistons. A long thread engagement secures the piston to the piston rod and, as an added safety feature, pistons are secured by an anaerobic adhesive.

7 Cushioning

Progressive deceleration is available by using profiled cushions at the head and cap – see Section C for details. The head end cushion is self aligning, while the polished cap end spear is an integral part of the piston rod.

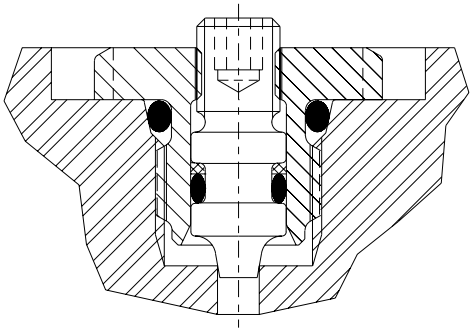
8 Floating Cushion Bushings and Sleeves

Closer tolerances – and therefore more effective cushioning – are permitted by the use of a floating cushion sleeve at the head end of the cylinder, and a floating cushion bushing at the cap end. A slotted cushion sleeve at the head end and the floating bronze cushion bushing in the cap, provide minimum fluid restriction at the start of the return stroke. This allows full pressure to be applied over the entire area of the piston, providing full power and fast cycle times.

For additional information – call your local Parker Cylinder Distributor.

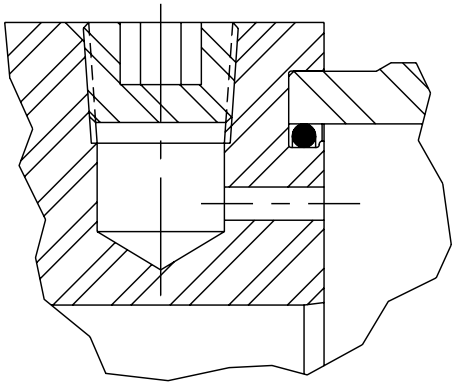
9 Cushion Adjustment

Needle valves are provided at both ends of the cylinder for precise cushion adjustment. 63 mm bores and smaller contain cartridge cushion assembly shown below.



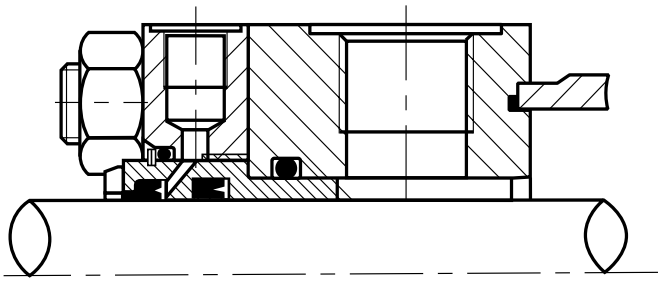
Air Bleeds

Available as an option at both ends, the air bleeds are recessed into the head and cap.

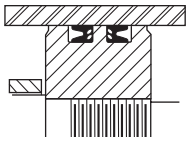


Gland Drains

The accumulation of fluid behind the gland wiperseal of long stroke cylinders, or cylinders with constant back pressure, can be relieved by specifying the option of a gland drain. A port between the wiperseal and primary seal allows fluid to be piped back to a reservoir. By fitting a transparent tube between the port and the reservoir, fluid loss from concealed or inaccessible cylinders can be monitored to provide an early indication of the need for gland servicing. Gland drains are described in greater detail in Section C of this catalog.

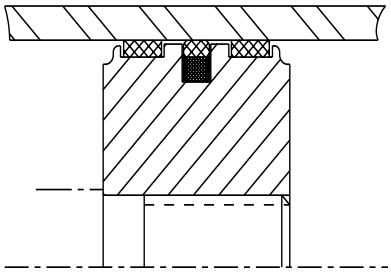


Piston Seals



Standard on 25mm, 32mm and 40mm bore sizes, Parker's Lipseal™ Piston provides zero leakage under static conditions for hydraulic pressures up to 3000 psi. Seals are self-compensating to conform to variations in pressure, mechanical deflection, and wear. Back-up washers prevent extrusion.

Standard on 50mm bore sizes and larger, Parker's B style piston is a single seal design which incorporates two wear strips. This design provides smooth operation, long bearing life, and high load carrying capacity.



Mixed Media Piston Seals

For applications requiring different media on either side of the piston specify Mixed Media Piston Seals with a W piston code. This option is ideal when hydraulic oil is on one side of the piston and air on the opposite side; and it can be equally effective when dissimilar fluids are on either side of the piston. Superior low-friction bi-directional sealing is accomplished by combining an energized filled PTFE seal with a redundant elastomer seal.

Servo Cylinders

Servo cylinders permit fine control of acceleration, velocity and position in applications where very low friction and an absence of stick-slip are required. They may be used in conjunction with integral or external transducers. Servo cylinders combine low friction piston and gland seals with specially selected tubes and rods. For low-friction applications – consult factory.

Seal Classes

To accommodate the many types of fluids and the varying temperature ranges used in industry, Parker offers a range of rod gland, piston and body seals. These are described in detail in Section C of this catalog.

B

ISO Cylinder Mounting Styles and Where to Find Them

The standard range of Parker Series HMI cylinders comprises 12 ISO mounting styles, to suit the majority of applications. General guidance for the selection of ISO cylinders is given below, with dimensional information about each mounting style shown on the following pages. Application-specific mounting information is shown in the mounting information section, Section C of this catalog.

Extended Tie Rods

Cylinders with TB, TC and TD mountings are suitable for straight line force transfer applications, and are particularly useful where space is limited. For compression (push) applications, cap end tie rod mountings are most appropriate; where the major load places the piston rod in tension (pull applications), head end mounting styles should be specified. Cylinders with tie rods extended at both ends may be attached to the machine member from either end, allowing the free end of the cylinder to support a bracket or switch.

Flange Mounted Cylinders

These cylinders are also suitable for use on straight line force transfer applications. Two flange mounting styles are available, offering either a head flange (JJ) or a cap flange (HH). Selection of the correct flange mounting style depends on whether the major force applied to the load will result in compression (push) or tension (pull) stresses on the piston rod. For compression-type applications, the cap mounting style is most appropriate; where the major load places the piston rod in tension, a head mounting should be specified.

Foot Mounted Cylinders

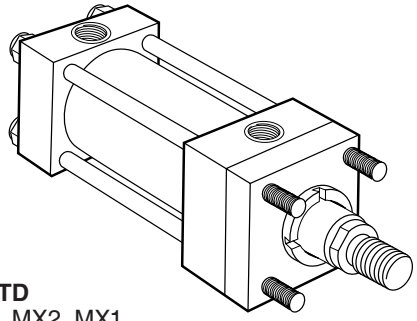
Style C, foot mounted cylinders do not absorb forces on their centerline. As a result, the application of force by the cylinder produces a moment which attempts to rotate the cylinder about its mounting bolts. It is important, therefore, that the cylinder should be firmly secured to the mounting surface and that the load should be effectively guided to avoid side loads being applied to rod gland and piston bearings. A thrust key modification may be specified to provide positive cylinder location.

Pivot Mountings

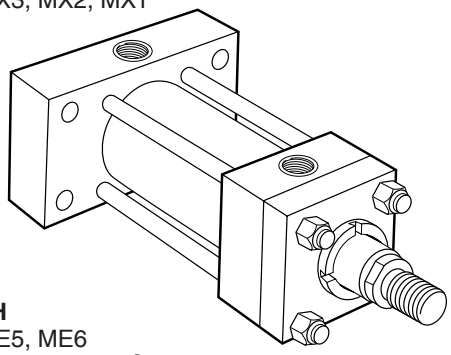
Cylinders with pivot mountings, which absorb forces on their centerlines, should be used where the machine member to be moved travels in a curved path. Pivot mountings may be used for tension (pull) or compression (push) applications. Cylinders using a fixed clevis, styles BB and B, may be used if the curved path of the piston rod travel is in a single plane; for applications where the piston rod will travel in a path on either side of the true plane of motion, a spherical bearing mounting SB is recommended.

Trunnion Mounted Cylinders

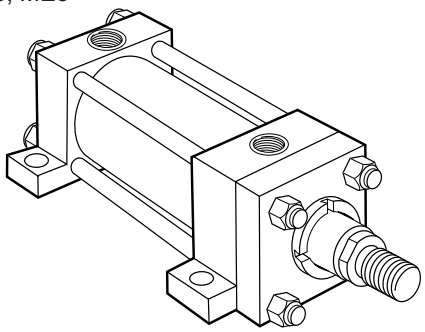
These cylinders, styles D, DB and DD, are designed to absorb force on their centerlines. They are suitable for tension (pull) or compression (push) applications, and may be used where the machine member to be moved travels in a curved path in a single plane. Trunnion pins are designed for shear loads only and should be subjected to minimum bending stresses.



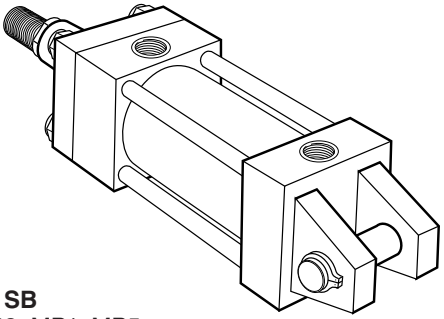
Styles TB, TC, TD
ISO Styles MX3, MX2, MX1 **TB**



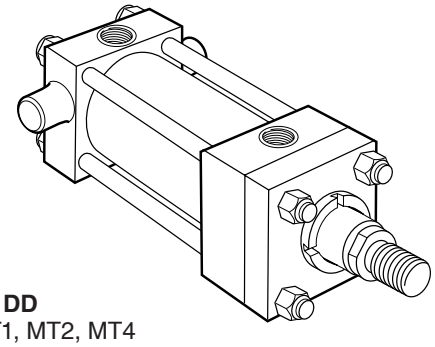
Styles JJ, HH
ISO Styles ME5, ME6 **HH**



Style C
ISO Style MS2 **C**



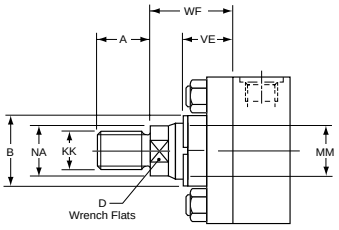
Styles B, BB, SB
ISO Styles MP3, MP1, MP5 **BB**



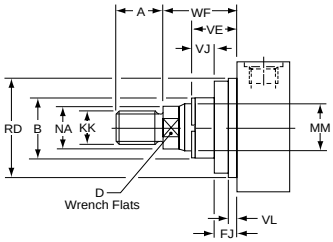
Styles D, DB, DD
ISO Styles MT1, MT2, MT4 **DB**

For additional information – call your local Parker Cylinder Distributor.

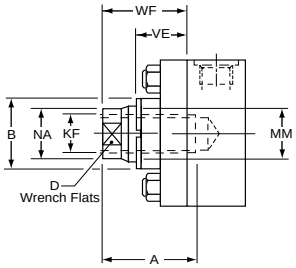
Parker Thread Styles 4 & 7 – All Except JJ Mount



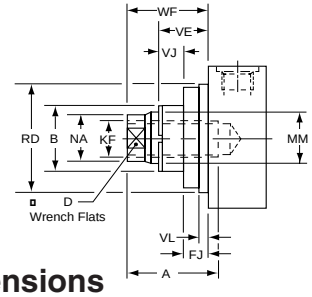
Parker Thread Styles 4 & 7 – JJ Mount



Parker Thread Style 9 – All Except JJ Mount



Parker Thread Style 9 – JJ Mount

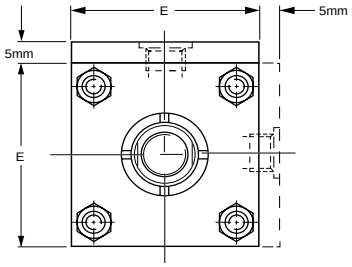


Parker Thread Styles 4 & 7
The smallest diameter rod end thread for each bore size is designated Style 4 when sup-plied with a No.1 rod. When the same rod end thread is supplied with a No. 2 or No. 3 rod, it is designated Style 7.

Parker Thread Style 9 – Short Stroke Cylinders
Style 9 (female) rod ends should not be used on 160mm or 200mm bore cylinders with a stroke of 50mm or less. Please consult the factory, with details of the application.

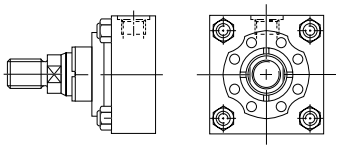
Parker Thread Style 3
Non-standard piston rod ends are designated 'Style 3'. A dimensional sketch or description should accompany the order. Please specify dimensions KK or KF, A, rod stand out WF and thread type.

25 & 32mm Bore Cylinders



5mm extra height applies to port face at head end only.

Gland Retainer – 160 and 200mm Bore
On all 160mm and 200mm bore ISO mounting styles except TB and TD, the gland retainer is separately bolted to the head, as shown.



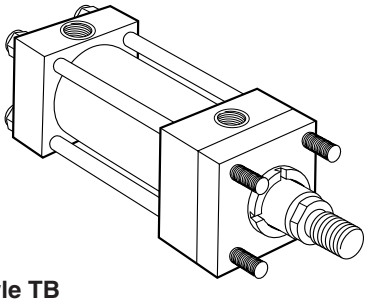
Piston Rod End Dimensions

Bore ϕ	Rod No.	MM Rod ϕ	Style 4 KK	Style 4 A	Style 7 KK	Style 7 A	Style 9 KF	Style 9 A	B f9	D	NA	VE	WF	JJ Mount Only VL min	JJ Mount Only RD f8	JJ Mount Only VJ	JJ Mount Only FJ
25	1	12	M10x1.25	14	-	-	M8x1	14	24	10	11	16	25	3	38	6	10
	2	18	M14x1.5	18	M10x1.25	14	M12x1.25	18	30	15	17	16					
32	1	14	M12x1.25	16	-	-	M10x1.25	16	26	12	13	22	35	3	42	12	10
	2	22	M16x1.5	22	M12x1.25	16	M16x1.5	22	34	18	21	22					
40	1	18	M14x1.5	18	-	-	M12x1.25	18	30	15	17	16	35	3	62	6	10
	2	28	M20x1.5	28	M14x1.5	18	M20x1.5	28	42	22	26	22				12	
50	1	22	M16x1.5	22	-	-	M16x1.5	22	34	18	21	22	41	4	74	6	16
	2	36	M27x2	36	M16x1.5	22	M27x2	36	50	30	34	25				9	
	3	28	M20x1.5	28	M16x1.5	22	M20x1.5	28	42	22	26	22				6	
63	1	28	M20x1.5	28	-	-	M20x1.5	28	42	22	26	22	48	4	75	6	16
	2	45	M33x2	45	M20x1.5	28	M33x2	45	60	39	43	29			88	13	
	3	36	M27x2	36	M20x1.5	28	M27x2	36	50	30	34	25				9	
80	1	36	M27x2	36	-	-	M27x2	36	50	30	34	25	51	4	82	5	20
	2	56	M42x2	56	M27x2	36	M42x2	56	72	48	54	29			105	9	
	3	45	M33x2	45	M27x2	36	M33x2	45	60	39	43	29					
100	1	45	M33x2	45	-	-	M33x2	45	60	39	43	29	57	5	92	7	22
	2	70	M48x2	63	M33x2	45	M48x2	63	88	62	68	32			125	10	
	3	56	M42x2	56	M33x2	45	M42x2	56	72	48	54	29				7	
125	1	56	M42x2	56	-	-	M42x2	56	72	48	54	29	57	5	105	9	20
	2	90	M64x3	85	M42x2	56	M64x3	85	108	80	88	32			150	10	22
	3	70	M48x2	63	M42x2	56	M48x2	63	88	62	68	32					
160	1	70	M48x2	63	-	-	M48x2	63	88	62	68	32	57	5	125	10	22
	2	110	M80x3	95	M48x2	63	M80x3	95	133	100	108	32			170	7	25
	3	90	M64x3	85	M48x2	63	M64x3	85	108	80	88	32					
200	1	90	M64x3	85	-	-	M64x3	85	108	80	88	32	57	5	150	10	22
	2	140	M100x3	112	M64x3	85	M100x3	112	163	128	138	32			210	7	25
	3	110	M80x3	95	M64x3	85	M80x3	95	133	100	108	32					

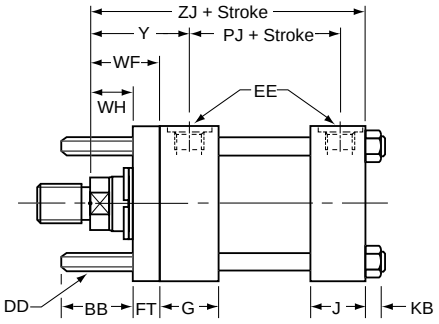
All dimensions are in millimeters unless otherwise stated.

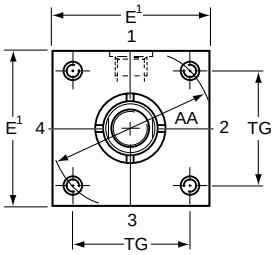
For Cylinder Division Plant Locations – See Page II.

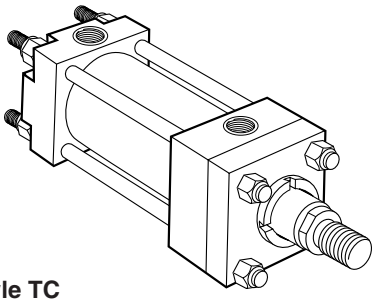
Parker Cylinder



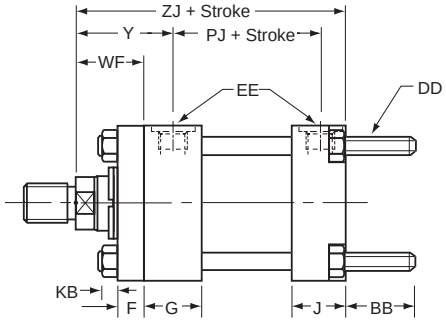
Style TB
Tie Rods Extended Head End
(ISO Style MX3)

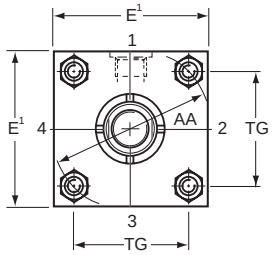


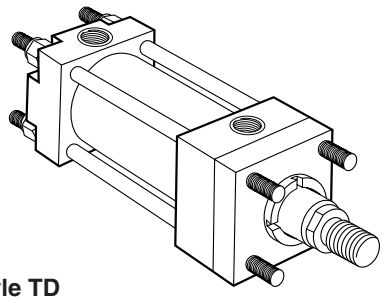




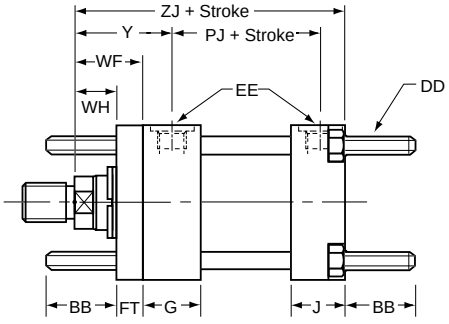
Style TC
Tie Rods Extended Cap End
(ISO Style MX2)

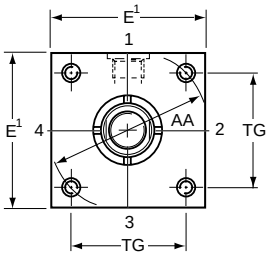






Style TD
Tie Rods Extended Both Ends
(ISO Style MX1)





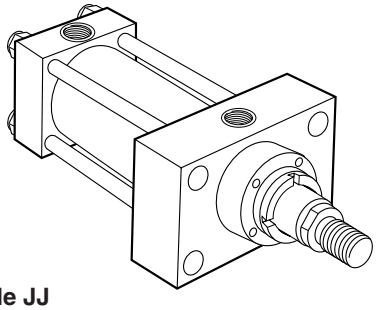
[1]Head depth increased by 5mm to accommodate port on 25mm and 32mm bore cylinders – see page 111

Dimensions – TB, TC & TD See also Rod End Dimensions, page 111

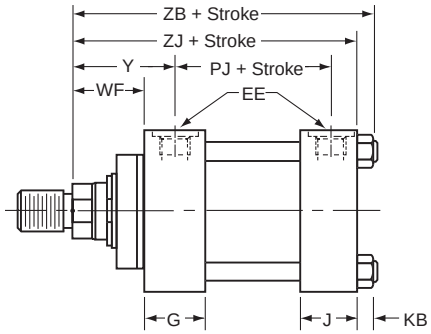
Bore ϕ	AA	BB	DD	E	EE BSP/G inches	F	FT	G	J	KB	TG	WF	WH	Y	+ Stroke	
															PJ	ZJ
25	40	19	M5x0.8	40[1]	1/4	10	10	40	25	4	28.3	25	15	50	53	114
32	47	24	M6x1	45[1]	1/4	10	10	40	25	5	33.2	35	25	60	56	128
40	59	35	M8x1	63	3/8	10	10	45	38	6.5	41.7	35	25	62	73	153
50	74	46	M12x1.25	75	1/2	16	16	45	38	10	52.3	41	25	67	74	159
63	91	46	M12x1.25	90	1/2	16	16	45	38	10	64.3	48	32	71	80	168
80	117	59	M16x1.5	115	3/4	20	20	50	45	13	82.7	51	31	77	93	190
100	137	59	M16x1.5	130	3/4	22	22	50	45	13	96.9	57	35	82	101	203
125	178	81	M22x1.5	165	1	22	22	58	58	18	125.9	57	35	86	117	232
160	219	92	M27x2	205	1	25	25	58	58	22	154.9	57	32	86	130	245
200	269	115	M30x2	245	1-1/4	25	25	76	76	24	190.2	57	32	98	165	299

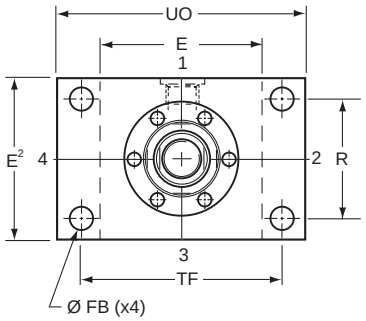
All dimensions are in millimeters unless otherwise stated.

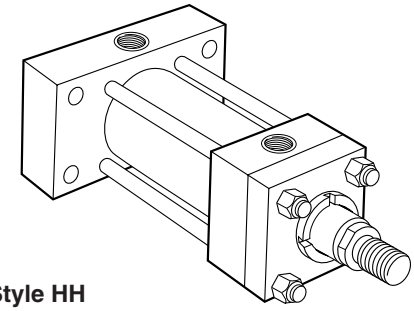
For additional information – call your local Parker Cylinder Distributor.



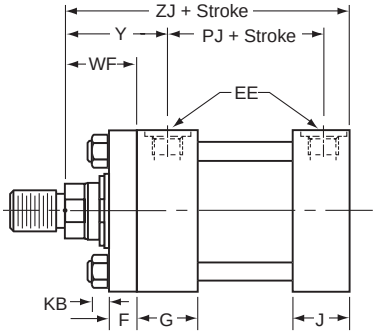
Style JJ
Head Rectangular Flange
(ISO Style ME5)

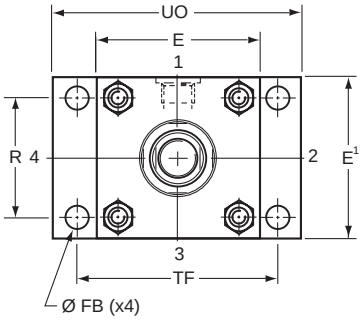


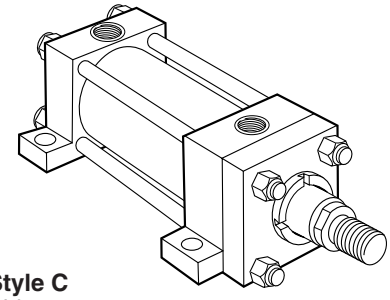




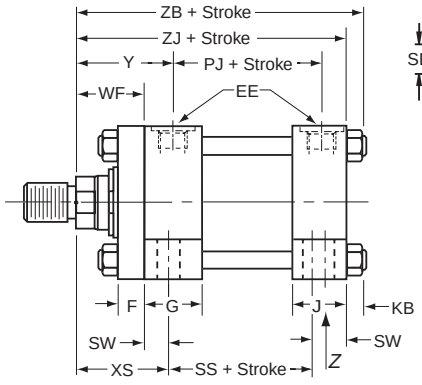
Style HH
Cap Rectangular Flange
(ISO Style ME6)

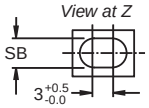




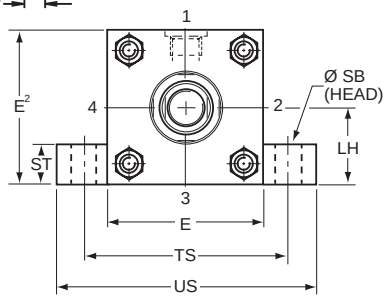


Style C
Side Lugs
(ISO Style MS2)





A thrust key may be used with this mounting style.



[1]Head depth increased by 5mm to accommodate port on 25mm and 32mm bore cylinders – see page 111.
[2]On 25mm and 32 mm bore C mount and JJ mount cylinders with port in position 2 or 4, head depth E is increased by 5mm in position 1.

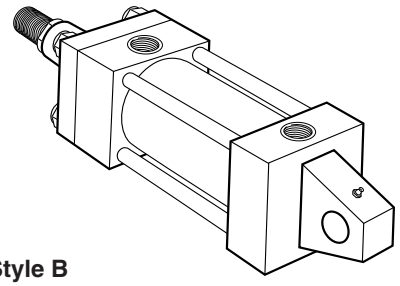
Dimensions – JJ, HH & C

See also Rod End Dimensions, page 111

Bore ϕ	E	EE BSP/G inches	F	FB	G	J	KB	LH h10	R	SB	ST	SW	TF	TS	UO	US	WF	XS	Y	+ Stroke			
																				PJ	SS	ZB	ZJ
25	40[1]	1/4	10	5.5	40	25	4	19	27	6.6	8.5	8	51	54	65	72	25	33	50	53	72	121	114
32	45[1]	1/4	10	6.6	40	25	5	22	33	9	12.5	10	58	63	70	84	35	45	60	56	72	137	128
40	63	3/8	10	11	45	38	6.5	31	41	11	12.5	10	87	83	110	103	35	45	62	73	97	166	153
50	75	1/2	16	14	45	38	10	37	52	14	19	13	105	102	130	127	41	54	67	74	91	176	159
63	90	1/2	16	14	45	38	10	44	65	18	26	17	117	124	145	161	48	65	71	80	85	185	168
80	115	3/4	20	18	50	45	13	57	83	18	26	17	149	149	180	186	51	68	77	93	104	212	190
100	130	3/4	22	18	50	45	13	63	97	26	32	22	162	172	200	216	57	79	82	101	101	225	203
125	165	1	22	22	58	58	18	82	126	26	32	22	208	210	250	254	57	79	86	117	130	260	232
160	205	1	25	26	58	58	22	101	155	33	38	29	253	260	300	318	57	86	86	130	129	279	245
200	245	1-1/4	25	33	76	76	24	122	190	39	44	35	300	311	360	381	57	92	98	165	171	336	299

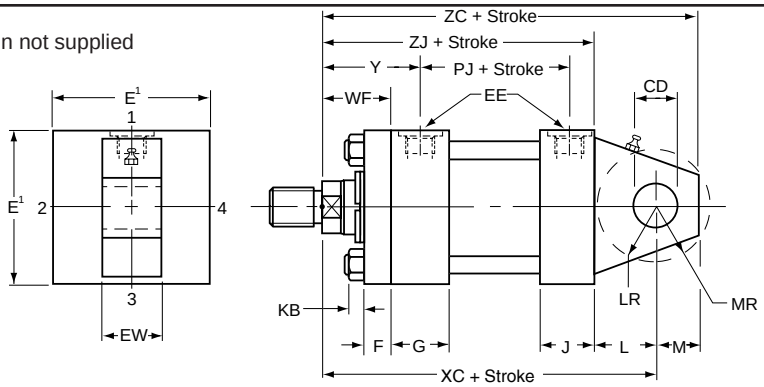
All dimensions are in millimeters unless otherwise stated.

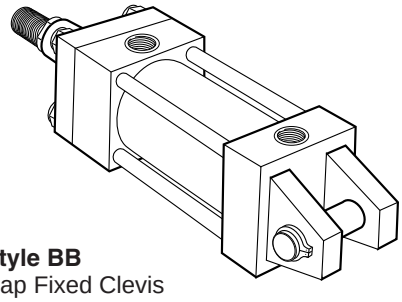
For Cylinder Division Plant Locations – See Page II.



Style B
Cap Fixed Eye
(ISO Style MP3)

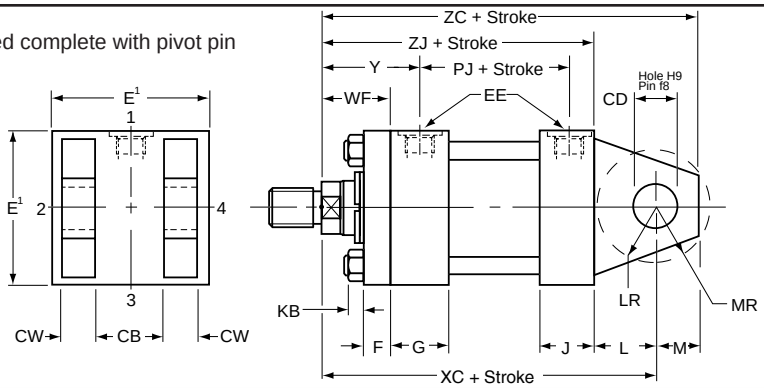
Pivot pin not supplied

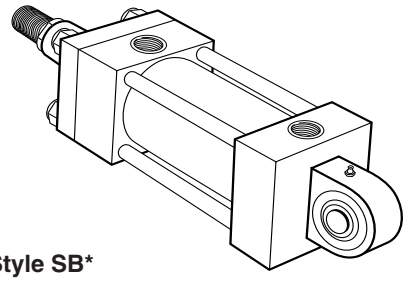




Style BB
Cap Fixed Clevis
(ISO Style MP1)

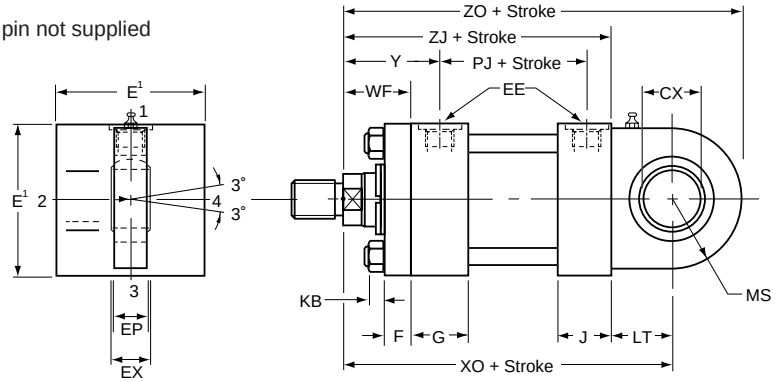
Supplied complete with pivot pin





Style SB*
Cap Fixed Eye
(ISO Style MP5)

Pivot pin not supplied



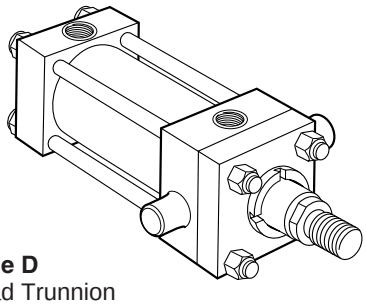
[1]Head depth increased by 5mm to accommodate port on 25mm and 32mm bore cylinders – see page 111
*Parker Style SB is also known as Style SBd under Parker's European model code system

Dimensions – B, BB & SB See also Rod End Dimensions, page 111

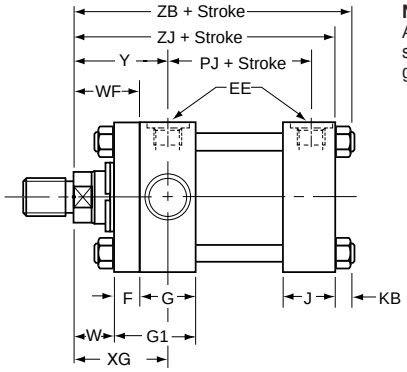
Bore	CB	CD	CW	CX	E	EE	EP	EW	EX	F	G	J	KB	L	LR	LT	M	MR	MS	WF	Y	+ Stroke					
ϕ	A16	H9				BSP/G inches		h14											max			PJ	XC	XO	ZC	ZJ	ZO
25	12	10	6	12-0.008	40[1]	1/4	8	12	10	10	40	25	4	13	12	16	10	12	20	25	50	53	127	130	137	114	150
32	16	12	8	16-0.008	45[1]	1/4	11	16	14	10	40	25	5	19	17	20	12	15	22.5	35	60	56	147	148	159	128	170.5
40	20	14	10	20-0.012	63	3/8	13	20	16	10	45	38	6.5	19	17	25	14	16	29	35	62	73	172	178	186	153	207
50	30	20	15	25-0.012	76	1/2	17	30	20	16	45	38	10	32	29	31	20	25	33	41	67	74	191	190	211	159	223
63	30	20	15	30-0.012	90	1/2	19	30	22	16	45	38	10	32	29	38	20	25	40	48	71	80	200	206	220	168	246
80	40	28	20	40-0.012	115	3/4	23	40	28	20	50	45	13	39	34	48	28	34	50	51	77	93	229	238	257	190	288
100	50	36	25	50-0.012	130	3/4	30	50	35	22	50	45	13	54	50	58	36	44	62	57	82	101	257	261	293	203	323
125	60	45	30	60-0.015	165	1	38	60	44	22	58	58	18	57	53	72	45	53	80	57	86	117	289	304	334	232	384
160	70	56	35	80-0.015	205	1	47	70	55	25	58	58	22	63	59	92	59	59	100	57	86	130	308	337	367	245	437
200	80	70	40	100-0.020	245	1-1/4	57	80	70	25	76	76	24	82	78	116	70	76	120	57	98	165	381	415	451	299	535

All dimensions are in millimeters unless otherwise stated.

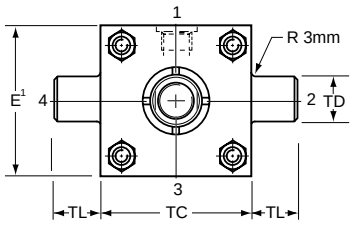
For additional information – call your local Parker Cylinder Distributor.

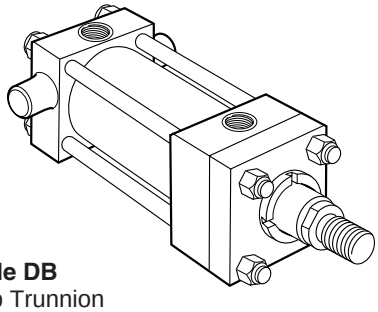


Style D
Head Trunnion
(ISO Style MT1)

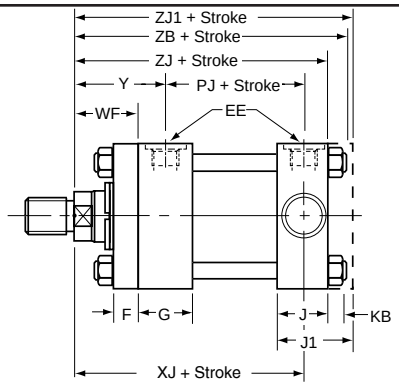


Notes:
A one-piece head and retainer is used on 100mm-200mm bore sizes – G1 dimension. On 160 and 200mm bores, the bolted gland is recessed, with tie rods screwed into the head.

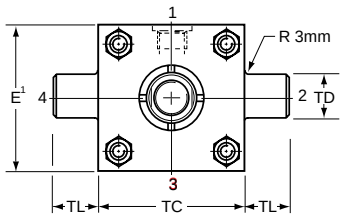


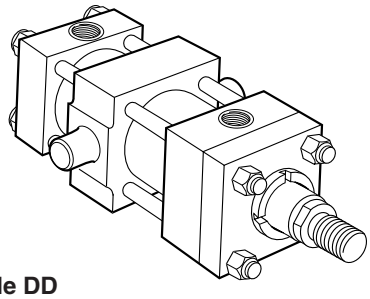


Style DB
Cap Trunnion
(ISO Style MT2)

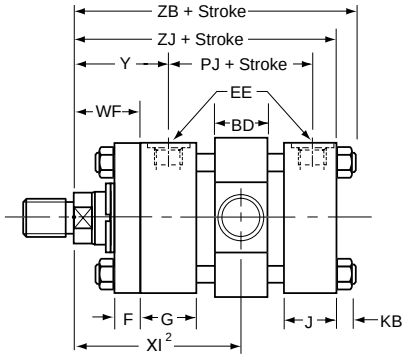


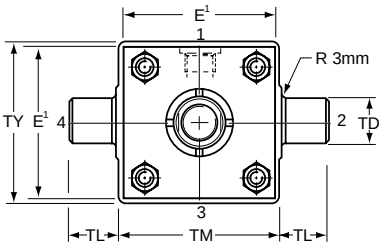
Note:
On 100-200mm bore cylinders, dimension J becomes J1. ZJ1 replaces ZB, and tie rods are screwed directly into the cap.





Style DD
Intermediate Fixed Trunnion
(ISO Style MT4)





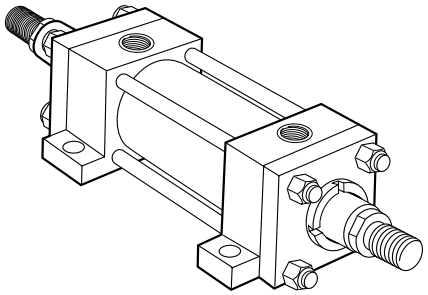
[1]Head depth increased by 5mm to accommodate port on 25mm and 32mm bore cylinders – see page 111
[2]Dimensions to be specified by customer

Dimensions – D, DB & DD

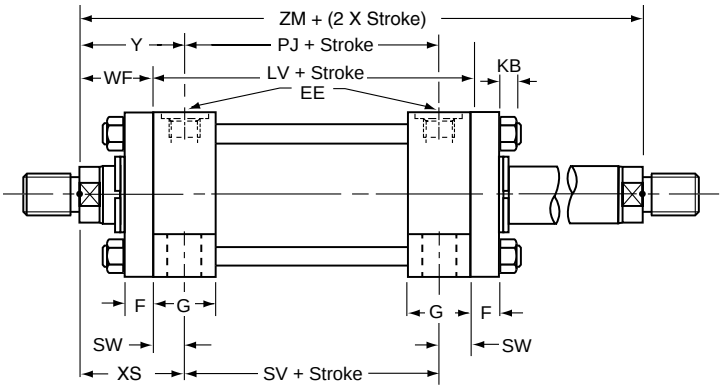
See also Rod End Dimensions, page 111

Bore ϕ	BD	E	EE BSP/G inches	F	G	G1	J	J1	KB	TC	TD f8	TL	TM	TY	W	WF	XG	Y	+ Stroke PJ	+ Stroke XJ	+ Stroke ZJ	+ Stroke ZJ1	+ Stroke ZB	Style DD min stroke	Min XI dim'n
25	20	40[1]	1/4	10	40	-	25	-	4	38	12	10	48	45	-	25	44	50	53	101	114	-	121	10	78
32	25	45[1]	1/4	10	40	-	25	-	5	44	16	12	55	54	-	35	54	60	56	115	128	-	137	10	90
40	30	63	3/8	10	45	-	38	-	6.5	63	20	16	76	76	-	35	57	62	73	134	153	-	166	15	97
50	40	76	1/2	16	45	-	38	-	10	76	25	20	89	89	-	41	64	67	74	140	159	-	176	15	107
63	40	90	1/2	16	45	-	38	-	10	89	32	25	100	95	-	48	70	71	80	149	168	-	185	15	114
80	50	115	3/4	20	50	-	45	50	13	114	40	32	127	127	-	51	76	77	93	168	190	194	212	20	127
100	60	130	3/4	22	50	72	45	58	13	127	50	40	140	140	35	57	71	82	101	187	203	216	225	20	138
125	73	165	1	22	58	80	58	71	18	165	63	50	178	178	35	57	75	86	117	209	232	245	260	25	153
160	90	205	1	25	58	88	58	88	22	203	80	63	215	216	32	57	75	86	130	230	245	275	279	30	161
200	110	245	1-1/4	25	76	108	76	108	24	241	100	80	279	280	32	57	85	98	165	276	299	330	336	30	190

All dimensions are in millimeters unless otherwise stated.



Double Rod Cylinder
Available with Styles TB, TD, JJ, C, D, DD (Style C illustrated)



Mounting Styles and Codes

Double rod cylinders are denoted by a 'K' in the ISO cylinder model code.

Dimensions

To obtain dimensional information for double rod cylinders, first select the desired mounting style by referring to the corresponding single rod model. Dimensions for the appropriate single rod model should be supplemented by those from the table opposite to provide a full set of dimensions.

Minimum Stroke Length – Style 9 Rod End

Where a style 9 (female) piston rod end is required on a double rod cylinder with a stroke of 80mm or less, and a bore of 80mm or above, please consult the factory.

Cushioning

Double rod cylinders can be supplied with cushions at either or both ends. Cushioning requirements should be specified by inserting a 'C' in the ordering code. See cushioning section, Section C of this catalog.

Double Rod Cylinders

For double rod cylinders, specify rod number and rod end symbols for both piston rods. A typical model number for a double rod cylinder would be:

100	K	JJ	HMI	R	E	1	4	M	1	4	M	125	M	11	44

Bore	Rod		Add Stroke			Add 2x Stroke
ϕ	No.	MM ϕ	LV	PJ	SV	ZM
25	1	12	104	53	88	154
	2	18				
32	1	14	108	56	88	178
	2	22				
40	1	18	125	73	105	195
	2	28				
50	1	22	125	74	99	207
	2	36				
	3	28				
63	1	28	127	80	93	223
	2	45				
	3	36				
80	1	36	144	93	110	246
	2	56				
	3	45				
100	1	45	151	101	107	265
	2	70				
	3	56				
125	1	56	175	117	131	289
	2	90				
	3	70				
160	1	70	188	130	130	302
	2	110				
	3	90				
200	1	90	242	160	172	356
	2	140				
	3	110				

All dimensions are in millimeters unless otherwise stated.

For additional information – call your local Parker Cylinder Distributor.

Accessory Selection

Accessories for the rod end of a cylinder are selected by reference to the rod end thread, while the same accessories, when used at the cap end, are selected by cylinder bore size. See tables of part numbers below, and on the following pages.

The rod clevises, plain rod eyes and spherical bearings fitted as accessories to the rod end have the same pin diameters as those used at the cylinder cap ends of the corresponding mounting styles – B, BB and SB – when fitted with the No.1 rod, or the No. 2 or No. 3 rods with Style 7 rod end.

Rod and Cap End Accessories

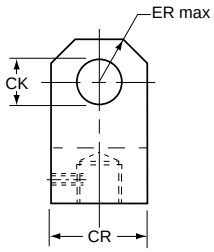
Accessories for the HMI ISO cylinder include:

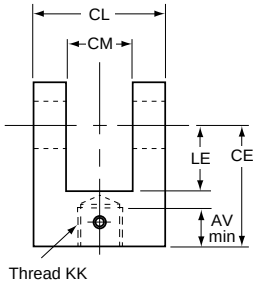
Rod End
- rod clevis, eye bracket and pivot pin
- plain rod eye, clevis bracket and pivot pin
- rod eye with spherical bearing

Cap End
- eye bracket for style BB mounting
- clevis bracket for style B mounting
- pivot pin for eye bracket and clevis bracket

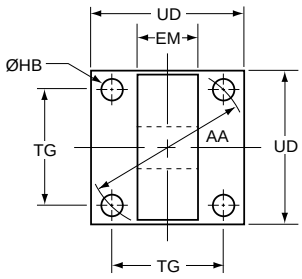
Rod Clevis, Eye Bracket and Pivot Pin

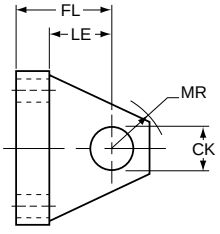
Thread KK	Rod Clevis	Eye Bracket	Pivot Pin	Nominal Force kN	Weight kg
M10x1.25	143447	144808	143477	8	0.3
M12x1.25	143448	144809	143478	12.5	0.6
M14x1.5	143449	144810	143479	20	0.8
M16x1.5	143450	144811	143480	32	2.2
M20x1.5	143451	144812	143480	50	2.7
M27x2	143452	144813	143481	80	5.9
M33x2	143453	144814	143482	125	9.4
M42x2	143454	144815	143483	200	17.8
M48x2	143455	144816	143484	320	26.8
M64x3	143456	144817	143485	500	39.0





Rod Clevis





Eye Bracket

All dimensions are in millimeters unless otherwise stated.

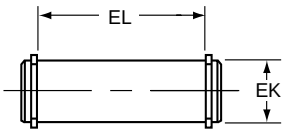
Rod Clevis Dimensions

Part No.	AV	CE	CK H9	CL	CM A16	CR	ER	KK	LE kg	Weight
143447	14	32	10	26	12	20	12	M10x1.25	14	0.08
143448	16	36	12	34	16	32	17	M12x1.25	19	0.25
143449	18	38	14	42	20	30	17	M14x1.5	19	0.32
143450	22	54	20	62	30	50	29	M16x1.5	32	1.0
143451	28	60	20	62	30	50	29	M20x1.5	32	1.1
143452	36	75	28	83	40	60	34	M27x2	39	2.3
143453	45	99	36	103	50	80	50	M33x2	54	2.6
143454	56	113	45	123	60	102	53	M42x2	57	5.5
143455	63	126	56	143	70	112	59	M48x2	63	7.6
143456	85	168	70	163	80	146	78	M64x3	83	13.0

Eye Bracket Dimensions

Part No.	CK H9	EM h13	FL	MR max	LE min	AA	HB	TG	UD
144808	10	12	23	12	13	40	5.5	28.3	40
144809	12	16	29	17	19	47	6.6	33.2	45
144810	14	20	29	17	19	59	9	41.7	65
144811	20	30	48	29	32	74	13.5	52.3	75
144812	20	30	48	29	32	91	13.5	64.3	90
144813	28	40	59	34	39	117	17.5	82.7	115
144814	36	50	79	50	54	137	17.5	96.9	130
144815	45	60	87	53	57	178	26	125.9	165
144816	56	70	103	59	63	219	30	154.9	205
144817	70	80	132	78	82	269	33	190.2	240

Pivot Pin for Clevis Bracket and Plain Rod Eye – Dimensions



Part No.	EK f8	EL	Weight kg
143477	10	29	0.02
143478	12	37	0.05
143479	14	45	0.08
143480	20	66	0.2
143481	28	87	0.4
143482	36	107	1.0
143483	45	129	1.8
143484	56	149	4.2
143485	70	169	6.0

Eye Bracket – Cap End Mounting for Style BB

Bore ϕ	Eye Bracket	Nominal Force kN	Weight kg
25	144808	8	0.2
32	144809	12.5	0.3
40	144810	20	0.4
50	144811	32	1.0
63	144812	50	1.4
80	144813	80	3.2
100	144814	125	5.6
125	144815	200	10.5
160	144816	320	15.0
200	144817	500	20.0

For Cylinder Division Plant Locations – See Page II.

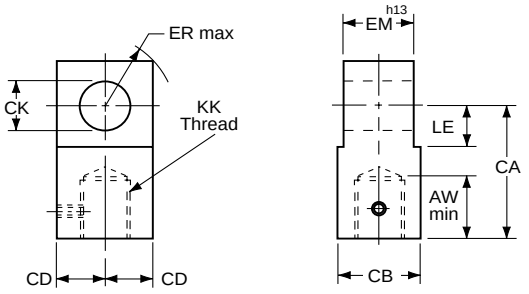
Plain Rod Eye, Clevis Bracket and Pivot Pin

Thread KK	Plain Rod Eye	Clevis Bracket	Pivot Pin	Nominal Force kN	Weight kg
M10x1.25	143457	143646	143477	8	0.5
M12x1.25	143458	143647	143478	12.5	1.0
M14x1.5	143459	143648	143479	20	1.3
M16x1.5	143460	143649	143480	32	3.2
M20x1.5	143461	143649	143480	50	3.8
M27x2	143462	143650	143481	80	6.9
M33x2	143463	143651	143482	125	12.5
M42x2	143464	143652	143483	200	26.0
M48x2	143465	143653	143484	320	47.0
M64x3	143466	143654	143485	500	64.0

Plain Rod Eye/Knuckle Dimensions

Part No.	AW	CA	CB	CD	CK H9	EM h13	ER	KK	LE	Weight kg
143457	14	32	18	9	10	12	12	M10x1.25	13	0.08
143458	16	36	22	11	12	16	17	M12x1.25	19	0.15
143459	18	38	20	12.5	14	20	17	M14x1.5	19	0.22
143460	22	54	30	17.5	20	30	29	M16x1.5	32	0.5
143461	28	60	30	20	20	30	29	M20x1.5	32	1.1
143462	36	75	40	25	28	40	34	M27x2	39	1.5
143463	45	99	50	35	36	50	50	M33x2	54	2.5
143464	56	113	65	50	45	60	53	M42x2	57	4.2
143465	63	126	90	56	56	70	59	M48x2	63	11.8
143466	85	168	110	70	70	80	78	M64x3	83	17.0

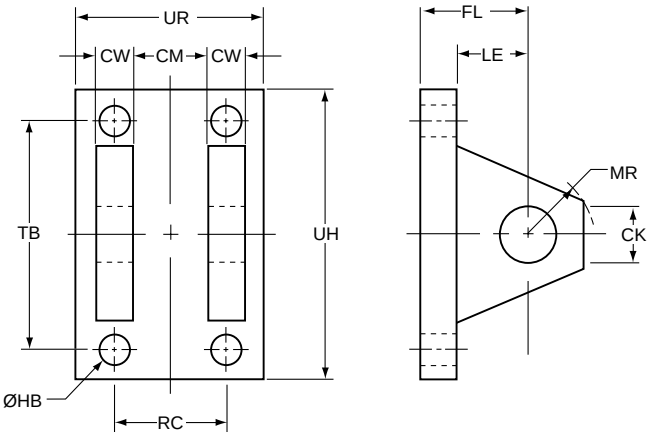
Plain Rod Eye/Knuckle



Clevis Bracket Dimensions

Part No.	CK H9	CM A16	CW	FL	MR max	HB	LE min	RC	TB	UR	UH
143646	10	12	6	23	12	5.5	13	18	47	35	60
143647	12	16	8	29	17	6.6	19	24	57	45	70
143648	14	20	10	29	17	9	19	30	68	55	85
143649	20	30	15	48	29	13.5	32	45	102	80	125
143650	28	40	20	59	34	17.5	39	60	135	100	170
143651	36	50	25	79	50	17.5	54	75	167	130	200
143652	45	60	30	87	53	26	57	90	183	150	230
143653	56	70	35	103	59	30	63	105	242	180	300
143654	70	80	40	132	78	33	82	120	300	200	360

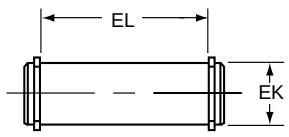
Clevis Bracket



Clevis Bracket – For Style B

Bore ϕ	Clevis Bracket	Nominal Force kN	Weight kg
25	143646	8	0.4
32	143647	12.5	0.8
40	143648	20	1.0
50	143649	32	2.5
63	143649	50	2.5
80	143650	80	5.0
100	143651	125	9.0
125	143652	200	20.0
160	143653	320	31.0
200	143654	500	41.0

Pivot Pin for Clevis Bracket and Plain Rod Eye – Dimensions



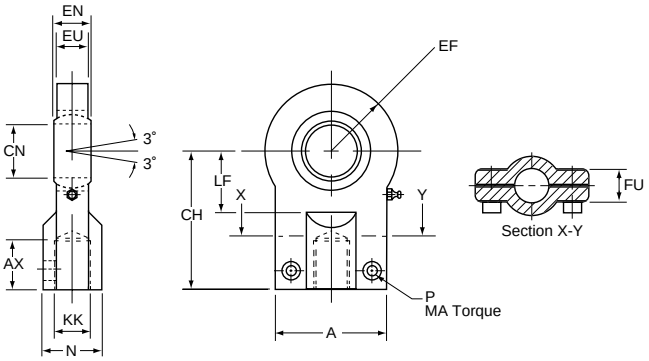
Part No.	EK f8	EL	Weight kg
143477	10	29	0.02
143478	12	37	0.05
143479	14	45	0.08
143480	20	66	0.2
143481	28	87	0.4
143482	36	107	1.0
143483	45	129	1.8
143484	56	149	4.2
143485	70	169	6.0

All dimensions are in millimeters unless otherwise stated.

For additional information – call your local Parker Cylinder Distributor.

Rod Eye with Spherical Bearing, Mounting Bracket and Pivot Pin

Thread KK	Rod Eye with Spherical Bearing	Mounting Bracket and Pivot Pin	Nominal Force kN	Weight kg
M10x1.25	145254	145530	8	0.2
M12x1.25	145255	145531	12.5	0.3
M14x1.5	145256	145532	20	0.4
M16x1.5	145257	145533	32	0.7
M20x1.5	145258	145534	50	1.3
M27x2	145259	145535	80	2.3
M33x2	145260	145536	125	4.4
M42x2	145261	145537	200	8.4
M48x2	145262	145538	320	15.6
M64x3	145263	145539	500	28.0



Rod Eye with Spherical Bearing

All spherical bearings should be re-packed with grease when servicing. In unusual or severe working conditions, consult the factory regarding the suitability of the bearing chosen.

Rod Eye with Spherical Bearing Dimensions

Part No.	A max	AX min	EF max	CH	CN	EN	EU	FU	KK	LF min	N max	MA max Nm	P
145254	40	15	20	42	12 -0.008	10 -.012	8	13	M10x1.25	16	17	10	M6
145255	45	17	22.5	48	16 -0.008	14 -.012	11	13	M12x1.25	20	21	10	M6
145256	55	19	27.5	58	20 -0.012	16 -.012	13	17	M14x1.5	25	25	25	M8
145257	62	23	32.5	68	25 -0.012	20 -.012	17	17	M16x1.5	30	30	25	M8
145258	80	29	40	85	30 -0.012	22 -.012	19	19	M20x1.5	35	36	45	M10
145259	90	37	50	105	40 -0.012	28 -.012	23	23	M27x2	45	45	45	M10
145260	105	46	62.5	130	50 -0.012	35 -.012	30	30	M33x2	58	55	80	M12
145261	134	57	80	150	60 -0.015	44 -.015	38	38	M42x2	68	68	160	M16
145262	156	64	102.5	185	80 -0.015	55 -.015	47	47	M48x2	92	90	310	M20
145263	190	86	120	240	100 -0.020	70 -.020	57	57	M64x3	116	110	530	M24

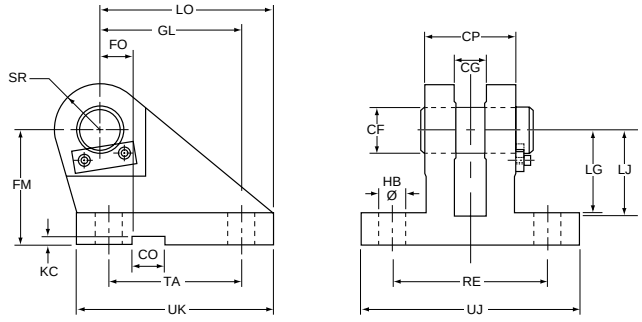
Mounting Bracket and Pivot Pin Dimensions - For Style SB

Part No.	CF K7/h6	CG +0.1, +0.3	CO N9	CP	FM js11	FO js14	GL js13	HB	KC 0, +0 30	LG	LJ	LO	RE js13	SR max	TA js13	UJ	UK
145530	12	10	10	30	40	16	46	9	3.3	28	29	56	55	12	40	75	60
145531	16	14	16	40	50	18	61	11	4.3	37	38	74	70	16	55	95	80
145532	20	16	16	50	55	20	64	14	4.3	39	40	80	85	20	58	120	90
145533	25	20	25	60	65	22	78	16	5.4	48	49	98	100	25	70	140	110
145534	30	22	25	70	85	24	97	18	5.4	62	63	120	115	30	90	160	135
145535	40	28	36	80	100	24	123	22	8.4	72	73	148	135	40	120	190	170
145536	50	35	36	100	125	35	155	30	8.4	90	92	190	170	50	145	240	215
145537	60	44	50	120	150	35	187	39	11.4	108	110	225	200	60	185	270	260
145538	80	55	50	160	190	35	255	45	11.4	140	142	295	240	80	260	320	340
145539	100	70	63	200	210	35	285	48	12.4	150	152	335	300	100	300	400	400

Cap Mounting Bracket and Pivot Pin

Bore ϕ	Mounting Bracket and Pivot Pin	Nominal Force kN	Weight kg
25	145530	8	0.6
32	145531	12.5	1.3
40	145532	20	2.1
50	145533	32	3.2
63	145534	50	6.5
80	145535	80	12.0
100	145536	125	23.0
125	145537	200	37.0
160	145538	320	79.0
200	145539	500	140.0

Mounting Bracket and Pivot Pin



All dimensions are in millimeters unless otherwise stated.

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

How to Order ISO Cylinders

Data Required On All Cylinder Orders

When ordering Series HMI cylinders, be sure to specify each of the following requirements:

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

a) Bore Size

b) Mounting Style
Specify your choice of mounting style – as shown and dimensioned in this catalog. If double rod is required, specify "with double rod."

c) Series Designation ("HMI")

d) Length of Stroke

e) Piston Rod Diameter
Call out rod diameter or rod code number. In Series HMI cylinders, standard rod diameters (Code No. 1) will be furnished if not otherwise specified, unless length of stroke makes the application questionable.

f) Piston Rod End Thread Style
Call out thread style number or specify dimensions. Thread style number 4 will be furnished if not otherwise specified.

g) Cushions (if required)
Specify "Cushion-head end," "Cushion-cap end" or "Cushion-both ends" as required. If cylinder is to have a double rod and only one cushion is required, be sure to specify clearly which end of the cylinder is to be cushioned.

h) Piston
Parker B style pistons are standard. Fluorocarbon also available.

i) Ports
BSP (ISO 228) are standard.

j) Fluid Medium
Series HMI hydraulic cylinders are equipped with seals for use with hydraulic oil. If other than hydraulic oil will be used, consult factory.

ADDITIONAL DATA is required on orders for cylinders with special modifications. For further information, consult factory.

Service Policy

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

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

Certified Dimensions

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

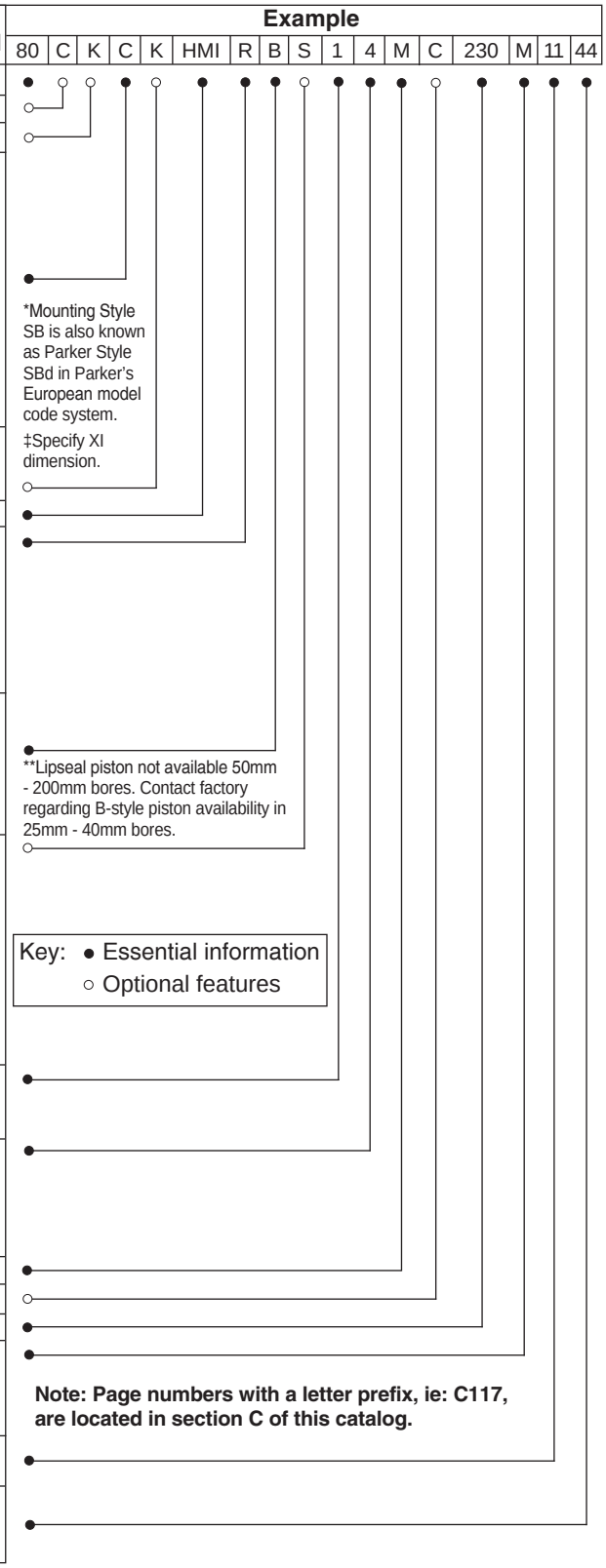
For additional information – call your local Parker Cylinder Distributor.

Series HMI Model Numbers – How to Develop and "Decode" Them

Parker Series HMI cylinders can be completely and accurately described by a model number consisting of coded symbols.

To develop a model number, select only those symbols that represent the cylinder required, and place them in the sequence indicated below.

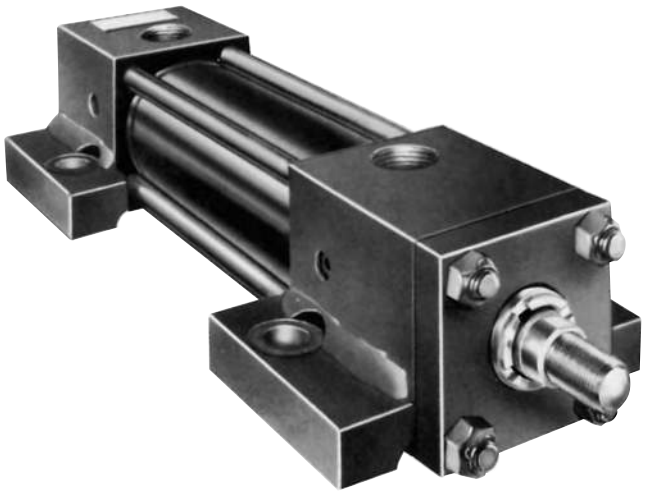
Feature	Description	Page	Symbol
Bore	Millimeters		–
Cushion – Head	If required	C117	C
Double Rod	If required	116	K
Mounting Style	Head Tie Rods Extended	112	TB
	Cap Tie Rods Extended	112	TC
	Both Ends Tie Rods Extended	112	TD
	Head Rectangular	113	JJ
	Cap Rectangular	113	HH
	Side Lugs	113	C
	Cap Fixed Eye	114	B
	Cap Fixed Clevis	114	BB
	Cap Fixed Eye with Spherical Bearing*	114	SB*
	Head Trunnion	115	D
	Cap Trunnion	115	DB
	Intermediate Fixed Trunnion‡	115	DD
Mounting Modifications	Thrust Key for Style C mounting only		
	– Thrust key - 25mm & 32mm bores	C112	P
	– Thrust key - 40mm bore and larger	C112	K
Series	Series name		HMI
Ports	BSP (ISO 228) – standard	C121	R
	BSPT (Taper Thread)	C121	B
	Metric Thread	C121	M
	Metric Thread per ISO 6149	C121	Y
	SAE – Straight Thread O-ring Port	C121	T
	NPTF (Dry Seal Pipe Thread)	C121	U
	SAE – Flange Ports (3000 PSI)	C121	P
Piston	Lipseal™ Piston** (standard 25mm - 40mm bores)	109	L
	B-Style Low Friction filled PTFE seals (standard 50mm - 200mm bores)	109	B
	Mixed Media Low Friction Piston seal (Optional 25mm - 200mm bores)	109	W
Special Features	One or more of the following:		S
	Gland Drain Port	C123	
	Oversize Ports	C120	
	Rod End Bellows	C123	
	Stop Tube	C115	
	Stroke Adjuster	C123	
	Tie Rod Supports	C113	
	Water Service Modifications	C122	
	Or to detailed descriptions or drawings supplied by customer		
Piston Rod Number	Rod No. 1	111	1
	Rod No. 2	111	2
	Rod No. 3	111	3
Piston Rod End	Style 4	111	4
	Style 7	111	7
	Style 9	111	9
	Style 3 (Special) Please supply description or drawing	111	3
Rod Thread	Metric (standard)	111	M
Cushion – Cap	If required	C117	C
Gross Stroke	Millimeters		–
Fluid Medium ISO 6743/4 (1982)	Mineral Oil HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 Oil, Air, Nitrogen – Group 1	C122	M
	Fluorocarbon – Group 5	C122	D
Port Positions	Head position 1-4	C120	1
	Cap position 1-4	C120	1
Air Bleeds	Head position 1-4	C120	4
	Cap position 1-4	C120	4
	No Air Bleed	C120	00



Note: Page numbers with a letter prefix, ie: C117, are located in section C of this catalog.

B

Series VH
Hydraulic Cylinders



Extra-long Tapered Cushions
Oversize Ports
Meets N.F.P.A. Specifications

Nominal Pressure - 3000 PSI
Standard Bore Sizes - $2^{1}/_{2}$" Through 8"
Piston Rod Diameters - 1" Through $5^{1}/_{2}$"
Fifteen Standard Mounting Styles

Series “VH” very heavy-duty hydraulic cylinders are premium quality cylinders–with operating capacities of 3,000 PSI. They fully meet NFPA standards. And to make sure every cylinder is premium-quality, Parker Hannifin subjects each and every one – not just batch samples – to tough inspection and performance tests.

OTHER SERIES “VH” FEATURES AND SPECIFICATIONS

Ports
Series “VH” ports are two sizes or larger than NFPA standards. Standard location is position 1 as shown in dimensional drawings. Where mountings do not interfere, ports may be located at positions 2, 3, or 4. Ports are not available at positions 2 or 4 on mounting style C, $2^{1}/_{2}$" thru 5" bore cylinders. SAE straight thread O-ring ports will be supplied unless otherwise specified.

Cushions
Cushions on Series “VH” cylinders are 3" long on all sizes except $3^{1}/_{4}$" and 4" bore sized equipped with 2" and $2^{1}/_{2}$" diameter piston rods which are supplied with cushions $2^{13}/_{16}$" long at head end. Self-centering floating cushion sleeve at head end and cushion spear at cap is tapered for $^{2}/_{3}$ its length to give maximum cushioning effect for $^{1}/_{3}$ its length.

Thrust Key
An extended retainer plate, to serve as a thrust key, can be supplied on mounting styles C and F. The thrust key would be the same as used on Parker Hannifin “2H” hydraulic cylinders.

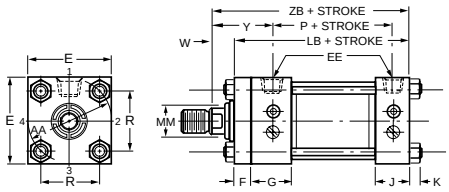
Air Bleeds
When specified, $^{1}/_{8}$" NPTF bleed ports are available at either head or cap end. For design and location, ask for Drawing 81292.

Accessories
Mounting accessories for Series “VH” are the same as used on Parker Hannifin Series 2H hydraulic cylinders. For dimensional data for rod clevis, knuckle, clevis bracket, mounting plate and pivot pin, see the Parker Series 2H section of this catalog.

*See Section C for actual design factors.

For additional information – call your local Parker Cylinder Distributor.

Basic Cylinder Style T
(NFPA Style MX01)

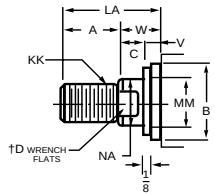


Rod end dimensions

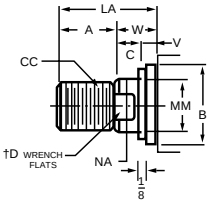
BORE	ROD NO.	ROD DIA.	THREAD		ROD EXTENSIONS AND PILOT DIMENSIONS									BASIC ENVELOPE AND MOUNTING DIMENSIONS							ADD STROKE		
						+.000 -.002									EE								
		MM	CC	KK	A	B	C	D	LA	NA	V	W	Y	E	NPTF◆	SAE°	F	G	J	K	LB	P	ZB
2 1/2	1(Std.)	1	7/8-14	3/4-16	1 1/8	1.499	1/2	7/8	1 7/8	15/16	1/4	3/4	4 1/8	3 1/2	1	16	5/8	3 3/4	3 1/2	7/16	9 3/8	3 1/2	10 9/16
	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	4 5/8										11 1/16
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	4 3/8										10 13/16
3 1/4	1(Std.)	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	4 3/16	4 1/2	1 1/4	20	3/4	3 3/4	3 1/2	9/16	9 3/4	4 1/8	11 3/16
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	4 9/16										11 9/16
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	4 7/16										11 7/16
4	1(Std.)	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3	1 11/16	1/4	1	4 7/16	5	1 1/4	20	7/8	3 3/4	3 1/2	9/16	10 1/8	4 3/8	11 11/16
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	4 13/16										12 1/16
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	4 9/16										11 13/16
5	1(Std.)	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	4 11/16	6 1/2	1 1/2	24	7/8	4	3 3/4	13/16	11 1/8	5 1/8	13 1/16
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 7/8	3 3/8	3/8	1 3/8	4 15/16										13 5/16
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	4 15/16										13 5/16
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	4 7/8	2 7/8	3/8	1 3/8	4 15/16										13 5/16
6	1(Std.)	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 1/4	2 3/8	1/4	1 1/4	4 7/8	7 1/2	2	32	1	4 1/4	4 1/4	7/8	12 3/8	6 1/8	14 1/2
	2	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/4	3 7/8	1/4	1 1/4	4 7/8										14 1/2
	3	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	4 3/4	2 7/8	1/4	1 1/4	4 7/8										14 1/2
	4	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 3/4	3 3/8	1/4	1 1/4	4 7/8										14 1/2
7	1(Std.)	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	4 3/4	2 7/8	1/4	1 1/4	4 3/4	8 1/2	2	32	1	4 1/4	4 1/4	1 1/4	12 1/2	6 1/2	15
	2	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/4	4 7/8	1/4	1 1/4	4 3/4										15
	3	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 3/4	3 3/8	1/4	1 1/4	4 3/4										15
	4	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/4	3 7/8	1/4	1 1/4	4 3/4										15
	5	4 1/4	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	5 3/4	4 3/8	1/4	1 1/4	4 3/4										15
8	1(Std.)	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 3/4	3 3/8	1/4	1 1/4	4 3/4	9 1/2	2 1/2	32	1	4 1/2	4 1/2	1 1/2	13 1/2	7 1/2	16 1/4
	2	5 1/2	5 1/4-12	4-12	5 1/2	6.249	1	4 5/8	6 3/4	5 3/8	1/4	1 1/4	4 3/4										16 1/4
	3	4	3 3/4-12	3-12	4	4.749	1	3 3/8	5 1/4	3 7/8	1/4	1 1/4	4 3/4										16 1/4
	4	4 1/2	4 1/4-12	3 1/4-12	4 1/2	5.249	1	3 7/8	5 3/4	4 3/8	1/4	1 1/4	4 3/4										16 1/4
	5	5	4 3/4-12	3 1/2-12	5	5.749	1	4 1/4	6 1/4	4 7/8	1/4	1 1/4	4 3/4										16 1/4

◆ SAE straight thread ports are standard and are indicated by port number. For dimensional information see Section C.
° NPTF ports are available at no extra charge.

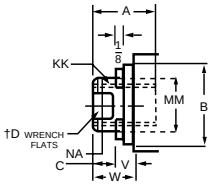
PISTON ROD END THREADS



PARKER THREAD STYLE 4
(NFPA SM)



PARKER THREAD STYLE 8
(NFPA IM)



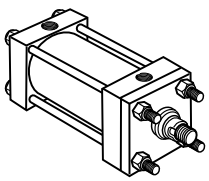
PARKER THREAD STYLE 9
(NFPA SF)

Style 4 Rod Ends recommended for applications where workpiece is secured against rod shoulder. When workpiece is not shouldered, Style 4 Rod Ends are recommended through 2" rod diameter, Style 8 on larger diameters. If rod end is not specified, Style 4 will be furnished.

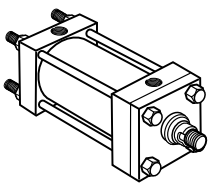
NOTE: Special piston rod end threads, two times length are available on 2 1/2" diameter piston rods and smaller. To order, specify thread Style 42 which has KK thread dia. or Style 82 which has CC thread dia. Other piston rod threads are available. To order, specify Style 3 and give desired dimensions for CC or KK, A and LA. For other specials, send dimensions or sketch.

† On 4 1/2" diameter rods and larger, 4 each .515 diameter spanner wrench holes will be provided.

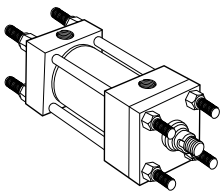
Tie Rod Mounted Styles TB, TC, TD (NFPA Styles MX3, MX2, MX1)



Style TB
(MX3)

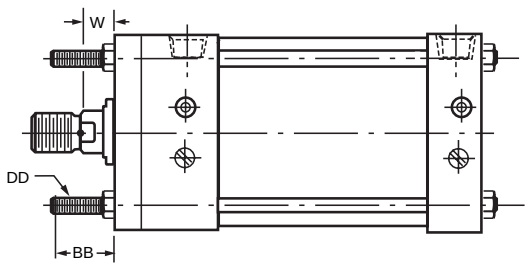


Style TC
(MX2)



Style TD
(MX1)

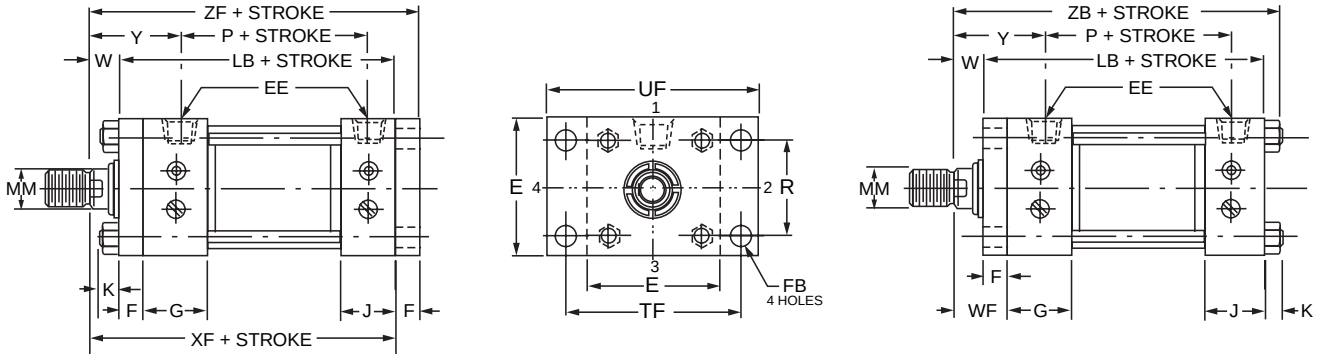
Style TB, Tie Rods Extended, is illustrated at right. Style TC, Cap Tie Rods Extended, and Style TD, Both Ends Tie Rods Extended, can be dimensioned from Style TB drawing.



For Cylinder Division Plant Locations – See Page II.

Flange Mountings

Style H, J, HB, JB



STYLE H (NFPA MF2)

STYLE J (NFPA MF1)

For Style "H" Mount

Bore Size	Max. PSI - Pull* Rod Code 1	2	3	4	5
2 1/2	3000	3000	3000	–	–
3 1/4	3000	3000	3000	–	–
4	3000	3000	3000	–	–
5	2000	3000	2000	2500	–
6	1800	2500	2000	2000	–
7	2000	3000	2000	2500	2800
8	1700	2500	1700	1800	2200

* Maximum pressure rating - pull application

For Style "J" Mount

Bore Size	Max. PSI - Push* Rod Code 1	2	3	4	5
2 1/2	2000	1100	1500	–	–
3 1/4	1800	1300	1400	–	–
4	1800	1300	1700	–	–
5	1300	800	1200	1000	–
6	1200	800	1000	900	–
7	1400	800	1200	1100	1000
8	1100	800	1000	1000	800

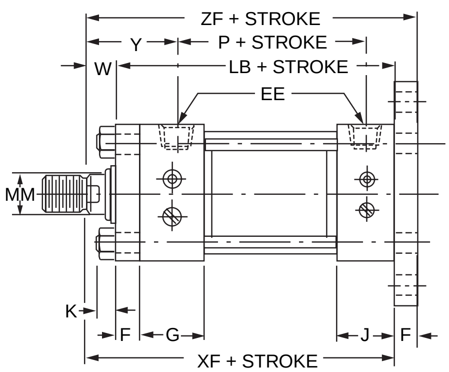
* Maximum pressure rating - push application

Specific Dimensions for Series VH Mounting Styles (in inches)

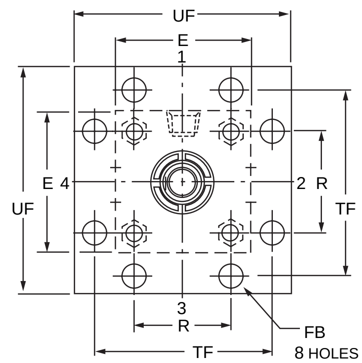
BORE	ROD NO.	ROD DIA.	AA	BB	BD	CB	+.000 CD◆ -.002	CW	DD	+.000 FA -.003	FB	L	+.000 LH -.002	LR	M	MR	ND	NT	PA	PC	PD	PF	R	SB•	ST
2 1/2	1 2 3	1 1 3/4 1 3/8	3.6	1 13/16	1 1/2	1 1/4	.751	5/8	1/2-20	.562	9/16	1 1/4	1.744	15/16	3/4	15/16	9/16 1/2 9/16	5/8-11	5/16	2 3/4	2 1/16	3 1/16	2.55	13/16	1
3 1/4	1 2 3	1 3/8 2 1 3/4	4.6	2 5/16	2	1 1/2	1.001	3/4	5/8-18	.687	11/16	1 1/2	2.244	1 1/4	1	1 3/16	7/8 11/16 7/8	3/4-10	3/8	2 1/2	2 5/8	2 15/16	3.25	13/16	1
4	1 2 3	1 3/4 2 1/2 2	5.4	2 5/16	2	2	1.376	1	5/8-18	.812	11/16	2 1/8	2.494	1 3/4	1 3/8	1 5/8	1 11/16 1	1-8	7/16	2 11/16	2 15/16	2 15/16	3.82	1 1/16	1 1/4
5	1 2 3 4	2 3 1/2 2 1/2 3	7.0	3 3/16	2	2 1/2	1.751	1 1/4	7/8-14	.812	15/16	2 1/4	3.244	2 1/16	1 3/4	2 1/8	1 1/8 1 1 1/8 1 1/8	1-8	7/16	2 15/16	3 11/16	3 3/16	4.95	1 1/16	1 1/4
6	1 2 3 4	2 1/2 4 3 3 1/2	8.1	3 5/8	3	2 1/2	2.001	1 1/4	1-14	.937	1 1/16	2 1/2	3.744	2 5/16	2	2 3/8	1 3/4 1 1/4 1 3/4 1 1/2	1 1/4-7	1/2	3 3/16	4 1/4	3 5/16	5.73	1 5/16	1 1/2
7	1 2 3 4 5	3 5 3 1/2 4 4 1/2	9.3	4 1/8	3	3	2.501	1 1/2	1 1/8-12	.937	1 3/16	3	4.244	2 3/4	2 1/2	2 7/8	1 1/8 1 1/8 1 1/8 1 1/8 1 1/8	1 1/2-6	1/2	2 15/16	4 3/4	3 1/8	6.58	1 9/16	1 3/4
8	1 2 3 4 5	3 1/2 5 1/2 4 4 1/2 5	10.6	4 1/2	3 1/2	3	3.001	1 1/2	1 1/4-12	.937	1 5/16	3 1/4	4.744	3 1/4	2 3/4	3 1/8	1 1/2 1 1/2 1 1/2 1 1/2 1 1/2	1 1/2-6	1/2	2 15/16	5 1/4	3 1/4	7.50	1 9/16	1 3/4

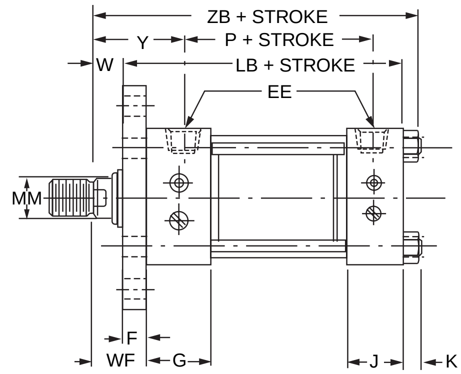
◆ Dimension CD is pin diameter. • Upper surface spotfaced for socket head screws. ◆◆ Dimension to be specified by customer.

For additional information – call your local Parker Cylinder Distributor.

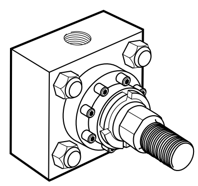


STYLE HB (NFPA MF6)





STYLE JB (NFPA MF5)



For 7" & 8" bores, this style retainer configuration applies to all but J and JB mounts.

For Style "JB" Mount

Bore Size	Max. PSI - Push* Rod Code 1	2	3	4	5
2 1/2	3000	3000	3000	–	–
3 1/4	3000	3000	3000	–	–
4	3000	3000	3000	–	–
5	3000	3000	3000	3000	–
6	3000	2700	3000	2700	–
7	3000	2700	3000	3000	3000
8	3000	2300	2500	2500	2500

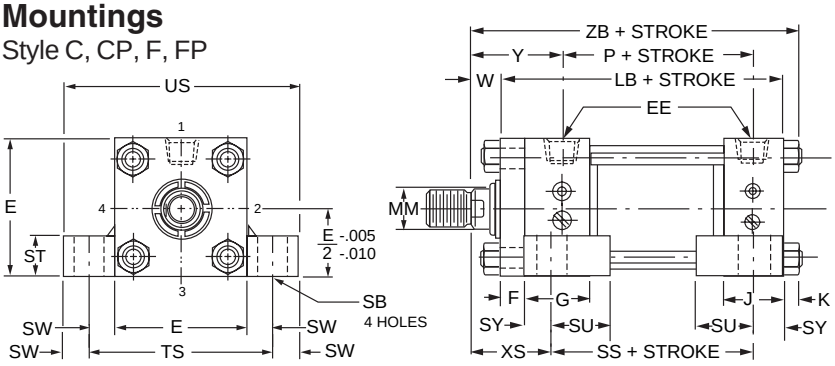
* Maximum pressure rating - push application

SU	SW	SY	TD +.000 -.001	TF	TL	TM	TN	TS	TY	UF	UM	UT	US	UW	XG	MIN. XI ◆◆	DD MTG. MIN. STK.	XS	XT	add stroke SN	SS	XC	XF	XJ	ZC	ZF
1 9/16	11/16	2 11/16	1.375	4 5/8	1 3/8	4	1 5/16	4 7/8	3 3/4	5 3/8	6 3/4	6 1/4	6 1/4	4 5/8	4 1/4 4 3/4 4 1/2	5 15/16 6 7/16 6 3/16	1/8	4 1/16 4 9/16 4 5/16	4 3/8 4 7/8 4 5/8	3	3 3/8	11 3/8 11 7/8 11 5/8	10 1/8 10 5/8 10 3/8	7 3/8 7 7/8 7 5/8	12 1/8 12 5/8 12 3/8	10 3/4 11 1/4 11
1 9/16	11/16	2 7/16	1.750	5 7/8	1 3/4	5	1 1/2	5 7/8	4 3/4	7 1/8	8 1/2	8	7 1/4	5 13/16	4 3/8 4 3/4 4 5/8	6 7/16 6 13/16 6 11/16	3/8	4 1/16 4 7/16 4 5/16	4 1/2 4 7/8 4 3/4	3 1/2	4 1/8	12 1/8 12 1/2 12 3/8	10 5/8 11 10 7/8	8 8 3/8 8 1/4	13 1/8 13 1/2 13 3/8	11 3/8 11 3/4 11 5/8
2	7/8	2 5/8	1.750	6 3/8	1 3/4	5 1/2	2 1/16	6 3/4	5 1/4	7 5/8	9	8 1/2	8 1/2	6 3/8	4 5/8 5 4 3/4	6 11/16 7 1/16 6 13/16	1/8	4 1/2 4 7/8 4 5/8	4 3/4 5 1/8 4 7/8	3 3/4	4	13 1/4 13 5/8 13 3/8	11 1/8 11 1/2 11 1/4	8 1/2 8 7/8 8 5/8	14 5/8 15 14 3/4	12 12 3/8 12 1/8
2	7/8	2 7/8	1.750	8 3/16	1 3/4	7	2 15/16	8 1/4	6 3/4	9 3/4	10 1/2	10	10	7 3/4	5 5 1/4 5 1/4 5 1/4	7 1/16 7 5/16 7 5/16 7 5/16	0	4 7/8 5 1/8 5 1/8 5 1/8	5 1/8 5 3/8 5 3/8 5 3/8	4 1/4	4 1/2	14 1/2 14 3/4 14 3/4 14 3/4	12 1/4 12 1/2 12 1/2 12 1/2	9 3/8 9 5/8 9 5/8 9 5/8	16 1/4 16 1/2 16 1/2 16 1/2	13 1/8 13 3/8 13 3/8 13 3/8
2 1/2	1 1/8	3 1/8	2.000	9 7/16	2	8 1/2	3 5/16	9 3/4	7 3/4	11 1/4	12 1/2	11 1/2	12	10 3/4	5 3/8 5 3/8 5 3/8 5 3/8	8 1/16 8 1/16 8 1/16 8 1/16	1/4	5 3/8 5 3/8 5 3/8 5 3/8	5 1/2 5 1/2 5 1/2 5 1/2	5 1/8	5 1/8	16 1/8 16 1/8 16 1/8 16 1/8	13 5/8 13 5/8 13 5/8 13 5/8	10 3/8 10 3/8 10 3/8 10 3/8	18 1/8 18 1/8 18 1/8 18 1/8	14 5/8 14 5/8 14 5/8 14 5/8
2 7/8	1 3/8	2 7/8	2.500	10 5/8	2 1/2	9 3/4	3 3/4	11 1/4	8 3/4	12 5/8	14 3/4	13 1/2	14	11 1/2	5 1/8 5 1/8 5 1/8 5 1/8 5 1/8	8 1/16 8 1/16 8 1/16 8 1/16 8 1/16	1/8	5 1/8 5 1/8 5 1/8 5 1/8 5 1/8	5 5/16 5 5/16 5 5/16 5 5/16 5 5/16	5 7/8	5 3/4	16 3/4 16 3/4 16 3/4 16 3/4 16 3/4	13 3/4 13 3/4 13 3/4 13 3/4 13 3/4	10 7/8 10 7/8 10 7/8 10 7/8 10 7/8	19 1/4 19 1/4 19 1/4 19 1/4 19 1/4	14 3/4 14 3/4 14 3/4 14 3/4 14 3/4
2 7/8	1 3/8	2 7/8	3.000	11 13/16	3	11	4 1/4	12 1/4	9 3/4	14	17	15 1/2	15	13 3/8	5 1/4 5 1/4 5 1/4 5 1/4 5 1/4	8 9/16 8 9/16 8 9/16 8 9/16 8 9/16	1/8	5 1/8 5 1/8 5 1/8 5 1/8 5 1/8	5 7/16 5 7/16 5 7/16 5 7/16 5 7/16	6 5/8	6 3/4	18 18 18 18 18	14 3/4 14 3/4 14 3/4 14 3/4 14 3/4	11 3/4 11 3/4 11 3/4 11 3/4 11 3/4	20 3/4 20 3/4 20 3/4 20 3/4 20 3/4	15 3/4 15 3/4 15 3/4 15 3/4 15 3/4

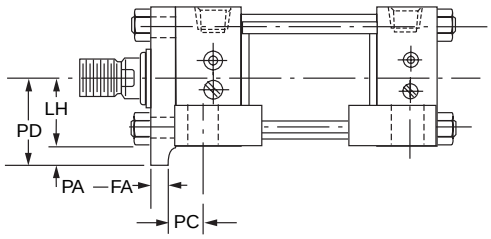
B

Side Mountings

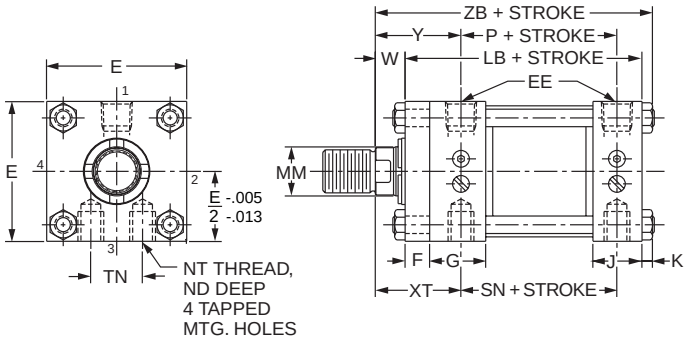
Style C, CP, F, FP



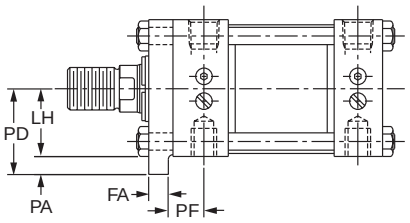
STYLE C (NFPA MS2)



STYLE CP Side Lugs with Thrust Key Modification



STYLE F (NFPA MS4)



STYLE FP Side Tapped with Thrust Key Modification

Specific Dimensions for Series VH Mounting Styles (in inches)

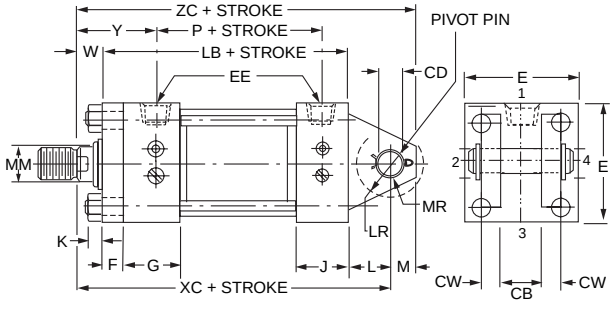
BORE	ROD NO.	ROD DIA.	AA	BB	BD	CB	+.000 CD◆ -.002	CW	DD	+.000 FA -.003	FB	L	+.000 LH -.002	LR	M	MR	ND	NT	PA	PC	PD	PF	R	SB•	ST
2 1/2	1 2 3	1 1 3/4 1 3/8	3.6	1 13/16	1 1/2	1 1/4	.751	5/8	1/2-20	.562	9/16	1 1/4	1.744	15/16	3/4	15/16	9/16 1/2 9/16	5/8-11	5/16	2 3/4	2 1/16	3 1/16	2.55	13/16	1
3 1/4	1 2 3	1 3/8 2 1 3/4	4.6	2 5/16	2	1 1/2	1.001	3/4	5/8-18	.687	11/16	1 1/2	2.244	1 1/4	1	1 3/16	7/8 11/16 7/8	3/4-10	3/8	2 1/2	2 5/8	2 15/16	3.25	13/16	1
4	1 2 3	1 3/4 2 1/2 2	5.4	2 5/16	2	2	1.376	1	5/8-18	.812	11/16	2 1/8	2.494	1 3/4	1 3/8	1 5/8	1 11/16 1	1-8	7/16	2 11/16	2 15/16	2 15/16	3.82	1 1/16	1 1/4
5	1 2 3 4	2 3 1/2 2 1/2 3	7.0	3 3/16	2	2 1/2	1.751	1 1/4	7/8-14	.812	15/16	2 1/4	3.244	2 1/16	1 3/4	2 1/8	1 1/8 1 1 1/8 1 1/8	1-8	7/16	2 15/16	3 11/16	3 3/16	4.95	1 1/16	1 1/4
6	1 2 3 4	2 1/2 4 3 3 1/2	8.1	3 5/8	3	2 1/2	2.001	1 1/4	1-14	.937	1 1/16	2 1/2	3.744	2 5/16	2	2 3/8	1 3/4 1 1/4 1 3/4 1 1/2	1 1/4-7	1/2	3 3/16	4 1/4	3 5/16	5.73	1 5/16	1 1/2
7	1 2 3 4 5	3 5 3 1/2 4 4 1/2	9.3	4 1/8	3	3	2.501	1 1/2	1 1/8-12	.937	1 3/16	3	4.244	2 3/4	2 1/2	2 7/8	1 1/8 1 1/8 1 1/8 1 1/8 1 1/8	1 1/2-6	1/2	2 15/16	4 3/4	3 1/8	6.58	1 9/16	1 3/4
8	1 2 3 4 5	3 1/2 5 1/2 4 4 1/2 5	10.6	4 1/2	3 1/2	3	3.001	1 1/2	1 1/4-12	.937	1 5/16	3 1/4	4.744	3 1/4	2 3/4	3 1/8	1 1/2 1 1/2 1 1/2 1 1/2 1 1/2	1 1/2-6	1/2	2 15/16	5 1/4	3 1/4	7.50	1 9/16	1 3/4

◆ Dimension CD is pin diameter. • Upper surface spotfaced for socket head screws. ◆◆ Dimension to be specified by customer.

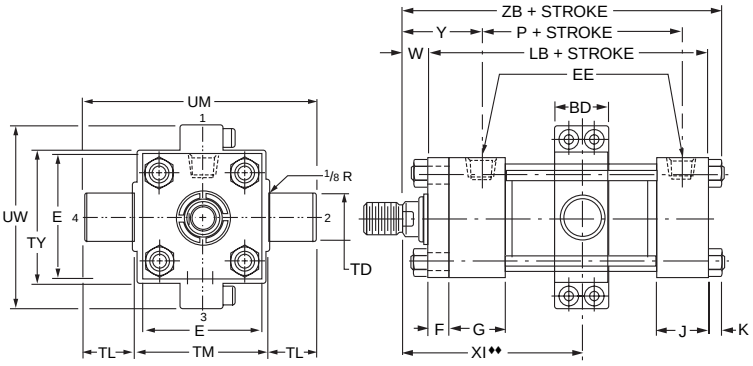
For additional information – call your local Parker Cylinder Distributor.

Pivot Mountings

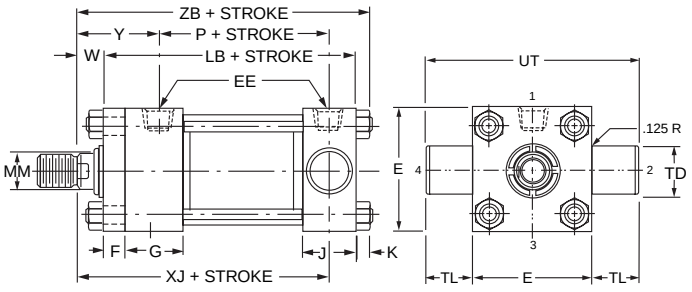
Styles BB, DB, D, DD



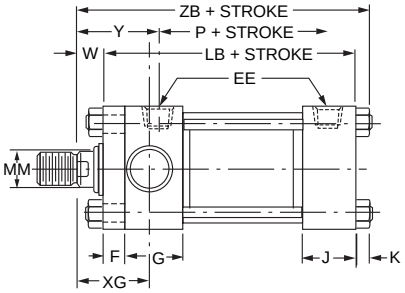
STYLE BB (NFPA MP1)



STYLE DD (NFPA MT4)



STYLE DB (NFPA MT2)

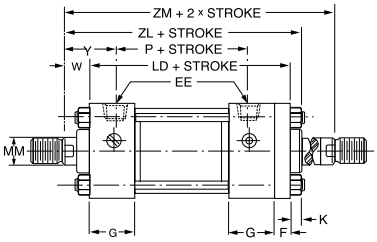


STYLE D (NFPA MT1)

SU	SW	SY	+.000 TD -.001	TF	TL	TM	TN	TS	TY	UF	UM	UT	US	UW	XG	MIN. XI ◆◆	DD MTG. MIN. STK.	XS	XT	ADD STROKE						
																				SN	SS	XC	XF	XJ	ZC	ZF
1 9/16	11/16	2 11/16	1.375	4 5/8	1 3/8	4	1 5/16	4 7/8	3 3/4	5 3/8	6 3/4	6 1/4	6 1/4	4 5/8	4 1/4 4 3/4 4 1/2	5 15/16 6 7/16 6 3/16	1/8	4 1/16 4 9/16 4 5/16	4 3/8 4 7/8 4 5/8	3	3 3/8	11 3/8 11 7/8 11 5/8	10 1/8 10 5/8 10 3/8	7 3/8 7 7/8 7 5/8	12 1/8 12 5/8 12 3/8	10 3/4 11 1/4 11
1 9/16	11/16	2 7/16	1.750	5 7/8	1 3/4	5	1 1/2	5 7/8	4 3/4	7 1/8	8 1/2	8	7 1/4	5 13/16	4 3/8 4 3/4 4 5/8	6 7/16 6 13/16 6 11/16	3/8	4 1/16 4 7/16 4 5/16	4 1/2 4 7/8 4 3/4	3 1/2	4 1/8	12 1/8 12 1/2 12 3/8	10 5/8 11 10 7/8	8 8 3/8 8 1/4	13 1/8 13 1/2 13 3/8	11 3/8 11 3/4 11 5/8
2	7/8	2 5/8	1.750	6 3/8	1 3/4	5 1/2	2 1/16	6 3/4	5 1/4	7 5/8	9	8 1/2	8 1/2	6 3/8	4 5/8 5 4 3/4	6 11/16 7 1/16 6 13/16	1/8	4 1/2 4 7/8 4 5/8	4 3/4 5 1/8 4 7/8	3 3/4	4	13 1/4 13 5/8 13 3/8	11 1/8 11 1/2 11 1/4	8 1/2 8 7/8 8 5/8	14 5/8 15 14 3/4	12 12 3/8 12 1/8
2	7/8	2 7/8	1.750	8 3/16	1 3/4	7	2 15/16	8 1/4	6 3/4	9 3/4	10 1/2	10	10	7 3/4	5 5 1/4 5 1/4 5 1/4	7 1/16 7 5/16 7 5/16 7 5/16	0	4 7/8 5 1/8 5 1/8 5 1/8	5 1/8 5 3/8 5 3/8 5 3/8	4 1/4	4 1/2	14 1/2 14 3/4 14 3/4 14 3/4	12 1/4 12 1/2 12 1/2 12 1/2	9 3/8 9 5/8 9 5/8 9 5/8	16 1/4 16 1/2 16 1/2 16 1/2	13 1/8 13 3/8 13 3/8 13 3/8
2 1/2	1 1/8	3 1/8	2.000	9 7/16	2	8 1/2	3 5/16	9 3/4	7 3/4	11 1/4	12 1/2	11 1/2	12	10 3/4	5 3/8 5 3/8 5 3/8 5 3/8	8 1/16 8 1/16 8 1/16 8 1/16	1/4	5 3/8 5 3/8 5 3/8 5 3/8	5 1/2 5 1/2 5 1/2 5 1/2	5 1/8	5 1/8	16 1/8 16 1/8 16 1/8 16 1/8	13 5/8 13 5/8 13 5/8 13 5/8	10 3/8 10 3/8 10 3/8 10 3/8	18 1/8 18 1/8 18 1/8 18 1/8	14 5/8 14 5/8 14 5/8 14 5/8
2 7/8	1 3/8	2 7/8	2.500	10 5/8	2 1/2	9 3/4	3 3/4	11 1/4	8 3/4	12 5/8	14 3/4	13 1/2	14	11 1/2	5 1/8 5 1/8 5 1/8 5 1/8 5 1/8	8 1/16 8 1/16 8 1/16 8 1/16 8 1/16	1/8	5 1/8 5 1/8 5 1/8 5 1/8 5 1/8	5 5/16 5 5/16 5 5/16 5 5/16 5 5/16	5 7/8	5 3/4	16 3/4 16 3/4 16 3/4 16 3/4 16 3/4	13 3/4 13 3/4 13 3/4 13 3/4 13 3/4	10 7/8 10 7/8 10 7/8 10 7/8 10 7/8	19 1/4 19 1/4 19 1/4 19 1/4 19 1/4	14 3/4 14 3/4 14 3/4 14 3/4 14 3/4
2 7/8	1 3/8	2 7/8	3.000	11 13/16	3	11	4 1/4	12 1/4	9 3/4	14	17	15 1/2	15	13 3/8	5 1/4 5 1/4 5 1/4 5 1/4 5 1/4	8 9/16 8 9/16 8 9/16 8 9/16 8 9/16	1/8	5 1/8 5 1/8 5 1/8 5 1/8 5 1/8	5 7/16 5 7/16 5 7/16 5 7/16 5 7/16	6 5/8	6 3/4	18 18 18 18 18	14 3/4 14 3/4 14 3/4 14 3/4 14 3/4	11 3/4 11 3/4 11 3/4 11 3/4 11 3/4	20 3/4 20 3/4 20 3/4 20 3/4 20 3/4	15 3/4 15 3/4 15 3/4 15 3/4 15 3/4

For Cylinder Division Plant Locations – See Page II.

DIMENSIONS
DOUBLE ROD CYLINDERS



To obtain dimensioning information on a double rod cylinder, first select the desired mounting style and refer to the corresponding single rod cylinder model shown on the preceding pages. After you have determined all necessary dimensions from that drawing, turn back to this page and supplement those dimensions with additional ones from this drawing and the table at right. These added dimensions provide the additional information needed to completely dimension a double rod cylinder model.

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

BORE SIZE	ROD NO.	ROD DIA.	ADD STROKE LD	ADD STROKE ZL	ADD STROKE SN_K	ADD STROKE SS_K	ADD 2X STROKE ZM
2 1/2	1	1	10 1/4	11 7/16	3	3 5/8	11 3/4
	2	1 3/4		11 15/16			12 3/4
	3	1 3/8		11 11/16			12 1/4
3 1/4	1	1 3/8	10 3/4	12 3/16	3 1/2	4 3/8	12 1/2
	2	2		12 9/16			13 1/4
	3	1		12 7/16			13
4	1	1 3/4	11 1/4	12 13/16	3 3/4	4 1/4	13 1/4
	2	2 1/2		13 3/16			14
	3	2		12 15/16			13 1/2
5	1	2	12 1/4	14 3/16	4 1/4	4 3/4	14 1/2
	2	3 1/2		14 7/16			15
	3	2 1/2		14 7/16			15
	4	3		14 7/16			15
6	1	2 1/2	13 3/8	15 1/2	4 7/8	5 1/8	15 7/8
	2	4					
	3	3					
	4	3 1/2					
7	1	3	13 1/2	15 3/4	5 3/8	5 3/4	16
	2	5					
	3	3 1/2					
	4	4					
	5	4 1/2					
8	1	3 1/2	14 1/2	16 13/16	6 1/8	6 3/4	17
	2	5 1/2					
	3	4					
	4	4 1/2					
	5	5					
REPLACES			**LB**	**ZB**	**SN**	**SS**	**—**
ON SINGLE ROD MOUNTING STYLE			**ALL MTG. STYLES**		**F**	**C**	**ALL MTG.**

HOW TO ORDER SERIES VH CYLINDERS

Note: Parker Series VH Cylinders can be completely & accurately described by a model number consisting of coded symbols. To develop a model number select only those symbols that represent the cylinder required and place them in the sequence shown in the chart below.

SERIES VH MODEL NUMBERS—HOW TO DEVELOP THEM—HOW TO DECODE THEM.

	BORE SIZE	CUSHION HEAD END	DOUBLE ROD	MOUNTING STYLE	MOUNTING MOD.	COMBINATION MOUNTING STYLE	SERIES	PISTON	PORTS	COMMON MODIFICATION	SPECIAL MODIFICATIONS	PISTON ROD NO.	ROD END THREAD STYLE NO.	ALTERNATE STANDARD ROD END THD. LENGTH	THREAD TYPE	CUSHION CAP END	STROKE
EXAMPLE	**6**	**C**	**K**	**C**	**P**	**TB**	**VH**		**T**	**V**	**S**	**1**	**4**	**2**	**A**	**C**	**X50**
	Specify 2 1/2" thru 8"	Specify only if Cushion Head End is required	Use only if Double Rod Cyl. is required	Specify mounting style T, TB, TC, TD, F, H, J, BB, C, D, DB, DD, HB, JB.	Specify P-for Thrust Key Mtg. M-for Manifold Ports	Specify any practical mtg. style available	Specify Series VH	For ring type piston no letter req'd. Use K for Hi-load Piston	Specify Port Type req'd. U=NPTF T=S.A.E. P=S.A.E. Flange Ports R=BSP B=BSPT G=Metric Y=metric ISO 6149	If required specify V=Fluoro-carbon Seals F=Nut Retained Piston X=E.P.R. Seals W=Water Service J=High Water Content Fluid See Section C	Specify only if special modifications are required. Do not use symbol "S" for rod end modifications.	Specify rod code no. See chart in Section C for min. Piston rod diameter	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 required	Specify A=UNF W=BSF M=Metric	Specify only if Cushion Cap End is required	Specify in inches. Show symbol "X" just ahead of stk. length.

Class 1 SEALS
Class 1 seals are the seals provided as standard in a cylinder assembly unless otherwise specified. For further information on fluid compatibility on operating limitations of all compounds, see Section C.
For the VH series cylinders the following make-up Class 1 Seals:

Primary Piston Rod Seal—Enhanced Polyurethane
Piston Rod Wiper—Nitrile
Piston Seals—Cast Iron Rings
Option—Nitrile lipseals with polymyte back-up washers
Option—Hi-Load, Filled P.T.F.E. seals with a nitrite expander
O-rings—Nitrile (nitrrile back-up washer when used)

For additional information – call your local Parker Cylinder Distributor.

Parker Cylinder

Hydraulic and Electrohydraulic Actuators

Series 2HX

B

Featuring…

- **Two Valve Manifold Options**
  - **– 7 Standard Bolt-on Manifolds**
  - **– 4 Standard Integral Manifolds**
- **Two Feedback Options**
  - **– LDT**
  - **– LRT**

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

Parker Series 2HX Actuators…

Bolt-on and Integral Servo/ Proportional/NFPA Valve Manifolds and Two Feedback Options

Series 2HX Electrohydraulic Actuators are specifically designed to meet today's demand for more efficient, low cost actuators that meet your application requirements.

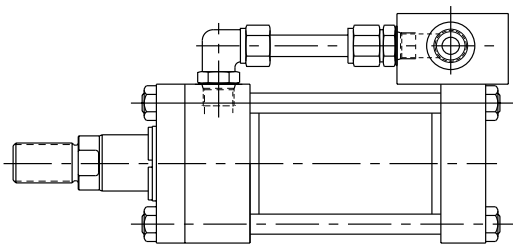
To ensure that every electrohydraulic actuator is premium quality, we subject each and every one – not just batch samples – to tough inspection **and** performance tests. Plus as the world's largest and lowest cost cylinder producer, we offer you the Series 2HX electrohydraulic actuator at the lowest cost that helps you stretch those tight design budgets without sacrificing quality.

Worldwide Distribution

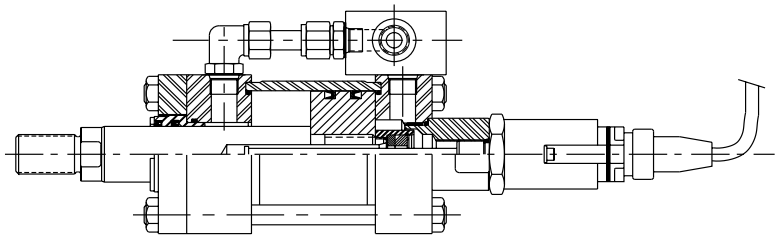
The Parker System is a worldwide network of manufacturing plants and distribution centers for fast, dependable service and delivery. Parker provides you with local sales and technical assistance from hundreds of stocking distributors and regional offices.

Contact Parker Cylinder Division for further assistance or information on designing the Series 2HX electrohydraulic actuator to meet your motion control requirements.

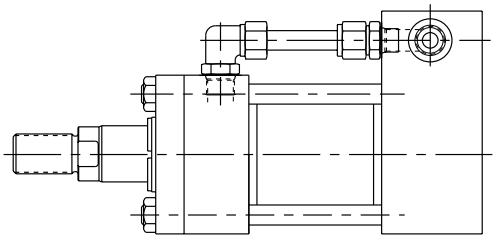
2HX with Bolt-On Manifold



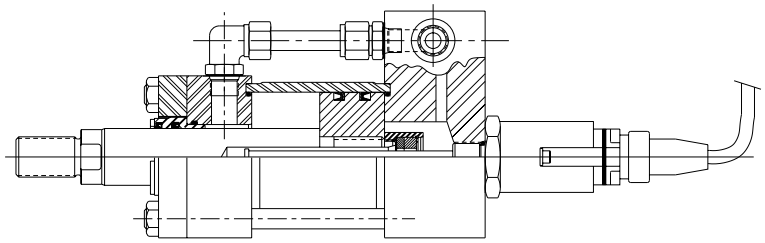
2HX with Bolt-On Manifold and LDT



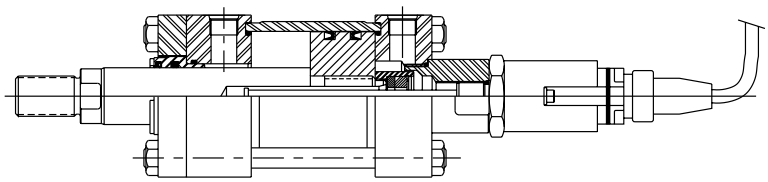
2HX with Intergral Manifold



2HX with Integral Manifold and LDT



2HX with LDT Feedback Only



For additional information – call your local Parker Cylinder Distributor.

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Note: for application information relating to the selection of cylinders based on bore sizes, rod diameters and mounting styles, refer to your current Parker Hydraulic Cylinder Catalog 0106, Section C or consult your Parker distributor.

B

Table A – Available Mounting and Manifold Position

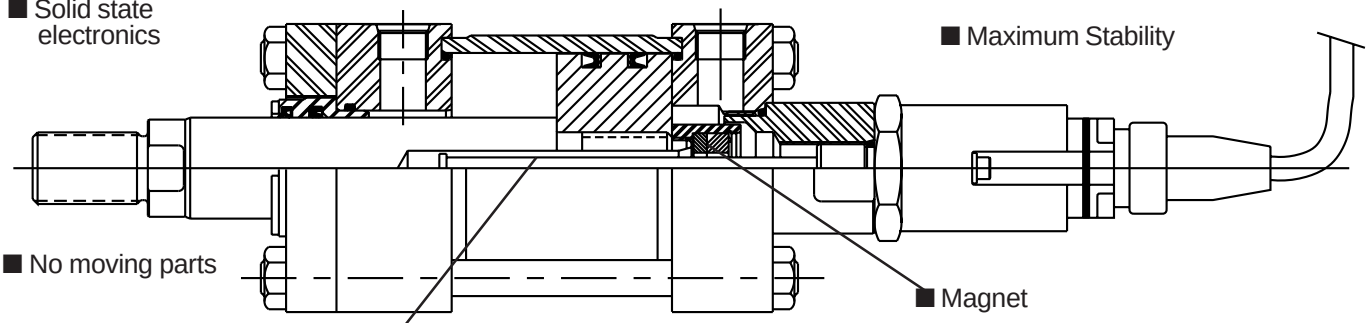
MOUNTING STYLE	DESCRIPTION	BOLT-ON-MANIFOLD MOUNTING POSITION		INTEGRAL MANIFOLD	APPLICABLE FEEDBACK DEVICES
		CAP END[1]	HEAD END[1]	CAP END ONLY	
TB	Head Tie Rods Extended	1,2,3,4	1,2,3,4	1	LRT and LDT†
TC	Cap Tie Rods Extended	1,2,3,4	1,2,3,4	N/A	
TD	Both Ends Tie Rods Extended	1,2,3,4	1,2,3,4	N/A	
J	Head Rectangular Flange	1,2,3,4	CF	1	LRT and LDT
JB	Head Square Flange	1,2,3,4	CF	1	
JJ	Head Rectangular	1,2,3,4	CF	1	
H	Cap Rectangular Flange	CF	1,2,3,4	N/A	LRT
HB	Cap Square Flange	CF	1,2,3,4	N/A	
HH	Cap Rectangular	CF	1,2,3,4	N/A	LRT and LDT†
C	Side Lug	1	1	1	LRT and LDT
E	Centerline Lug	1,3	1,3	N/A	
F	Side Tapped	1;2&4 CF	1;2&4 CF	1	
CB	Side End Angles	1;2&4 CF	1;2&4 CF	N/A	LRT
G	Side End Lugs	1;2&4 CF	1;2&4 CF	N/A	
BB*	Cap Fixed Clevis	CF	1,2,3,4	1	LRT and LDT††
D	Head Trunnion	1,2,3,4	1,3	1	LRT and LDT
DB	Cap Trunnion	1,3	1,2,3,4	N/A	
DD	Intermediate Fixed Trunnion	1,2,3,4	1,2,3,4	1	
SB*	Spherical Bearing	CF	1,2,3,4	1	LRT and LDT††

Note:
* Overhang of Bolt-On-Manifold may affect mounting and application of cylinder, consult factory.
1 If cylinder has cushions, needle and check valve will be located at standard positions.
† LDT Feedback devices extend beyond the face of the cap and may interfere with cap end mounts – consult LDT dimensions in this catalog.
†† When LDT Feedback devices are selected with cap end mounts a false stage cylinder body is required. See dimensions and information on page 194.

N/A = Not Available
CF = Consult Factory

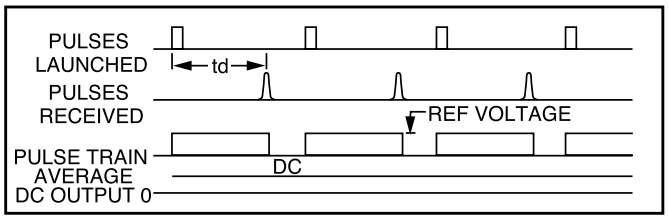
Linear Displacement Transducer Series 2HX-LDT

- Compact design for easy installation
- Infinite Resolution
- Maximum Stability
- Solid state electronics
- No moving parts
- Magnet
- Sealed stainless steel probe withstands 3000 psi



Magnetostriction

In a LDT position sensor, a pulse is induced in a specially-designed magnetostrictive waveguide by the momentary interaction of two magnetic fields. One field comes from a movable magnet which passes along the outside of the sensor tube, the other field comes from a current pulse or interrogation pulse launched along the waveguide. The interaction between the two magnetic fields produces a strain pulse, which travels at sonic speed along the waveguide until the pulse is detected at the head of the sensor. The position of the magnet is determined with high precision by measuring the elapsed time between the launching of the electronic interrogation pulse and the arrival of the strain pulse. As a result, accurate non-contact position sensing is achieved with absolutely no wear to the sensing components.



An average of 200 ultrasonic strain pulses are launched for every reading. With so many readings taken for each position, vibration and shock have negligible effect on the readings. The transducer assembly is shielded to eliminate interference caused by electromagnetic fields in the radio frequency range. In addition, static magnetic fields of several hundred gauss must get as close as 3/16" from the protective tube before any interference in transducer operation occurs.

Standard Specifications

Parameter	Specification
Resolution:	*Analog:* Infinite *Digital:* 1 ÷ [gradient x crystal freq. (mHz) x circulation]
Non-Linearity:	±0.02% or ±0.05 mm (±0.002 in.), whichever is greater 0.002 in. is the minimum absolute linearity and varies with sensor model
Repeatability:	Equal to resolution
Hysteresis:	<0.02 mm (0.0008 in.)
Outputs:	*Analog:* Voltage or Current *Digital:* Start/Stop or PWM
Measuring Range:	*Analog:* 25 to 2540 mm (1 to 100 in.) *Digital:* 25 to 7600 mm (1 to 300 in.)
Operating Voltage:	+13.5 to 26.4 Vdc (±0%): Strokes ≤1525 mm (60 in.) +24 Vdc (±10%): Strokes > 1525 mm (60 in.)
Power Consumption:	100 mA
Operating Temperature:	*Head Electronics:* -40 to 85°C (-40 to 185°F) *Sensing Element:* -40 to 105°C (-40 to 221°F)
EMC Test*:	DIN EN 50081-1 (Emissions); DIN EN 50082-2 (Immunity)
Shock Rating:	100 g (single hit)/IEC standard 68-2-27 (survivability)
Vibration Rating:	5 g/10-150 Hz/IEC standard 68-2-6
Adjustability: *(for active sensors only)*	Field adjustable zero and span to 5% of active stroke
Update Time:	*Analog:* ≤1 ms *Digital:* Minimum = [Stroke (specified in inches) + 3] x 9.1 µs
Operating Pressure:	5000 psi static; 10,000 psi spike
Housing Style/ Enclosure:	Aluminum die-cast head, IP 67 stainless steel rod & flange (LH flange: M18 x 1.5 or 3/4-16 UNF-3A)

**EMC test specification does not include sensors with the RB connection style.*

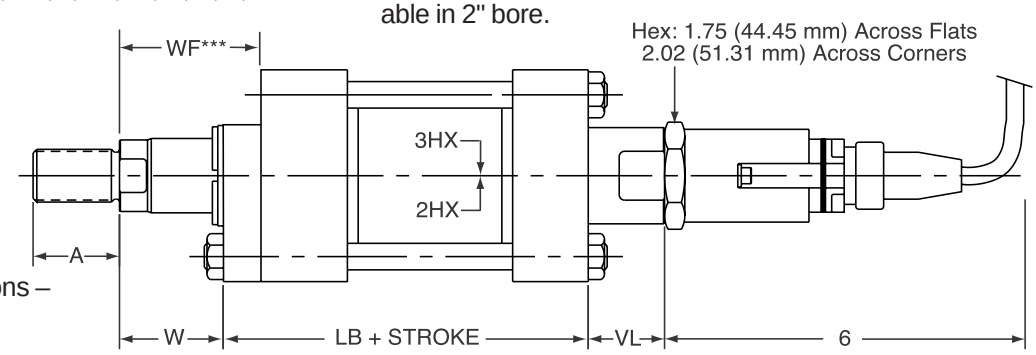
The above specifications for analog sensors are assuming that output ripple is averaged by the measuring device as with any typical analog device. Specifications are subject to change without notice. Consult the factory for specifications critical to your needs.

For additional information – call your local Parker Cylinder Distributor.

Cylinder with Linear Displacement Transducer

Cylinders utilizing LDT feedback are available in the following mounting styles: TB, TC, TD, J, JB, JJ, C, E, F, CB, G, D, DB and DD.

Note: On styles H, HB, BB and SB, consult factory for dimensional changes. Styles F, CB and G are not available in 2" bore.



Basic Series 2HX Cylinders

Style T Mounting

Envelope and Rod End Dimensions – See Table 1

Table 1 – Envelope and Rod End Dimensions

For additional dimensions, consult Series 2H and Series 3H 7" and 8" Bore, of this catalog.

Bore	Rod No.	Rod Dia. mm	A	KK Style 4	CC Style 8	LB Add Stroke	VL	4 to 1 Design Factor (PSI)**
2	1	1	1 1/8	3/4 - 16	7/8 - 14	5 1/4	1 3/8	3000
	2	1 3/8	1 5/8	1-14	1 1/4 - 12	5 1/4	1 3/8	3000
2 1/2	1	1	1 1/8	3/4 - 16	7/8 - 14	5 3/8	1 3/8	1800
	2	1 3/4	2	1 1/4 - 12	1 1/2 - 12	5 3/8	1 3/8	3000
	3	1 3/8	1 5/8	1-14	1 1/4 - 12	5 3/8	1 3/8	3000
3 1/4	1	1 3/8	1 5/8	1-14	1 1/4 - 12	6 1/4	1 1/4	2130
	2	2	2 1/4	1 1/2 - 12	1 3/4 - 12	6 1/4	1 1/4	3000
	3	1 3/4	2	1 1/4 - 12	1 1/2 - 12	6 1/4	1 1/4	3000
4	1	1 3/4	2	1 1/4 - 12	1 1/2 - 12	6 5/8	1 1/4	2580
	2	2 1/2	3	1 7/8 - 12	2 1/4 - 12	6 5/8	1 1/4	3000
	3	2	2 1/4	1 1/2 - 12	1 3/4 - 12	6 5/8	1 1/4	3000
5	1	2	2 1/4	1 1/2 - 12	1 3/4 - 12	7 1/8	1 1/4	2510
	2	3 1/2	3 1/2	2 1/2 - 12	3 1/4 - 12	7 1/8	1 1/4	3000
	3	2 1/2	3	1 7/8 - 12	2 1/4 - 12	7 1/8	1 1/4	3000
	4	3	3 1/2	2 1/4 - 12	2 3/4 - 12	7 1/8	1 1/4	3000
6	1	2 1/2	3	1 7/8 - 12	2 1/4 - 12	8 3/8	1 3/8	3000
	2	4	4	3 - 12	3 3/4 - 12	8 3/8	1 3/8	3000
	3	3	3 1/2	2 1/4 - 12	2 3/4 - 12	8 3/8	1 3/8	3000
	4	3 1/2	3 1/2	2 1/2 - 12	3 1/4 - 12	8 3/8	1 3/8	3000
7*	1	3	3 1/2	2 1/4 - 12	2 3/4 - 12	9 1/2	13/32	3000
	2	5	5	3 1/2 - 12	4 3/4 - 12	9 1/2	13/32	3000
	3	3 1/2	3 1/2	2 1/2 - 12	3 1/4 - 12	9 1/2	13/32	3000
	4	4	4	3 - 12	3 3/4 - 12	9 1/2	13/32	3000
	5	4 1/2	4 1/2	3 1/4 - 12	4 1/4 - 12	9 1/2	13/32	3000
8*	1	3 1/2	3 1/2	2 1/2 - 12	3 1/4 - 12	10 1/2	13/32	3000
	2	5 1/2	5 1/2	4 - 12	5 1/4 - 12	10 1/2	13/32	3000
	3	4	4	3 - 12	3 3/4 - 12	10 1/2	13/32	3000
	4	4 1/2	4 1/2	3 1/4 - 12	4 1/4 - 12	10 1/2	13/32	3000
	5	5	5	3 1/2 - 12	4 3/4 - 12	10 1/2	13/32	3000

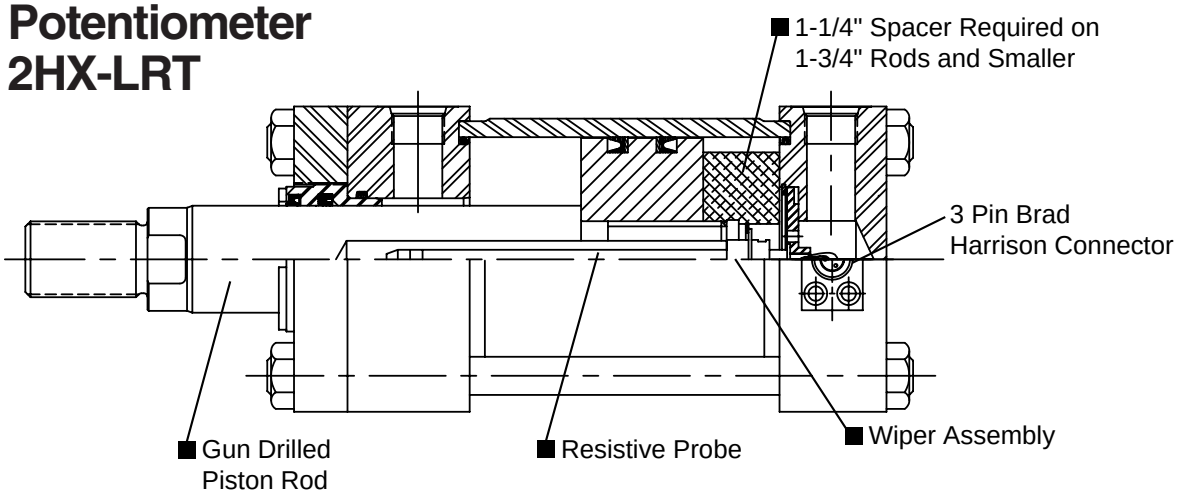
†**Note:** The rod end dimensions shown are based on the use of a linear displacement transducer with a rod end dead zone of 2.5 inches or less. LDT's with longer dead zones require a rod extension. The LDT will be permanently damaged if the proper rod extension is not used. Consult factory if an LDT with longer dead band is going to be used.

**The 4:1 design factor is based on the tensile strength of the piston to rod connection.

*Specify Series 3HX.

***For 7-8" Bore 3HX callout dimension WF.

Linear Potentiometer Series 2HX-LRT

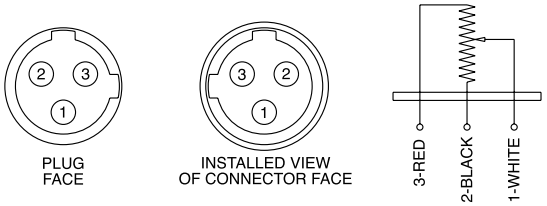


Standard Features

- Available in strokes to 120".
- Unique, easy to apply cylinder position sensing system.
- Infinite resolution, high linearity and repeatability.
- Innovative, resistive element is made of conductive plastic.
- 3 pin Brad Harrison electrical connector available at any cap position not occupied by a port or mount.

How It Works

The Parker LRT is a uniquely designed position sensor that uses a resistive element and wiper assembly to provide an analog output signal of a cylinder's position. The LRT is a dual element type linear potentiometer with two independent elements mounted on either side of a anodized aluminum extrusion. The LRT operates as a voltage divider. This is done by shorting through the extrusion with the wiper assembly. The position of the wiper changes the resistive load proportional to its position along the cylinder stroke. The LRT is energized by applying a voltage across the unit, typically 10 VDC. As the resistive load changes with the cylinder stroke, the output voltage changes proportionally. The output voltage at the end point of the cylinder stroke is dictated by the input voltage applied across the device. The probe is mounted into the cylinder cap and inserted into the gun drilled piston rod. The compactness of the design only adds to the envelope dimensions of cylinders with 1-3/4" rods and smaller. Envelope dimensions of cylinders with larger rods are unaffected.



Pin Chart

Pin Number	On Cable	On LRT	Function
1	Green	White (wiper)	Output
2	Red w/Blk	Black (resistor base)	V-
3	Red w/White	Red (resistor tip. power)	V+

Standard Specifications

Non-Linearity: Less than 0.1% of full scale up to 48" stroke. Less than 1.0% of full scale over 48" stroke.

Repeatability: .001 inch

Input Voltage: Nominal 5-50 Vdc

Operating Temperature Range: -40°F to +160°F*

Cylinder Stroke Length: Up to 120"

Electrical Connector: Brad Harrison 3-pin micro connector interface at pos. #4 standard. (Unless occupied by a port or mount.)

Total Resistance: 800Ω per inch of stroke (±20%) + end resistance.

End Resistance: 800Ω

Maximum Velocity: 30 inches per second

Life Expectancy: Greater that 50 x 10^6 cycles (Based on 1" stroke @ 10 ips)

Fluid Medium: Petroleum based hydraulic fluids

End Voltage Loss: (V source) x 400/stroke x 800

Power Dissipation: supply voltage squared, divided by the total resistance.

The LRT requires a high impedance interface greater than 100K ohms. A maximum of 1 microamp should be required from the LRT.

The accuracy of a given feedback device is a composite of the following factors:

Temperature Coefficient: The shift in output due to temperature change. This is a combination of the effect of temperature on the cylinder, the transducer and the electronics.

These factors which are normally additive refer to the feedback device itself. The performance achieved by a given system depends on the various factors such as system stiffness, valve performance, friction, temperature variation, and backlash in mechanical linkages to the cylinder.

In the case of front flange mounted cylinders, the stretch of the cylinder due to hydraulic pressure changes may affect position repeatability and system performance.

*A high temperature option is offered to 300°F (consult factory).

For additional information – call your local Parker Cylinder Distributor.

Cylinder with Linear Potentiometer Feedback (LRT)

Cylinders utilizing LRT feedback are available in the following mounting styles: TB, TC, TD, J, JB, JJ, C, E, F, CB, G, D, DB, DD, H, HB, HH, BB, SB.

Basic Series 2HX Cylinders

Style T Mounting

Envelope and Rod End Dimensions – See Table 1

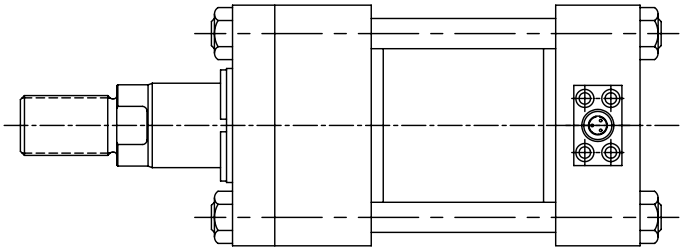


Table 1 – Envelope and Rod End Dimensions

For additional dimensions, consult Series 2H and Series 3H 7" and 8" Bore, of this catalog.

Bore	Rod No.	Rod Dia. mm	A	Thread Sizes KK Style 4	Thread Sizes CC Style 8	†† LB Add Stroke	4 to 1 Design Factor (PSI)**
2	1	1	1 1/8	3/4 - 16	7/8 - 14	6 1/2	3000
	2	1 3/8	1 5/8	1-14	1 1/4 - 12	6 1/2	3000
2 1/2	1	1	1 1/8	3/4 - 16	7/8 - 14	6 5/8	1800
	2	1 3/4	2	1 1/4 - 12	1 1/2 - 12	6 5/8	3000
	3	1 3/8	1 5/8	1-14	1 1/4 - 12	6 5/8	3000
3 1/4	1	1 3/8	1 5/8	1-14	1 1/4 - 12	7 1/2	2130
	2	2	2 1/4	1 1/2 - 12	1 3/4 - 12	6 1/4	3000
	3	1 3/4	2	1 1/4 - 12	1 1/2 - 12	7 1/2	3000
4	1	1 3/4	2	1 1/4 - 12	1 1/2 - 12	7 7/8	2580
	2	2 1/2	3	1 7/8 - 12	2 1/4 - 12	6 5/8	3000
	3	2	2 1/4	1 1/2 - 12	1 3/4 - 12	6 5/8	3000
5	1	2	2 1/4	1 1/2 - 12	1 3/4 - 12	7 1/8	2510
	2	3 1/2	3 1/2	2 1/2 - 12	3 1/4 - 12	7 1/8	3000
	3	2 1/2	3	1 7/8 - 12	2 1/4 - 12	7 1/8	3000
	4	3	3 1/2	2 1/4 - 12	2 3/4 - 12	7 1/8	3000
6	1	2 1/2	3	1 7/8 - 12	2 1/4 - 12	8 3/8	3000
	2	4	4	3 - 12	3 3/4 - 12	8 3/8	3000
	3	3	3 1/2	2 1/4 - 12	2 3/4 - 12	8 3/8	3000
	4	3 1/2	3 1/2	2 1/2 - 12	3 1/4 - 12	8 3/8	3000
7*	1	3	3 1/2	2 1/4 - 12	2 3/4 - 12	9 1/2	3000
	2	5	5	3 1/2 - 12	4 3/4 - 12	9 1/2	3000
	3	3 1/2	3 1/2	2 1/2 - 12	3 3/4 - 12	9 1/2	3000
	4	4	4	3 - 12	3 3/4 - 12	9 1/2	3000
	5	4 1/2	4 1/2	3 1/4 - 12	4 1/4 - 12	9 1/2	3000
8*	1	3 1/2	3 1/2	2 1/2 - 12	3 1/4 - 12	10 1/2	3000
	2	5 1/2	5 1/2	4 - 12	5 1/4 - 12	10 1/2	3000
	3	4	4	3 - 12	3 3/4 - 12	10 1/2	3000
	4	4 1/2	4 1/2	3 1/4 - 12	4 1/4 - 12	10 1/2	3000
	5	5	5	3 1/2 - 12	4 3/4 - 12	10 1/2	3000

††Cylinders with rod sizes less than 2" require the addition of a 1 1/4" spacer on the cap end of the piston to carry the wiper assembly. These LB dimensions reflect the additional length.

†A mini LRT (MLRT) is available for 5/8" rods – consult factory.

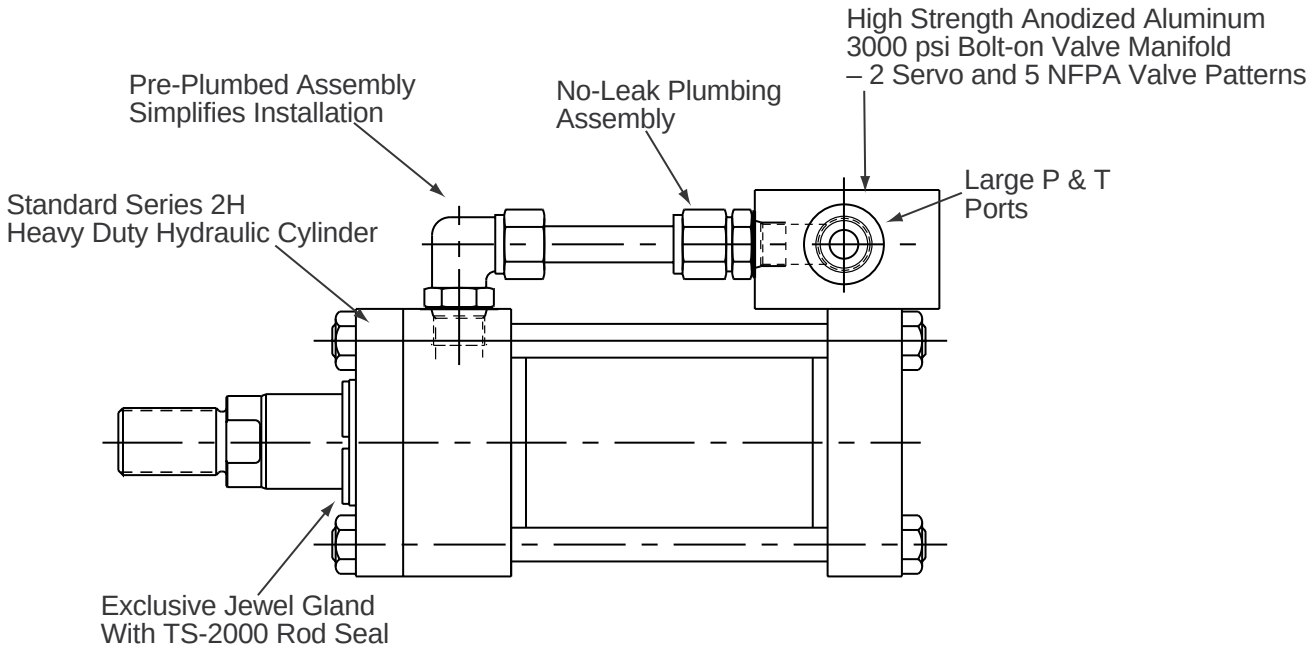
**The 4:1 design factor is based on the tensile strength of the piston to rod connection.

*Specify Series 3HX.

***For 7-8" Bore 3HX callout dimension WF.

For Cylinder Division Plant Locations – See Page II.

Hydraulic Linear Actuator with Bolt-on Servo/NFPA Valve Manifold and Two Feedback Options



Innovative Motion Control

Parker's new Series 2HX is an integrated assembly that eliminates transducer mounting brackets, valve manifolds, plumbing and other items associated with using separate components. The versatility of the Series 2HX allows you to design cost effective actuators for accurate position and velocity control for your specific application.

Features and Benefits

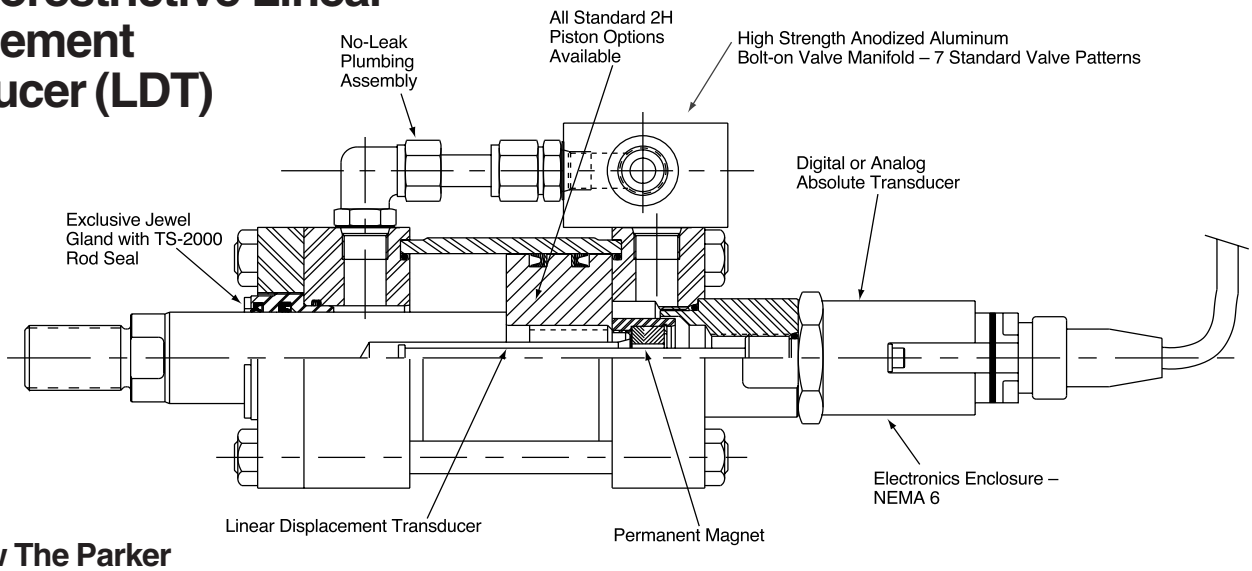
- Minimum hydraulic line runs with closed cylinder and valve coupling
- Simplified machine design with integrated components
- Eliminates the need for limit switches, deceleration valves, shock absorbers, and mechanical linkages in many applications
- Minimum interference with standard mounting dimensions
- Manifold may be mounted on head or cap end at any position not occupied by a mount
- 7 standard valve patterns
- Integral mounted valve eliminates assembly time and fittings.
- Custom manifolds available – consult factory

Custom Options Available

- Low friction rod gland – see the end of this series section.
- Hi-Load Piston
- Protective feedback enclosures
- Intrinsically safe modifications
- Explosion proof linear transducers
- Feedback devices in stock for quick delivery of common stroke lengths
- Closed-loop control for maximum productivity
- Performance-tested actuators
- Complete, tested cylinder/feedback assemblies customized to your needs

For additional information – call your local Parker Cylinder Distributor.

2HX with Bolt-on Manifold and Magnetorestrictive Linear Displacement Transducer (LDT)

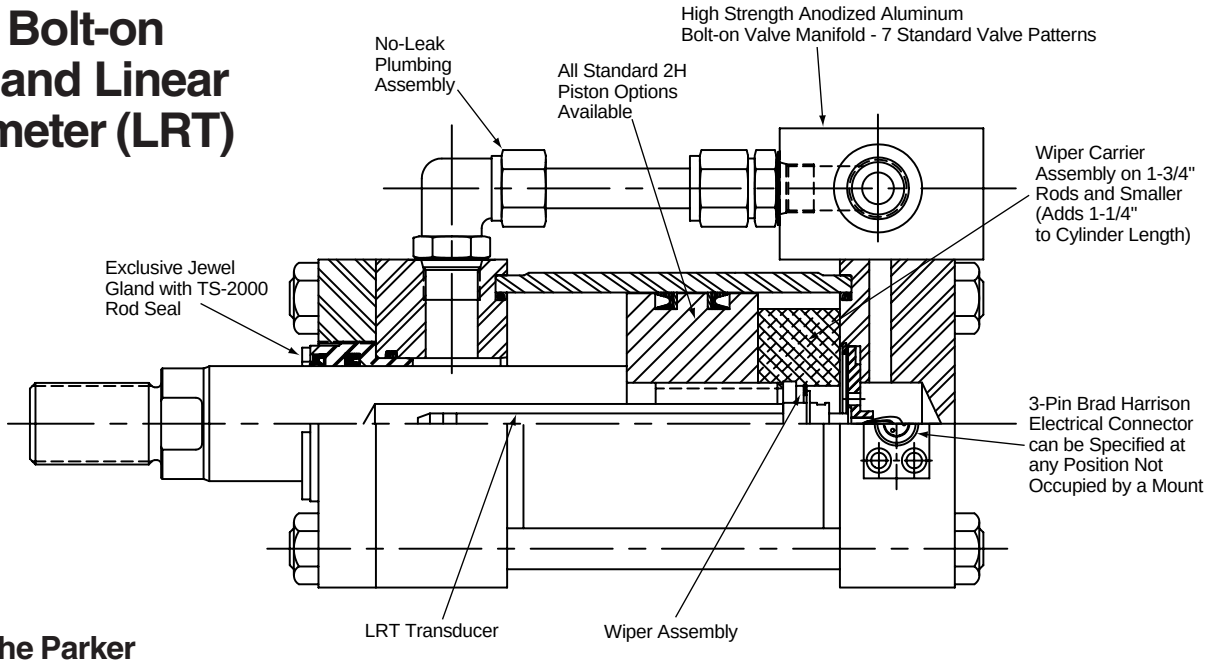


Here's How The Parker LDT Feeds Back Linear Position

The linear displacement transducer is rigidly attached to the cap end of the cylinder, and runs the full stroke length inside a hollow piston rod. A magnet is attached to the cylinder piston. As the piston moves through the stroke, the transducer is able to define the exact position of the magnet by measuring the time interval between the initiation and the return of the strain pulses launched in the transducer wave guide.

For LDT specifications see page 204.

2HX with Bolt-on Manifold and Linear Potentiometer (LRT)



Here's How The Parker LRT Feeds Back Linear Position

The LRT feedback device is essentially a linear potentiometer which provides a cost effective solution for applications where a contacting device is acceptable. The potentiometer is fixed to the rear cap of the cylinder and runs the full length inside a hollow piston rod. The wiper assembly is fixed to the piston. As the piston moves through the stroke, the wiper voltage changes in proportion to the cylinder position.

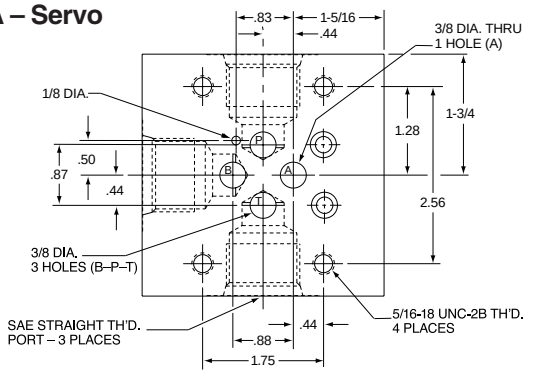
For specifications on the LRT see page 209.

Bolt-on Manifolds

Parker Series 2HX cylinders are available with Bolt-on Manifolds. Manifolds can be mounted on the head or cap end of a Parker Series 2H or 3H cylinders.

Available Bolt-on Manifold Valve Patterns

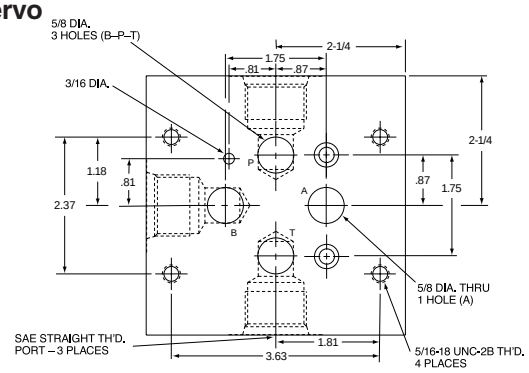
Group A – Servo



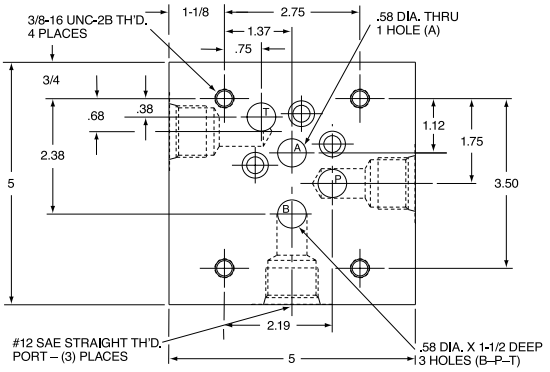
Servo Valve Mount Interchange Chart

Group A	Group D
PARKER BD-15	PARKER BD-30
ATCHLEY 215A-XXX	ATCHLEY 240-XXX
MOOG 62 SERIES	
MOOG 73 SERIES	MOOG 78 SERIES
MOOG 760 SERIES	
PEGASUS M &	PEGASUS 180L
MP SERIES	PEGASUS 180R
VICKERS SM4-20-X-X-10	VICKERS SM4-40-X-X-10

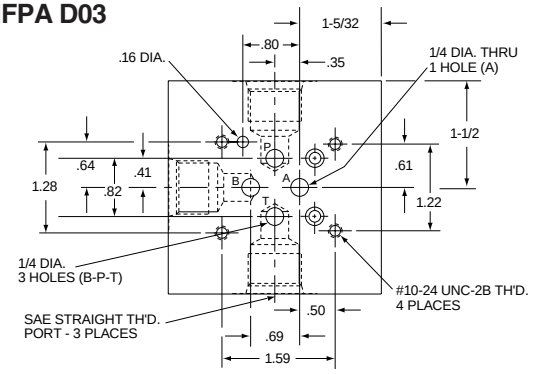
Group D – Servo



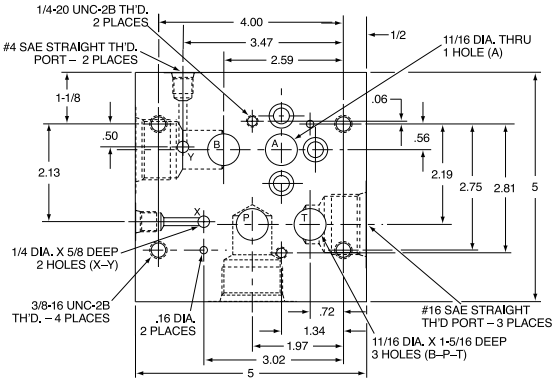
Group J – NFPA D06



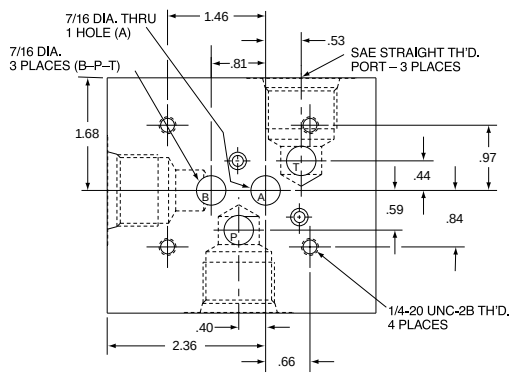
Group G – NFPA D03



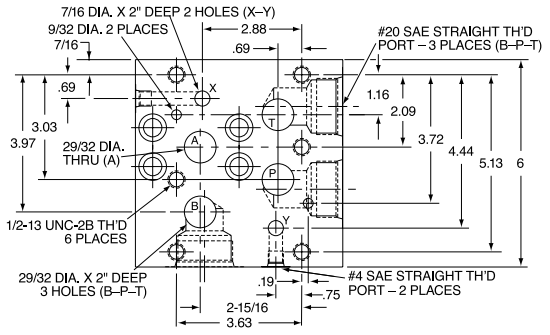
Group K – NFPA D07



Group H – NFPA D05

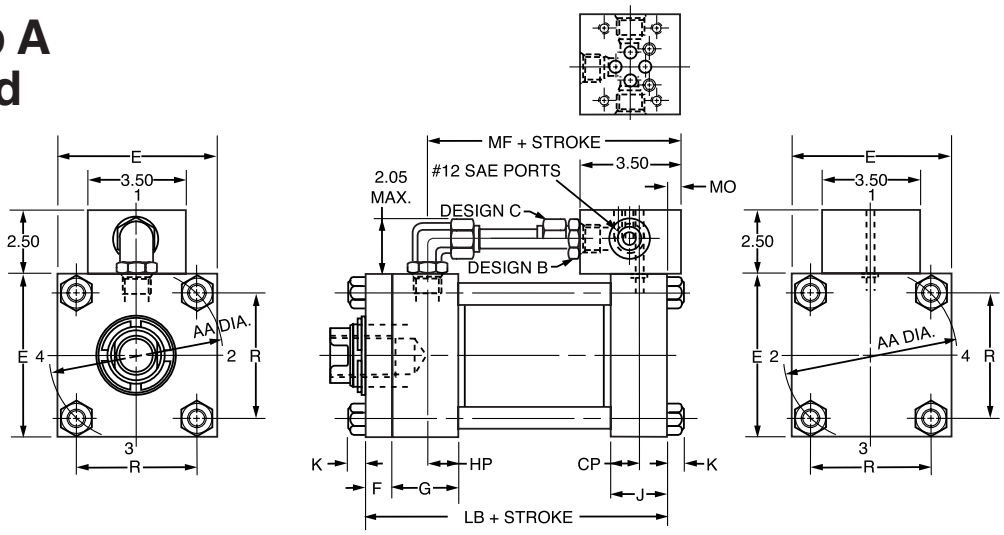


Group M – NFPA D08



For additional information – call your local Parker Cylinder Distributor.

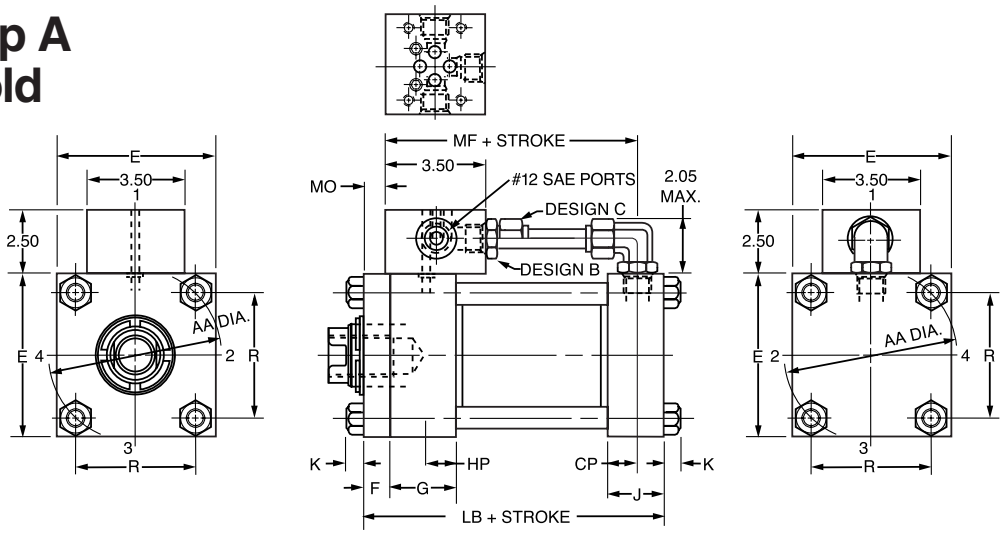
2HX with Group A Bolt-on Manifold Cap End
(Parker BD-15 Servo)



Group A/Parker BD-15 Valve Manifold, Cap End Mounted, Series 2HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	Min. Stroke	Min. Stroke
2.00	.562	3.000	4.187	.750	.750	.625	1.75	1.50	.438	2.9	2.05	5.250	1.625	2.875
2.50	.562	3.500	4.312	.750	.750	.625	1.75	1.50	.438	3.6	2.55	5.375	1.500	2.750
3.25	.468	4.500	4.875	.906	.906	.750	2.00	1.75	.562	4.6	3.25	6.250	.875	2.125
4.00	.468	5.000	5.125	.906	.906	.875	2.00	1.75	.562	5.4	3.82	6.625	.625	1.875
5.00	.468	6.500	5.625	.906	.906	.875	2.00	1.75	.812	7.0	4.95	7.125	.125	1.375
6.00†	.062	7.500	6.187	1.000	1.000	1.000	2.25	2.25	.875	8.1	5.73	8.375	0	.875

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart. †Consult Factory for 6" Bore DD Mount.
*Design C used only for strokes in "Design C" column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

2HX with Group A Bolt-on Manifold Head End
(Parker BD-15 Servo)



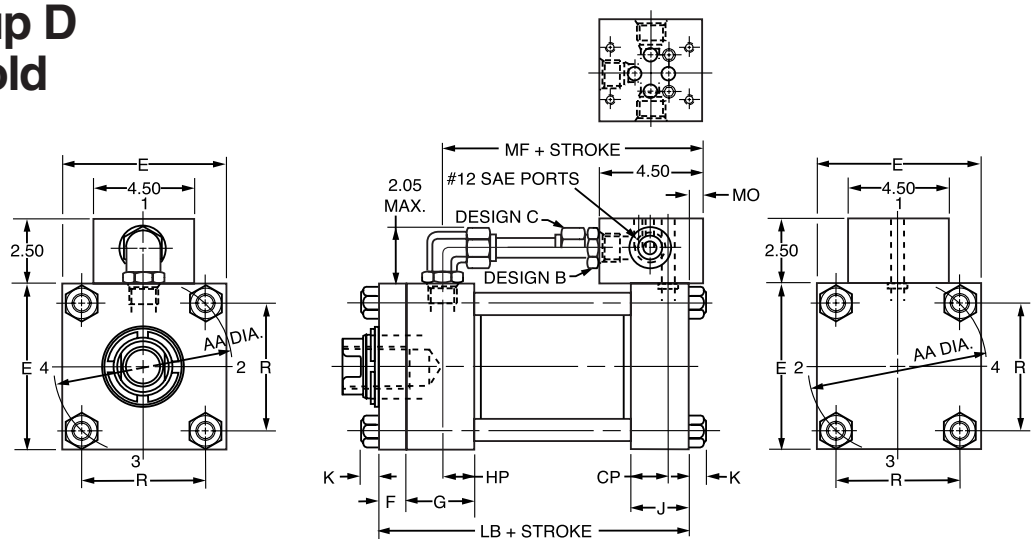
Group A/Parker BD-15 Valve Manifold, Head End Mounted, Series 2HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	Min. Stroke	Min. Stroke
2.00	.312	3.000	4.187	.750	.750	.625	1.75	1.50	.438	2.9	2.05	5.250	1.625	2.875
2.50	.312	3.500	4.312	.750	.750	.625	1.75	1.50	.438	3.6	2.55	5.375	1.500	2.750
3.25	.532	4.500	4.875	.906	.906	.750	2.00	1.75	.562	4.6	3.25	6.250	.875	2.125
4.00	.657	5.000	5.125	.906	.906	.875	2.00	1.75	.562	5.4	3.82	6.625	.625	1.875
5.00	.657	6.500	5.625	.906	.906	.875	2.00	1.75	.812	7.0	4.95	7.125	.125	1.375
6.00†	.938	7.500	6.187	1.000	1.000	1.000	2.25	2.25	.875	8.1	5.73	8.375	0	.875

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart. †Consult Factory for 6" Bore DD Mount.
*Design C used only for strokes in "Design C" column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

For Cylinder Division Plant Locations – See Page II.

2HX with Group D Bolt-on Manifold Cap End

(Parker BD-30 Servo)

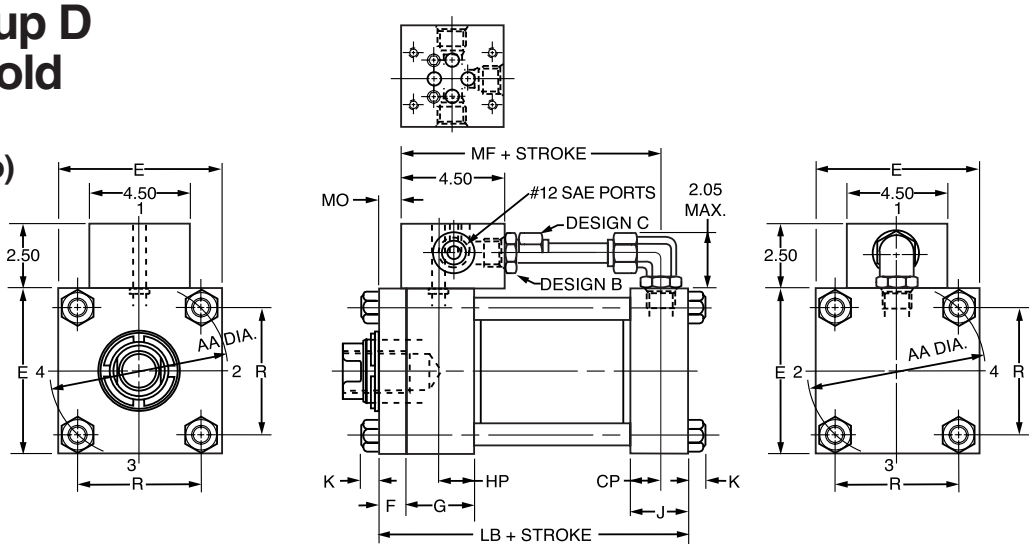


Group D/Parker BD-30 Valve Manifold, Cap End Mounted, Series 2HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	Min. Stroke	Min. Stroke
3.25	.531	4.500	4.937	.906	.906	.750	2.00	1.75	.562	4.6	3.25	6.250	1.875	3.125
4.00	.531	5.000	5.187	.906	.906	.875	2.00	1.75	.562	5.4	3.82	6.625	1.625	2.875
5.00	.531	6.500	5.687	.906	.906	.875	2.00	1.75	.812	7.0	4.95	7.125	1.125	2.375
6.00†	.125	7.500	6.250	1.000	1.000	1.000	2.25	2.25	.875	8.1	5.73	8.375	.500	1.750

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart.
*Design C used only for strokes in “Design C” column on chart and greater strokes.
†Consult Factory for 6" Bore DD Mount.
Standard Operating Pressure is 3000 PSI.

2HX with Group D Bolt-on Manifold Head End

(Parker BD-30 Servo)

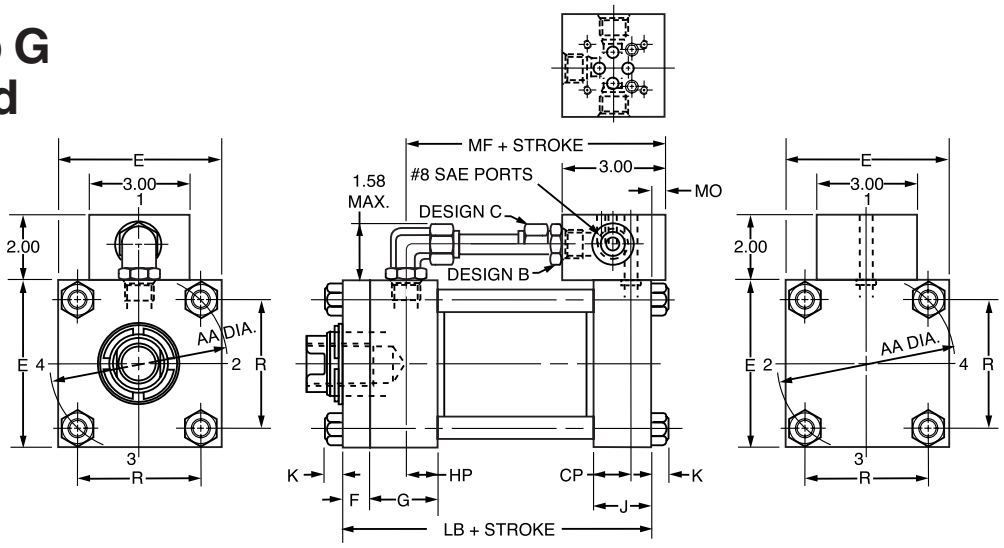


Group A/Parker BD-30 Valve Manifold, Head End Mounted Series 2HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	Min. Stroke	Min. Stroke
3.25	.469	4.500	4.937	.906	.906	.750	2.00	1.75	.562	4.6	3.25	6.250	1.875	3.125
4.00	.594	5.000	5.187	.906	.906	.875	2.00	1.75	.562	5.4	3.82	6.625	1.625	2.875
5.00	.594	6.500	5.687	.906	.906	.875	2.00	1.75	.812	7.0	4.95	7.125	1.125	2.375
6.00†	.875	7.500	6.250	1.000	1.000	1.000	2.25	2.25	.875	8.1	5.73	8.375	.500	1.750

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart.
*Design C used only for strokes in “Design C” column on chart and greater strokes.
†Consult Factory for 6" Bore DD Mount.
Standard Operating Pressure is 3000 PSI.

For additional information – call your local Parker Cylinder Distributor.

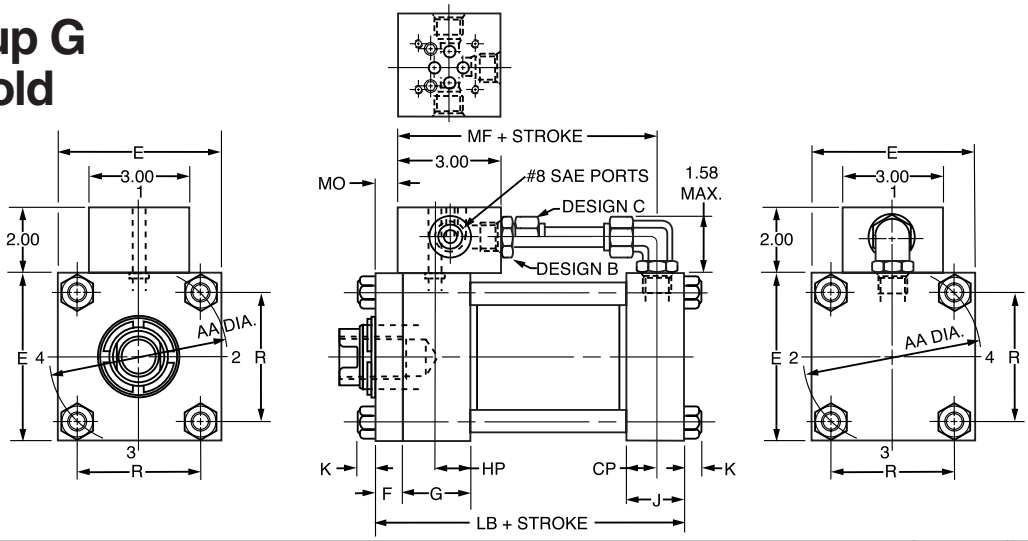
2HX with Group G Bolt-on Manifold Cap End
(NFPA D03)



Group G/NFPA D03 Valve Manifold, Cap End Mounted Series 2HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	Min. Stroke	Min. Stroke
2.00	.406	3.000	4.031	.750	.750	.625	1.75	1.50	.438	2.9	2.05	5.250	.875	1.750
2.50	.406	3.500	4.156	.750	.750	.625	1.75	1.50	.438	3.6	2.55	5.375	.750	1.625
3.25	.312	4.500	4.718	.906	.906	.750	2.00	1.75	.562	4.6	3.25	6.250	.250	1.000
4.00	.312	5.000	4.968	.906	.906	.875	2.00	1.75	.562	5.4	3.82	6.625	0	.750
5.00	.312	6.500	5.468	.906	.906	.875	2.00	1.75	.812	7.0	4.95	7.125	0	.250
6.00†	N/A	7.500	6.031	1.000	1.000	1.000	2.25	2.25	.875	8.1	5.73	8.375	0	0

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart. †Consult Factory for 6" Bore DD Mount.
*Design C used only for strokes in “Design C” column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

2HX with Group G Bolt-on Manifold Head End
(NFPA D03)

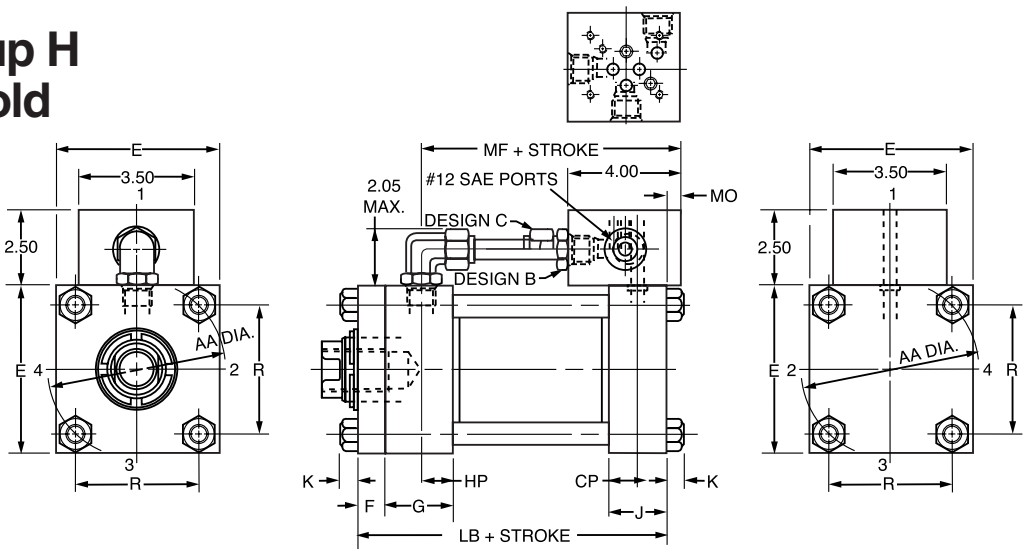


Group G/NFPA D03 Valve Manifold, Head End Mounted, Series 2HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	Min. Stroke	Min. Stroke
2.00	.468	3.000	4.031	.750	.750	.625	1.75	1.50	.438	2.9	2.05	5.250	.875	1.750
2.50	.468	3.500	4.156	.750	.750	.625	1.75	1.50	.438	3.6	2.55	5.375	.750	1.625
3.25	.688	4.500	4.718	.906	.906	.750	2.00	1.75	.562	4.6	3.25	6.250	.250	1.000
4.00	.813	5.000	4.968	.906	.906	.875	2.00	1.75	.562	5.4	3.82	6.625	0	.750
5.00	.813	6.500	5.468	.906	.906	.875	2.00	1.75	.812	7.0	4.95	7.125	0	.250
6.00†	1.109	7.500	6.031	1.000	1.000	1.000	2.25	2.25	.875	8.1	5.73	8.375	0	0

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart. †Consult Factory for 6" Bore DD Mount.
*Design C used only for strokes in “Design C” column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

For Cylinder Division Plant Locations – See Page II.

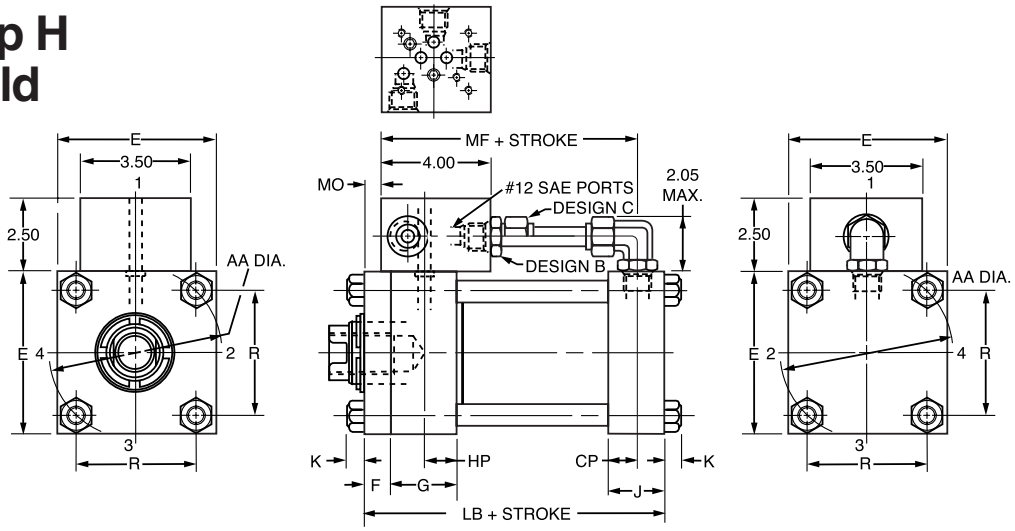
2HX with Group H Bolt-on Manifold Cap End
(NFPA D05)



Group H/NFPA D05 Valve Manifold, Cap End Mounted Series 2HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	Min. Stroke	Min. Stroke
2.00	.891	3.000	4.51	.750	.750	.625	1.750	1.500	.438	2.9	2.05	5.250	1.750	3.000
2.50	.891	3.500	4.64	.750	.750	.625	1.750	1.500	.438	3.6	2.55	5.375	1.625	2.875
3.25	.797	4.500	5.2	.906	.906	.750	2.000	1.750	.562	4.6	3.25	6.250	1.125	2.375
4.00	.797	5.000	5.45	.906	.906	.875	2.000	1.750	.562	5.4	3.82	6.625	.875	2.125
5.00	.797	6.500	5.95	.906	.906	.875	2.000	1.750	.812	7.0	4.95	7.125	.375	1.625
6.00†	.391	7.500	6.51	1.000	1.000	1.000	2.250	2.250	.875	8.1	5.73	8.375	0	1.000

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart. †Consult Factory for 6" Bore DD Mount.
*Design C used only for strokes in “Design C” column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

2HX with Group H Bolt-on Manifold Head End
(NFPA D05)

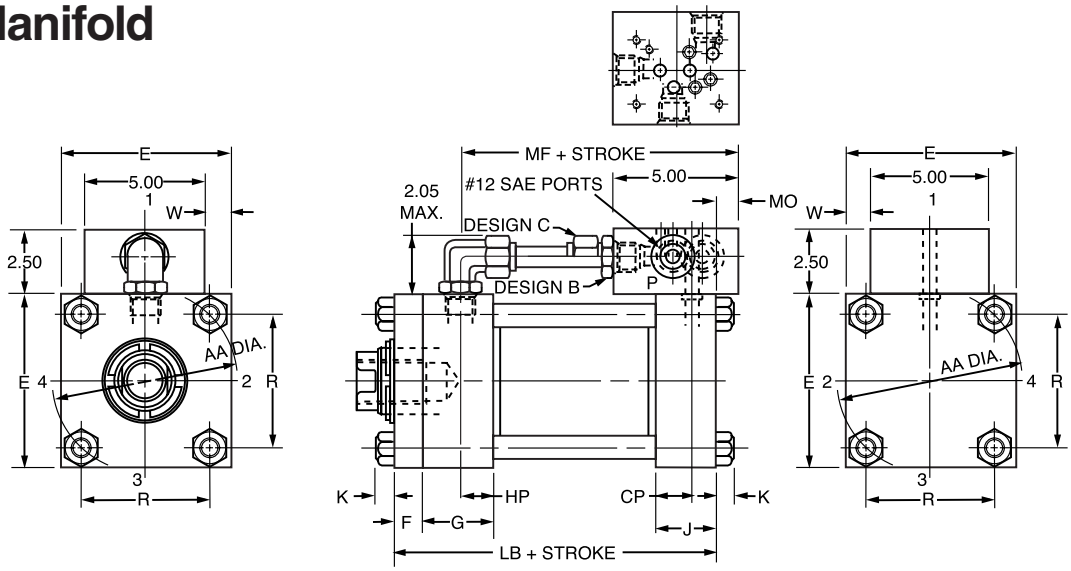


Group H/NFPA D05 Valve Manifold, Head End Mounted Series 2HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	Min. Stroke	Min. Stroke
2.00	0	3.000	4.51	.750	.750	.625	1.75	1.50	.438	2.9	2.05	5.250	1.750	3.000
2.50	0	3.500	4.64	.750	.750	.625	1.75	1.50	.438	3.6	2.55	5.375	1.625	2.875
3.25	.203	4.500	5.20	.906	.906	.750	2.00	1.75	.562	4.6	3.25	6.250	1.125	2.375
4.00	.328	5.000	5.45	.906	.906	.875	2.00	1.75	.562	5.4	3.82	6.625	.875	2.125
5.00	.328	6.500	5.95	.906	.906	.875	2.00	1.75	.812	7.0	4.95	7.125	.375	1.625
6.00†	.609	7.500	6.51	1.000	1.000	1.000	2.25	2.25	.875	8.1	5.73	8.375	0	1.000

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart. †Consult Factory for 6" Bore DD Mount.
*Design C used only for strokes in “Design C” column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

For additional information – call your local Parker Cylinder Distributor.

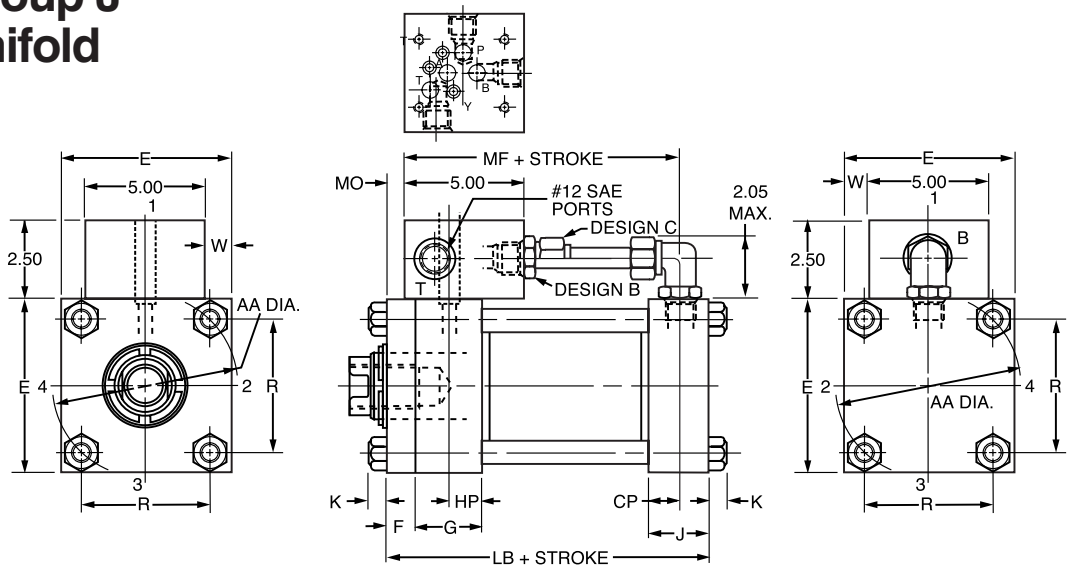
2HX with Group J Bolt-on Manifold Cap End
(NFPA D06)



Group J/NFPA D06 Valve Manifold, Cap End Mounted Series 2HX Cylinder														Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	W	Min. Stroke	Min. Stroke
6.00	.620	7.500	6.745	1.000	1.000	1.000	2.250	2.250	.875	8.100	5.730	8.375	1.250	.625	1.750

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart. Consult Factory for DD Mount.
*Design C used only for strokes in “Design C” column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

2HX with Group J Bolt-on Manifold Head End
(NFPA D06)

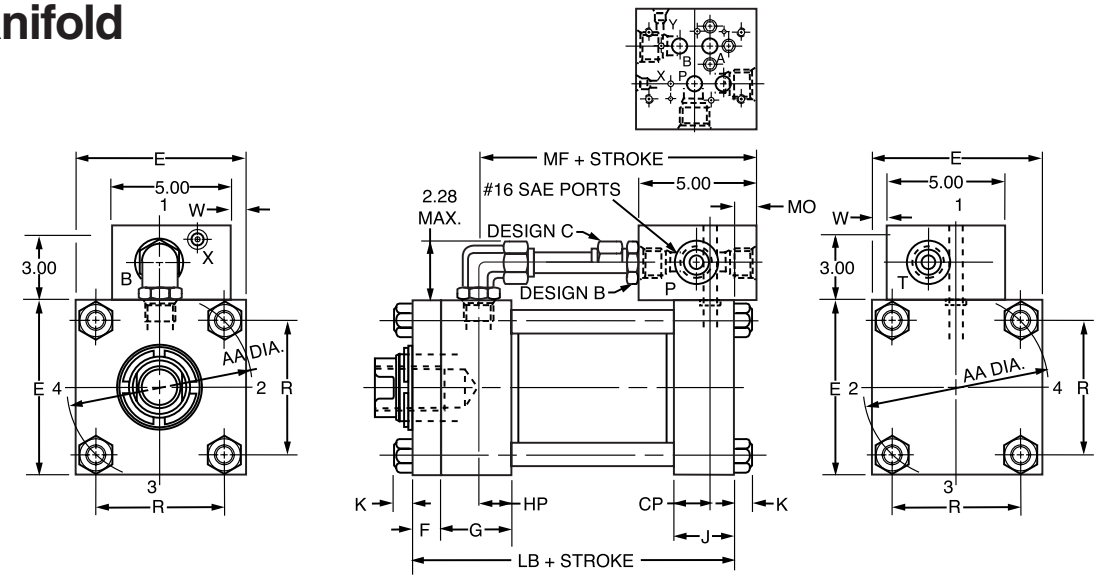


Group J/NFPA D06 Valve Bolt-on Manifold, Head End Mounted, Series 2HX Cylinder														Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	W	LB	Min. Stroke	Min. Stroke
6.00	.380	7.500	6.745	1.000	1.000	1.000	2.25	2.25	.875	8.1	5.73	1.250	8.375	.625	1.750

Design A (not shown) used only if stroke is shorter than minimum stroke shown for "Design B" on chart; consult factory, engineering required.
*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart. Consult Factory for DD Mount.
*Design C used only for strokes in “Design C” column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

For Cylinder Division Plant Locations – See Page II.

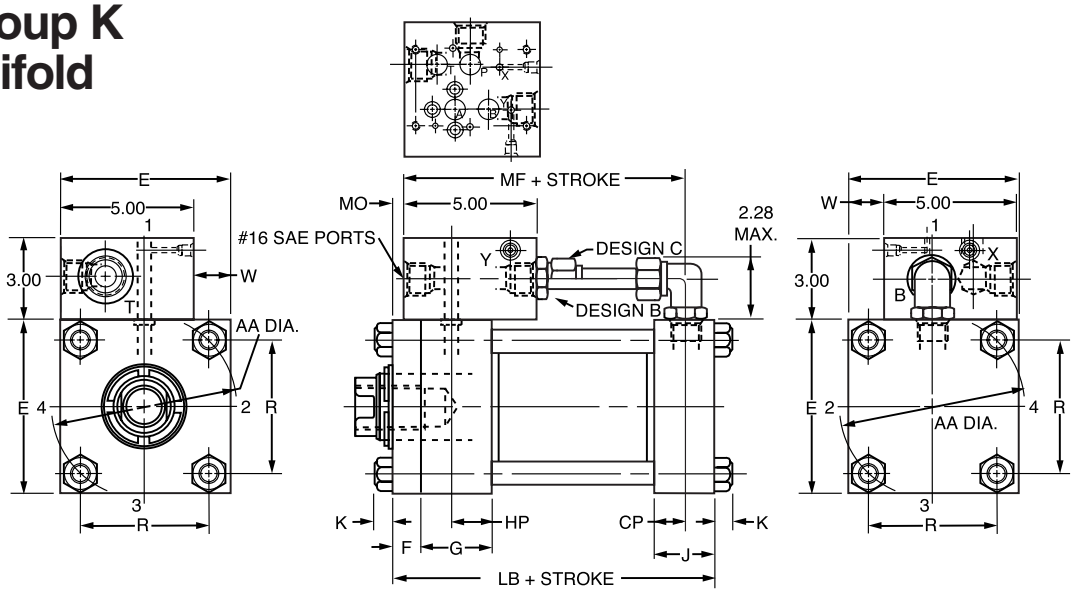
2HX with Group K Bolt-on Manifold Cap End
(NFPA D07)



Group K/NFPA D07 Valve Manifold, Cap End Mounted Series 2HX Cylinder														Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	LB	W	Min. Stroke	Min. Stroke
6.00	.590	7.500	6.715	1.000	1.000	1.000	2.250	2.250	.875	8.100	5.730	8.375	.435	1.104	2.285

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart. Consult Factory for DD Mount.
*Design C used only for strokes in “Design C” column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

2HX with Group K Bolt-on Manifold Head End
(NFPA D07)

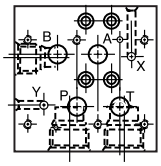


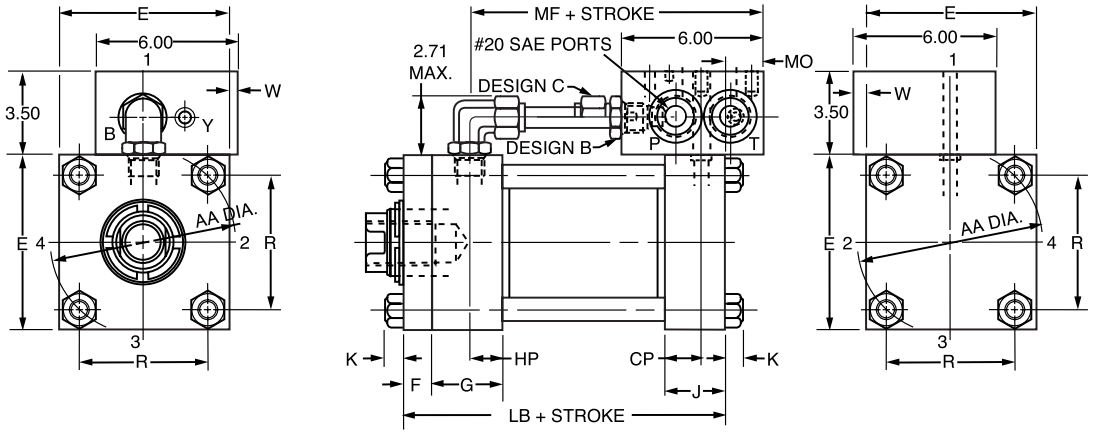
Group J/NFPA D07 Valve Bolt-on Manifold, Head End Mounted, Series 2HX Cylinder														Design B*	Design C*
Bore	MO	E	MF	CP	HP	F	G	J	K	AA	R	W	LB	Min. Stroke	Min. Stroke
6.00	.410	7.500	6.715	1.000	1.000	1.000	2.25	2.25	.875	8.1	5.73	2.065	8.375	1.104	2.285

Design A (not shown) used only if stroke is shorter than minimum stroke shown for "Design B" on chart; consult factory, engineering required.
*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart. Consult Factory for DD Mount.
*Design C used only for strokes in “Design C” column on chart and greater strokes. Standard Operating Pressure is 3000 PSI.

For additional information – call your local Parker Cylinder Distributor.

2HX with Group M Bolt-on Manifold Cap End
(NFPA D08)

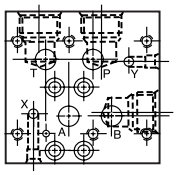


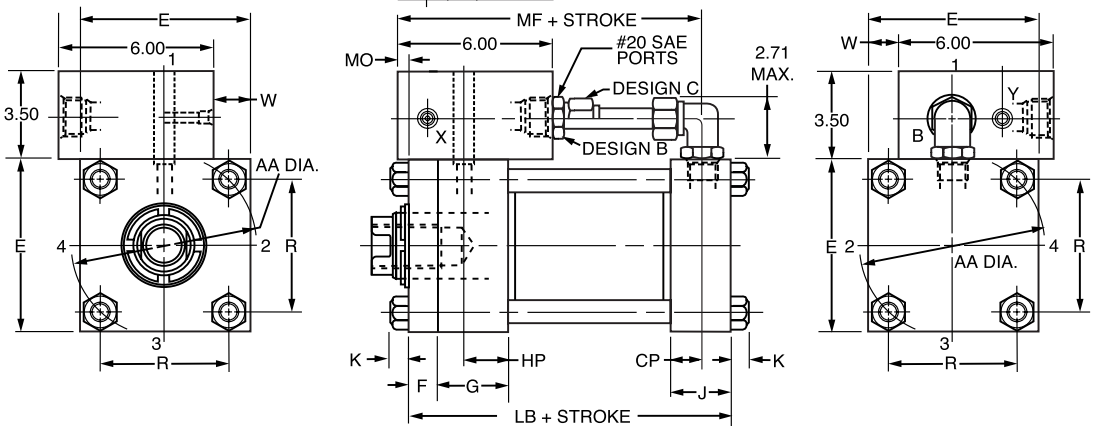


Group M/NFPA D08 Valve Manifold, Cap End Mounted Series 2HX Cylinder														Design B*	Design C*
Bore	**MO**	**E**	**MF**	**CP**	**HP**	**F**	**G**	**J**	**K**	**AA**	**R**	**LB**	**W**	**Min. Stroke**	**Min. Stroke**
6.00	1.566	7.500	7.816	1.286	1.125	1.000	2.250	2.250	.875	8.100	5.730	8.375	.250	1.75	3.00

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart.
*Design C used only for strokes in “Design C” column on chart and greater strokes.
Consult Factory for DD Mount.
Standard Operating Pressure is 3000 PSI.

2HX with Group M Bolt-on Manifold Head End
(NFPA D08)





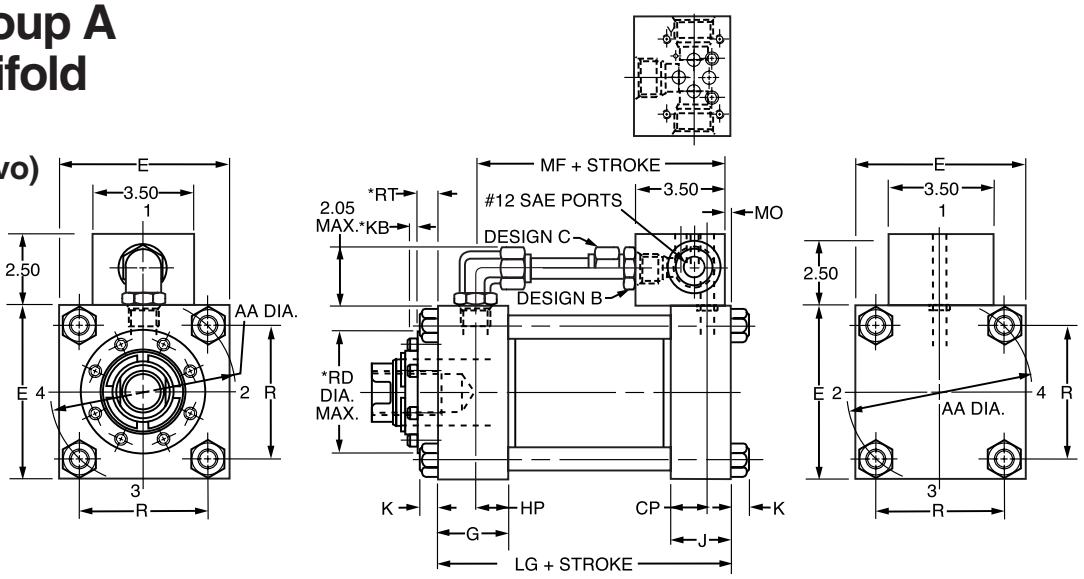
Group M/NFPA D08 Valve Bolt-on Manifold, Head End Mounted, Series 2HX Cylinder														Design B*	Design C*
Bore	**MO△**	**E**	**MF**	**CP**	**HP**	**F**	**G**	**J**	**K**	**AA**	**R**	**W†**	**LB**	**Min. Stroke**	**Min. Stroke**
6.00	.500	7.500	7.813	1.188	1.220	1.000	2.25	2.25	.875	8.1	5.73	1.755	8.375	1.75	3.00

Design A (not shown) used only if stroke is shorter than minimum stroke shown for "Design B" on chart; consult factory, engineering required.
*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart.
*Design C used only for strokes in “Design C” column on chart and greater strokes.
△BOM will overhang past head face.
Consult Factory for DD Mount.
Standard Operating Pressure is 3000 PSI.
†BOM will overhang past head face.

For Cylinder Division Plant Locations – See Page II.

3HX with Group A Bolt-on Manifold Cap End

(Parker BD-15 Servo)



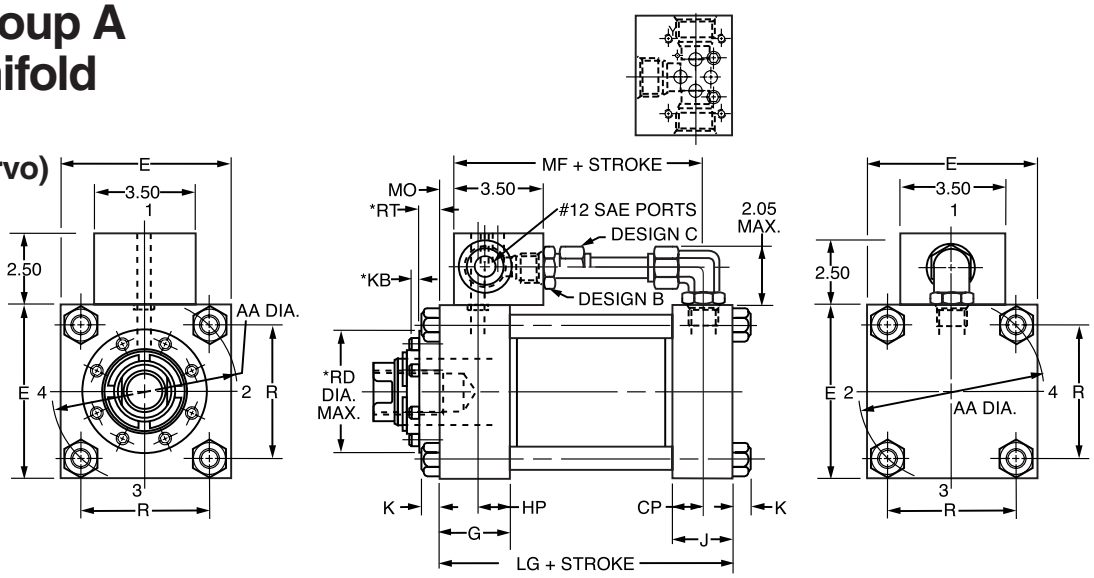
Group A/Parker BD-15 Valve Manifold, Cap End Mounted Series 3HX Cylinder												Design B*	Design C*
Bore	**MO**	**E**	**MF**	**CP**	**HP**	**G**	**J**	**K**	**AA**	**R**	**LG**	**Min. Stroke**	**Min. Stroke**
7.00	.188	8.500	6.813	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50	0	.375
8.00	.313	9.500	7.563	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50	N/A	0

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

3HX with Group A Bolt-on Manifold Head End

(Parker BD-15 Servo)



Group A/Parker BD-15 Valve Manifold, Head End Mounted Series 3HX Cylinder												Design B*	Design C*
Bore	**MO**	**E**	**MF**	**CP**	**HP**	**G**	**J**	**K**	**AA**	**R**	**LG**	**Min. Stroke**	**Min. Stroke**
7.00	.188	8.500	6.813	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50	0	.375
8.00	.313	9.500	7.563	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50	N/A	0

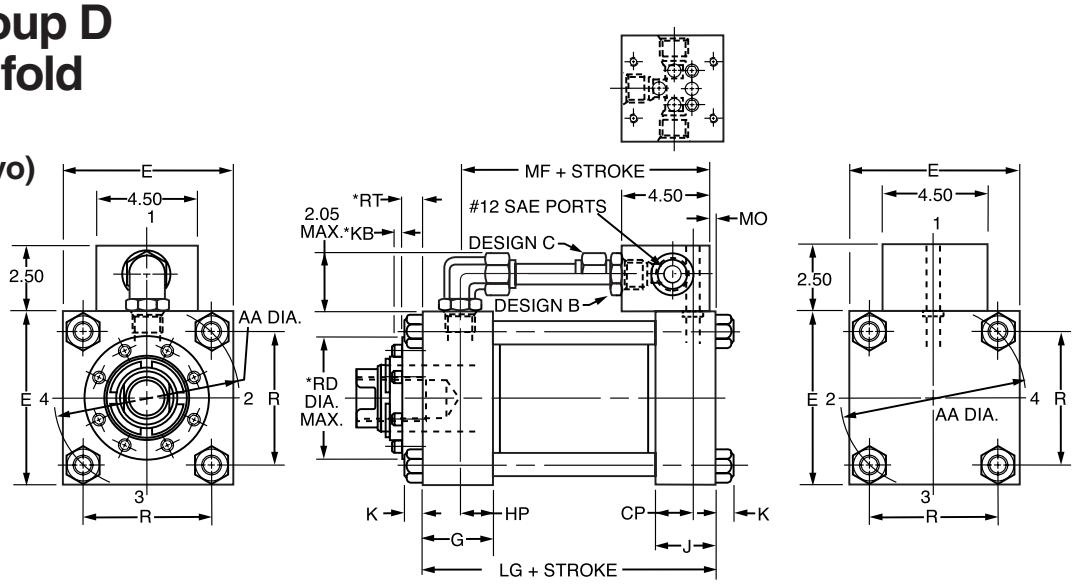
*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

For additional information – call your local Parker Cylinder Distributor.

3HX with Group D Bolt-on Manifold Cap End

(Parker BD-30 Servo)



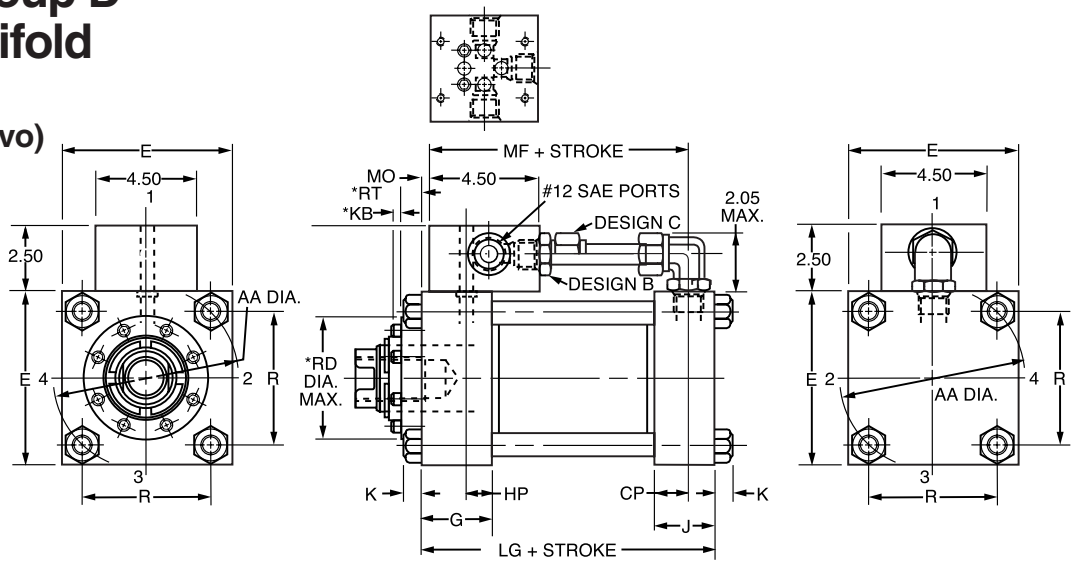
Group D/Parker BD-30 Valve Manifold, Cap End Mounted Series 3HX Cylinder												Design B*	Design C*
Bore	MO	E	MF	CP	HP	G	J	K	AA	R	LG	Min. Stroke	Min. Stroke
7.00	.125	8.500	6.875	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50	0	1.250
8.00	.250	9.500	7.625	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50	0	.500

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

3HX with Group D Bolt-on Manifold Head End

(Parker BD-30 Servo)



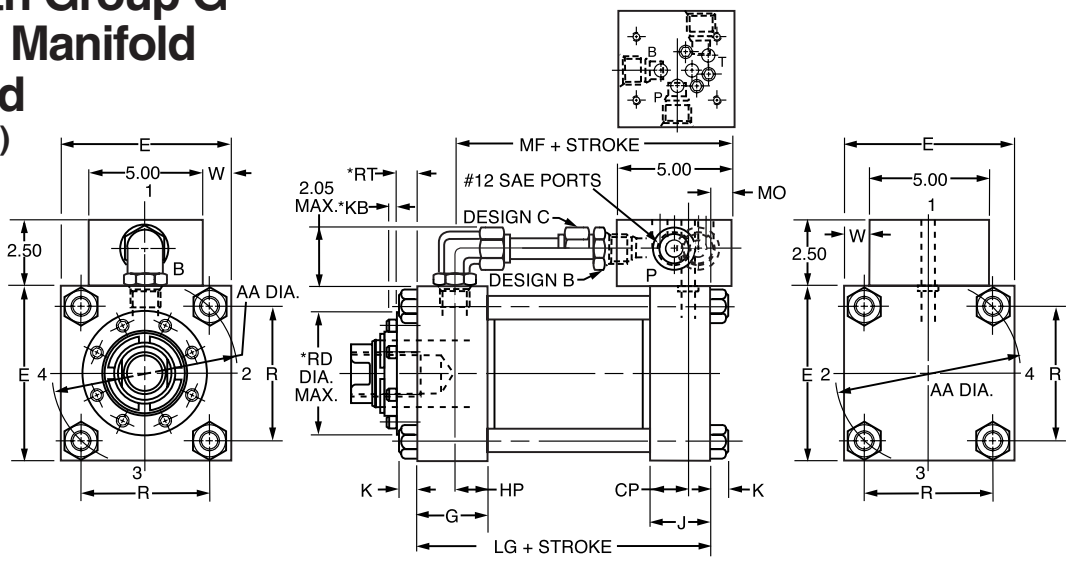
Group D/Parker BD-30 Valve Manifold, Head End Mounted Series 3HX Cylinder												Design B*	Design C*
Bore	MO	E	MF	CP	HP	G	J	K	AA	R	LG	Min. Stroke	Min. Stroke
7.00	.125	8.500	6.875	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50	0	1.250
8.00	.250	9.500	7.625	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50	0	.500

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

For Cylinder Division Plant Locations – See Page II.

3HX with Group G Bolt-on Manifold Cap End
(NFPA D03)

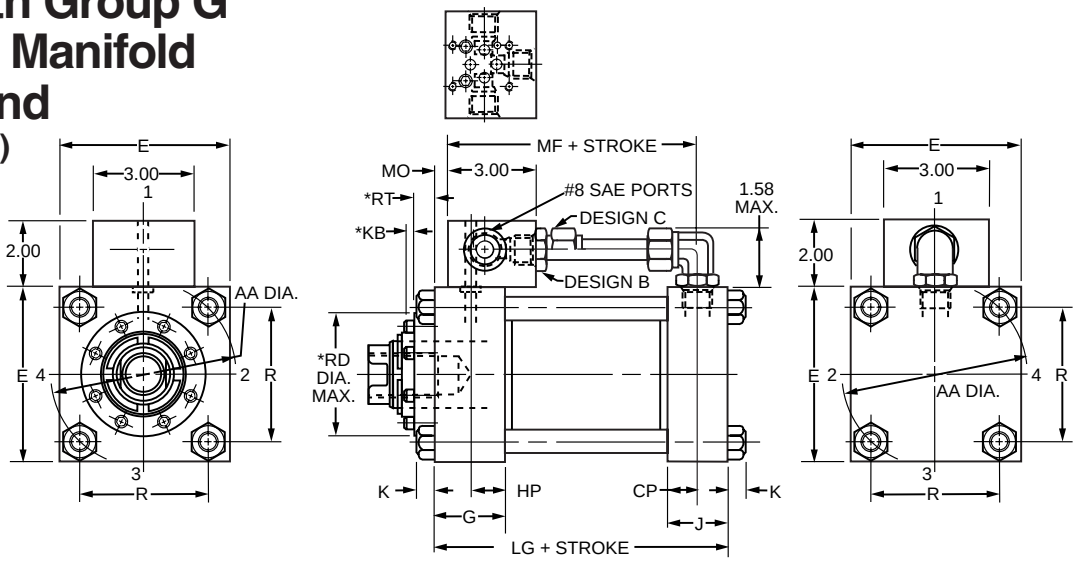


Group G/NFPA D03 Valve Manifold, Cap End Mounted Series 3HX Cylinder											
Bore	**MO**	**E**	**MF**	**CP**	**HP**	**G**	**J**	**K**	**AA**	**R**	**LG**
7.00	.344	8.500	6.656	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50
8.00	.469	9.500	7.406	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50

*Design B used only if stroke falls in between “Design B” and “Design C” min. stroke columns on chart.
*Design C used only for strokes in “Design C” column on chart and greater strokes.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

3HX with Group G Bolt-on Manifold Head End
(NFPA D03)



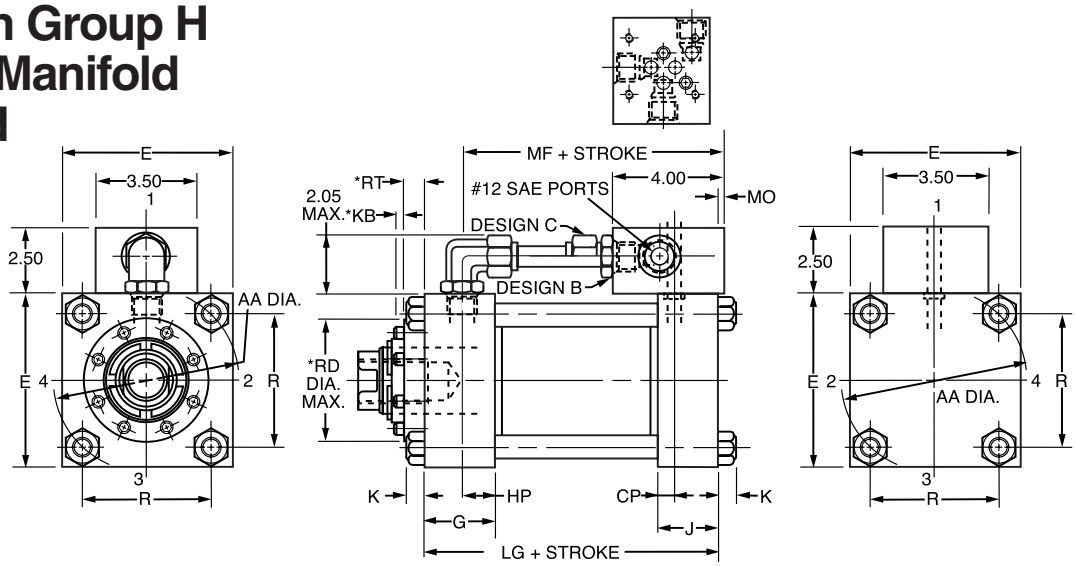
Group G/NFPA D03 Valve Manifold, Head End Mounted Series 3HX Cylinder											
Bore	**MO**	**E**	**MF**	**CP**	**HP**	**G**	**J**	**K**	**AA**	**R**	**LG**
7.00	.344	8.500	6.656	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50
8.00	.469	9.500	7.406	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50

*Design B used only if stroke falls in between “Design B” and ‘Design C” min. stroke columns on chart.
*Design C used only for strokes in “Design C” column on chart and greater strokes.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

For additional information – call your local Parker Cylinder Distributor.

3HX with Group H Bolt-on Manifold Cap End
(NFPA D05)

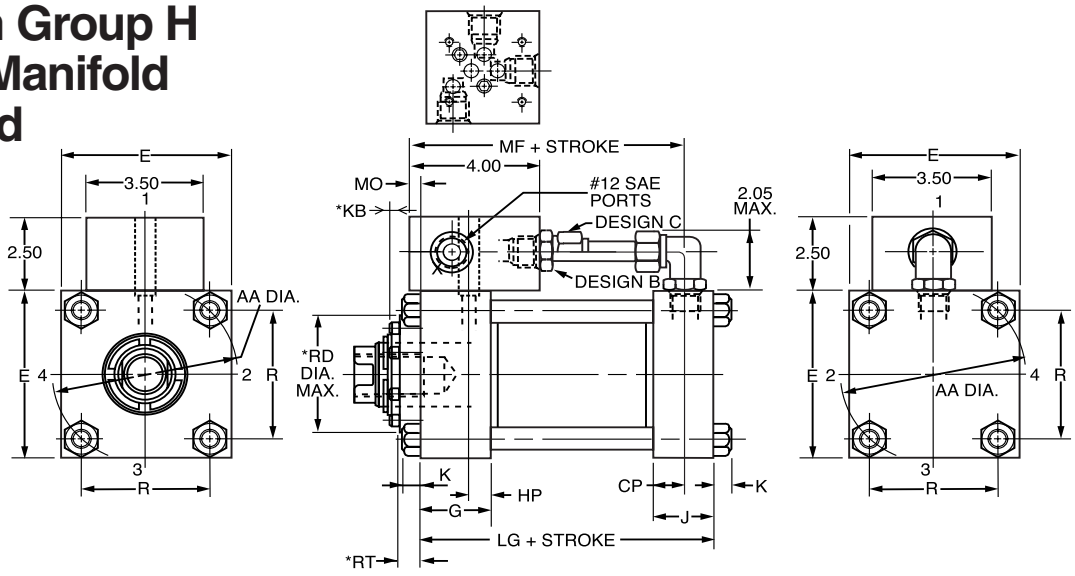


Group H/NFPA D05 Valve Manifold, Cap End Mounted Series 3HX Cylinder												Design B*	Design C*
Bore	MO	E	MF	CP	HP	G	J	K	AA	R	LG	Min. Stroke	Min. Stroke
7.00	.141△	8.500	7.141	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50	0	.50
8.00	.016△	9.500	7.891	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50	N/A	0

△BOM will overhang cap face
*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

3HX with Group H Bolt-on Manifold Head End
(NFPA D05)



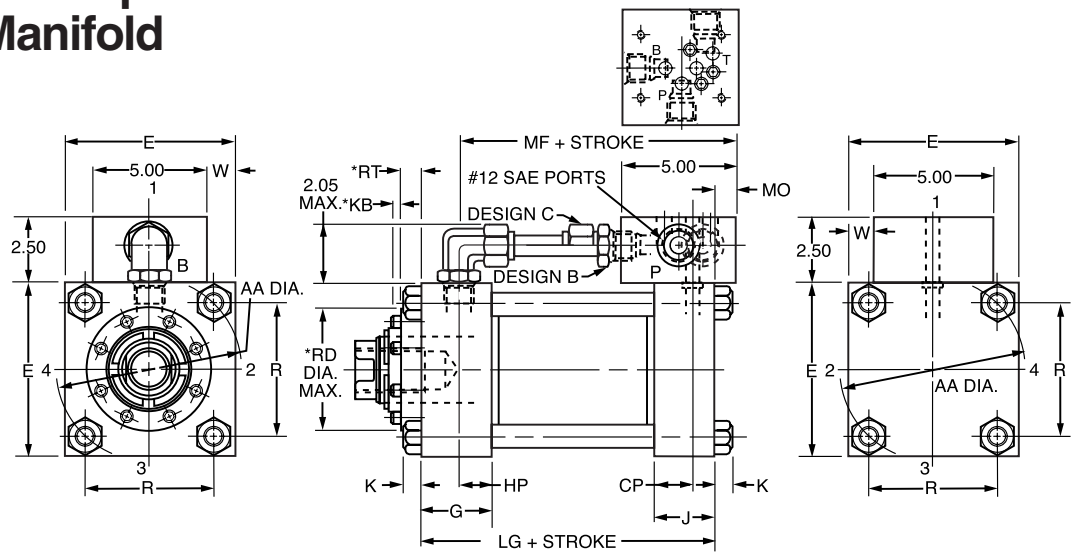
Group H/NFPA D05 Valve Manifold, Head End Mounted Series 3HX Cylinder												Design B*	Design C*
Bore	MO	E	MF	CP	HP	G	J	K	AA	R	LG	Min. Stroke	Min. Stroke
7.00	.141△	8.500	7.141	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50	0	.50
8.00	.016△	9.500	7.891	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50	N/A	0

△BOM will overhang cap face
*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

For Cylinder Division Plant Locations – See Page II.

3HX with Group J Bolt-on Manifold Cap End
(NFPA D06)

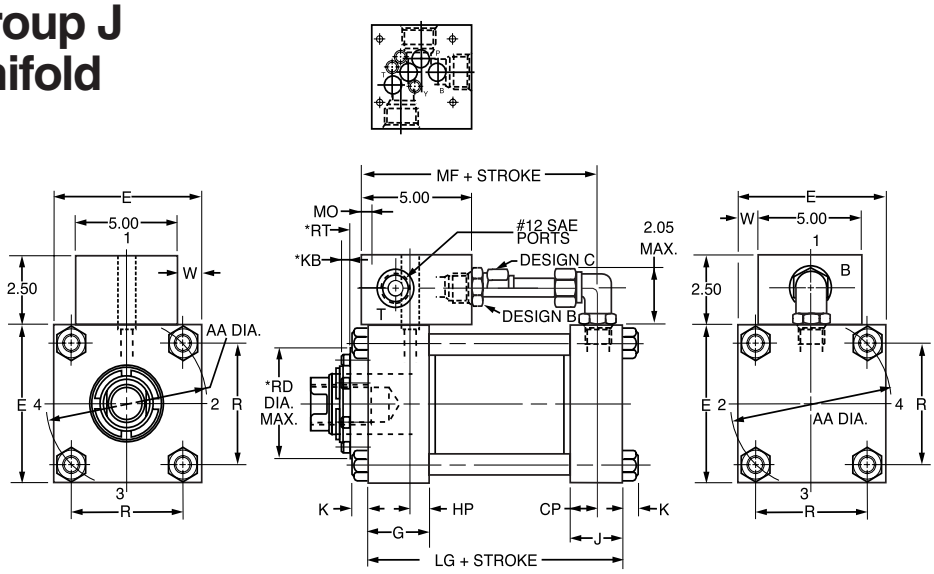


Group J/NFPA D06 Valve Manifold, Cap End Mounted Series 3HX Cylinder													Design B*	Design C*
Bore	**MO**	**E**	**MF**	**CP**	**HP**	**G**	**J**	**K**	**AA**	**R**	**LG**	**W**	**Min. Stroke**	**Min. Stroke**
7.00	.375△	8.500	7.375	1.250	1.250	2.750	2.750	1.000	9.300	6.580	8.500	1.750	.25	1.125
8.00	.250△	9.500	8.125	1.375	1.375	3.000	3.000	1.062	10.600	7.500	9.500	2.250	0	.375

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.
△BOM will overhang past cap face.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

3HX with Group J Bolt-on Manifold Head End
(NFPA D06)



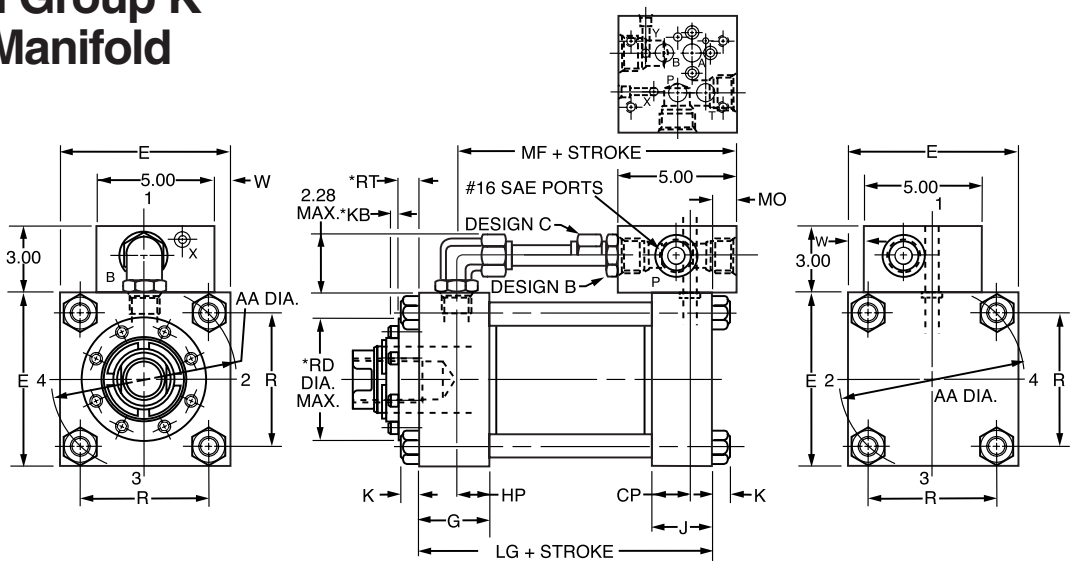
Group J/NFPA D06 Valve Bolt-on Manifold, Head End Mounted, Series 3HX Cylinder													Design B*	Design C*
Bore	**MO**	**E**	**MF**	**CP**	**HP**	**G**	**J**	**K**	**AA**	**R**	**LG**	**W**	**Min. Stroke**	**Min. Stroke**
7.00	.375△	8.500	7.375	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50	1.75	.250	1.125
8.00	.250△	9.500	8.125	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50	2.25	0	.375

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.
△BOM will overhang past head face.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

For additional information – call your local Parker Cylinder Distributor.

3HX with Group K Bolt-on Manifold Cap End
(NFPA D07)

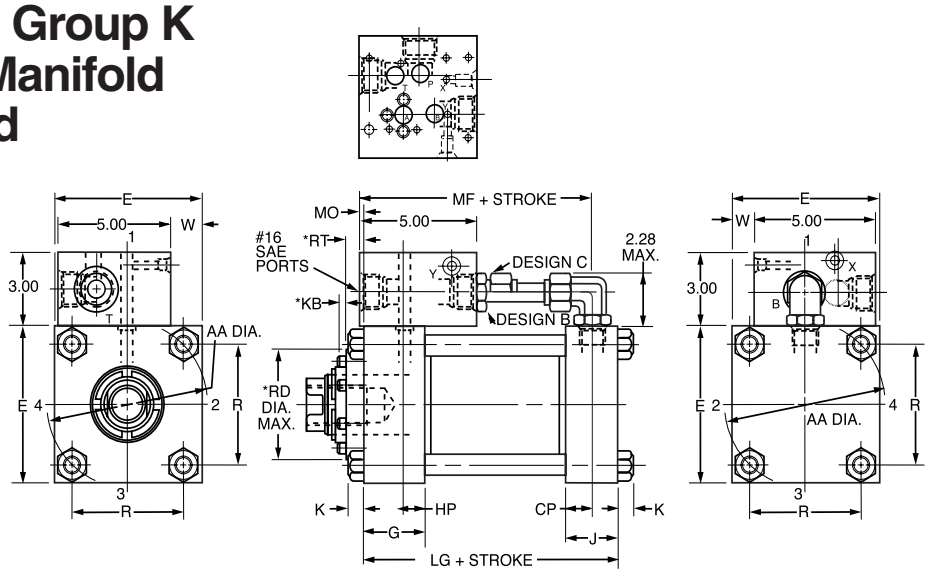


Group K/NFPA D07 Valve Manifold, Cap End Mounted Series 3HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	G	J	K	AA	R	LG	W	Min. Stroke	Min. Stroke
7.00	.344△	8.500	7.344	1.250	1.250	2.750	2.750	1.000	9.300	6.580	8.500	.935	.750	1.750
8.00	.219△	9.500	8.094	1.375	1.375	3.000	3.000	1.062	10.600	7.500	9.500	1.435	0	1.000

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.
△BOM will overhang past cap face.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

3HX with Group K Bolt-on Manifold Head End
(NFPA D07)



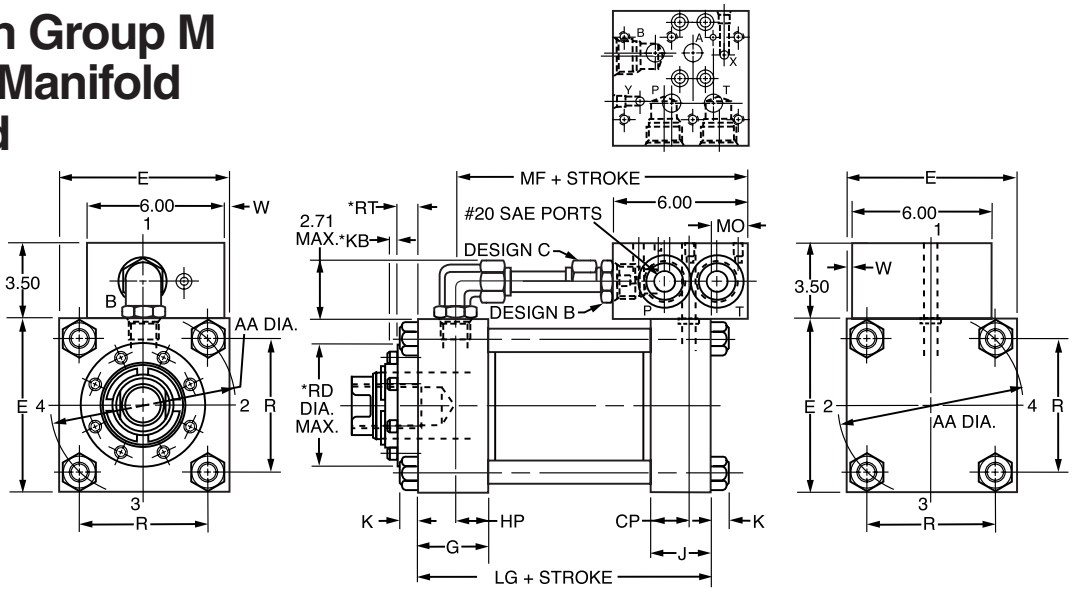
Group K/NFPA D07 Valve Bolt-on Manifold, Head End Mounted, Series 3HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	G	J	K	AA	R	LG	W	Min. Stroke	Min. Stroke
7.00	.344△	8.500	7.344	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50	2.565	.750	1.75
8.00	.219△	9.500	8.094	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50	3.065	0	1.000

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.
△BOM will overhang past head face.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

For Cylinder Division Plant Locations – See Page II.

3HX with Group M Bolt-on Manifold Cap End
(NFPA D08)

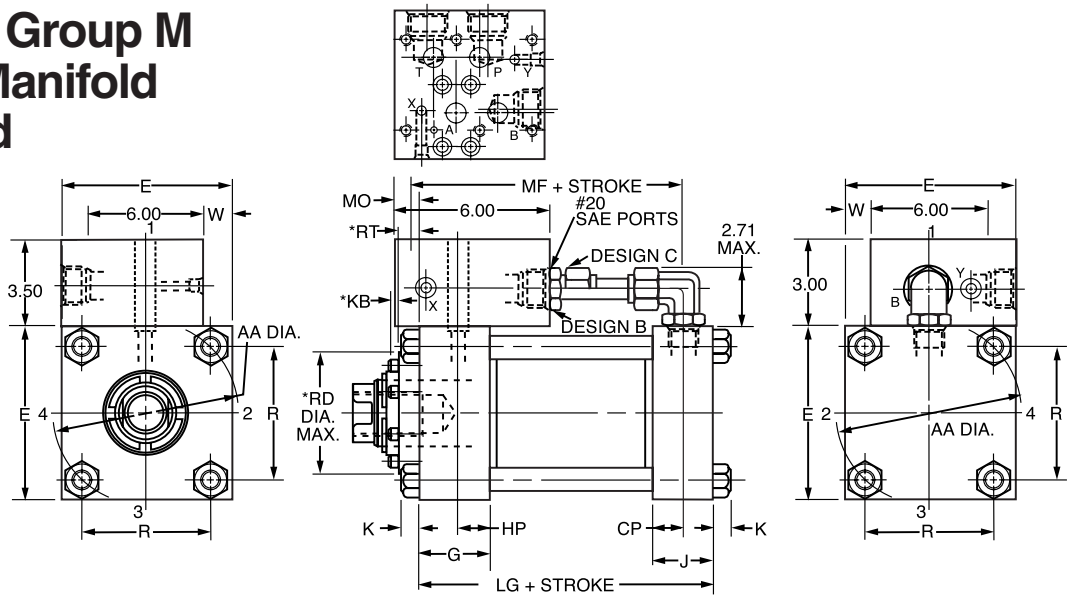


Group M/NFPA D08 Valve Manifold, Cap End Mounted Series 3H Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	G	J	K	AA	R	LG	W	Min. Stroke	Min. Stroke
7.00	1.031△	8.500	8.031	1.250	1.250	2.750	2.750	1.000	9.300	6.580	8.500	.250	1.375	2.625
8.00	.906△	9.500	8.781	1.375	1.375	3.000	3.000	1.062	10.600	7.500	9.500	.750	.625	1.938

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.
△BOM will overhang past cap face.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

3HX with Group M Bolt-on Manifold Head End
(NFPA D08)



Group M/NFPA D08 Valve Bolt-on Manifold, Head End Mounted, Series 3HX Cylinder													Design B*	Design C*
Bore	MO	E	MF	CP	HP	G	J	K	AA	R	LG	W	Min. Stroke	Min. Stroke
7.00	1.031△	8.500	8.031	1.250	1.250	2.75	2.75	1.000	9.3	6.58	8.50	2.250	1.375	2.625
8.00	.906△	9.500	8.781	1.375	1.375	3.00	3.00	1.062	10.6	7.50	9.50	2.750	.625	1.938

*Design B used only if stroke falls in between "Design B" and "Design C" min. stroke columns on chart.
*Design C used only for strokes in "Design C" column on chart and greater strokes.
△BOM will overhang past head face.

*See Parker Series 3H for dimensions.
Standard Operating Pressure is 3000 PSI.
Consult Factory for DD Mount.

For additional information – call your local Parker Cylinder Distributor.

Series 2HX and 3HX Mounting Dimensions

The Parker Series 2HX and 3HX Bolt-on Manifold option does not affect the standard envelope and mounting dimensions of the base Parker Series 2H or 3H Heavy Duty Hydraulic Cylinder except where noted on previous pages of this catalog. All standard Parker Series 2H and 3H mounting styles are available with the Series 2HX and 3HX Bolt-on Manifold option. For base cylinder dimensions refer to the Parker Series 2H and 3H sections of the Parker Actuator Catalog.

Series 2HX and 3HX Bolt-on Manifolds may be specified at any head or cap position which does not interfere with the mounting style selected. For available manifold mounting positions see Table A on page B-165. Manifold position must be specified when ordering.

For Parker mounting style DD refer to the minimum and maximum XI dimensions in Table 1 and Table 2 below.

Consult Factory for 6" Bore 2HX and 7"-8" Bore 3HX with Style DD Mounts.

Table 1 – Head End Mounted Bolt-on Manifold Maximum and Minimum 'XI' Location for Style DD Mounts

Series	Bore	MX	MN Bolt-on Manifold						
			Group A	Group D	Group G	Group H	Group J	Group K	Group M
2HX	2	3	4.563	N/A	4.219	4.734	N/A	N/A	N/A
	2.5	3.125	4.563	N/A	4.219	4.734	N/A	N/A	N/A
	3.25	3.5	5.032	5.969	4.688	5.203	N/A	N/A	N/A
	4	3.875	5.156	6.094	4.813	5.328	N/A	N/A	N/A
	5	4.375	5.156	6.094	4.813	5.328	N/A	N/A	N/A
	6	CONSULT FACTORY							
3HX	7	CONSULT FACTORY							
	8	CONSULT FACTORY							
3LX	2	2.25	N/A	N/A	3.906	N/A	N/A	N/A	N/A
	2.5	2.375	N/A	N/A	3.906	N/A	N/A	N/A	N/A
	3.25	2.625	4.875	N/A	4.531	5.047	N/A	N/A	N/A
	4	2.625	4.875	N/A	4.531	5.047	N/A	N/A	N/A
	5	2.875	4.875	N/A	4.531	5.047	N/A	N/A	N/A
	6	3	5.375	6.313	5.031	5.547	N/A	N/A	N/A
	8	3.125	5.375	6.313	5.031	5.547	N/A	N/A	N/A

Maximum and Minimum 'XI' Location

2H & 3L Series
Min. 'XI' = W + MN
Max. 'XI' = W + MX + Stroke

3H Series
Min. 'XI' = WF + MN
Max. 'XI' = W + MX + Stroke

Table 2 – Cap End Mounted Bolt-on Manifold Maximum and Minimum 'XI' Location for Style DD Mounts

Series	Bore	MN	MX Bolt-on Manifold						
			Group A	Group D	Group G	Group H	Group J	Group K	Group M
2HX	2	3.125	1.562	N/A	1.906	1.391	N/A	N/A	N/A
	2.5	3.125	1.687	N/A	2.031	1.516	N/A	N/A	N/A
	3.25	3.75	2.218	1.281	2.563	2.047	N/A	N/A	N/A
	4	3.875	2.593	1.656	2.938	2.422	N/A	N/A	N/A
	5	3.875	3.093	2.156	3.438	2.922	N/A	N/A	N/A
	6	CONSULT FACTORY							
3HX	7	CONSULT FACTORY							
	8	CONSULT FACTORY							
3LX	2	2.625	N/A	N/A	0.969	N/A	N/A	N/A	N/A
	2.5	2.625	N/A	N/A	1.094	N/A	N/A	N/A	N/A
	3.25	3.375	1.125	N/A	1.469	0.953	N/A	N/A	N/A
	4	3.375	1.125	N/A	1.469	0.953	N/A	N/A	N/A
	5	3.375	1.375	N/A	1.719	1.203	N/A	N/A	N/A
	6	4	1.625	0.687	1.969	1.453	N/A	N/A	N/A
	8	4	1.75	0.812	2.093	1.578	N/A	N/A	N/A

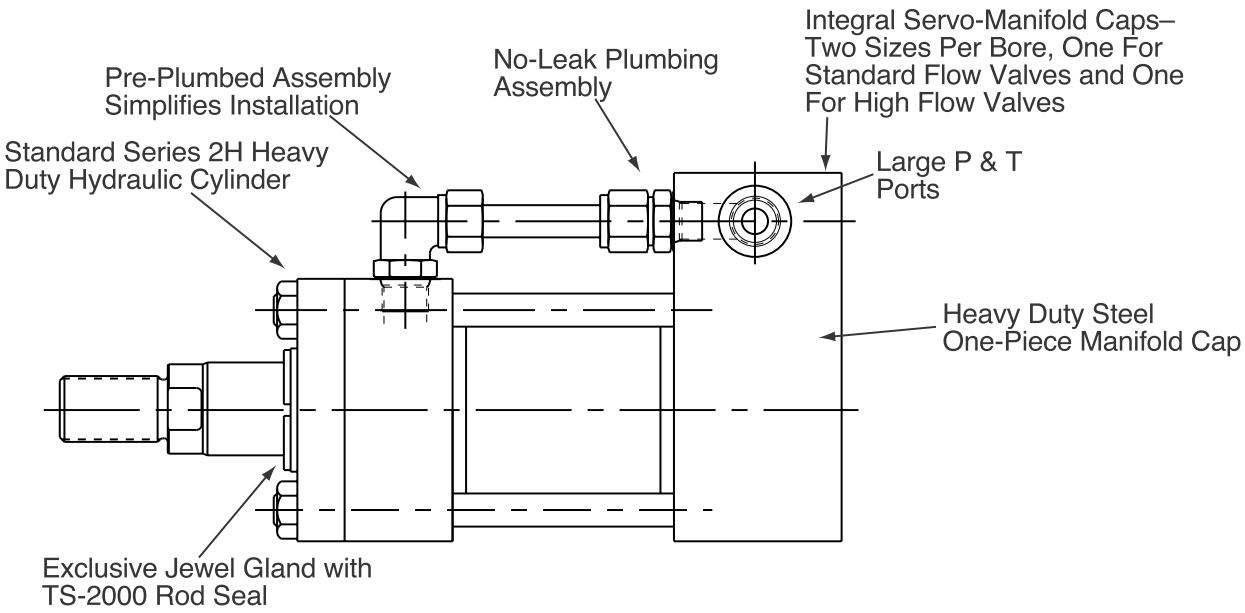
Maximum and Minimum 'XI' Location

2H & 3L Series
Min. 'XI' = W + MN
Max. 'XI' = W + MX + Stroke

3H Series
Min. 'XI' = WF + MN
Max. 'XI' = W + MX + Stroke

For Cylinder Division Plant Locations – See Page II.

Hydraulic Linear Actuator with Integral Servo/NFPA Valve Manifold and Two Feedback Options



Innovative Motion Control

Parker's new Series 2HX is an integrated assembly that eliminates transducer mounting brackets, valve manifolds, plumbing and other items associated with using separate components. The versatility of the Series 2HX allows you to design an actuator for accurate position and velocity control for your specific application.

Features and Benefits

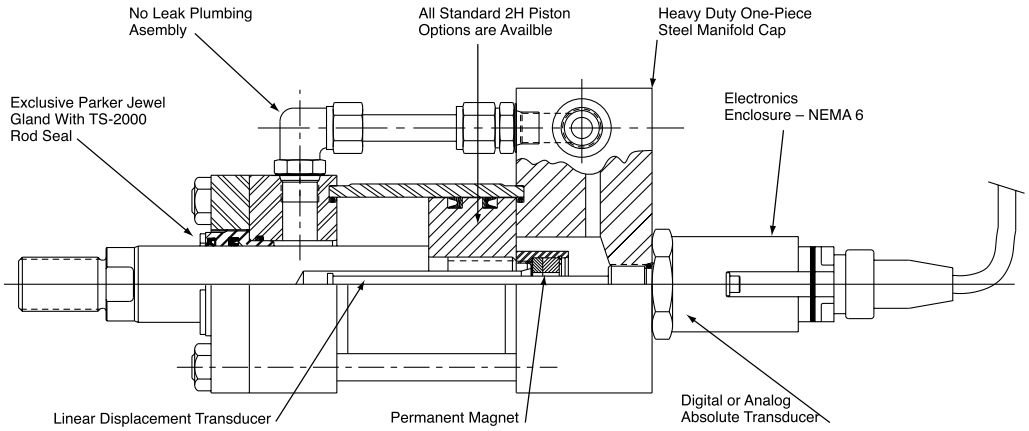
- Minimum hydraulic line runs with close cylinder and valve coupling.
- Simplified machine design with integrated components.
- Eliminates need for limit switches, deceleration valves, shock absorbers, and mechanical linkages in many applications.
- Minimum interference with standard mounting dimensions.
- Blank manifold caps can be machined to meet customer valve mounting specifications.
- Integral mounted valve eliminates assembly time and fittings.
- Custom supplied servo valve and equivalent feedback device can be integrated into the cylinder.

Custom Options Available

- Low friction rod gland – see page 211 for specifications.
- Low friction piston – see page C34 for specifications.
- Protective feedback enclosures.
- Intrinsically safe modifications.
- Explosion proof linear transducers.
- Feedback devices in stock for quick delivery of common stroke lengths.
- Closed-loop control for maximum productivity.
- Performance-tested actuators.
- Complete, tested cylinder/feedback assemblies customized to your needs.

For additional information – call your local Parker Cylinder Distributor.

2HX with Integral Valve Manifold and Magnetorestrictive Linear Displacement Transducer (LDT)

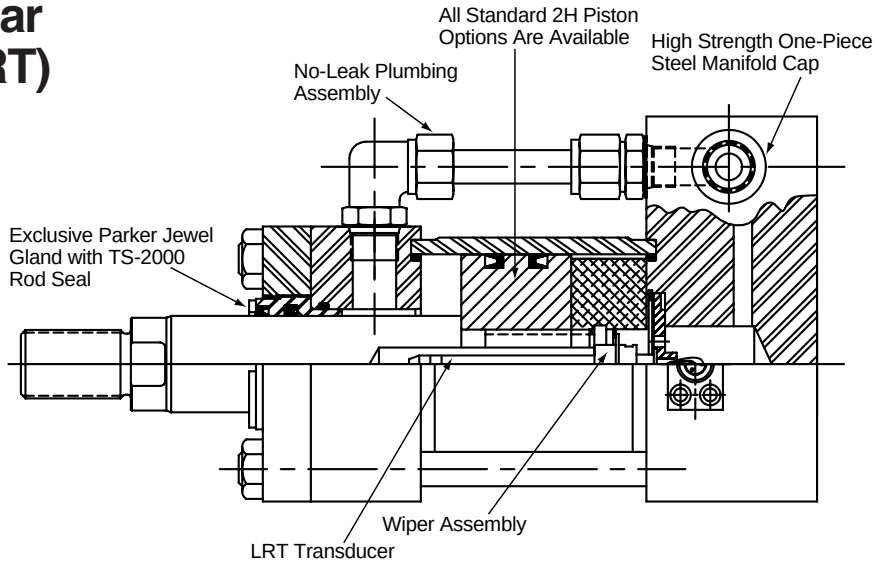


Here's How The Parker LDT Feeds Back Linear Position

The linear displacement transducer is rigidly attached to the cap end of the cylinder, and runs the full stroke length inside a hollow piston rod. A magnet is attached to the cylinder piston. As the piston moves through the stroke, the transducer is able to define the exact position of the magnet by measuring the time interval between the initiation and the return of strain pulses launched in the transducer wave guide.

For LDT specifications see page 204.

2HX with Integral Valve Manifold and Linear Potentiometer (LRT)



Here's How The Parker LRT Feeds Back Linear Position

The LRT feedback device is essentially a linear potentiometer which provides a cost effective solution for applications where a contacting device is acceptable. The potentiometer is fixed to the rear cap of the cylinder and runs the full length inside a hollow piston rod. The wiper assembly is fixed to the piston. As the piston moves through the stroke, the wiper voltage changes in proportion to the cylinder position.

For specifications on the LRT see page 209.

Integral Manifolds

Parker Series 2HX cylinders are available with integral valve mounts. There are four standard patterns available. All Integral Valve Patterns will be supplied on the cap end at position #1. Special Valve Patterns may be supplied — consult factory. Integral Valve Mounts are available on 2" through 5" Bores.

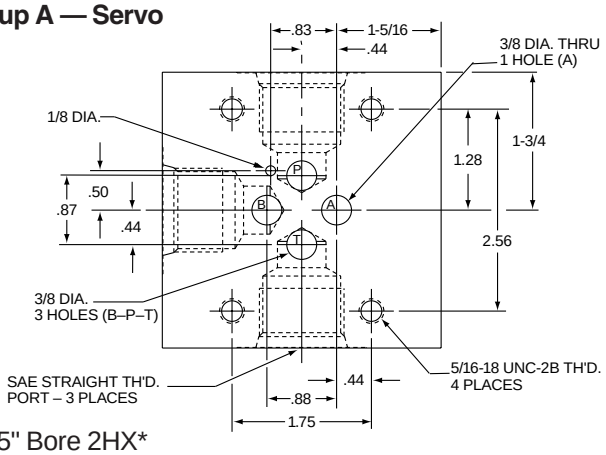
Servo Valve Mounting Interchange Chart

(All Valves in Each Group Have Interchangeable Mounts)

Group A	Group D
Parker BD-15	Parker BD-30
Atchley 215A-XXX	Atchley 240-XXX
MOOG 62 Series MOOG 73 Series MOOG 760 Series	MOOG 78 Series
Pegasus M & MP Series	Pegasus 180L Pegasus 180R
Vickers SM4-20-X-X-10	Vickers SM4-40-X-X-10

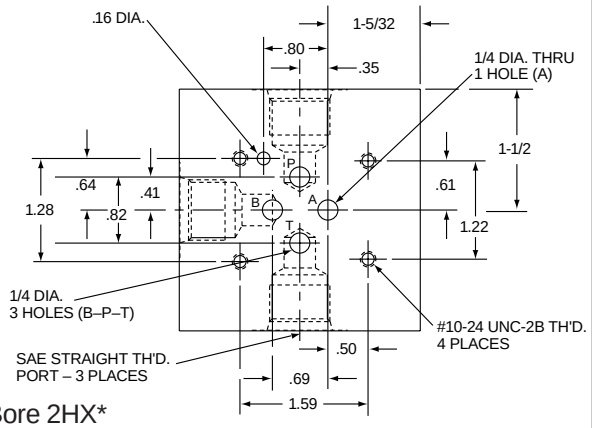
Standard Integral Valve Patterns

Group A — Servo



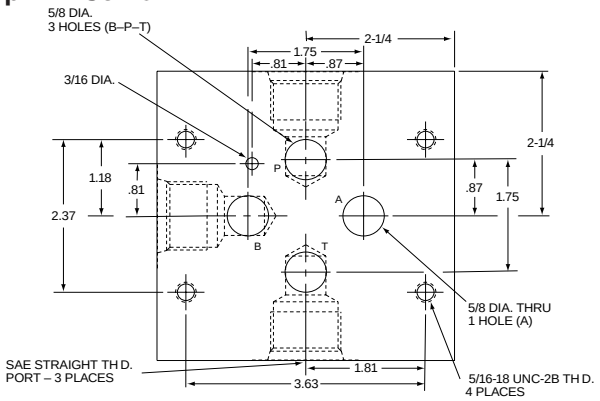
2" - 5" Bore 2HX*

Group G — NFPA DO3



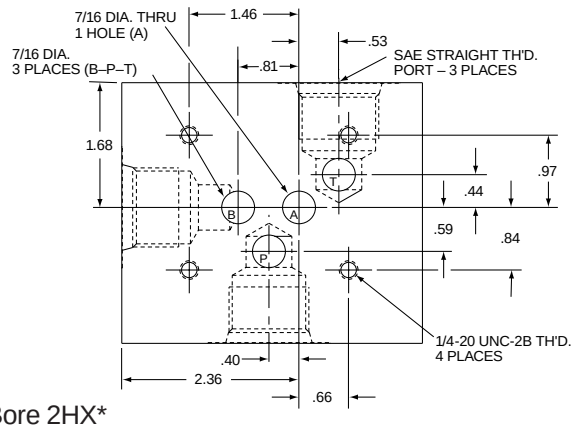
2" - 5" Bore 2HX*

Group D — Servo



2" - 5" Bore 2HX*

Group H — NFPA DO5



2" - 5" Bore 2HX*

*Note: For Integral Manifolds on larger bore sizes consult factory.

For additional information – call your local Parker Cylinder Distributor.

2HX with Integral Manifold — General Information

Bore & Rod Diameters

Standard bore and rod diameters for electro-hydraulic actuators are shown on the following pages of this catalog. Other sizes can be supplied as specials on request.

For heavy-duty or high-cycling applications, the use of a larger rod diameter is recommended. Refer to Section C, page 96 for proper sizing of piston rods.

Stroke Length

If an integrally mounted position transducer is specified, the maximum stroke length will normally be limited by the type of transducer.

Stop Tube

An internal stop tube (piston spacer) is recommended in cases where the combination of stroke length and mounting style option could result in excessive bearing loads on the piston or rod gland. Please refer to Section C of this catalog.

A stop tube may also be used to eliminate the need for an extended rod end with the LDT Model.

Mounting Styles

Mounting styles available as standard on 2HX integral manifold actuators are shown in this catalog. If other mountings are required, please consult factory.

Cushioning

On cylinders fitted with integral feedback, cushioning is available as a standard option at both ends. Double rod (equal area) cylinders can have the normal cushion option at both ends.

Pressure Ratings

Series 2HX integral manifold actuators have a nominal working pressure of 3000 psi. Recommended maximum working pressures for 2HX integral manifold actuators with Feedback option (LDT or LRT) are given below. These pressure ratings are given as a guide for typical applications. For applications involving high cycle rates, high frequencies or shock loads, please consult factory.

Parker Series 2HX Pressure Ratings

Bore	Rod No.	Rod Dia. MM	4 to 1 Design Factor (PSI)*
2	1	1	3000†
	2	1 3/8	3000
2 1/2	1	1	1800†
	2	1 3/4	3000
	3	1 3/8	3000
3 1/4	1	1 3/8	2130
	2	2	3000
	3	1 3/4	3000
4	1	1 3/4	2580
	2	2 1/2	3000
	3	2	3000
5	1	2	2510
	2	3 1/2	3000
	3	2 1/2	3000
	4	3	3000

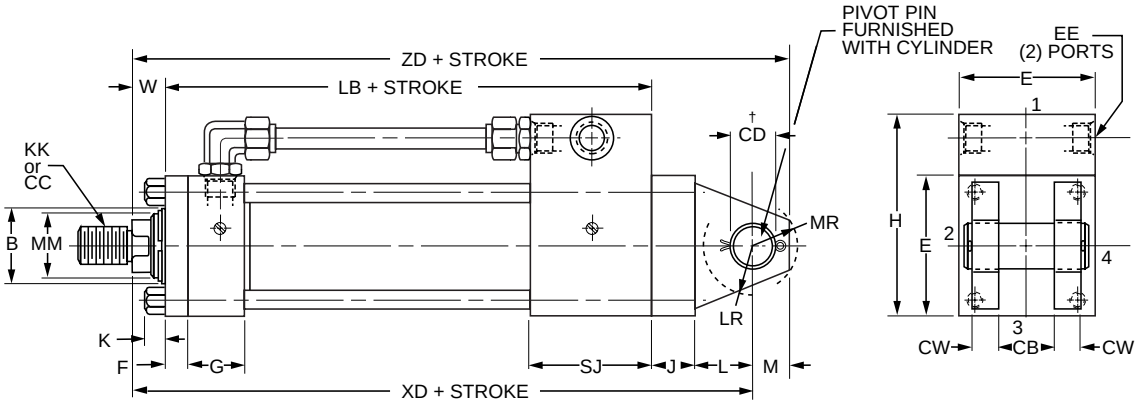
*The 4 to 1 design factor is based on the tensile strength of the piston to rod connection.

†A mini LRT (MLRT) is available for 1" Rods – Consult Factory.

B

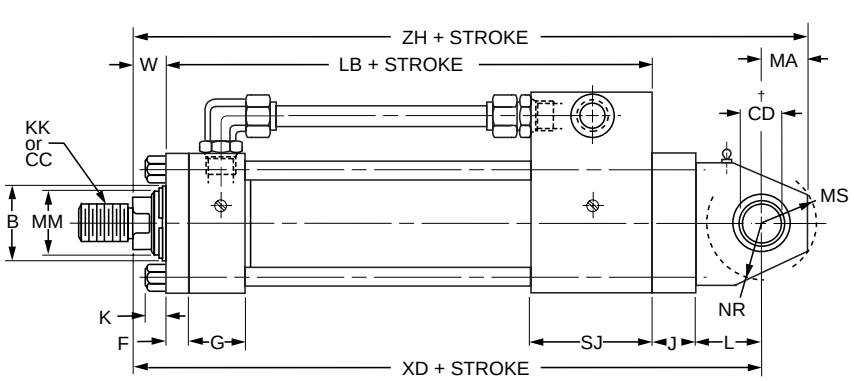
Cap Fixed Clevis

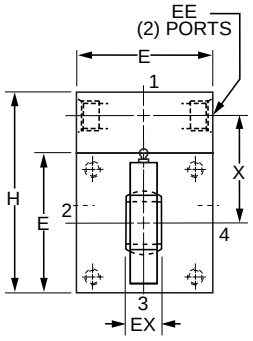
Style BB with No Feedback



Cap Spherical Bearing

Style SB with No Feedback



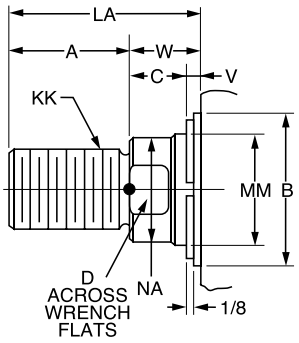


SB	Pressure Rating
2"	2200
2½"	1450
3¼"	1500
4	1850
5"	2000

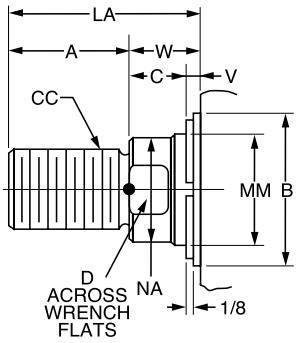
Pressure rating is for maximum life of cylinder and bearing based on dynamic load of commercial bearing.

Rod End Dimensions — See Table 2

Thread Style 4
(NFPA Style SM)



Thread Style 8
(NFPA Style IM)



"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1 — Envelope and Mounting Dimensions

Bore	E	SAE EE *	SAE EE **	F	G	H *	H **	J	K	L	M	X *	X **	LR	MR	CB	CW	+.000 -.002 CD†	EX	MA	MS	NR	LB Add Stroke *	LB Add Stroke **	SJ *	SJ **
2	3	10	NA	5/8	1 3/4	4 7/8	NA	1 1/2	7/16	1 1/4	3/4	1 7/8	NA	1	15/16	1 1/4	5/8	.751	21/32	1	1 3/8	1	6 5/8	8 1/8	2 7/8	NA
2 1/2	3 1/2	10	12	5/8	1 3/4	5 3/8	5 5/8	1 1/2	7/16	1 1/4	3/4	2 1/4	3.04	15/16	15/16	1 1/4	5/8	.751	21/32	1	1 3/8	1	6 3/4	8 1/4	2 7/8	4 3/8
3 1/4	4 1/2	12	12	3/4	2	6 5/8	6 5/8	1 1/2	9/16	1 1/2	1	2 3/4	3.54	1 1/4	1 3/16	1 1/2	3/4	1.001	7/8	1 1/4	1 11/16	1 1/4	7 3/8	8 7/8	2 7/8	4 3/8
4	5	12	12	7/8	2	7 1/8	7 1/8	1 3/4	9/16	2 1/8	1 3/8	3 1/8	3.125	1 3/4	1 5/8	2	1	1.376	1 3/16	1 7/8	2 7/16	1 5/8	9 1/4	9 1/4	4 3/8	4 3/8
5	6 1/2	12	12	7/8	2	8 5/8	8 5/8	1 3/4	13/16	2 1/4	1 3/4	3 5/8	3.625	2 1/16	2 1/8	2 1/2	1 1/4	1.751	1 17/32	2 1/2	2 7/8	2 1/16	9 3/4	9 3/4	4 3/8	4 3/8

†Dimension CD is pin diameter.
*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
** For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H.

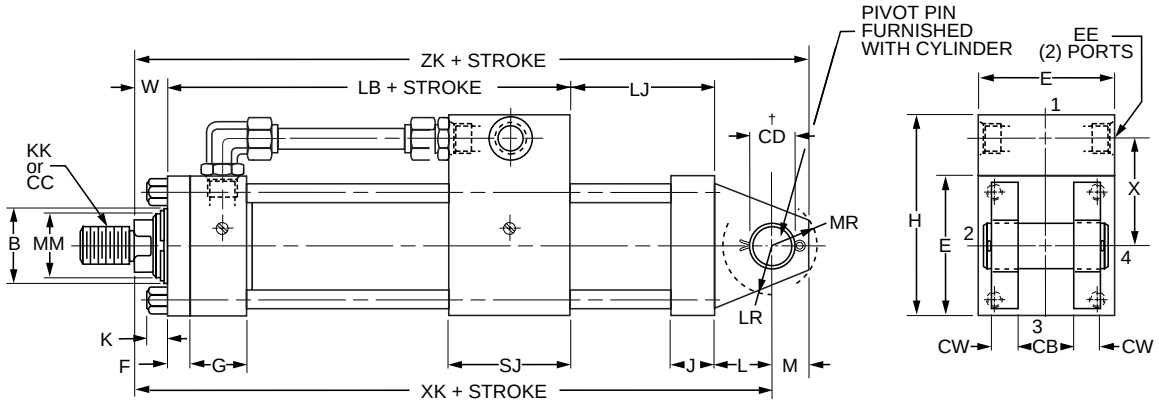
Table 2 — Rod End and Envelope Dimensions

Bore	Rod No.	Rod Dia. MM	Thread CC	Thread KK	A	+.000 -.002 B	C	D	LA	NA	V	W	Add Stroke XD *	Add Stroke XD **	Add Stroke ZD *	Add Stroke ZD **	Add Stroke ZH *	Add Stroke ZH **
2	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	10 3/8	11 7/8	11 1/8	12 5/8	11 3/8	12 7/8
2 1/2	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	10 3/4	12 1/14	11 1/2	13	11 3/4	13 1/4
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	10 1/2	12	11 1/4	12 3/4	11 1/2	13
3 1/4	1	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	11 1/4	12 3/4	12 1/4	13 3/4	12 1/2	14
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	11 5/8	13 1/8	12 5/8	14 1/8	12 7/8	14 3/8
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	11 1/2	13	12 1/2	14	12 3/4	14 1/4
4	1	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3	1 11/16	1/4	1	14 1/8	14 1/8	15 1/2	15 1/2	16	16
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	14 1/2	14 1/2	15 7/8	15 7/8	16 3/8	16 3/8
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	14 1/4	14 1/4	15 5/8	15 5/8	16 1/8	16 1/8
5	1	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	14 7/8	14 7/8	16 5/8	16 5/8	17 3/8	17 3/8
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 7/8	3 3/8	3/8	1 3/8	15 1/8	15 1/8	16 7/8	16 7/8	17 5/8	17 5/8
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	15 1/8	15 1/8	16 7/8	16 7/8	17 5/8	17 5/8
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	4 7/8	2 7/8	3/8	1 3/8	15 1/8	15 1/8	16 7/8	16 7/8	17 5/8	17 5/8

*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
** For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H.

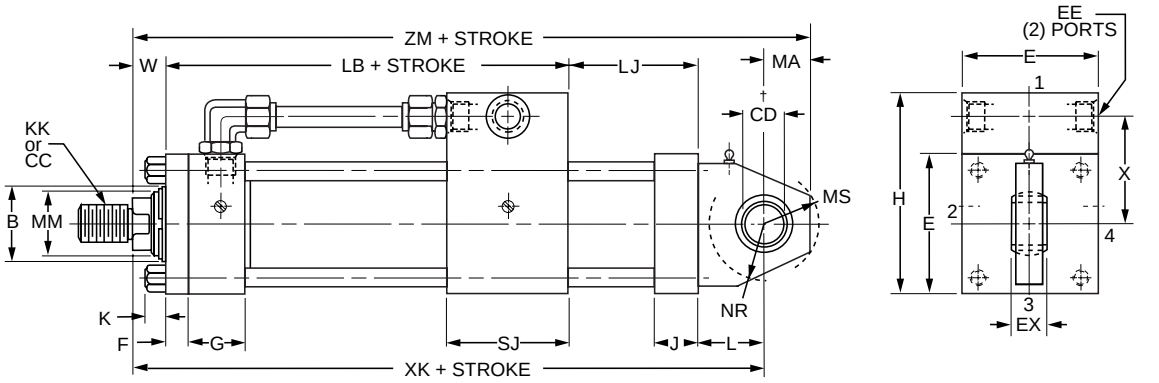
Cap Fixed Clevis

Style BB with LDT and LRT Feedback



Cap Spherical Bearing

Style SB with LDT and LRT Feedback

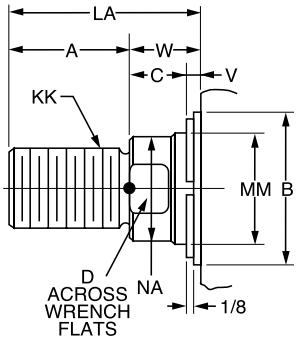


SB	Pressure Rating
2"	2200
2½"	1350
3¼"	1350
4"	1400
5"	1800

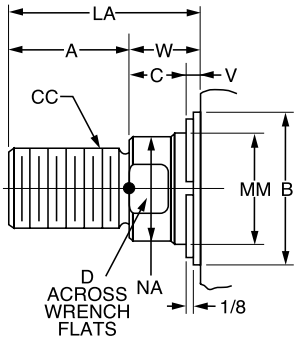
Pressure rating is for maximum life of cylinder and bearing based on dynamic load of commercial bearing.

Rod End Dimensions — See Table 2

Thread Style 4
(NFPA Style SM)



Thread Style 8
(NFPA Style IM)



"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1 — Envelope and Mounting Dimensions

Bore	E	SAE EE *	SAE EE **	F	G	H *	H **	J	K	L	M	X *	X **	LR	MR	CB	CW	+.000 -.002 CD†	EX	MA	MS	NR	LB Add Stroke *	LB Add Stroke **	SJ *	SJ **	LJ††
2	3	10	NA	5/8	1 3/4	4 7/8	NA	1 1/2	7/16	1 1/4	3/4	1 7/8	NA	1	15/16	1 1/4	5/8	.751	21/32	1	1 3/8	1	6 5/8	NA	2 7/8	NA	5 1/2
2 1/2	3 1/2	10	12	5/8	1 3/4	5 3/8	5 5/8	1 1/2	7/16	1 1/4	3/4	2 1/4	3.04	15/16	15/16	1 1/4	5/8	.751	21/32	1	1 3/8	1	6 3/4	8 1/4	2 7/8	4 3/8	5 1/2
3 1/4	4 1/2	12	12	3/4	2	6 5/8	6 5/8	1 1/2	9/16	1 1/2	1	2 3/4	3.54	1 1/4	1 3/16	1 1/2	3/4	1.001	7/8	1 1/4	1 11/16	1 1/4	7 3/8	8 7/8	2 7/8	4 3/8	5 1/2
4	5	12	12	7/8	2	7 1/8	7 1/8	1 3/4	9/16	2 1/8	1 3/8	3 1/8	3.125	1 3/4	1 5/8	2	1	1.376	1 3/16	1 7/8	2 7/16	1 5/8	9 1/4	9 1/4	4 3/8	4 3/8	5 3/4
5	6 1/2	12	12	7/8	2	8 5/8	8 5/8	1 3/4	13/16	2 1/4	1 3/4	3 5/8	3.625	2 1/16	2 1/8	2 1/2	1 1/4	1.751	1 17/32	2 1/2	2 7/8	2 1/16	9 3/4	9 3/4	4 3/8	4 3/8	5 3/4

†Dimension CD is pin diameter.
*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
** For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H.
††"RO" style integral cable only on LDT.
For RB style connection on LDT consult factory for LJ, ZK, XK dimensions.
Velocity of LRT actuators must not exceed 30 ips.

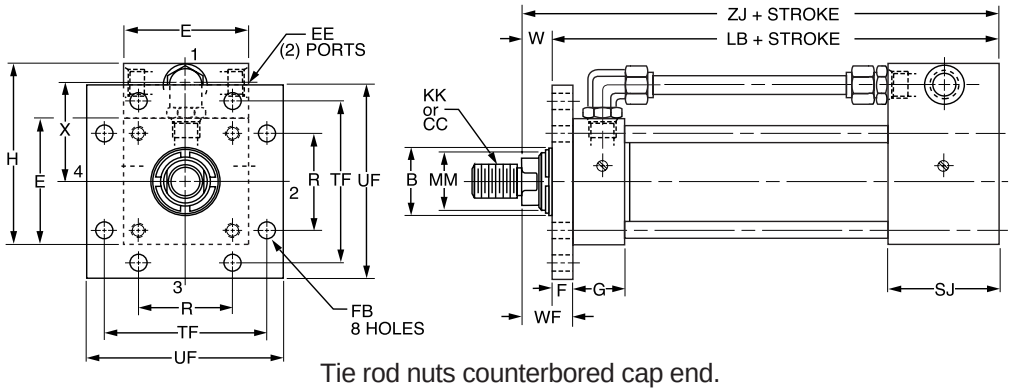
Table 2 — Rod End and Envelope Dimensions

Bore	Rod No.	Rod Dia. MM	Thread CC	Thread KK	A	+.000 -.002 B	C	D	LA	NA	V	W	Add Stroke XK *	Add Stroke XK **	Add Stroke ZK *	Add Stroke ZK **	Add Stroke ZM *	Add Stroke ZM **
2	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	14 3/8	15 7/8	15 1/8	16 5/8	15 3/8	16 7/8
2 1/2	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	14 3/4	16 1/14	15 1/2	17	15 3/4	17 1/4
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	14 1/2	16	15 1/4	16 3/4	15 1/2	17
3 1/4	1	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	15 1/4	16 3/4	16 1/4	17 3/4	16 1/2	18
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	15 5/8	17 1/8	16 5/8	18 1/8	16 7/8	18 3/8
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	15 1/2	17	16 1/2	18	16 3/4	18 1/4
4	1	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3	1 11/16	1/4	1	18 1/8	18 1/8	19 1/2	19 1/2	20	20
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	18 1/2	18 1/2	19 7/8	19 7/8	20 3/8	20 3/8
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	18 1/4	18 1/4	19 5/8	19 5/8	20 1/8	20 1/8
5	1	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	18 7/8	18 7/8	20 5/8	20 5/8	21 3/8	21 3/8
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 7/8	3 3/8	3/8	1 3/8	19 1/8	19 1/8	20 7/8	20 7/8	21 5/8	21 5/8
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	19 1/8	19 1/8	20 7/8	20 7/8	21 5/8	21 5/8
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	4 7/8	2 7/8	3/8	1 3/8	19 1/8	19 1/8	20 7/8	20 7/8	21 5/8	21 5/8

Note: Electrical port or connector will be provided at position 1 of rear cap.
Mounting styles BB, B, SB with analog LDT feedback require the use of Analog Output Module (AOM).
*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
** For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H.

Head Square Flange

Style JB — All Feedback Types



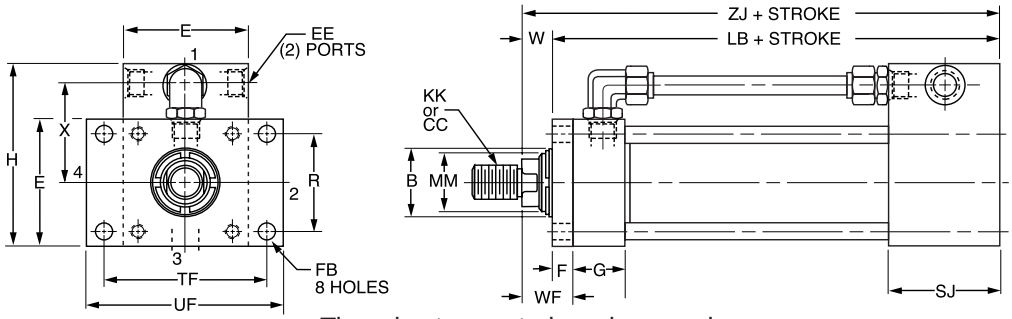
Tie rod nuts counterbored cap end.

Head Rectangular Flange

Style J — All Feedback Types

Bore Size	Max. PSI — Push* Rod Code 1	2	3	4	5
1 1/2	2500	1500	—	—	—
2	2500	1500	—	—	—
2 1/2	2500	1500	1900	—	—
3 1/4	2500	1500	2100	—	—
4	2500	1500	1800	—	—
5	2200	750	1650	1200	—

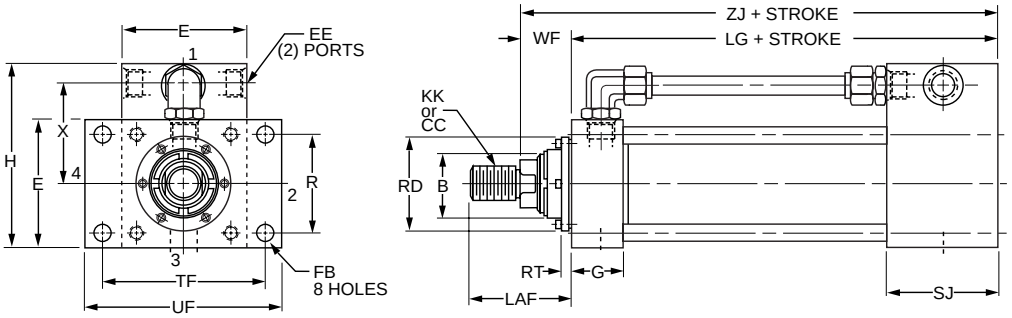
*Maximum pressure rating — push application.



Tie rod nuts counterbored cap end.

Head Rectangular

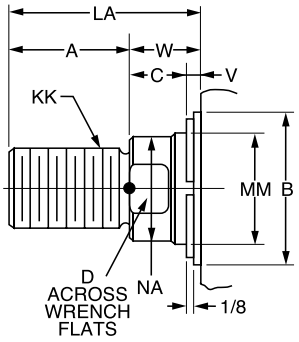
Style JJ — All Feedback Types



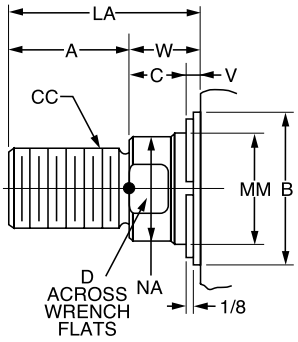
Tie rod nuts counterbored cap end.

Rod End Dimensions — See Table 2

Thread Style 4
(NFPA Style SM)



Thread Style 8
(NFPA Style IM)



"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1 — Envelope and Mounting Dimensions

Bore	E	SAE EE *	SAE EE **	F	G	H *	H **	K	R	X *	X **	FB	TF	UF	LB Add Stroke *	LB Add Stroke **	LG Add Stroke *	LG Add Stroke **	SJ *	SJ **
2	3	10	NA	5/8	1 3/4	4 7/8	NA	7/16	2.05	1 7/8	NA	9/16	4 1/8	5 1/8	6 5/8	NA	6	NA	2 7/8	NA
2 1/2	3 1/2	10	12	5/8	1 3/4	5 3/8	5 5/8	7/16	2.55	2 1/4	3.04	9/16	4 5/8	5 5/8	6 3/4	8 1/4	6 1/8	7 5/8	2 7/8	4 3/8
3 1/4	4 1/2	12	12	3/4	2	6 5/8	6 5/8	9/16	3.25	2 3/4	3.54	11/16	5 7/8	7 1/8	7 3/8	8 7/8	6 5/8	8 1/8	2 7/8	4 3/8
4	5	12	12	7/8	2	7 1/8	7 1/8	9/16	3.82	3 1/8	3.125	11/16	6 3/8	7 5/8	9 1/4	9 1/4	8 3/8	8 3/8	4 3/8	4 3/8
5	6 1/2	12	12	7/8	2	8 5/8	8 5/8	13/16	4.95	3 5/8	3.625	15/16	8 3/16	9 3/4	9 3/4	9 3/4	8 7/8	8 7/8	4 3/8	4 3/8

*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
**For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H. Velocity of LRT actuators must not exceed 30 ips.

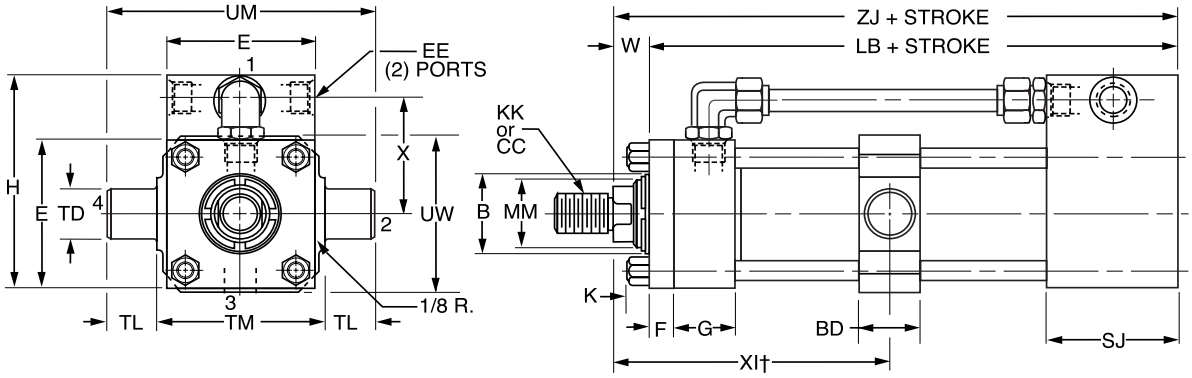
Table 2 — Rod End and Envelope Dimensions

Bore	Rod No.	Rod Dia. MM	Thread CC	Thread KK	A	+.000 -.002 B	C	D	LA	LAF	NA	V	W	Max. RD	RT	WF	ZJ Add Stroke *	ZJ Add Stroke **
2	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	3 1/4	1 5/16	3/8	1	3	3/8	1 5/8	7 5/8	9 1/8
2 1/2	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	3 7/8	1 11/16	1/2	1 1/4	3 1/2	3/8	1 7/8	8	9 1/2
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	3 1/4	1 5/16	3/8	1	3	3/8	1 5/8	7 3/4	9 1/4
3 1/4	1	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	3 1/4	1 5/16	1/4	7/8	3	3/8	1 5/8	8 1/4	9 3/4
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	4 1/4	1 15/16	3/8	1 1/4	4	5/8	2	8 5/8	10 1/8
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	3 7/8	1 11/16	3/8	1 1/8	3 1/2	3/8	1 7/8	8 1/2	10
4	1	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3	3 7/8	1 11/16	1/4	1	3 1/2	3/8	1 7/8	10 1/4	10 1/4
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	5 1/4	2 3/8	3/8	1 3/8	4 1/2	5/8	2 1/4	10 5/8	10 5/8
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	4 1/4	1 15/16	1/4	1 1/8	4	5/8	2	10 3/8	10 3/8
5	1	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	4 1/4	1 15/16	1/4	1 1/8	4	5/8	2	10 7/8	10 7/8
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 7/8	5 3/4	3 3/8	3/8	1 3/8	5 3/4	5/8	2 1/4	11 1/8	11 1/8
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	5 1/4	2 3/8	3/8	1 3/8	4 1/2	5/8	2 1/4	11 1/8	11 1/8
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	4 7/8	5 3/4	2 7/8	3/8	1 3/8	5 1/4	5/8	2 1/4	11 1/8	11 1/8

*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
**For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H. Velocity of LRT actuators must not exceed 30 ips.

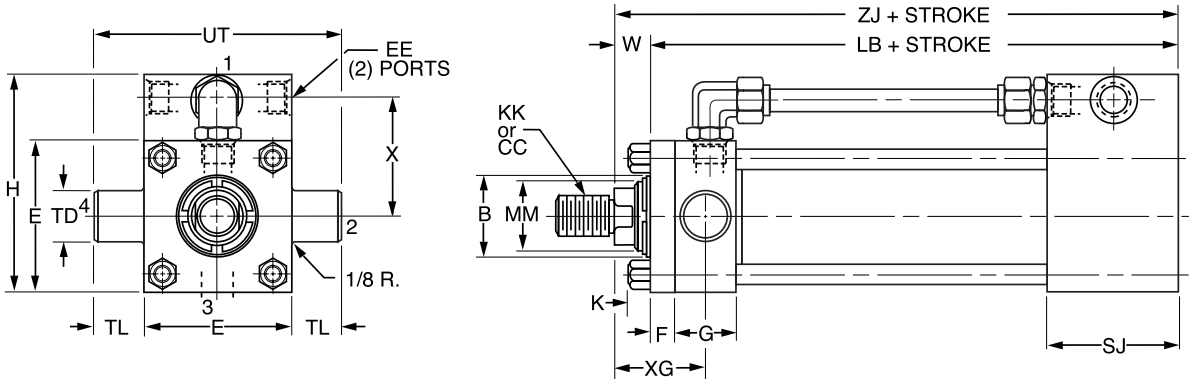
Intermediate Trunnion

Style DD — All Feedback Types



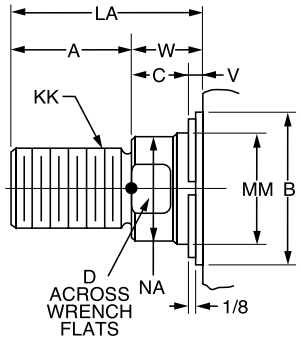
Head Trunnion

Style D — All Feedback Types

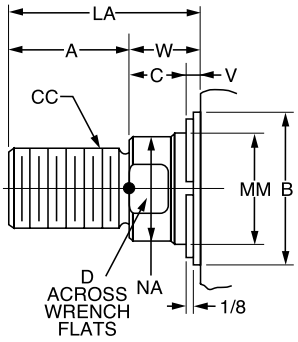


Rod End Dimensions — See Table 2

Thread Style 4
(NFPA Style SM)



Thread Style 8
(NFPA Style IM)



"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1 — Envelope and Mounting Dimensions

Bore	BD	E	SAE EE *	SAE EE **	F	G	H *	H **	K	X *	X **	+.000 -.001 TD	TL	TM	UW	UM	UT	LB Add Stroke *	LB Add Stroke **	SJ *	SJ **
2	1 1/2	3	10	NA	5/8	1 3/4	4 7/8	NA	7/16	1 7/8	NA	1.375	1 3/8	3 1/2	4 1/8	6 1/4	5 3/4	6 5/8	NA	2 7/8	NA
2 1/2	1 1/2	3 1/2	10	12	5/8	1 3/4	5 3/8	5 5/8	7/16	2 1/4	3.04	1.375	1 3/8	4	4 5/8	6 3/4	6 1/4	6 3/4	8 1/4	2 7/8	4 3/8
3 1/4	2	4 1/2	12	12	3/4	2	6 5/8	6 5/8	9/16	2 3/4	3.54	1.750	1 3/4	5	5 13/16	8 1/2	8	7 3/8	8 7/8	2 7/8	4 3/8
4	2	5	12	12	5/8	2	7 1/8	7 1/8	9/16	3 1/8	3.125	1.750	1 3/4	5 1/2	6 3/8	9	8 1/2	9 1/4	9 1/4	4 3/8	4 3/8
5	2	6 1/2	12	12	7/8	2	8 5/8	8 5/8	13/16	3 5/8	3.625	1.750	1 3/4	7	7 3/4	10 1/2	10	9 3/4	9 3/4	4 3/8	4 3/8

*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
** For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H. Velocity of LRT actuators must not exceed 30 ips.

Table 2 — Rod End and Envelope Dimensions

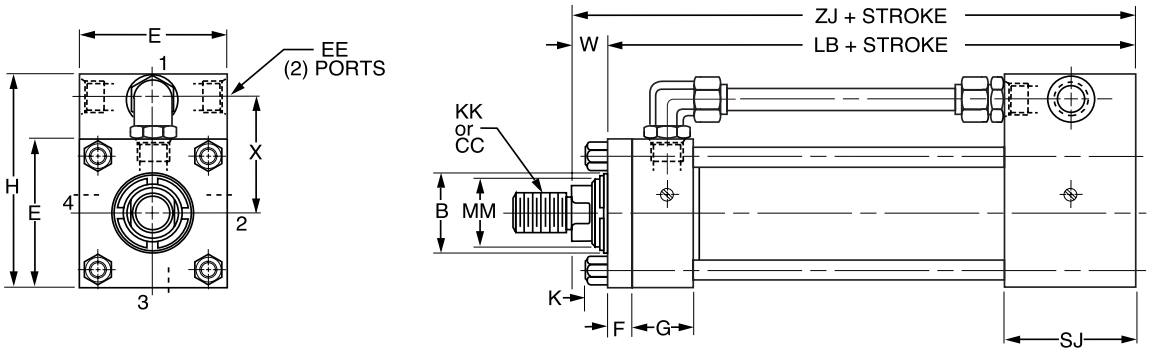
Bore	Rod No.	Rod Dia. MM	Thread CC	Thread KK	A	+.000 -.002 B	C	D	LA	NA	V	W	XG	Min. XI†	ZJ Add Stroke *	ZJ Add Stroke **
2	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 1/2	4 3/16	7 5/8	9 1/8
2 1/2	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	2 3/4	4 7/16	8	9 1/2
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	2 1/2	4 3/16	7 3/4	9 1/4
3 1/4	1	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	2 5/8	4 11/16	8 1/4	9 3/4
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	3	5 1/16	8 5/8	10 1/8
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	2 7/8	4 15/16	8 1/2	10
4	1	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3	1 11/16	1/4	1	2 7/8	4 15/16	10 1/4	10 1/4
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	3 1/4	5 5/16	10 5/8	10 5/8
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	3	5 1/16	10 3/8	10 3/8
5	1	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	3	5 1/16	9 7/8	10 7/8
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 7/8	3 3/8	3/8	1 3/8	3 1/4	5 5/16	11 1/8	11 1/8
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	3 1/4	5 5/16	11 1/8	11 1/8
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	4 7/8	2 7/8	3/8	1 3/8	3 1/4	5 5/16	11 1/8	11 1/8

†Dimension XI to be specified by customer.
*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
** For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H.

B

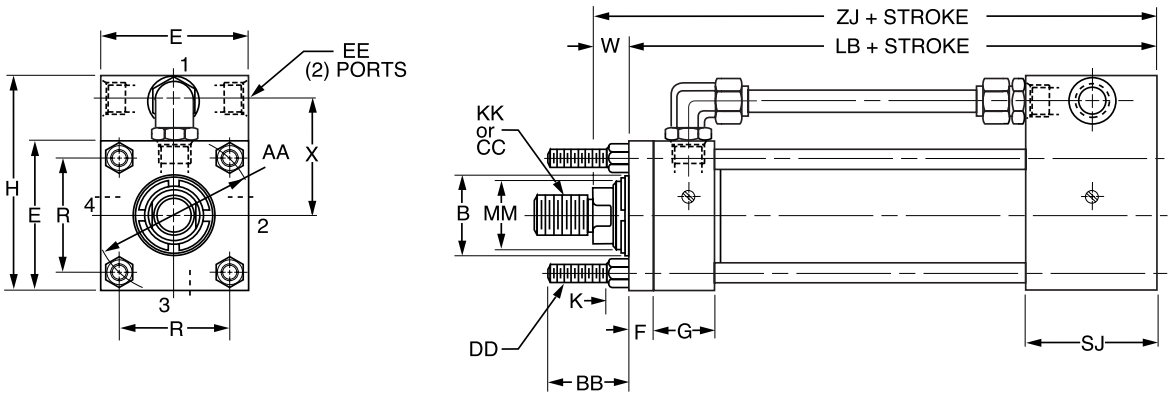
No Mount

Style T — All Feedback Types



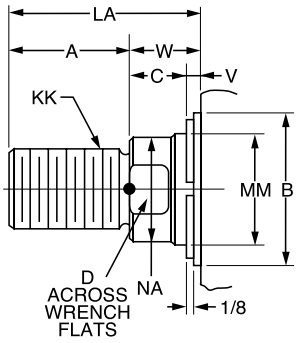
Tie Rods Extended Head End

Style TB — All Feedback Types

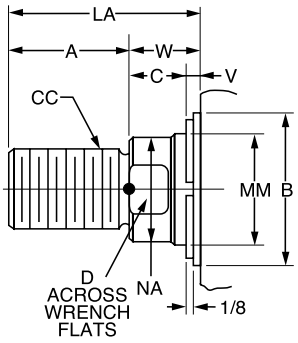


Rod End Dimensions — See Table 2

Thread Style 4
(NFPA Style SM)



Thread Style 8
(NFPA Style IM)



"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1 — Envelope and Mounting Dimensions

Bore	AA	BB	DD	E	SAE EE *	SAE EE **	F	G	H *	H **	K	R	X *	X **	LB Add Stroke *	LB Add Stroke **	SJ *	SJ **
2	2.90	1 13/16	1/2-20	3	10	NA	5/8	1 3/4	4 7/8	NA	7/16	2.05	1 7/8	NA	6 5/8	NA	2 7/8	NA
2 1/2	3.60	1 13/16	1/2-20	3 1/2	10	12	5/8	1 3/4	5 3/8	5 5/8	7/16	2.55	2 1/4	3.04	6 3/4	8 1/4	2 7/8	4 3/8
3 1/4	4.60	2 5/16	5/8-18	4 1/2	12	12	3/4	2	6 5/8	6 5/8	9/16	3.25	2 3/4	3.54	7 3/8	8 7/8	2 7/8	4 3/8
4	5.40	2 5/16	5/8-18	5	12	12	7/8	2	7 1/8	7 1/8	9/16	3.82	3 1/8	3.125	9 1/4	9 1/4	4 3/8	4 3/8
5	7.00	3 3/16	7/8-14	6 1/2	12	12	7/8	2	8 5/8	8 5/8	13/16	4.95	3 5/8	3.625	9 3/4	9 3/4	4 3/8	4 3/8

*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
**For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H. Velocity of LRT actuators must not exceed 30 ips.

Table 2 — Rod End and Envelope Dimensions

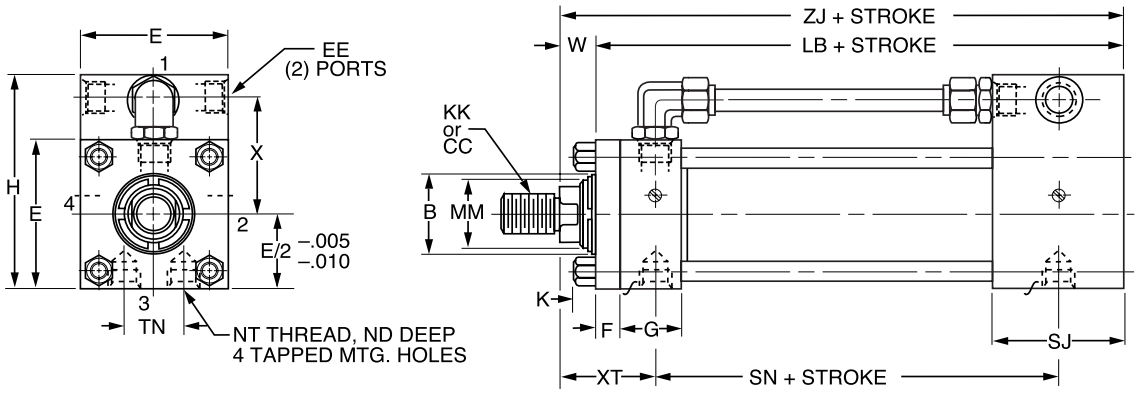
Bore	Rod No.	Rod Dia. MM	Thread CC	Thread KK	A	+.000 -.002 B	C	D	LA	NA	V	W	ZJ Add Stroke *	ZJ Add Stroke **
2	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	7 5/8	9 1/8
2 1/2	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	8	9 1/2
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	7 3/4	9 1/4
3 1/4	1	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	8 1/4	9 3/4
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	8 5/8	10 1/8
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	8 1/2	10
4	1	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3	1 11/16	1/4	1	10 1/4	10 1/4
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	10 5/8	10 5/8
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	10 3/8	10 3/8
5	1	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	9 7/8	10 7/8
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 7/8	3 3/8	3/8	1 3/8	11 1/8	11 1/8
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	11 1/8	11 1/8
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	4 7/8	2 7/8	3/8	1 3/8	11 1/8	11 1/8

*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
**For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H.

B

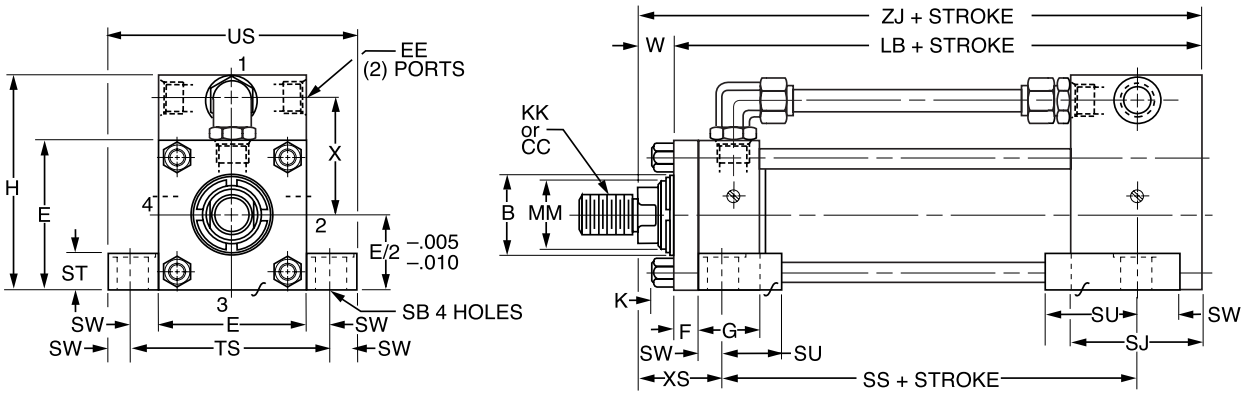
Side Tapped

Style F — All Feedback Types



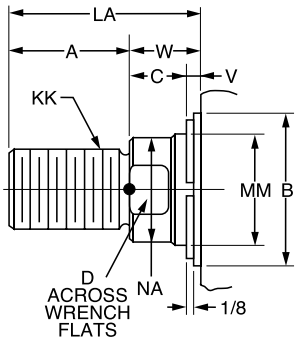
Side Lugs

Style C — All Feedback Types

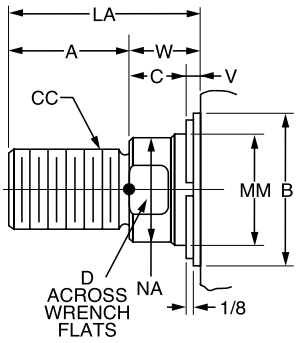


Rod End Dimensions — See Table 2

Thread Style 4
(NFPA Style SM)



Thread Style 8
(NFPA Style IM)



"Special" Thread Style 3

Special thread, extension, rod eye, blank, etc., are also available.

To order, specify "Style 3" and give desired dimensions for CC or KK, A and LA. If otherwise special, furnish dimensioned sketch.

For additional information – call your local Parker Cylinder Distributor.

Table 1 — Envelope and Mounting Dimensions

Bore	E	SAE EE *	SAE EE **	F	G	H *	H **	J	K	X *	X **	NT	SB†	ST	SU	SW	TN	TS	US	LB Add Stroke *	LB Add Stroke **	SJ *	SJ **	Add Stroke SS	Add Stroke SN
2	3	10	NA	5/8	1 3/4	4 7/8	NA	1 1/2	7/16	1 7/8	NA	1/2-13	9/16	3/4	1 1/4	1/2	15/16	4	5	6 5/8	NA	2 7/8	NA	3 5/8	2 7/8
2 1/2	3 1/2	10	12	5/8	1 3/4	5 3/8	5 5/8	1 1/2	7/16	2 1/4	3.04	5/8-11	13/16	1	1 9/16	11/16	15/16	4 7/8	6 1/4	6 3/4	8 1/4	2 7/8	4 3/8	3 3/8	3
3 1/4	4 1/2	12	12	3/4	2	6 5/8	6 5/8	1 1/2	9/16	2 3/4	3.54	3/4-10	13/16	1	1 9/16	11/16	1 1/2	5 7/8	7 1/4	7 3/8	8 7/8	2 7/8	4 3/8	4 1/8	3 1/2
4	5	12	12	7/8	2	7 1/8	7 1/8	1 3/4	9/16	3 1/8	3.125	1-8	1 1/16	1 1/4	2	7/8	2 1/16	6 3/4	8 1/2	9 1/4	9 1/4	4 3/8	4 3/8	4	3 3/4
5	6 1/2	12	12	7/8	2	8 5/8	8 5/8	1 3/4	13/16	3 5/8	3.625	1-8	1 1/16	1 1/4	2	7/8	2 15/16	8 1/4	10	9 3/4	9 3/4	4 3/8	4 3/8	4 1/2	4 1/4

*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
**For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H. Velocity of LRT actuators must not exceed 30 ips.
† Upper surface spot faced for socket head screws.

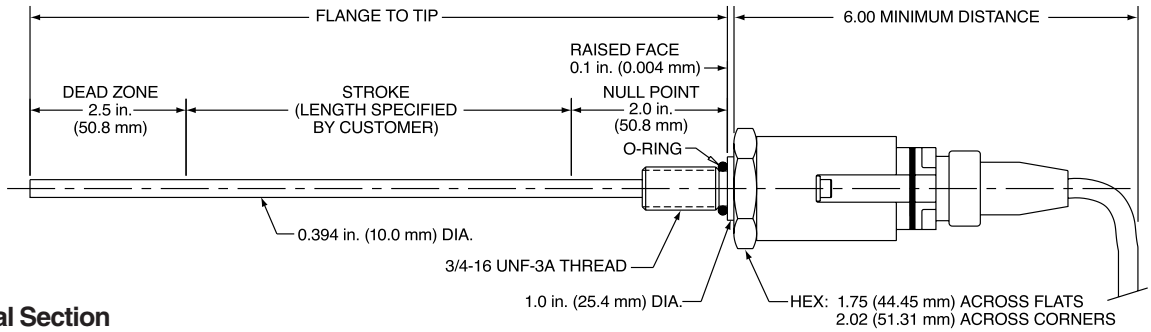
Table 2 — Rod End and Envelope Dimensions

Bore	Rod No.	Rod Dia. MM	Thread Style 8 CC	Thread Style 4 & 9 KK	A	+.000 -.002 B	C	D	LA	NA	V	W	ND	XS	XT	ZJ Add Stroke *	ZJ Add Stroke **
2	2	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	7/16	2 1/8	2 5/8	7 5/8	9 1/8
2 1/2	2	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/4	1 11/16	1/2	1 1/4	1/2	2 9/16	2 7/8	8	9 1/2
	3	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 5/8	1 5/16	3/8	1	1/2	2 5/16	2 5/8	7 3/4	9 1/4
3 1/4	1	1 3/8	1 1/4-12	1-14	1 5/8	1.999	5/8	1 1/8	2 1/2	1 5/16	1/4	7/8	11/16	2 5/16	2 3/4	8 1/4	9 3/4
	2	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 1/2	1 15/16	3/8	1 1/4	11/16	2 11/16	3 1/8	8 5/8	10 1/8
	3	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3 1/8	1 11/16	3/8	1 1/8	11/16	2 9/16	3	8 1/2	10
4	1	1 3/4	1 1/2-12	1 1/4-12	2	2.374	3/4	1 1/2	3	1 11/16	1/4	1	11/16	2 3/4	3	10 1/4	10 1/4
	2	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	11/16	3 1/8	3 3/8	10 5/8	10 5/8
	3	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	11/16	2 7/8	3 1/8	10 3/8	10 3/8
5	1	2	1 3/4-12	1 1/2-12	2 1/4	2.624	7/8	1 11/16	3 3/8	1 15/16	1/4	1 1/8	1	2 7/8	3 1/8	9 7/8	10 7/8
	2	3 1/2	3 1/4-12	2 1/2-12	3 1/2	4.249	1	3	4 7/8	3 3/8	3/8	1 3/8	1	3 1/8	3 3/8	11 1/8	11 1/8
	3	2 1/2	2 1/4-12	1 7/8-12	3	3.124	1	2 1/16	4 3/8	2 3/8	3/8	1 3/8	1	3 1/8	3 3/8	11 1/8	11 1/8
	4	3	2 3/4-12	2 1/4-12	3 1/2	3.749	1	2 5/8	4 7/8	2 7/8	3/8	1 3/8	1	3 1/8	3 3/8	11 1/8	11 1/8

*For lower flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group A, G.
**For higher flow valves — see Standard Integral Valve Patterns in this 2HX Section, Group D, H.

Transducer

LDT Technical Specifications

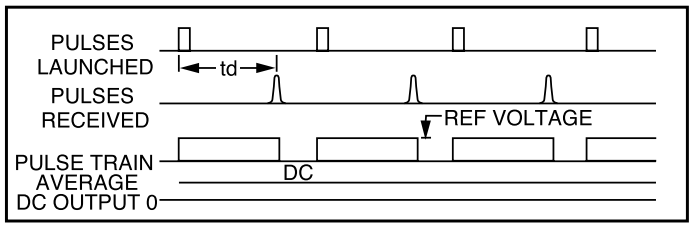


LDT Technical Section

The 2HX-LDT Actuator is the most versatile actuator that we offer. Utilizing the Temposonics LH™ feedback device, there are three distinct outputs available to suit most applications. Velocity is limited primarily by the limits of mechanical components outside of the actuator, although position update time can affect the system ramp-down. The 2HX-LDT Actuator is the industry favorite in tough, rugged machinery applications. A key advantage is the absolute position output which is not lost if there is a power failure.

Magnetostriction

In a LDT position sensor, a pulse is induced in a specially-designed magnetostrictive waveguide by the momentary interaction of two magnetic fields. One field comes from a movable magnet which passes along the outside of the sensor tube, the other field comes from a current pulse or interrogation pulse launched along the waveguide. The interaction between the two magnetic fields produces a strain pulse, which travels at sonic speed along the waveguide until the pulse is detected at the head of the sensor. The position of the magnet is determined with high precision by measuring the elapsed time between the launching of the electronic interrogation pulse and the arrival of the strain pulse. As a result, accurate non-contact position sensing is achieved with absolutely no wear to the sensing components.



An average of 200 ultrasonic strain pulses are launched for every reading. With so many readings taken for each position, vibration and shock have negligible effect on the readings. The transducer assembly is shielded to eliminate interference caused by electromagnetic fields in the radio frequency range. In addition, static magnetic fields of several hundred gauss must get as close as $^{3}/_{16}$" from the protective tube before any interference in transducer operation occurs.

Features

- High immunity to shock and vibration
- Replaceable sensing element
- Single voltage input +13 to 26.4Vdc
- 3000 psi operating pressure
- Multiple outputs from on-board electronics
- Easy installation and maintenance
- Standard strokes up to 100" (analog), 120" (digital)
- Includes 5' extension cable with RB connector standard

If cylinder includes false stage enclosure, LDT will be supplied with RO Integral Pigtail Cable (5' length). Refer to pages 194 and 195 for “LJ” and “E” dimensions.

Feedback Accuracy

The accuracy of a given feedback device is a composite of a number of factors, the most important of which are:

Resolution – The smallest movement of the device that will produce a measurable output.

Non-Linearity – The deviation of the signal from a straight line output.

Repeatability – The maximum deviation of output signal for repeated positioning to a fixed point.

Hysteresis – The deviation of the signal when approaching a fixed point from opposite directions.

Temperature Coefficient – The shift in output due to temperature change. This is a combination of the effect of temperature on the cylinder, the transducer and the electronics.

These factors which are normally additive refer to the feedback device itself. The performance achieved by a given system depends on the various factors such as system stiffness, valve performance, friction, temperature variation, and backlash in mechanical linkages to the cylinder.

In the case of front flange mounted cylinders, the stretch of the cylinder due to hydraulic pressure changes may affect position repeatability and system performance.

For additional information – call your local Parker Cylinder Distributor.

Standard Specifications

Parameter	Specification
Resolution:	*Analog:* Infinite *Digital:* 1 ÷ [gradient x crystal freq. (mHz) x circulation]
Non-Linearity:	±0.02% or ±0.05 mm (±0.002 in.), whichever is greater 0.002 in. is the minimum absolute linearity and varies with sensor model
Repeatability:	Equal to resolution
Hysteresis:	<0.02 mm (0.0008 in.)
Outputs:	*Analog:* Voltage or Current *Digital:* Start/Stop or PWM
Measuring Range:	*Analog:* 25 to 2540 mm (1 to 100 in.) *Digital:* 25 to 7600 mm (1 to 300 in.)
Operating Voltage:	+13.5 to 26.4 Vdc (±0%): Strokes ≤1525 mm (60 in.) +24 Vdc (±10%): Strokes > 1525 mm (60 in.)
Power Consumption:	100 mA
Operating Temperature:	*Head Electronics:* -40 to 85°C (-40 to 185°F) *Sensing Element:* -40 to 105°C (-40 to 221°F)
EMC Test*:	DIN EN 50081-1 (Emissions); DIN EN 50082-2 (Immunity)
Shock Rating:	100 g (single hit)/IEC standard 68-2-27 (survivability)
Vibration Rating:	5 g/10-150 Hz/IEC standard 68-2-6
Adjustability: *(for active sensors only)*	Field adjustable zero and span to 5% of active stroke
Update Time:	*Analog:* ≤1 ms *Digital:* Minimum = [Stroke (specified in inches) + 3] x 9.1 µs
Operating Pressure:	5000 psi static; 10,000 psi spike
Housing Style/ Enclosure:	Aluminum die-cast head, IP 67 stainless steel rod & flange (LH flange: M18 x 1.5 or 3/4-16 UNF-3A)

**EMC test specification does not include sensors with the RB connection style.*

The above specifications for analog sensors are assuming that output ripple is averaged by the measuring device as with any typical analog device. Specifications are subject to change without notice. Consult the factory for specifications critical to your needs.

***Note:** LDT comes standard with an RB style connector and 5' extension cable. If cylinder includes style A protective enclosure, LDT will be supplied with RO Integral Pigtail Cable (5' length).*

***Note:** Velocity output or velocity and position output requires use of an AOM.*

LDT Output Options

The LDT utilizes on-board electronics contained in the sensor head to generate several absolute output options. The required output must be specified at the time of order. In applications where it is desirable to locate the output electronics in a remote location, or where the sensor head is not accessible, an optional Analog Output Module (AOM) is available. The standard outputs for each option are listed below.

Standard LDT Outputs

- Analog Position (absolute)
  0 to +10V DC or +10 to 0V DC
  4 to 20mA or 20 to 4mA (grounded)
  0 to 20mA or 20 to 0mA (grounded)
- Digital Position (absolute)
  Differential Start/Stop
  PWM Pulse Duration
- Neuter (For use with AOM)
  Single Pulse Square Wave

Note: Velocity output or velocity and position output requires use of an AOM.

Analog Output Module: AOM Option

The Analog Output Module provides an absolute analog displacement or optional velocity output signal. It contains the electronics to send the interrogation pulse to the LDT and receive the return pulse from the LDT. The AOM is mounted separately from the LDT and comes standard with strain relief connectors. Optional MS connectors are available.

Note: An LDT with Neuter output is required for use with an AOM. AOM is recommended to allow adjustment for cap mounting styles B, BB and SB.

Optional metal MS connectors are only available for connection to the AOM. The connection at the probe requires an MS-style connector. For applications requiring true MS connectors at the probe, consult factory.

AOM Output Specifications

Displacement Outputs:

Voltage

0 to 10V DC — forward and reverse acting (forward standard)
0 to -10V DC — forward and reverse acting
-10 to +10V DC — forward and reverse acting
0 to +5V DC — forward and reverse acting
-5 to +5V DC — forward and reverse acting

Current

4 to 20 mA grounded (forward and reverse)
4 to 20 mA ungrounded (forward and reverse)

Velocity Outputs:

inches/second = ±10V DC
(1 to 400 in/sec)

Power Supply:

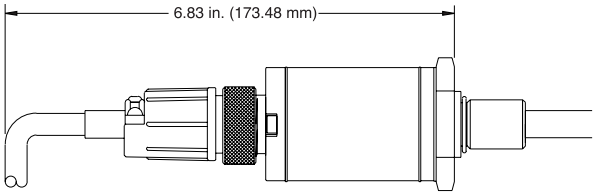
+24V DC standard
±15V DC optional

For Cylinder Division Plant Locations – See Page II.

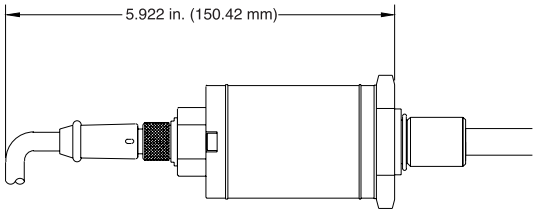
LDT Connector Options

The LDT is available with three standard Connector Options as shown below. The style RB connector with a 5' extension cable is standard except for BB and SB mounting styles. RO style connector is standard for BB and SB mounting styles with a false stage enclosure. Please specify the connector option at the time of order.

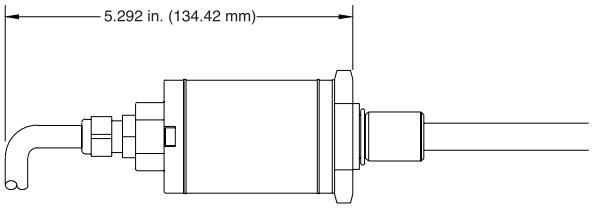
Style RB — Connector with Cable



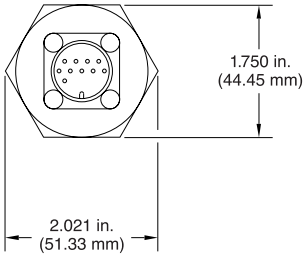
Style RG – Connector with Cable



Style RO — Integral Pigtail Cable



Hex Dimensions



TOP VIEW

Table A — LDT Wiring with RB* Style Connector and Cable

For Temposonics LH™		Pulse-Duration Output (External Interrogation)	Pulse-Duration Output (Internal Interrogation)	Start/Stop Output	Neuter Output	Analog Output (Voltage or Current)	
Pin No.	Wire Color Solid Leads (Note 2)	Function	Function	Function	Function	Function	Function
1	White	DC Ground	DC Ground	DC Ground	DC Ground	DC Ground	DC Ground
2	Brown	Frame Ground	Frame Ground	Frame Ground	Frame Ground	Frame Ground	Frame Ground
3	Gray	(-) Gate	(-) Gate	(-) Gate	—	0 - 10 Vdc Return	Current Return
4	Pink	(+) Gate	(+) Gate	(+) Gate	—	0 to 10 Vdc	4 to 20 mA or 0 to 20 mA or 20 to 4mA or 20 to 0 mA *(See Figure A-1)*
5	Red	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc
6	Blue	—	—	—	—	—	—
7	Black	—	—	—	Signal Return	10 to 0 Vdc	—
8	Violet	—	—	—	Signal Output	10 - 0 Vdc Return	—
9	Yellow	(+) Interrogation (Note 4)	—	(+) Interrogation	(+) Interrogation (Note 3)	—	—
10	Green	(-) Interrogation (Note 4)	—	(-) Interrogation	(+) Interrogation (Note 3)	—	—

Notes for Table A:

1. Interrogation pulse: 1 to 4 microseconds maximum pulse duration.
2. **WARNING:** For single-ended interrogation, the unused interrogation lead must be connected to DC ground.
3. When using a Temposonics LH™ position sensor with a pulse-width-modulated output (w/external interrogation) or Start/Stop output, it is recommended that both the positiive and negative interrogations leads are connected to a differentiated driving source to produce a differential interrogation signal.
4. **Important:** Frame ground should always be connected. When using MT, M, FT or F extension cables frame ground is the BROWN wire.

* RB style connectors are supplied as standard on all LDT's unless specified otherwise.

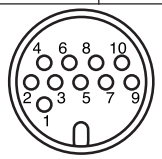


Figure A-1 — LDT Pin Diagram

For additional information – call your local Parker Cylinder Distributor.

Table B: LDT Wiring with Integral Pigtail Cable*

	Pulse-Duration Output (External Interrogation)	Pulse-Duration Output (Internal Interrogation)	Start/Stop Output	Neuter Output	Analog Output (Voltage or Current)	
Integral Cable Color Code	Function	Function	Function	Function	Function (Voltage)	Function (Current)
White	DC Ground	DC Ground	DC Ground	DC Ground	DC Ground	DC Ground
Drain Wire	Frame Ground	Frame Ground	Frame Ground	Frame Ground	Frame Ground	Frame Ground
Gray	(-) Gate	(-) Gate	(-) Gate	Signal Return	0 - 10 Vdc Return	4 to 20 mA Out
Pink	(+) Gate	(+) Gate	(+) Gate	Signal Output	0 to 10 Vdc	Return *(See Figure B-1)*
Red	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc	+13.5 to 26.4 Vdc
Yellow	(+) Interrogation (Note 3)	—	(+) Interrogation (Note 3)	(+) Interrogation (Note 2)	10 to 0 Vdc	
Green	(-) Interrogation (Note 3)	—	(-) Interrogation (Note 3)	(-) Interrogation (Note 2)	10 - 0 Vdc Return	

Notes for Table A:
1. Interrogation pulse: 1 to 4 microseconds maximum pulse duration.
2. **Warning:** For single-ended interrogation, the unused interrogation lead must be connected to DC ground.
3. When replacing a Temposonics II™ position sensor with a pulse-duration output (with external interrogation) or a Start/Stop output, it is recommended that both the positive and negative interrogation leads are connected to a differentiated driving source to produce a differential interrogation signal.
4. **Important:** Frame ground should always be connected.

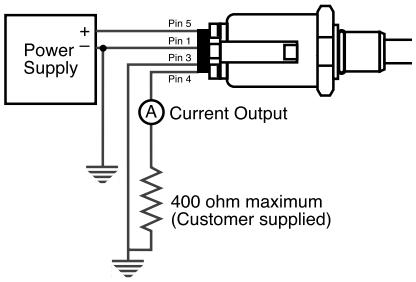


Figure B-1 —
LDT with Current Output

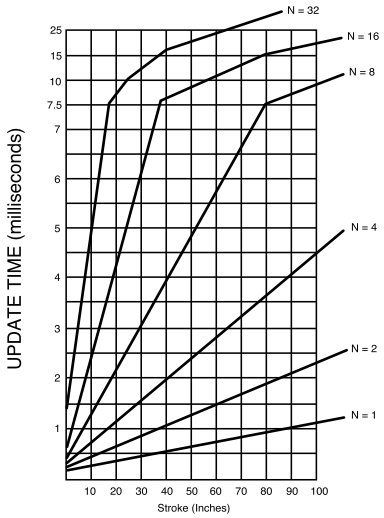
Note: Style RO Integral Pigtail Cables are supplied as standard on LDTs used with styles A and F protective enclosures.

B

Digital Output Signal (PWM)

The Digital Output Electronics mounted in the head of the LDT provides the interrogation pulse to the probe. The pulse is reflected to the Digital Output Electronics by the magnet which strokes along the length of the transducer.

Figure 1. Update time (ms) = [(4.5 + stroke) inches x 0.01086 ms] x N



The LDT with PWM Digital Output provides a 5 Vdc TTL compatible pulse with modulated square wave signal which can be transmitted to a digital counter card, Parker PMC Motion Controller, or various other customer supplied devices. The amount of time, in milliseconds, that the output is “Hi,” or near 5 volts, is directly proportional to the position of the cylinder piston. This time can also be called the “width” of the square wave in milliseconds. Besides being proportional to the position of the cylinder piston, this width can be controlled by varying the signal sampling rate (called “recirculations”). The advantage of increasing the recirculations is in improved resolution. The sacrifice is in update time and maximum stroke length. Figure 1 shows the relationship of recirculations, minimum update time, and stroke length. Figure 2 shows the relationship of recirculations, resolution, and stroke.

We recommend the TTL interface for most LDT applications requiring digital feedback; many electronic controllers are equipped to utilize this output. BCD and natural binary outputs are available — consult factory.

Figure 2 —
Recirculations, Resolutions and Stroke Length

Term Base = 28 Megahertz Clock					
Recirculations	1	2	4	8	15
Resolution (inches/pulse)	0.004	0.002	0.001	0.0005	0.00035
Maximum stroke (inches)	258	127	61	28	12

Parker Series 2HX with LDT and Analog Output Module (AOM)

Wiring Connections and Analog Output Module Dimensions

An electrical Noise Filter and Low Ripple Output Filter are standard.

Analog Output Module

Shown with strain relief cable connectors.
Refer to Installation Bulletin 1170-TSD-2 for more detailed wiring information.

Terminal Block Connections

Terminal Block 1 — Output Signal Connections

TB1-A Displacement Output (+)
TB1-B Displacement Output (-)
TB1-C Velocity (+) (Optional)
TB1-D Velocity (-) (Optional)
TB1-E Reserved for Options
TB1-F Reserved for Options
TB1-G Reserved for Options
Note: For the optional pin assignments refer to the label inside the module.

Terminal Block 2 — Transducer Connections (LDT with Neuter Output)

Terminal	Pre-1995 Cable Colors	1995 Cable Colors	Function
TB2-B	White/Blue Stripe	White	DC Ground
	Blue/White Stripe	Brown	Frame
	White/Brown Stripe	Black	Return
	Gray/White Stripe	Green	DC Ground
TB2-C	Brown/White Stripe	Violet	Return Pulse Output
TB2-E	White/Gray Stripe	Yellow	Interrogation Pulse
TB2-F	White/Green Stripe	Red	VCC (12 Vdc)

Note: Cable must be grounded at or near AOM.
Note: The Transducer is supplied with a pre-wired cable.

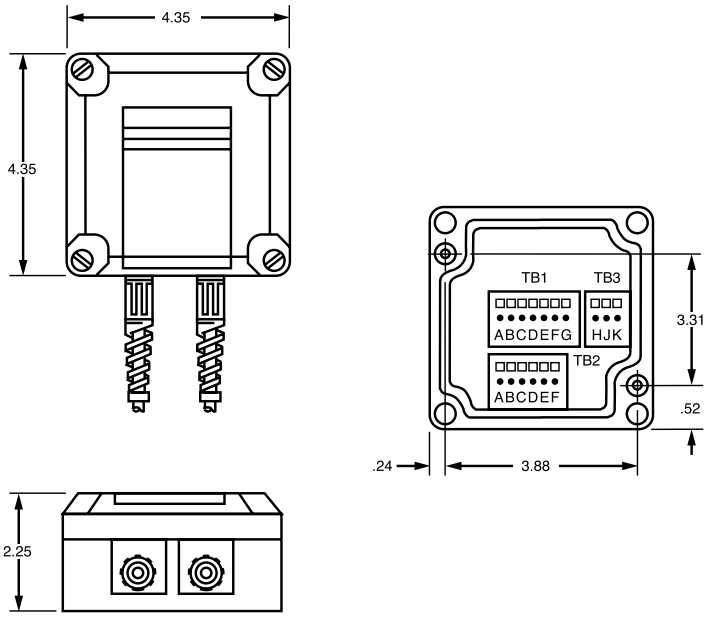
Terminal Block 3 — Power Supply Connections

TB3-H +15 Vdc
TB3-J -15 Vdc
TB3-K DC Common

Mounting

(2) Socket Hex Cap Screws
#10-32 UNF-2A Thread

Max. distance from transducer - 250 ft.

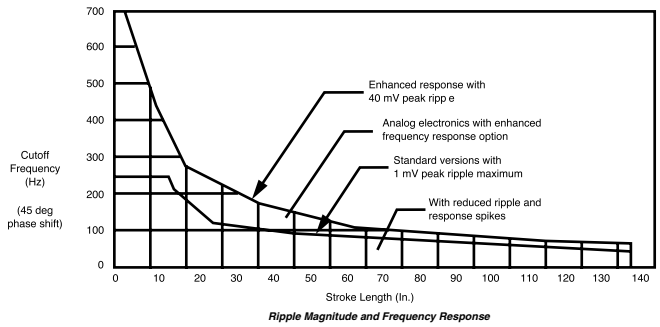


Note: AOMs require the use of an LDT with Neuter Output.

Frequency Response

Analog Systems

The analog output module produces a DC output signal with an AC ripple component. The group shown illustrates the following relationship between frequency response and AC ripple.



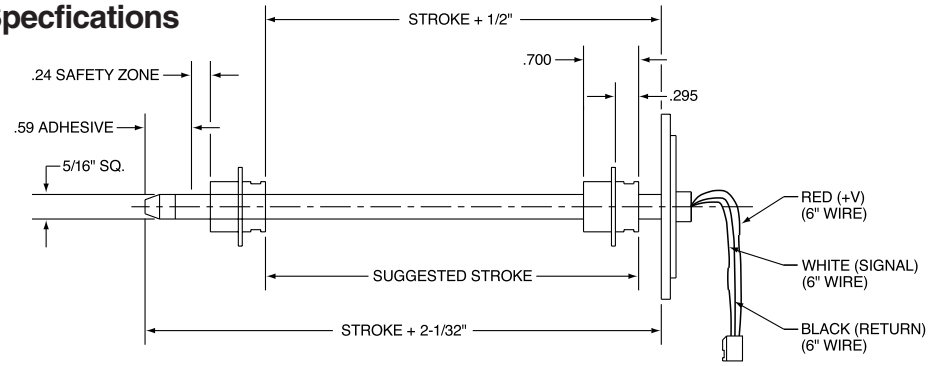
Ripple Magnitude and Frequency Response

It shows that the AC ripple fundamental frequency is related to stroke length. For shorter strokes, this frequency is usually beyond the response capability of the analog control loop. Notice that the ripple frequency equals the frequency of the interrogation pulse.

It shows how the magnitude of the ripple is related to frequency response. You can enhance response by allowing the ripple to increase. Alternatively, you can use a low level of ripple, with reduced response, for applications where response is less critical, such as required for A/D converters with high resolution. Unless specified, the response will be on the 1 mV curve.

For additional information – call your local Parker Cylinder Distributor.

Transducer
LRT Technical Specfications



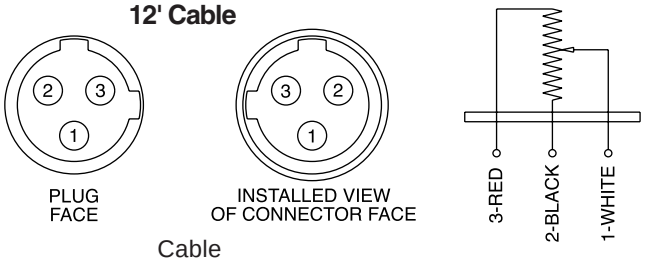
Standard Features

- Available in strokes to 120".
- Unique, easy to apply cylinder position sensing system.
- Infinite resolution, high linearity and repeatability.
- Innovative, resistive element is made of conductive plastic.
- 3 pin Brad Harrison electrical connector available at any cap position not occupied by a port or mount.

How It Works

The Parker LRT is a uniquely designed position sensor that uses a resistive element and wiper assembly to provide an analog output signal of a cylinder's position. The LRT is a dual element type linear potentiometer with two independent elements mounted on either side of an anodized aluminum extrusion. The LRT operates as a voltage divider. This is done by shorting through the extrusion with the wiper assembly. The position of the wiper changes the resistive load proportional to its position along the cylinder stroke. The LRT is energized by applying a voltage across the unit, typically 10 VDC. As the resistive load changes with the cylinder stroke, the output voltage changes proportionally. The output voltage at the end point of the cylinder stroke is dictated by the input voltage applied across the device. The probe is mounted into the cylinder cap and inserted into the gun drilled piston rod. The compactness of the design only adds to the envelope dimensions of cylinders with 1-3/4" rods and smaller. Envelope dimensions of cylinders with larger rods and integral cap style cylinders are unaffected.

12' Cable



Cable
#0854430012

Standard Specifications

Non-Linearity: Less than 0.1% of full scale up to 48" stroke. Less than 1.0% of full scale over 48" stroke.

Repeatability: .001 inch

Input Voltage: Nominal 5-50 Vdc

Operating Temperature Range: -40°F to +160°F*

Cylinder Stroke Length: Up to 120"

Electrical Connector: Brad Harrison 3-pin micro connector interface at position #4 standard.

Total Resistance: 800 per inch of stroke (±20%) + end resistance.

End Resistance: 800

Maximum Velocity: 30 inches per second

Life Expectancy: Greater that 50 x 10^6 cycles (Based on 1" stroke @ 10 ips)

Fluid Medium: Petroleum based hydraulic fluids. May not be used with water based or high water content fluids.

End Voltage Loss: (V source) x (400/stroke x 800)

Power Dissipation: supply voltage squared, divided by the total resistance.

The LRT requires a high impedance interface greater than 100K ohms. A maximum of 1 microamp should be required from the LRT.

The accuracy of a given feedback device is a composite of the following factors:

Temperature Coefficient: The shift in output due to temperature change. This is a combination of the effect of temperature on the cylinder, the transducer and the electronics.

These factors which are normally additive refer to the feedback device itself. The performance achieved by a given system depends on the various factors such as system stiffness, valve performance, friction, temperature variation, and backlash in mechanical linkages to the cylinder.

In the case of front flange mounted cylinders, the stretch of the cylinder due to hydraulic pressure changes may affect position repeatability and system performance.

*A high temperature option is offered to 300°F (consult factory).

Pin Chart

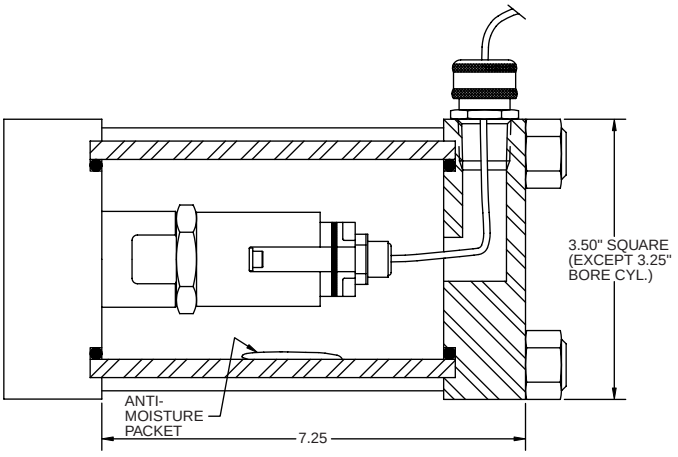
Pin Number	On Cable	On LRT	Function
1	Green	White (wiper)	Ouput
2	Red w/Blk	Black (resistor base)	V-
3	Red w/White	Red (resistor tip. power)	V+

B

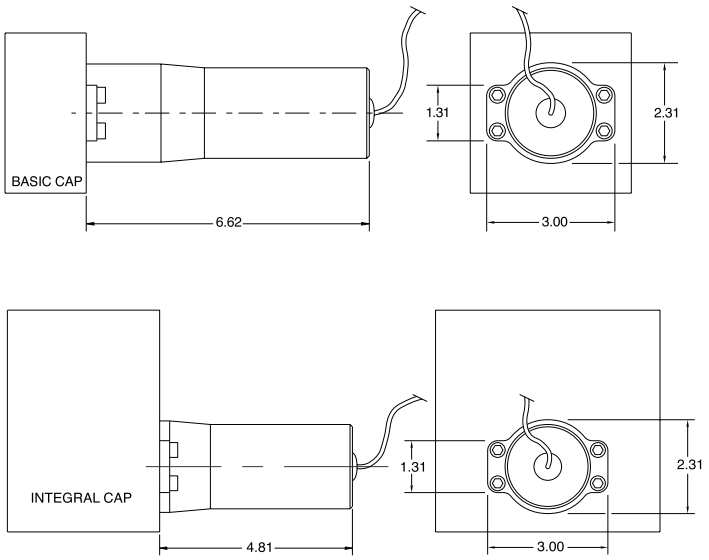
Protective Enclosures for Feedback Devices

Style A — For LDT and LRT, all bore sizes. Extra heavy-duty enclosure consisting of cylinder body tube and end cap. Consult factory for dimensions. Connector type must be specified.

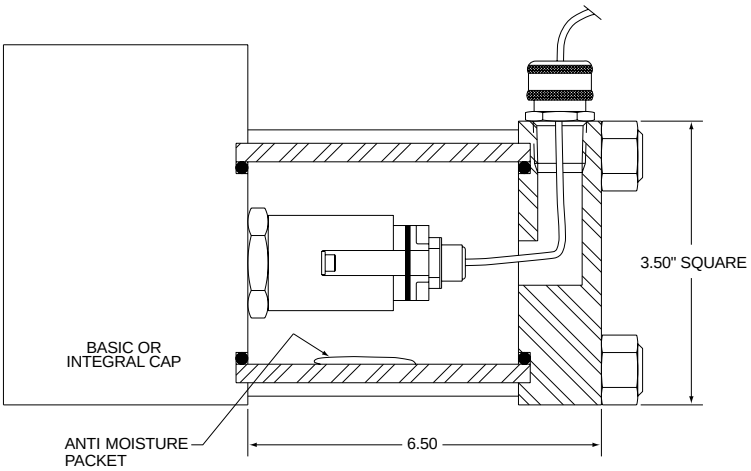
Note: Since this design uses common tie rods, the actuator must be disassembled to service or install feedback devices.



Style D — For LDT Basic and Intergral Cap. Specify connector type (not available on 2" bore).



Style F — For LDT and LRT
For 4" bore and larger only.
Use Style A for $2^1/_2$" and $3^1/_4$" bore.



Intrinsically Safe LDT
An intrinsically safe system is a system approved by Factory Mutual as intrinsically safe for use in Class I, Division I, Group A, B, C, or D hazardous locations. The system requires approved safety barriers and a 6 wire LDT. Consult factory for detailed information.

Explosion Proof LDT
Factory Mutual Approved

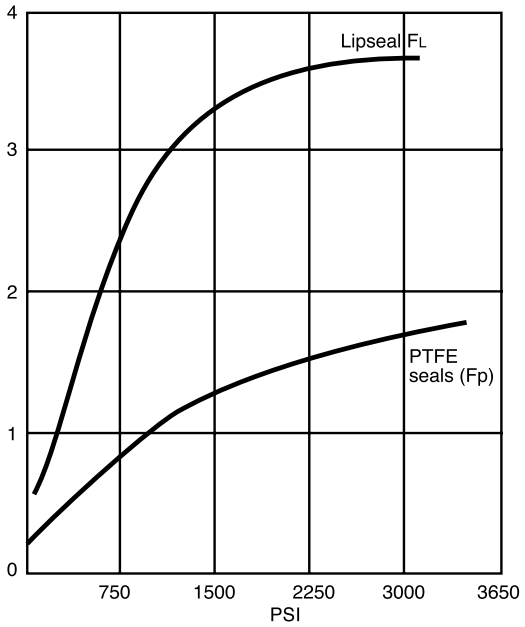
For additional information – call your local Parker Cylinder Distributor.

Gland Drain

Available for high speed applications is a gland drain fitted with the low friction option to prevent pressure buildup between the seals, and must be piped back to tank independent of the return line. If an independent drain line is not possible, alternative designs can be supplied.

Seal Friction

Seal friction under a given set of working conditions is not easily calculated due the multiplicity of variables involved. The following graph is offered as a guide for use in performance calculations, but for critical applications 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	$12d + 12F_Ld + 24F_LD$
Lipseal Rod w/ Low Friction Piston	$12d + 12F_Ld + 12F_pD$
Low Friction Rod + Piston	$12d + 30F_pd + 6F_pD$

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:	$F_L \times 1.5$
Low Friction:	$F_p \times 1.0$

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) $\cong 12d + 30F_pd + 6F_pD$

Friction (lbs. force) $\cong 12\ (1.75) + 30\ (1.3 \times 1.75) + 6\ (1.3 \times 3.25)$

Friction (lbs. force) $\cong 115$

Breakaway Friction Calculation

$F_p \times 1.0 \cong F_p$

Based on zero pressure:

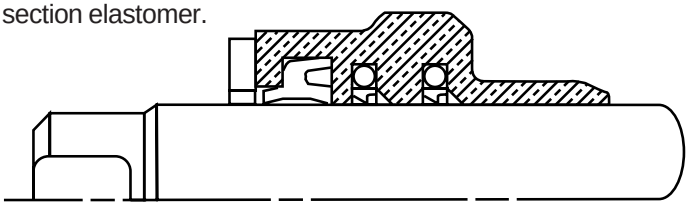
Friction (lbs. force) $\cong 12d + 30F_pd + 6F_pD$

Friction (lbs. force) $\cong 12\ (1.75) + 30\ (1.3 \times 1.75) + 6\ (1.3 \times 3.25)$

Friction (lbs. force) $\cong 43$

Low Friction Gland

Below is a cross-sectional representation of a Parker Series 2HX low friction gland. The dual step seals are of a bronze-filled PTFE material. The expanders are a square cross section elastomer.



Operating Temperature Danger

The piston to piston-rod threaded connection is secured with an anaerobic adhesive which is temperature sensitive. Operation of the cylinder outside of the following guidelines can cause the piston rod to unthread itself from the piston. Cylinders ordered with standard seals are assembled with anaerobic adhesive with a maximum temperature rating of +165°F. Cylinders ordered with Fluorocarbon seals are assembled with an anaerobic adhesive with a maximum temperature rating of +250°F. When cylinders are intended for use above +250°F, a pinned piston to piston-rod connection must be specified. Consult factory for details.

Consult factory for the compatibility of Fluorocarbon with specific hydraulic fluids.

Fluid Compatibility

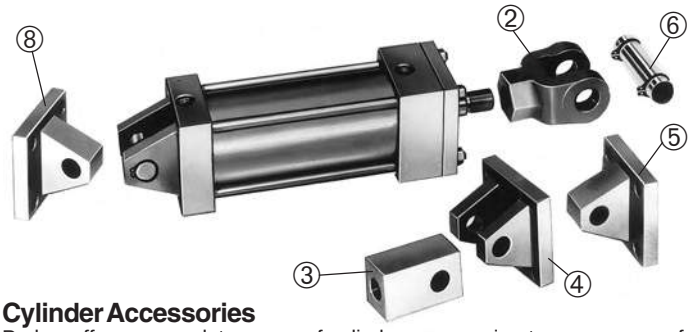
Parker Series 2HX actuators are equipped with seals and materials compatible with petroleum base hydraulic oils. For other fluids, consult factory.

How to Order Low Friction Rod Gland

Place an “S” in the “special” position in the model number and specify “Low Friction Rod Gland.”

B

Series 2HX
Electrohydraulic Actuators



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, Knuckle, Clevis Bracket and Pivot Pin. To select the proper part number for any desired accessory, refer to Chart A below and look opposite the thread size of the rod end as indicated in the first column. The Pivot Pins, Eye Brackets and Clevis Brackets are listed opposite the thread size which their mating Knuckles or Clevises fit.

Chart A

Thread Size	Mating Parts			Mating Parts			Alignment Coupler
	Rod Clevis	Eye Bracket	Pin	Knuckle	Clevis Bracket	Pin	
5/16-24	51221	74077	—	74075	74076	74078	134757 0031
7/16-20	50940	69195	68368	69089	69205	68368	134757 0044
1/2-20	50941	69195	68368	69090	69205	68368	134757 0050
3/4-16	50942	69196	68369	69091	69206	68369	134757 0075
3/4-16	133284	69196	68369	69091	69206	68369	134757 0075
7/8-14	50943	*85361	68370	69092	69207	68370	134757 0088
1-14	50944	*85361	68370	69093	69207	68370	134757 0100
1-14	133285	*85361	68370	69093	69207	68370	134757 0100
1 1/4-12	50945	69198	68371	69094	69208	68371	134757 0125
1 1/4-12	133286	69198	68371	69094	69208	68371	134757 0125
1 1/2-12	50946	*85362	68372	69095	69209	68372	133739 0150
1 3/4-12	50947	*85363	68373	69096	69210	69215	133739 0175
1 7/8-12	50948	*85363	68373	69097	69210	69215	133739 0188
2 1/4-12	50949	*85364	68374	69098	69211	68374	Consult Factory
2 1/2-12	50950	*85365	68375	69099	69212	68375	
2 3/4-12	50951	*85365	68375	69100	69213	69216	
3 1/4-12	50952	73538	73545	73536	73542	73545	
3 1/2-12	50953	73539	73547	73437	73542	73545	
4-12	50954	73539	73547	73438	73543	82181	
4 1/2-12	—	—	—	73439	73544	73547	

*Cylinder accessory dimensions conform to NFPA recommended standard NFPA/T3.6.8 R1-1984, NFPA recommended standard fluid power systems — cylinder — dimensions for accessories for cataloged square head industrial types. Parker adopted this standard in April, 1985. Eye Brackets or Mounting Plates shipped before this date may have different dimensions and will not necessarily interchange with the NFPA standard. For dimensional information on older style Eye Brackets or Mounting Plates consult Drawing #144805 or previous issues of this catalog.

Accessory Load Capacity

The various accessories on this and the following page have been load rated for your convenience. The load capacity in lbs., shown on the opposite page is the recommended maximum load for that accessory based on a 4:1 design factor in tension. (Pivot pin is rated in shear.) Before specifying, compare the actual load or the tension (pull) force at maximum operating pressure of the cylinder with the load capacity of the accessory you plan to use. If load or pull force of cylinder exceeds load capacity of accessory, consult factory.

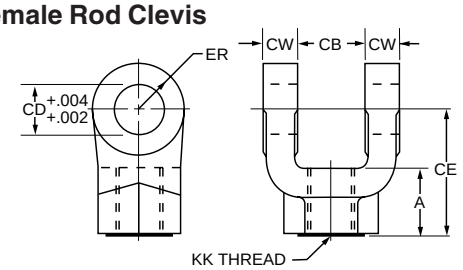
Chart B

Mtg. Plate Part No.	Series 2HX Bore Size
69195	1 1/2"
69196	2", 2 1/2"
*85361	3 1/4"
69198	4"
*85362	5"
*85363	6"
*85364	7"
*85365	8"

Mounting Plates

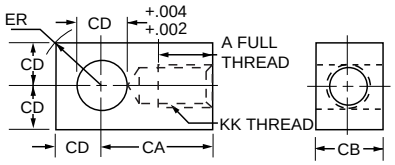
Mounting Plates for Style BB (clevis mounted) cylinders are offered. To select proper part number for your application, refer to Chart B to above right.

② Female Rod Clevis



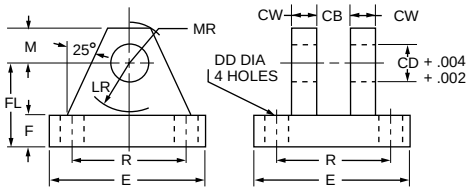
Order to fit thread size.

③ Knuckle (Female Rod Eye)



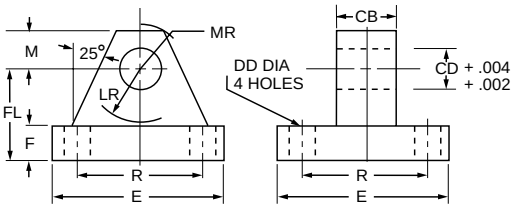
Order to fit thread size.

④ Clevis Bracket for Knuckle



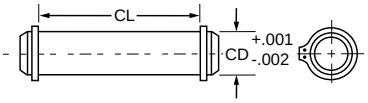
Order to fit Knuckle.

⑧ Mounting Plate or ⑤ Eye Bracket



1. When used to mate with the Rod Clevis, select from Chart A.
2. When used to mount the Style BB cylinders, select from the Mounting Plate Selection Table. See Chart B at lower left.

⑥ Pivot Pin



1. Pivot Pins are furnished with Clevis Mounted Cylinders as standard.
2. Pivot Pins are furnished with (2) Retainer Rings.
3. Pivot Pins must be ordered as separate item if to be used with Knuckles, Rod Clevises, or Clevis Brackets.

For additional information – call your local Parker Cylinder Distributor.

	Female Rod Clevis Part Number																		
	51221†	50940	50941	50942	133284	50943	50944	133285	50945	133286	50946	50947	50948	50949	50950	50951	50952	50953	50954
A	13/16	3/4	3/4	1 1/8	1 1/8	1 5/8	1 5/8	1 5/8	1 7/8	2	2 1/4	3	3	3 1/2	3 1/2	3 1/2	3 1/2‡†	4‡†	4‡†
CB	11/32	3/4	3/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	2	2	2 1/2	2 1/2	2 1/2	3	3	3	4	4 1/2	4 1/2
CD	5/16	1/2	1/2	3/4	3/4	1	1	1	1 3/8	1 3/8	1 3/4	2	2	2 1/2	3	3	3 1/2	4	4
CE	2 1/4	1 1/2	1 1/2	2 1/8	2 3/8	2 15/16	2 15/16	3 1/8	3 3/4	4 1/8	4 1/2	5 1/2	5 1/2	6 1/2	6 3/4	6 3/4	7 3/4	8 13/16	8 13/16
CW	13/64	1/2	1/2	5/8	5/8	3/4	3/4	3/4	1	1	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	2	2 1/4	2 1/4
ER	19/64	1/2	1/2	3/4	3/4	1	1	1	1 3/8	1 3/8	1 3/4	2	2	2 1/2	2 3/4	2 3/4	3 1/2	4	4
KK	5/16-24	7/16-20	1/2-20	3/4-16	3/4-16	7/8-14	1-14	1-14	1 1/4-12	1 1/4-12	1 1/2-12	1 3/4-12	1 7/8-12	2 1/4-12	2 1/2-12	2 3/4-12	3 1/4-12	3 1/2-12	4-12
Load Capacity Lbs. ⊖	2600	4250	4900	11200	11200	18800	19500	19500	33500	33500	45600	65600	65600	98200	98200	98200	156700	193200	221200

	Knuckle Part Number																
	74075	69089	69090	69091	69092	69093	69094	69095	69096	69097	69098	69099	69100	73536	73437	73438	73439
A	3/4	3/4	3/4	1 1/8	1 1/8	1 5/8	2	2 1/4	2 1/4	3	3 1/2	3 1/2	3 5/8	4 1/2	5	5 1/2	5 1/2
CA	1 1/2	1 1/2	1 1/2	2 1/16	2 3/8	2 13/16	3 7/16	4	4 3/8	5	5 13/16	6 1/8	6 1/2	7 5/8	7 5/8	9 1/8	9 1/8
CB	7/16	3/4	3/4	1 1/4	1 1/2	1 1/2	2	2 1/2	2 1/2	2 1/2	3	3	3 1/2	4	4	4 1/2	5
CD	7/16	1/2	1/2	3/4	1	1	1 3/8	1 3/4	2	2	2 1/2	3	3	3 1/2	3 1/2	4	4
ER	19/32	23/32	23/32	1 1/16	1 7/16	1 7/16	1 31/32	2 1/2	2 27/32	2 27/32	3 9/16	4 1/4	4 1/4	4 31/32	4 31/32	5 11/16	5 11/16
KK	5/16-24	7/16-20	1/2-20	3/4-16	7/8-14	1-14	1 1/4-12	1 1/2-12	1 3/4-12	1 7/8-12	2 1/4-12	2 1/2-12	2 3/4-12	3 1/4-12	3 1/2-12	4-12	4 1/2-12
Load Capacity Lbs. ⊖	3300	5000	5700	12100	13000	21700	33500	45000	53500	75000	98700	110000	123300	161300	217300	273800	308500

	Clevis Bracket for Knuckle Part Number												
	74076	69205	69206	69207	69208	69209	69210	69211	69212	69213	73542	73543	73544
CB	15/32	3/4	1 1/4	1 1/2	2	2 1/2	2 1/2	3	3	3 1/2	4	4 1/2	5
CD	7/16	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3	3 1/2	4	4
CW	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2
DD	17/64	13/32	17/32	21/32	21/32	29/32	1 1/16	1 3/16	1 5/16	1 5/16	1 13/16	2 1/16	2 1/16
E	2 1/4	3 1/2	5	6 1/2	7 1/2	9 1/2	12 3/4	12 3/4	12 3/4	12 3/4	15 1/2	17 1/2	17 1/2
F	3/8	1/2	5/8	3/4	7/8	7/8	1	1	1	1	1 11/16	1 15/16	1 15/16
FL	1	1 1/2	1 7/8	2 1/4	3	3 5/8	4 1/4	4 1/2	6	6	6 11/16	7 11/16	7 11/16
LR	5/8	3/4	1 3/16	1 1/2	2	2 3/4	3 3/16	3 1/2	4 1/4	4 1/4	5	5 3/4	5 3/4
M	3/8	1/2	3/4	1	1 3/8	1 3/4	2 1/4	2 1/2	3	3	3 1/2	4	4
MR	1/2	5/8	29/32	1 1/4	1 21/32	2 7/32	2 25/32	3 1/8	3 19/32	3 19/32	4 1/8	4 7/8	4 7/8
R	1.75	2.55	3.82	4.95	5.73	7.50	9.40	9.40	9.40	9.40	12.00	13.75	13.75
Load Capacity Lbs. ⊖	3600	7300	14000	19200	36900	34000	33000	34900	33800	36900	83500	102600	108400

	Eye Bracket and Mounting Plate Part Number										
	74077	69195	69196	85361*	69198	85362*	85363*	85364*	85365*	73538	73539
CB	5/16	3/4	1 1/4	1 1/2	2	2 1/2	2 1/2	3	3	4	4 1/2
CD	5/16	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4
DD	17/64	13/32	17/32	21/32	21/32	29/32	1 1/16	1 3/16	1 5/16	1 13/16	2 1/16
E	2 1/4	2 1/2	3 1/2	4 1/2	5	6 1/2	7 1/2	8 1/2	9 1/2	12 5/8	14 7/8
F	3/8	3/8	5/8	7/8	7/8	1 1/8	1 1/2	1 3/4	2	1 11/16	1 15/16
FL	1	1 1/8	1 7/8	2 3/8	3	3 3/8	4	4 3/4	5 1/4	5 11/16	6 7/16
LR	5/8	3/4	1 1/4	1 1/2	2 1/8	2 1/4	2 1/2	3	3 1/4	4	4 1/2
M	3/8	1/2	3/4	1	1 3/8	1 3/4	2	2 1/2	2 3/4	3 1/2	4
MR	1/2	9/16	7/8	1 1/4	1 5/8	2 1/8	2 7/16	3	3 1/4	4 1/8	5 1/4
R	1.75	1.63	2.55	3.25	3.82	4.95	5.73	6.58	7.50	9.62	11.45
Load Capacity Lbs. ⊖	1700	4100	10500	20400	21200	49480	70000	94200	121900	57400	75000

	Pivot Pin Part Number													
	74078	68368	68369	68370	68371	68372	68373	69215	68374	68375	69216	73545	82181	73547•
CD	7/16	1/2	3/4	1	1 3/8	1 3/4	2	2	2 1/2	3	3	3 1/2	4	4
CL	1 5/16	1 7/8	2 5/8	3 1/8	4 1/8	5 3/16	5 3/16	5 11/16	6 3/16	6 1/4	6 3/4	8 1/4	8 5/8	9
Shear Capacity Lbs.⊖	6600	8600	19300	34300	65000	105200	137400	137400	214700	309200	309200	420900	565800	565800

*Cylinder accessory dimensions conform to NFPA recommended standard NFPA/T3.6.8 R1-1984, NFPA recommended standard fluid power systems — cylinder — dimensions for accessories for cataloged square head industrial types. Parker adopted this standard in April, 1985. Eye Brackets or Mounting Plates shipped before this date may have different dimensions and will not necessarily interchange with the NFPA standard. For dimensional information on older style Eye Brackets or Mounting Plates consult Drawing #144805 or previous issues of this catalog.

⊖ See Accessory Load Capacity note on previous page.

•These sizes supplied with cotter pins.

†Includes Pivot Pin.

Consult appropriate cylinder rod end dimensions for compatibility.

For Cylinder Division Plant Locations – See Page II.

How to Order

Parker Series 2HX 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 in Table A opposite. 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. For additional cylinder specifications and dimensions see Parker Series 2H section.

When a Series 2HX actuator is ordered the following information must be developed.

1) The basic actuator model number including 2HX under Series as shown in Table A opposite.

2) If a rod extension is required, specify rod end thread Style 3.

3) A six digit code describing the valve and feedback type if any, and the supplier (Parker or customer).

4) If an actuator is to accept a D03, D05, D06, D07, or D08 pattern valve no additional information is necessary. If an actuator is to accept a servo valve or include any valve furnished by Parker, a manufacturer and model number should be supplied below the five digit code.

5) If a cylinder is to include a feedback device the following information must be called out below the six digit code:

Linear Displacement Transducer (LDT)

Analog Position

1) Position Output Signal and connection type (RB, RO)

2) Electrical Cable Length (from probe if integral cable)

3) Cable Length to AOM (if AOM specified)

Analog Position and Velocity

1) Position Output Signal

2) Velocity Output Signal and maximum piston velocity for calibration in inches per second

3) Electrical Cable Length to AOM

Digital Position

1) Specify Pulse Duration Output only (Specify Internal or External Interrogation and the number of circulations)

2) Data Ready Line

3) Update Time

Linear Potentiometer (LRT)

1) Electrical connector position 1-4 cap end

2) Gross and net stroke if 1.75" rod dia. or smaller

Other Feedback Device

1) Device Type, Manufacturer, and Model Number

2) Output Signal

Integral Manifold Option

The integral manifold option is only available with the Parker Series 2HX 2" through 5" bores. All integral manifolds are available at the cap end position #1 only. For special integral manifolds for Parker Series 3LX and 3HX — consult factory.

Bolt-On Manifold Option

The bolt-on manifold option is available with Parker Series 2HX, 3LX and 3HX. Manifolds may be located on either the head or cap end at any position that does not interfere with mounting. For manifolds available by bore size, see the dimensions section of the catalog.

Feedback Option

Parker Series 2HX, 3LX, and 3HX actuators may be ordered prepared for a feedback device or prepared for and supplied with a feedback device. The Parker LRT option may only be ordered installed at the factory. See the ordering code on the opposite page. Parker's standard LDT option is a Temposonics™ LH position sensor. To specify another manufacturer's magneto-restrictive position sensor place an "S" in the cylinder model code and specify the manufacturer's name and model number. Parker will install any other type and brand of feedback specified by the customer as long as it is reasonably designed to fit into an NFPA type cylinder — consult factory.

For additional information – call your local Parker Cylinder Distributor.

2HX Series Model Codes

The Parker 2HX Series model code is based on the standard Parker 2H Series model code system. The common modifications available for the Parker 2H are available with the Parker 2HX configuration as long as the modifications do not interfere with the Valve and Feedback options selected. The Bolt-On Manifold and Feedback options described in this catalog and outlined below are available with the Parker 3L Series medium-duty hydraulic cylinder and with the Parker 3H Series (7" and 8" bore) heavy-duty hydraulic cylinder. Specify "3LX" and "3HX" respectively in the model code described below. Integral manifolds are **not** available as standard for the 3LX and 3HX.

Table A — Basic Model Numbers

Bore Size	Cushion Head End	Double Rod	Mounting Style	Mounting Modification	Series	Piston	Ports	Common Modifications	Special Modifications	Piston Rod Number	Rod End Thread Style	Thread Type	Cushion Cap End	Stroke
4.00	C	—	TC	P	2HX	L	T	V*	S	1	4	A	—	X24.00
Specify. Consult dimension tables for available bore sizes. Also see Parker Series 2H.	Specify only if cushion Head End is required.	Consult factory for double rod cylinders.	Specify Mounting Style. Consult dimension tables for available mounting styles. Also see Parker Series 2H.	Specify P- for thrust key mounting. *ONLY IF REQUIRED.	Specify Series 2HX for 2"-6" bores, 3HX for 7" and 8" bores, 3LX for medium-duty 2" - 6" bores.	Use L for Lipseal Piston. Use K for Hi-Load Piston. Use C for ring type piston.	Specify "T" for SAE straight thread ports. (all manifolds) Optional ports available without manifolds (see 2H).	If required specify V = Viton Seals E = EPR Seals. Consult Section C, page 83 for fluid compatability information.	Specify an "S" for all special modifications not called out in the six digit code below.	Specify rod code number. Consult dimension tables for available rod diameters and section C, page 96 for rod buckling consider-ations.	Specify Style 4, Small Male. Style 8, Intermediate Male. Style 3, Special. Specify KK, A, LA or W dimension required.	Specify A = UNF W = BSF M = Metric	Cap End Cushions are not available with LDT or LRT feedback. Specify C for cap cushion with no feedback.	Specify in inches. Show symbol "x" just ahead of stroke length.

Table B — Valve and Feedback Codes (Required for 2HX Ordering)

Valve Manifold	Valve Pattern Group	Valve Location	Feedback Option	Feedback Furnished	Feedback Protective Enclosures
N = None	N = Not applicable	N = Not Applicable	N = None	N = Not Applicable	N = Not Applicable
B = Bolt-On*	A = Servo Group A††	H = Head	C = LDT•	1 = Prepare to accept	A = False Stage
I = Integral**	D = Servo Group D††	C = Cap	F = LRT••	2 = Included	D = Light Duty
	G = D03 (Group G)		X = Other***		F = Medium Duty
	H = D05 (Group H)		(Please specify)***		
	J = D06 (Group J)†				
	K = D07 (Group K)†		B = BALLUFF		
	M = D08 (Group M)†				
	X = Other***				
	(Please Specify)***				

* Bolt-On Manifolds will be located at position #1 unless an "S" is placed in the cylinder model code and the mounting position is indicated. Bolt-On Manifolds may be positioned on either the head or cap end at any location not occupied by a mount or port or cushion.
** Integral Manifolds are only available at cap end position #1.
*** When selecting "other" an "S" must be placed in the model code and the valve or feedback device must be specified by the customer.
† Valve patterns D06 (Group J), D07 (Group K), and D08 (Group M) are *only* available as Bolt-On Manifolds. Consult factory for DD Mounts.
†† See Valve group table on page 154 & 174 for Servo Valve mounting pattern descriptions.
• When an LDT is to be supplied by the customer, Parker prepares the actuator with an SAE port, magnet, and gun drilled to accept a 2.5" dead zone LDT.
•• LRTs can *only* be installed by Parker at the factory. Electrical connector will be at position #4 standard.

Example 1: Actuator with LDT feedback only (2.5" dead band LDT), and 0 to 10 VDC grounded output with 15 foot electrical cable.

2.50" C-2HXT 34 x 12.000"
NNNC2N
1) 0 to 10 VDC
2) 15 foot electrical cord

Example 2: Actuator to **accept** a BD-30 servo valve and to **include** analog LDT with velocity output, 15 ips max velocity, low friction seals and extra-heavy-duty enclosure. Cushioned head end.

6.0 CC 2HX TS 14 A x 60
BDCC2A
Low friction piston and rod seals
Velocity calibration: +10 VDC = 15 ips extending

For Cylinder Division Plant Locations – See Page II.

Parker TS-2000 seal designed to eliminate cylinder rod seal leakage.

Parker Series 2H Heavy Duty and Series 3L Medium Duty Hydraulic Cylinders with the TS-2000 seal offers positive protection against cylinder rod leakage under the most demanding applications.

The TS-2000 seal is the product of countless hours of research, development and extensive field testing and is only available on Parker Cylinders.

Based on the popular Parker Serrated Lipseal rod design, the TS-2000 incorporates the pressure-compensated, uni-directional characteristics of a U-cup with the multiple edge sealing effectiveness of compression-type stacked-packings.

The goal for the Parker team was to design a rod seal suitable for all types of applications, regardless of pressure profile. It had to be composed of a material that would not react chemically with hydraulic fluids. And it had to produce better and more reliable "dry rod" performance than the standard serrated lip-seal design in a broad range of applications.

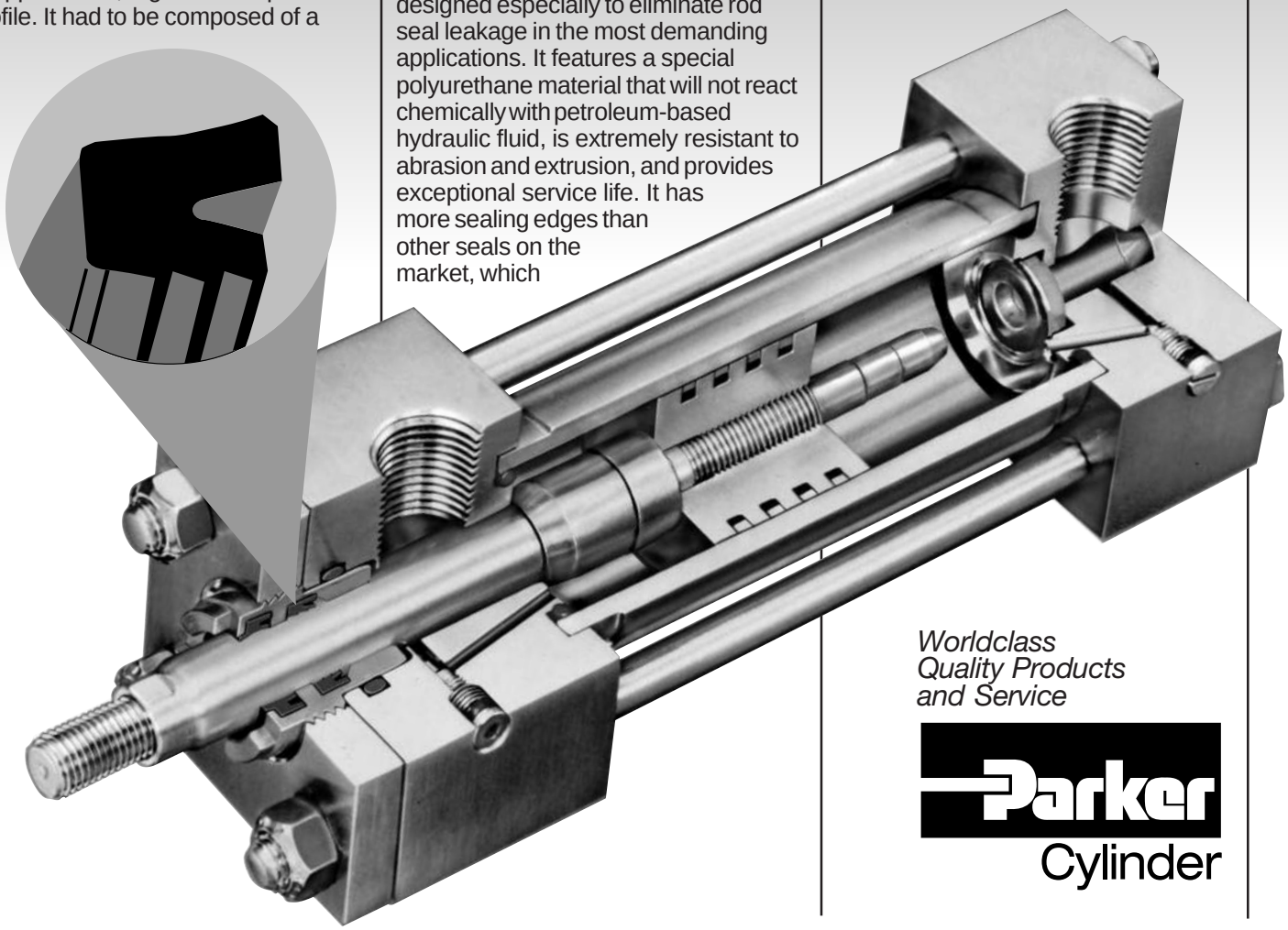
"Jewel" gland with wiperseal and TS-2000 cylinder rod seal.

The result is the TS-2000 seal, designed especially to eliminate rod seal leakage in the most demanding applications. It features a special polyurethane material that will not react chemically with petroleum-based hydraulic fluid, is extremely resistant to abrasion and extrusion, and provides exceptional service life. It has more sealing edges than other seals on the market, which in turn produces "dry rod" performance. The seal geometry was refined for maximum stability in the groove and has excellent performance characteristics throughout a broad range of pressures and piston rod velocities.

The Parker design team was successful!

TS-2000 rod seal has not failed in any of the test applications in the lab or on the job, no matter how tough or demanding.

For more information on the TS-2000 call or write your local Parker distributor or Parker Hannifin Corporation, Cylinder Division, 500 S. Wolf Road, Des Plaines, IL 60016, 847-298-2400.



Worldclass Quality Products and Service

Parker Cylinder

For additional information – call your local Parker Cylinder Distributor.

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

Cylinder Parts Identification and Seal Kit Data (Index pg. 40) 40-70

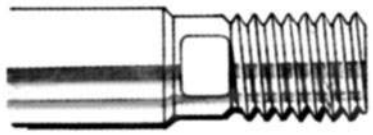
Application Engineering Data (Index pg. 79) ... 79-130

C

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

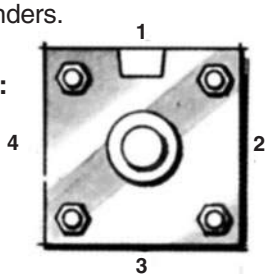
Custom Options and Modifications



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 90° or 180° 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.

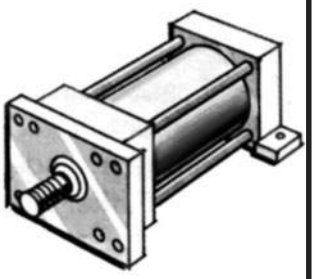
The location of the cushion needle valve or check valve can be located in relation to the port at the customers' request.

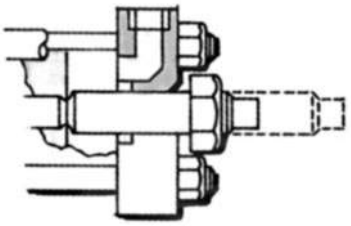
Other port options: Extra ports: If specified on your order, most industrial cylinders can be supplied with extra ports on the sides of heads or caps that are not occupied by mountings or cushion valves.

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

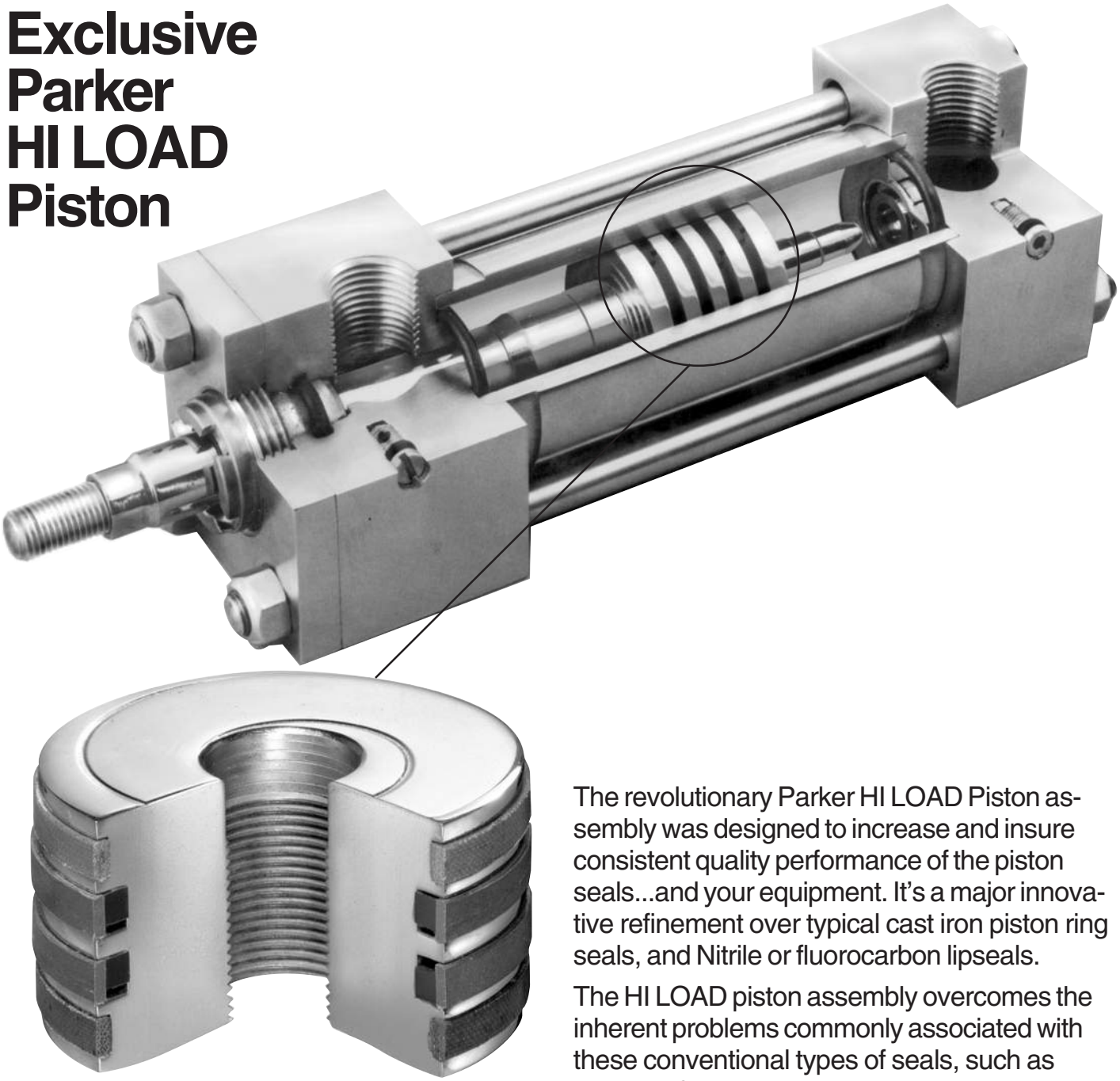
Feature	Hydraulic Series					Pneumatic Series	
	2H	3H	VH	3L	HD	2A	MA
Non-Lube (N)* (1)						●	●
High Water Content Fluids (J)**	●	●	●	●	●		
Special Piston Rod Ends (1)	●	●	●	●	●	●	●
Rod End Threads 2 X Std. Length (1)	●	●	●	●	●	●	●
Port Relocation (2)	●	●	●	●	●	●	●
Extra Ports (2)	●	●	●	●	●	●	●
SAE “O” Ring Port (2)	●	●	●	●	●	●	
Oversize Port (2)	●	●	●	●	●	●	
Mounting Combinations (2)	●	●	●	●	●	●	●
Stroke Adjusters (2)	●	●	●	●	●	●	
Spring Return (5)	●	●	●	●	●	●	●
Spring Extend (5)	●	●	●	●	●	●	●
Water Service (2)	●	●	●	●	●	●	●
Hi-Load Piston (4,1)	●	●	●		●		
CLS Magnetic Sensors	●	●		●	●	●	
Reed Switches							●
Fluorocarbon 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.
(5) Consult factory.

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 fluorocarbon lipseals.

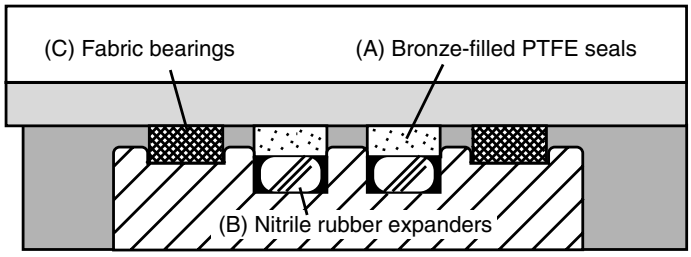
The HI LOAD piston assembly overcomes the inherent problems commonly associated with these conventional types of seals, such as scoring of the cylinder bore due to contamination, and it virtually eliminates leakage flow. It can also reduce or eliminate the need for stop tubing. It has much greater side 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 PTFE ring design.

The HI LOAD piston assembly is comprised of two square-cut bronze-filled PTFE 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.



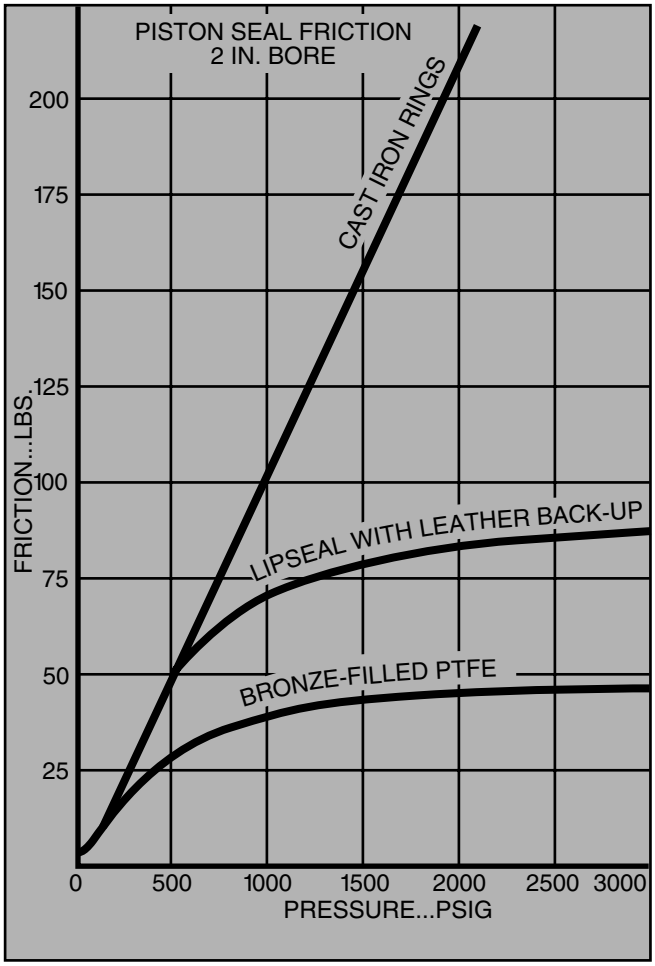
Reduced scoring. Low friction. The non-metallic wear rings eliminate all metal-to-metal contact between the piston and cylinder body. Some scoring may occur even with the use of compatible materials such as cast iron or bronze for the piston and steel for the cylinder body. The combination of the high 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 PTFE 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 PTFE 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 under-neath, and are therefore dynamically self-sealing just as cast iron rings are.

The bronze-filled PTFE 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.

C

Cylinder End-of-Stroke Proximity Sensors

For Parker Series 2A, 2H, 3L, 3H & HMI Cylinders

"EPS" Style Inductive Sensors
For General Industrial AC and DC Applications

"CLS" Style Magnetic Sensors
Including Extreme Temperature Applications

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

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.

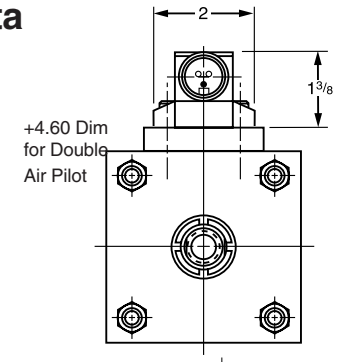
Features

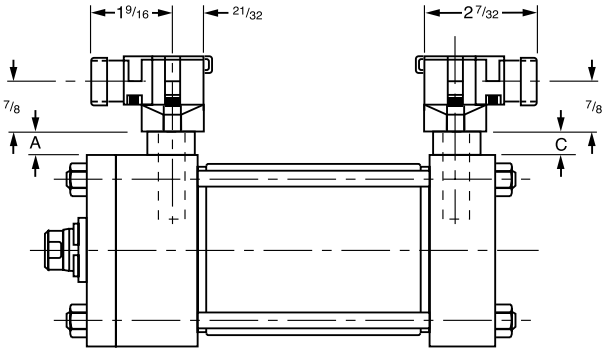
- Completely Solid State – no moving parts to wear out
- Pneumatic or Hydraulic Use – mounts directly to 2A, 2AN, 3AN, 3L and 2H Series cylinders
- Rotates in 300° – simplifies set-up (EPS-5 only)
- Low Leakage Current – directly compatible with programmable controllers
- Meets enclosure types 3, 4, 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

For Cylinder Division Plant Locations – See Page II.

Dimensional Data

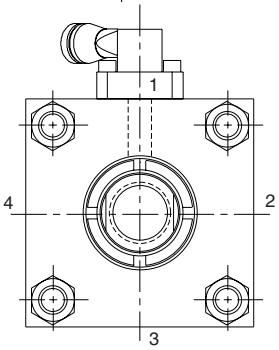
EPS-5 Automotive Applications

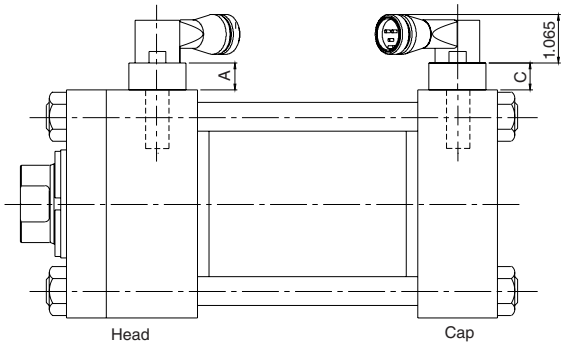




EPS-7 Heavy Duty Industrial Applications

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

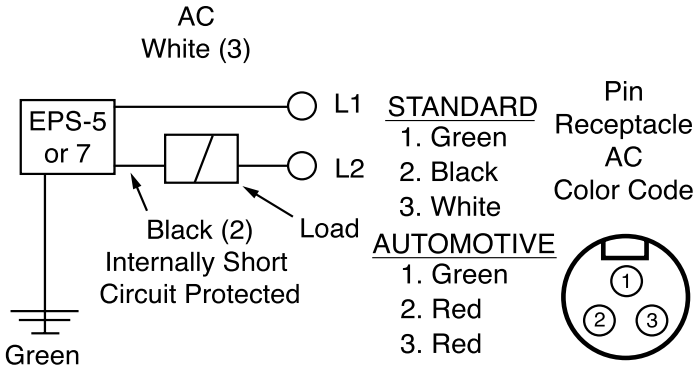




For basic cylinder dimensions, consult section A, for pneumatic cylinders and section B, for hydraulic cylinders.

Series	A max.	C max.
2H/3H 1.5"-8" bores	.86"	1.75"
3L	1.55"	1.05"
2A	1.55"	1.30"
For exact dimensions, see Bulletin 0840-G-E1.		

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.

	Parker Part No.	
Cable Length	Automotive	Standard
3'	085356003	0853550003
6'	085356006	0853550006
9'	085356009	—
12'	0853560012	0853550012

Series and Parallel Wiring

When Parker EPS-5, 6 or 7 proximity switches are used as inputs to programmable controllers the preferred practice is to connect each switch to a separate input channel of the PC. Series or parallel operations may then be accomplished by the internal PC programming.

Parker EPS-5, 6 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.

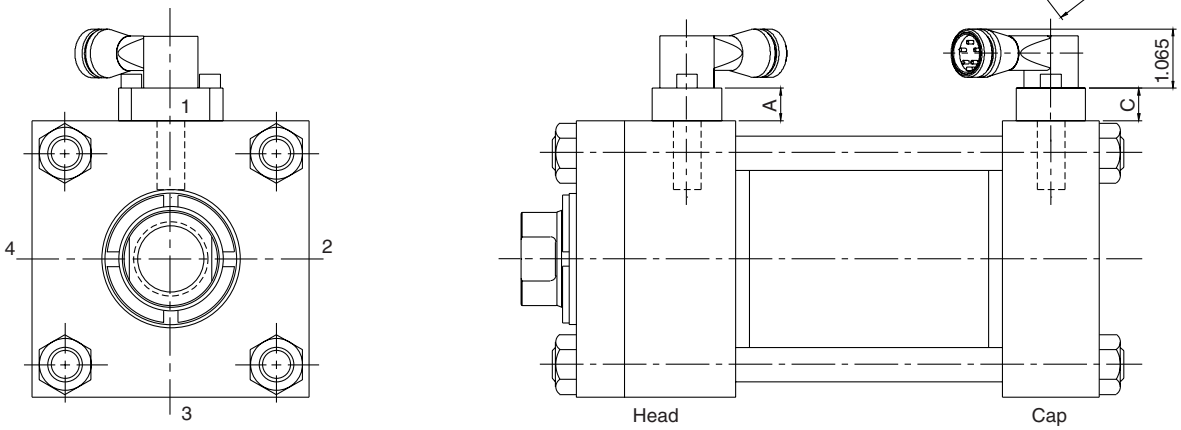
Parker EPS-5, 6 or 7 switches may also be hard wired for parallel operation. However, the leakage current of each switch will pass through the load. The total of all leakage currents must not exceed the current required to actuate the load. In most cases, the use of two or more EPS-5, 6 or 7 switches in parallel will require the use of a bypass (shunt) resistor.

For additional information – call your local Parker Cylinder Distributor.

EPS-6 Low Voltage DC Proximity Switch

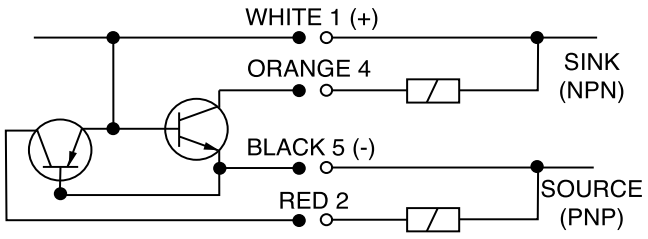
Features

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



Series	A max.	C max.
2H/3H 1.5"-8" bores	.86"	1.75"
3L	1.55"	1.05"
2A	1.55"	1.30"
For exact dimensions, see Bulletin 0840-G-E1.		

Wiring Diagrams and Information

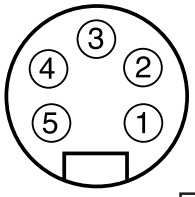


LED Function	"Ready"	"Target"
Power Applied (No Target)	ON	OFF
Target Present	OFF	ON
Short Circuit Condition	FLASH	FLASH

Connectors

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

Plug Pin and Cable Identification

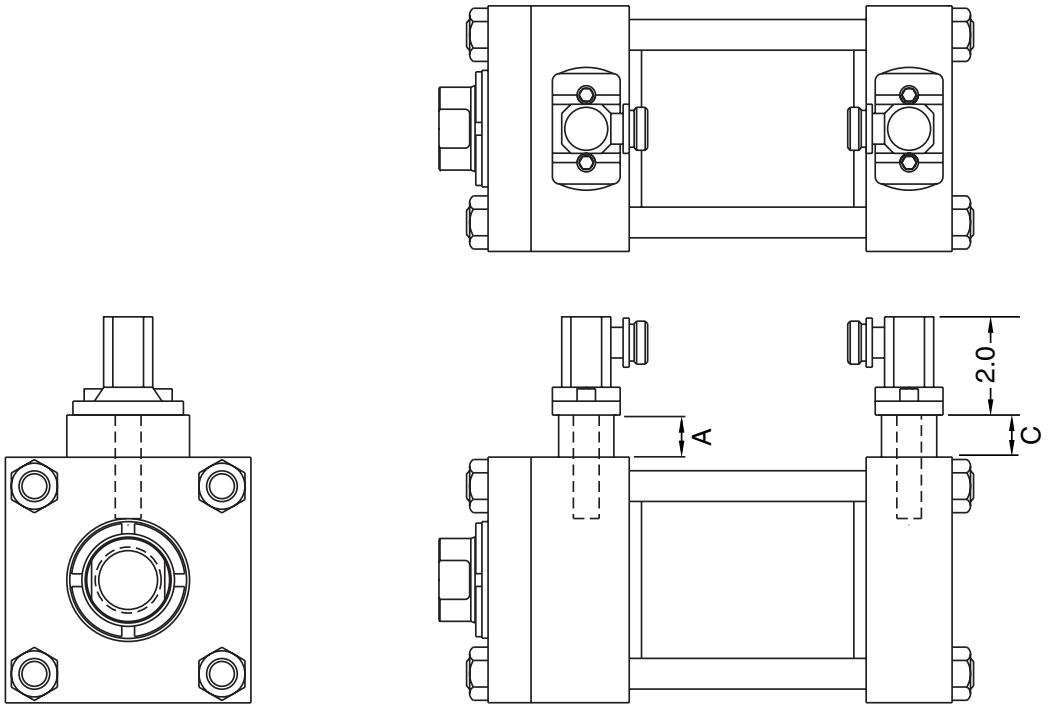


1) +10 to 30 VDC (White)
2) Source (Red)
3) Grounded not connected nor required
4) Sink (Orange)
5) Common (Black)

Cable Length	Parker No.
3	085917 0003
6	085917 0006
12	085917 0012

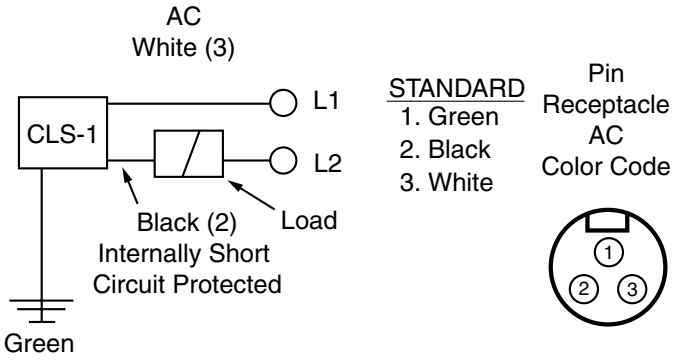
For Cylinder Division Plant Locations – See Page II.

CLS 1 & 4 Sensors



Series	A max.	C max.
2H/3H 1.5"-8" bores	.86"	1.75"
3L	1.55"	1.05"
2A	1.55"	1.30"
For exact dimensions, see Bulletin 0840-G-E1		

Wiring Diagrams and Information



STANDARD
1. Green
2. Black
3. White

Pin
Receptacle
AC
Color Code

Connectors

The male quick disconnect on the Parker CLS-1 is a Brad Harrison 40909 connector.

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

	Parker Part No.
Cable Length	Standard
3'	0853550003
6'	0853550006
9'	—
12'	0853550012

The connection for the CLS-4 are 144" PTFE insulated flying leads with 1/2" conduit hub. 3-wire: Common (black), Normally open(blue), and Normally closed (red).

For additional information – call your local Parker Cylinder Distributor.

Table 1 CODES FOR 2A, 2AN, & 3L SERIES CYLINDERS WITH EPS 5, 6 & 7 SENSORS

BORE	SERIES	ROD DIA	2A ROD #	3L ROD #	STANDARD PROBE LOCATION "GG"	SPACER HEIGHT "C"	SWITCH CODE	SPACER CODE	EPS5 BOLT CODE (1)	EPS 6,7 BOLT CODE (1)	OPTIONAL STROKE TO GO
1.5	2A/3L	0.63	1	1	0.59	0.688	1	FK	F99	299	0.44
		1	2	2	0.59	0.876	1	1K	199	399	0.44
		CAP	-	-	0.63	0.468	1	BK	GD9	1D9	0.17
2	2A/3L	0.63	1	1	0.59	0.579	1	D2	0E9	2E9	0.44
		1.375	2	2	0.59	0.829	1	H2	199	399	0.44
		1	3	3	0.59	0.688	1	F2	F99	299	0.44
		CAP	-	-	0.63	1.048	2	EG2	299	499	0.17
2.5	2A/3L	0.63	1	7	0.63	0.296	1	E	F9	29	0.48
		1.75	2	3	0.63	0.796	1	EH	29	49	0.48
		1	3	2	0.63	0.421	1	G	19	39	0.48
		1.38	4	1	0.63	0.608	1	DF	29	39	0.48
		CAP	-	-	0.63	0.780	2	FG	29	49	0.17
3.25	2A/3L	1	1	1	0.88	0.858	2	FH	39	49	0.73
		2	2	4	0.56	0.608	1	DF	29	39	0.42
		1.375	3	2	0.88	0.249	1	D	FE	2E	0.73
		1.75	5	3	0.88	0.421	1	G	19	39	0.73
		CAP	-		0.75	0.546	2	J	29	39	0.34
4	2A/3L	1	1	7	0.88	0.499	2	H	19	39	0.73
		2.5	2	4	0.56	0.546	1	J	29	39	0.42
		1.375	3	2	0.88	0.671	2	DG	29	49	0.73
		1.75	4	1	0.88	0.858	2	FH	39	49	0.73
		2	5	3	0.56	0.249	0	D	FE	2E	0.42
		CAP	-		0.75	0.170	2	C	0D	1D	0.34
5	2A/3L	1	1	7	0.88	0.796	3	EH	39	49	0.72
		3.5	2	2	0.56	0.546	1	J	29	39	0.42
		1.38	3	8	0.88	0.170	2	C	FD	2D	0.72
		1.75	4	1	0.88	0.358	2	F	F9	29	0.72
		2	5	3	0.56	0.546	2	J	29	39	0.42
		2.5	6	4	0.56	0.858	2	FH	39	49	0.42
		3	7	5	0.56	0.296	1	E	F9	29	0.42
		CAP	-	-	0.75	0.499	3	H	19	39	0.34
6	2A/3L	1.38	1	7	1.13	0.499	3	H	29	39	0.98
		4	2	2	0.81	0.296	1	E	29	29	0.66
		1.75	3	1	1.13	0.671	3	DG	29	49	0.98
		2	4	3	0.81	0.858	3	FH	39	49	0.66
		2.5	5	4	0.81	0.358	2	F	29	29	0.66
		3	6	5	0.81	0.608	2	DF	29	39	0.66
		3.5	7	6	0.81	0.858	2	FH	39	49	0.66
		CAP	-	-	0.75	0.109	3	A	1D	1D	0.34
7	2A	1.38	1	7	1.13	0	3	NONE	G	1	0.98
		1.75	3	8	1.13	0.170	3	C	FD	2D	0.98
		2	4	1	0.81	0.358	3	F	F9	29	0.66
		CAP	-	-	0.94	1.296	4	EHH	5B	6B	0.53
8	2A/3L	1.38	1	7	1.13	1.171	4	DGH	4B	6B	0.98
		5.5	2	2	0.69	0.921	2	GH	5B	5B	0.54
		1.75	3	8	1.13	1.358	4	FHH	5B	6B	0.98
		2	4	1	0.81	1.546	4	HHJ	6C	7C	0.66
		2.5	5	3	0.81	0.170	3	C	FD	2D	0.66
		3	6	4	0.81	0.421	3	G	19	39	0.66
		3.5	7	5	0.81	0.671	3	DG	29	49	0.66
		4	8	6	0.81	0.110	2	A	GD	1D	0.66
		5	9	0	0.81	0.671	2	DG	29	49	0.66
		CAP	-	-	0.94	0.796	4	EH	39	49	0.63
10	2A	1.75	1	-	1.38	0.296	4	E	F9	29	1.22
		2	3	-	1.06	0.499	4	H	19	39	0.91
		2.5	4	-	1.06	0.499	4	EH	39	49	0.91
		3	5	-	1.06	1.046	4	DEH	4B	5B	0.91
		3.5	6	-	1.06	1.296	4	EHH	5B	6B	0.91
		4	7	-	1.06	0	3	NONE	G	1	0.91
		5	9	-	0.94	0.421	3	G	19	39	0.79
		5.5	0	-	0.94	0.671	3	DG	29	49	0.79
		CAP	-	-	0.94	0	4	NONE	G	1	0.53

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

For Cylinder Division Plant Locations – See Page II.

Table 2 CODES FOR 2H, AND 7-8" 3H SERIES CYLINDERS WITH EPS 5, 6 & 7 SENSORS

BORE	SERIES	ROD DIA	ROD NUMBER	STANDARD PROBE LOCATION "GG"	SPACER HEIGHT "C"	SWITCH CODE	SPACER CODE	EPS5 BOLT CODE (1)	EPS 6,7 BOLT CODE (1)	OPTIONAL STROKE TO GO
1.5	2H	0.63	1	0.880	0.439	1	A2	GD9	1D9	.422
		1	2	0.880	0.626	1	E2	F99	299	.422
		CAP	-	0.937	1.048	2	EG2	299(2)	499(2)	.381
2	2H	1	1	0.880	0.439	1	A2	GD9	1D9	.442
		1.375	2	0.880	0.579	1	D2	0D9	2E9	.442
		CAP	-	0.875	0.938	2	DF2	299	399	.319
2.5	2H	1	1	0.880	0.170	1	C	FD	2D	.475
		1.75	2	0.880	0.546	1	J	29	39	.475
		1.375	3	0.880	0.358	1	F	F9	39	.475
		CAP	-	0.875	0.671	2	DG	29	49	.319
3.25	2H	1.375	1	1.125	0.671	2	DG	29	49	.725
		2	2	0.812	0.249	1	D	FD	2	.417
		1.75	3	1.125	0.858	2	FH	39	49	.725
		CAP	-	1.062	0.296	2	E	F9	29	.506
4	2H	1.75	1	1.125	0.608	2	DF	29	39	.725
		2.5	2	0.812	0.296	1	E	F9	29	.417
		2	3	0.812	0	1	NONE	G	1	.417
		CAP	-	1.000	0.170	2	C	FD	2D	.444
5	2H	2	1	0.812	0.858	3	FH	39	49	.417
		3.5	2	0.812	0.858	2	FH	39	49	.417
		2.5	3	0.812	0.358	2	F	F9	29	.417
		3	4	0.812	0.608	2	DF	29	39	.417
		CAP	-	0.875	0.358	3	F	F9	29	.319
6	2H	2.5	1	1.062	0.671	3	DG	29	49	.663
		4	2	1.062	0.608	2	DF	29	39	.663
		3	3	1.062	0.109	2	A	GD	1	.663
		3.5	4	0.812	0.358	2	F	F9	29	.417
		CAP	-	1.250	1.749	4	DHHH	6A	8D	.683
7	2H/3H	3	1	1.562	0.421	3	G	19	39	1.162
		5	2	1.437	0.671	2	DG	29	49	1.037
		3.5	3	1.562	0.671	3	DG	29	49	1.162
		4	4	1.062	0.109	2	A	GD	1D	.663
		4.5	5	1.437	0.358	2	F	F9	29	1.037
		CAP	-	1.687	1.421	4	GHH	51	7B	1.117
8	2H/3H	3.5	1	1.812	0.170	3	C	FD	2D	1.412
		5.5	2	1.687	0.421	2	G	19	39	1.287
		4	3	1.062	0.421	3	G	19	39	.663
		4.5	4	1.437	0.671	3	DG	29	49	1.037
		5	5	1.437	0.170	2	C	FD	2D	1.037
		CAP	-	1.687	0.921	4	GH	31	5B	1.183

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

For additional information – call your local Parker Cylinder Distributor.

Table 3 CODES FOR **HMI SERIES** CYLINDERS WITH EPS 5, 6 & 7 SENSORS

BORE	SERIES	ROD DIA	ROD #	STANDARD PROBE LOCATION "GG"	SPACER HEIGHT "C"	SWITCH CODE	SPACER CODE	EPS5 BOLT CODE (1)	EPS 6,7 BOLT CODE (1)	OPTIONAL STROKE TO GO
40*	HMI	18	1	0.875	0.688	1	F3	HPP	HPP	.532
		28	2	0.875	0.688	1	F3	HPP	HPP	.532
		CAP	-	0.875	1.048	2	EG3	KPPZ	KPP	.656
50*	HMI	22	1	0.875	1.188	2	FH3	KPP	KPP	.532
		36	2	0.875	0.626	1	E3	HPP	HPP	.532
		28	3	0.875	0.500	1	C3	HPP	HNP	.532
		CAP	-	0.875	0.829	2	H3	JPP	JPP	.656
63	HMI	28	1	0.875	0.249	1	D	HN	HN	.500
		45	2	0.875	0.546	1	J	JS	JP	.500
		36	3	0.875	0.358	1	F	JR	HP	.500
		CAP	-	0.875	0.671	2	DG	KT	KP	.656
80	HMI	36	1	1.125	0.671	2	DG	KT	KP	.500
		56	2	0.812	0.296	1	E	HN	HN	.500
		45	3	1.125	0.858	2	FH	KJ	KP	.500
		CAP	-	1.000	0.296	2	E	HR	HP	.656
100	HMI	45	1	1.125	0.608	2	DF	JT	JP	.500
		70	2	0.812	0.358	1	F	HR	HP	.500
		56	3	0.812	0.858	2	FH	KU	KP	.500
		CAP	-	1.000	0.170	2	C	HV	HN	.656
125	HMI	56	1	0.812	0.170	2	C	HV	HN	.500
		90	2	0.812	0.109	1	A	LV	LN	.500
		70	3	0.812	0.499	2	H	JS	JP	.500
		CAP	-	1.000	0.421	3	G	JS	JP	.656
160	HMI	70	1	1.062	0.499	3	H	JS	JP	.500
		110	2	1.062	0.499	2	H	JS	JP	.500
		90	3	1.062	0.109	2	A	LV	LN	.500
		CAP	-	1.312	0.546	4	J	XW	MQ	.670
200	HMI	90	1	1.562	0.170	3	C	HV	HN	.670
		140	2	1.687	0.421	2	G	JS	JP	.670
		110	3	1.687	0.546	3	J	JS	JP	.670
		CAP	-	1.937	0.671	4	DG	KT	KP	.670

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

*TC and TD mountings: The tie rod nuts will be exposed and not counterbored into the cap.

C

Table 4 — Mounting Bolts
Two mounting bolts are required per switch.

Code #	Parker Part #	Bolt Length Inches	Bolt Type
0	010634-0048	0.75	1/4-20 SHCS
1	010634-0100	1.00	1/4-20 SHCS
2	010634-0116	1.25	1/4-20 SHCS
3	010634-0132	1.50	1/4-20 SHCS
4	010634-0148	1.75	1/4-20 SHCS
5	010634-0200	2.00	1/4-20 SHCS
6	010634-0216	2.25	1/4-20 SHCS
7	010634-0232	2.50	1/4-20 SHCS
8	010634-0248	2.75	1/4-20 SHCS
9	010628-0024	0.38	#8-32 SHCS
A	010628-0032	0.50	#8-32 SHCS
B	010628-0100	1.00	#8-32 SHCS
C	010628-0132	1.50	#8-32 SHCS
D	010453-0024	0.38	#8-32 FHCS
E	010453-0032	0.50	#8-32 FHCS
F	010634-0056	0.88	1/4-20 SHCS
G	010634-0040	0.62	1/4-20 SHCS
Mounting Bolts for HMI		**Bolt Length mm**	
H	147421-0030	30	M6X1.0 SHCS
J	147421-0040	40	M6X1.0 SHCS
K	147421-0045	45	M6X1.0 SHCS
L	147421-0025	25	M6X1.0 SHCS
M	147421-0065	65	M6X1.0 SHCS
N	148722-0210	10	M6X1.0 SHCS
P	148764-0010	10	M6X1.0 SHCS (LOW HEAD)
Q	147419-0035	35	M4X0.7 SHCS
R	148722-0212	12	M4X0.7 FHSC
S	148722-0216	16	M4X0.7 FHSC
T	148722-0220	20	M4X0.7 FHSC
U	-	-	-
V	148722-0208	8	M4X0.7 FHSC
W	-	-	-
X	147421-0065	65	M6X1.0 SHCS
Y	-	-	-
Z	0108800016	1/4" HI COLLAR LOCK WASHER, 4 REQ'D	

FHSC=Flat Head Socket Screw

Table 5 — Spacer Blocks

Letter Code	Parker Part #	Spacer Thickness (inches)	Letter Code	Parker Part #	Spacer Thickness (inches)
A	085469-0110	.109	**EH**	085469-0797	.796
B	085467-0000	.138	**FH**	085469-0859	.858
C	085469-0171	.170	**GH**	085469-0922	.921
D	085469-0250	.249	**BGG**	085469-0983	.982
E	085469-0297	.296	**DEH**	085469-1047	1.046
F	085468-0359	.358	**DGH**	085469-1172	1.171
G	085469-0422	.421	**EHH**	085469-1297	1.296
H	085469-0500	.499	**FHH**	085469-1359	1.358
J	085469-0547	.546	**GHH**	085469-1422	1.421
K	085466-0000	.330	**HHJ**	085469-1547	1.546
DF	085469-0609	.608	**DHHH**	085469-1750	1.749
DG	085469-0672	.671	**1**	085468-0547	.546
EG	085469-0719	.718	**2**	085482-0000	.330
FG	085469-0781	.780	**3***	087583-0000	0.330

One O-Ring per spacer, Size# 2 - 15, Cylinder Division Part Number 010024-0003 (Fluorocarbon)

* Used on HMI only

Table 6 - Available Mounting Positions for EPS-5, 6, 7

EPS 5,6,7		Sensor Location for Series 2A,2AN,3L,2H,7&8"3H, HMI									
MOUNTING STYLES		Bore Size (in inches)									
Bores sizes (inches):		**1.5**	**2**	**2.5**	**3.25**	**4**	**5**	**6**	**7**	**8**	**10**
HMI bores sizes (mm):		**40**	**50**	**63**	**80**	**100**	**125**	**160**		**200**	
T,TB,TC,TD,BB,DD,BC	**HEAD**	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
	CAP	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
J,D,JJ (see note 3)	**HEAD**	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
	CAP	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
H,DB,HH	**HEAD**	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
	CAP	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
C (see note 2)	**HEAD**	1	1	1	1	1	1	1,2,4	1,2,4	1,2,4	1,2,4
	CAP	1	1	1	1	1	1	1,2,4	1,2,4	1,2,4	1,2,4
E	**HEAD**	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
	CAP	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
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	1,2,4
	CAP	1	1	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4
JB	**HEAD**	NA	NA	NA	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
	CAP	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
HB	**HEAD**	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
	CAP	NA	NA	NA	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4

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

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

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

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

For Cylinder Division Plant Locations – See Page II.

Specifications

Style:	EPS-7	EPS-5	EPS 6	CLS 1	CLS 4
Code Designator:	H	R	D	F	B
Description:	Economical, General Purpose, 2 wire device, primarily for AC applications. Use EPS 5 only for automotive industry customers who specify them.		Ecomical, General Purpose, 3 wire, DC sensor, dual output: sinking and sourcing	Functional replacement for AB (Mechanical) Limit Switches in many applications, or where customer needs NC contacts, zero leakage, higher or lower load current than EPS-style	Functional replacement for AB (Mechanical) Limit Switches in many High Temperature applications, or where customer needs NC contacts, zero leakage, zero voltage drop, higher or lower load current than EPS-style.
Supply Voltage:	20 to 250 VAC/DC	50 to 200 VAC/DC	10 to 30 VDC	10 to 200 VAC/DC	10 to 200 VAC/DC
Load Current, min:	3 mA	5 mA	3 mA	NA	NA
Load Current, max:	300 mA	500 mA	200 mA	4 AMPS @ 120 VAC 3 AMPS @ 24VDC	4 AMPS @ 120 VAC 3 AMPS @ 24 VDC
Leakage Current:	1.7 mA, max.	1.7 mA, max.	10 micro amps max	–	–
Voltage Drop:	7 V, max.	10 V, max.	2 VDC max.	1V	NA
Operating Temperature:	-14° to +158° F	-14° to +158°F	-14° to +158°F	-40°F to +160°F	-40°F to +400°F
Sensor Type:	Inductive proximity	Inductive proximity	Inductive proximity	non-contacting magnetically actuated	non-contacting magnetically actuated
Part Number:	148897****	146617****	148896****	148275****	149109****
Part Number Suffix**:**	**** 4-digit suffix indicates probe length: 0125=1.25", 0206=2.06", 0288=2.875", 0456=4.562"				
Connection:	3 pin mini	3 pin mini	5 pin mini	3 pin mini	144" PTFE Coated Flying Leads with 1/2" conduit hub
Enclosure Rating:	IEC IP67	NEMA 3, 4, 13	IEC IP67	NEMA 1, 2, 3, 4, 4x, 5, 6, 6P, 11, 12, 12K, 13	NEMA 1, 2, 3, 4, 4x, 5
LED indication:	Yes	Yes	Yes	Yes	No
Short Circuit Protection:	Yes	Yes	Yes	No	No
Weld Field Immunity:	Yes	Yes	Yes	Yes	Yes
Output:	2 wire, Normally Open with leakage current	2 wire, Normally Open with leakage current	Dual Output: DC Sinking and DC Sourcing, user selectable via wiring	SPDT (Single Pole Double Throw), Normally Open/Normally Closed, Form C	SPDT (Single Pole Double Throw), Normally Open/Normally Closed, Form C
Approvals/Marks:	CE, UL, CSA	UL	CE, UL, CSA	UL, CSA	UL, CSA
Make/Break Location:	0.125" from end of stroke, typical. Tolerance is =/-.125"				
Wiring Instructions:	Pin 1: AC Ground (Green) Pin 2: Output (Black) Pin 3: AC Line (White)	Pin 1: AC Ground (Green) Pin 2: Output (Black) Pin 3: AC Line (White)	Pin 1) +10 to 30 VDC (White) Pin 2) Sourcing Output (Red) Pin 3) Grounded (not connected or required) Pin 4) Sinking Output (Orange) Pin 5) DC Common (Black)	Pin 1: Common (Green) Pin 2: Normally Closed (Black) Pin 3: Normally Open (White)	Common: (Black) Normally Open: (Blue) Normally Closed: (Red)
Cable: 6'	085355-0006	085355-0006	085917-0006	085355-0006	–
Cable: 12'	085355-0012	085355-0012	085917-0012	085355-0012	–
Cable: 6', Right Angle	087547-0006	087547-0006	–	087547-0006	–

For additional information – call your local Parker Cylinder Distributor.

Cylinder End-of-Stroke Proximity Sensors

Parker EPS proximity switches may be ordered on Series 2A, 2AN, 3L, 3H and HMI 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 bulletin 0840-G-E1 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 od 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. leng h.

How to Specify EPS Switches

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

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

Example = BXXXX-42BGG denotes a switch on the cap end only, CLS-4

Head End

R	1	3	A	GG
Specify: "R" = EPS-5 "H" = EPS-7 "D" = EPS-6 "F" = CLS-1 "B" = CLS-4 "N" = Prep for switches only	Port Location See Figure 1.	Switch Location See Figure 1.	Switch Orientation See Figure 2 for EPS-7 and Eps-6 only.	Actuation Point GG = End of Stroke FF = Stroke to Go; See 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

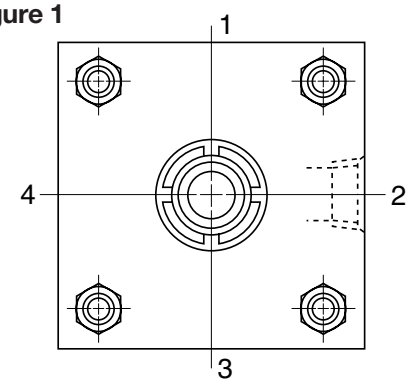
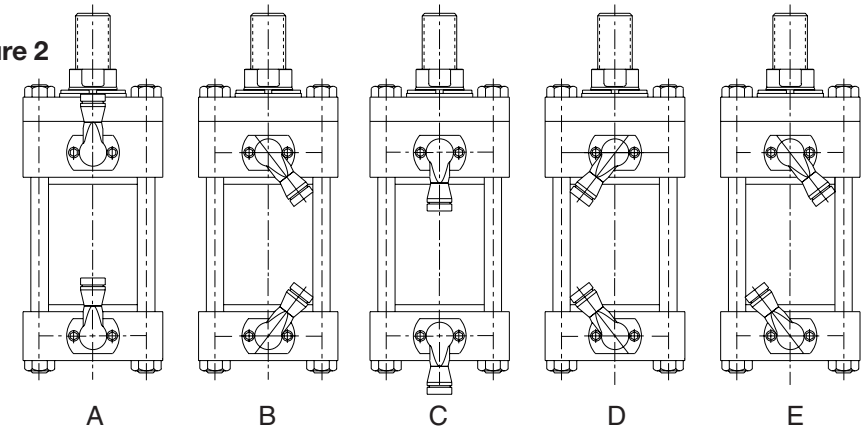


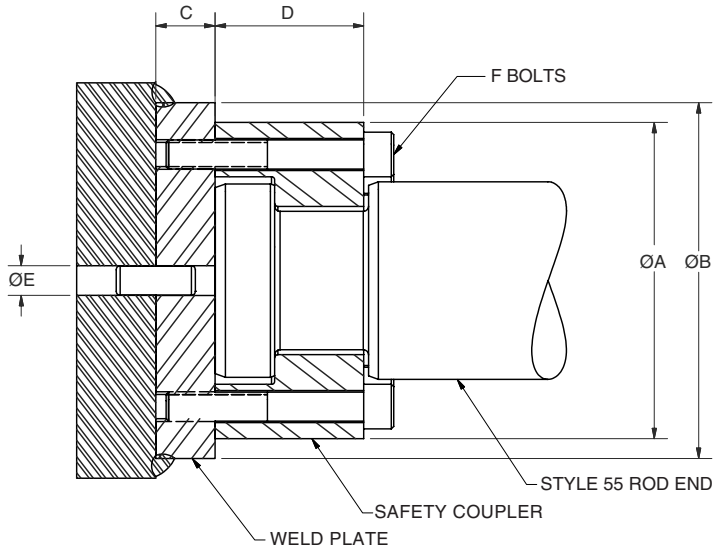
Figure 2



C

Parker "Style 55" Piston Rod End

Safety Couplers and Weld Plates



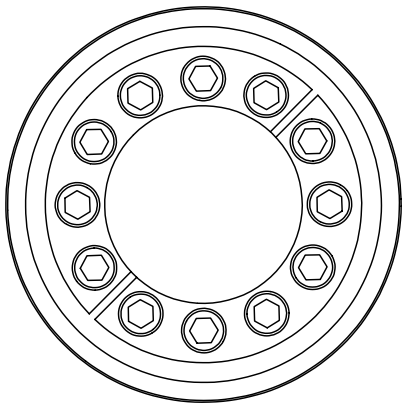


Table 1 — Part Numbers and Dimensions

ROD DIA.	A	B	C	D	E	F	BOLT SIZE	BOLT CIRCLE	SAFETY COUPLER PART NO.	WELD PLATE PART NO.
.625	1.50	2.00	.50	.56	.250	4	#10-24 x .94 LG	1.125	147234 0062	148174 0062
1.00	2.00	2.50	.50	.88	.250	6	.250-20 x 1.25 LG	1.500	147234 0100	148174 0100
1.375	2.50	3.00	.63	1.00	.250	6	.312-18 x 1.0" LG	2.000	147234 0138	148174 0138
1.75	3.00	4.00	.63	1.25	.250	8	.312-18 x 1.75 LG	2.375	147234 0175	148174 0175
2.00	3.50	4.00	.75	1.63	.375	12	.375-16 x 2.25 LG	2.687	147234 0200	148174 0200
2.50	4.00	4.50	.75	1.88	.375	12	.375-16 x 2.50 LG	3.187	147234 0250	148174 0250
3.00	5.00	5.50	1.00	2.38	.375	12	.500-13 x 3.25 LG	4.000	147234 0300	148174 0300
3.50	5.88	7.00	1.00	2.63	.375	12	.625-11 x 3.50 LG	4.687	147234 0350	148174 0350
4.00	6.38	7.00	1.00	2.63	.375	12	.625-11 x 3.50 LG	5.187	147234 0400	148174 0400
4.50	6.88	8.00	1.00	3.13	.375	12	.625-11 x 4.00 LG	5.687	147234 0450	148174 0450
5.00	7.38	8.00	1.00	3.13	.375	12	.625-11 x 4.00 LG	6.187	147234 0500	148174 0500
5.50	8.25	9.00	1.25	3.88	.375	12	.750-10 x 5.00 LG	6.875	147234 0550	148174 0550
7.00	10.38	11.00	1.75	4.00	.500	12	1.00-8 x 5.50 LG	8.750	147234 0700	148174 0700
8.00	11.38	12.00	2.00	4.00	.500	16	1.00-8 x 5.50 LG	9.750	147234 0800	148174 0800
8.50	12.38	13.00	2.00	4.00	.500	16	1.00-8 x 5.50 LG	10.750	147234 0850	148174 0850
9.00	13.12	14.00	2.25	4.00	.500	12	1.25-7 x 6.00 LG	–	147234 0900	148174 0900
10.00	14.12	15.00	2.50	4.50	.500	16	1.25-7 x 6.50 LG	12.125	147234 1000	148174 1000

Note: Screws are not included with safety coupler or weld plate.

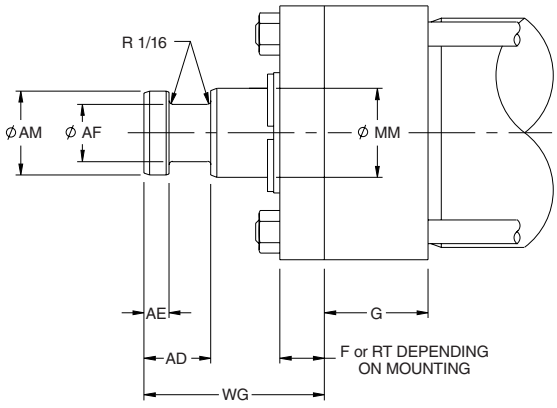
For additional information – call your local Parker Cylinder Distributor.

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

Piston Bumper Seal Option Now Available For Series 2A & 2AN

Impact dampening Piston Bumper Seals are now optional for Series 2A & 2AN cylinders 1.50" - 5.00" bores (except 1.50" & 2.00" bores with code 2 rods). The Piston Bumper Seal combines the features of low-friction, rounded lipseals and impact-dampening bumpers to provide reduced noise and smoother end-of-stroke deceleration. At pressure greater than 80 psi the compressible Buna Nitrile or Fluorocarbon Piston Bumper Seal has minimal effect on stroke loss. When specified, Piston Bumper Seals will be provided on both ends of the piston, eliminating the need to specify head end or cap end only.

Bumper Seals Reduce Noise

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

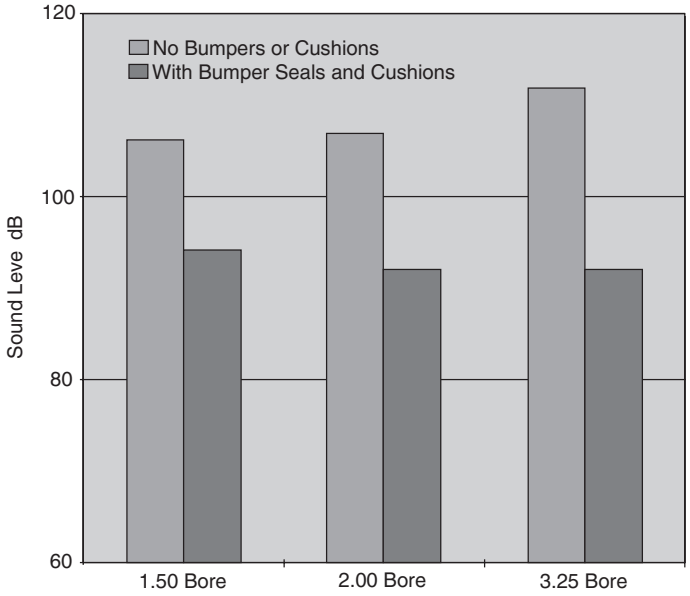
Impact noise was recorded at a distance of 3 feet from the front of the cylinder, inside a semi-anechoic chamber. Cylinders were operating at 95 psi.

Piston Bumper Seals Have Minimum Effect on Stroke Length

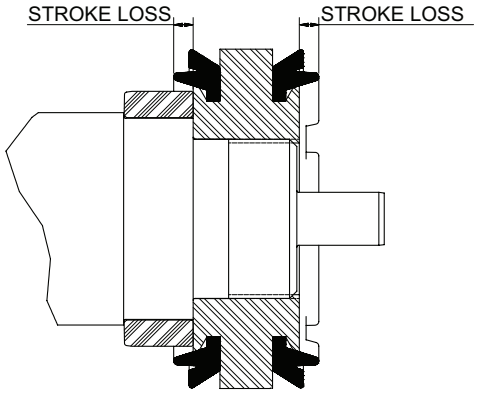
The chart below depicts typical amounts of overall stroke loss incurred at various system pressures. The amount of stroke loss may vary slightly due to design tolerances of seal size, variance in seal durometer and compression set associated with cylinder wear. To determine the stroke loss at either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

Note: There will be an increase in the cylinder W piston rod extension dimension equal to cap end stroke loss.

Sound Level Comparison



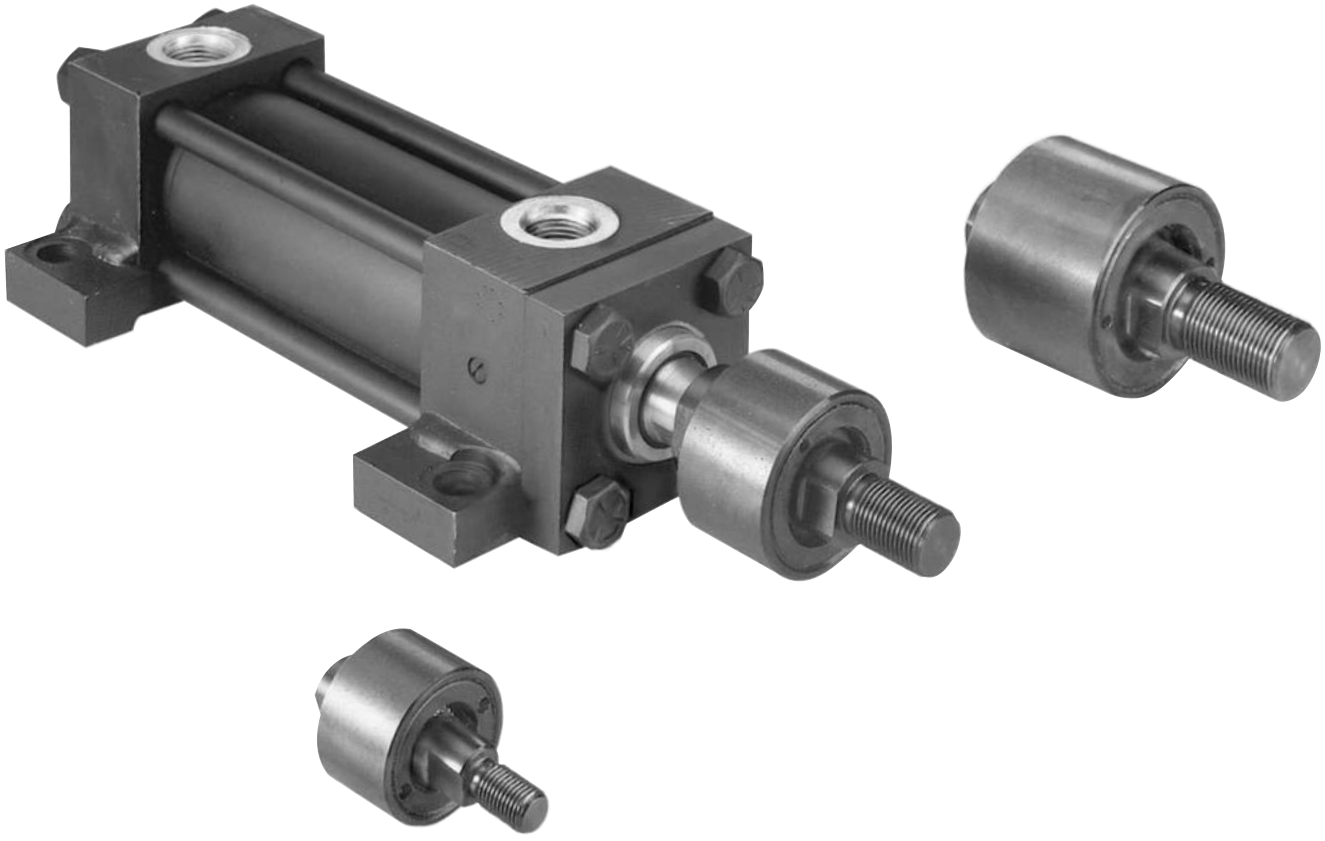
Bumper Seal Option



Pressure (psi)	Typical Overall Stroke Loss (inch) by Bore Ø					
	1.50	2.00	2.50	3.25	4.00	5.00
0	0.16	0.13	0.19	0.22	0.22	0.19
20	0.12	0.11	0.12	0.18	0.12	0.15
40	0.10	0.08	0.09	0.12	0.10	0.10
60	0.08	0.07	0.07	0.09	0.06	0.07
80	0.06	0.05	0.05	0.06	0.04	0.02
100	0.05	0.03	0.02	0.04	0.02	0.01

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

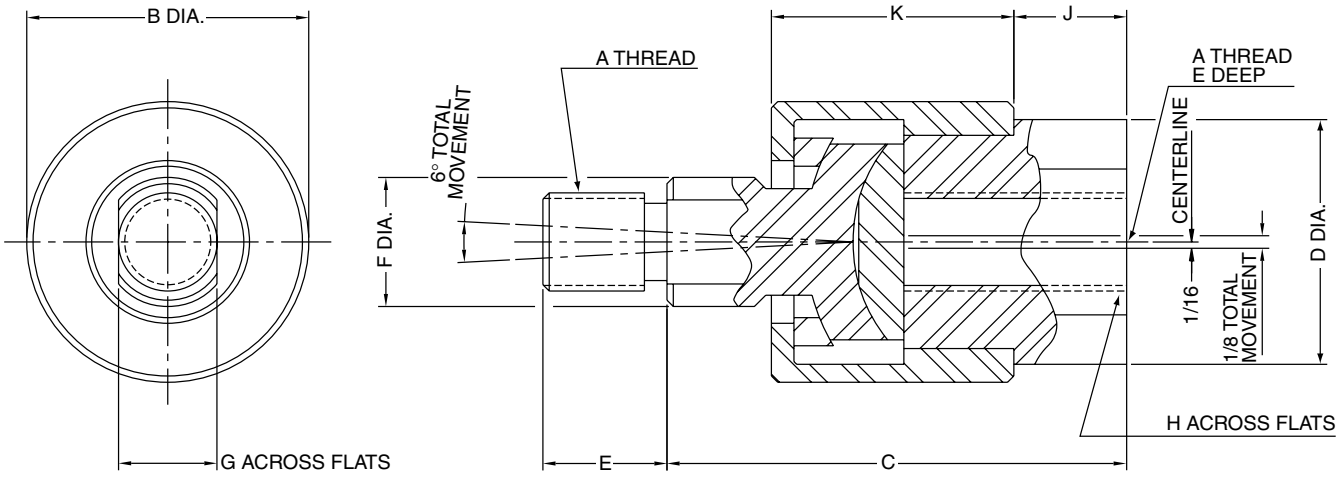


Table 1 — Part Numbers and Dimensions

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	3	2 3/8	1 5/8	1 7/16	1 1/4	1 7/8	3/4	1 25/32	19425	4.8
1347570125	1 1/4-12	3 1/8	3	2 3/8	1 5/8	1 7/16	1 1/4	1 7/8	3/4	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

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

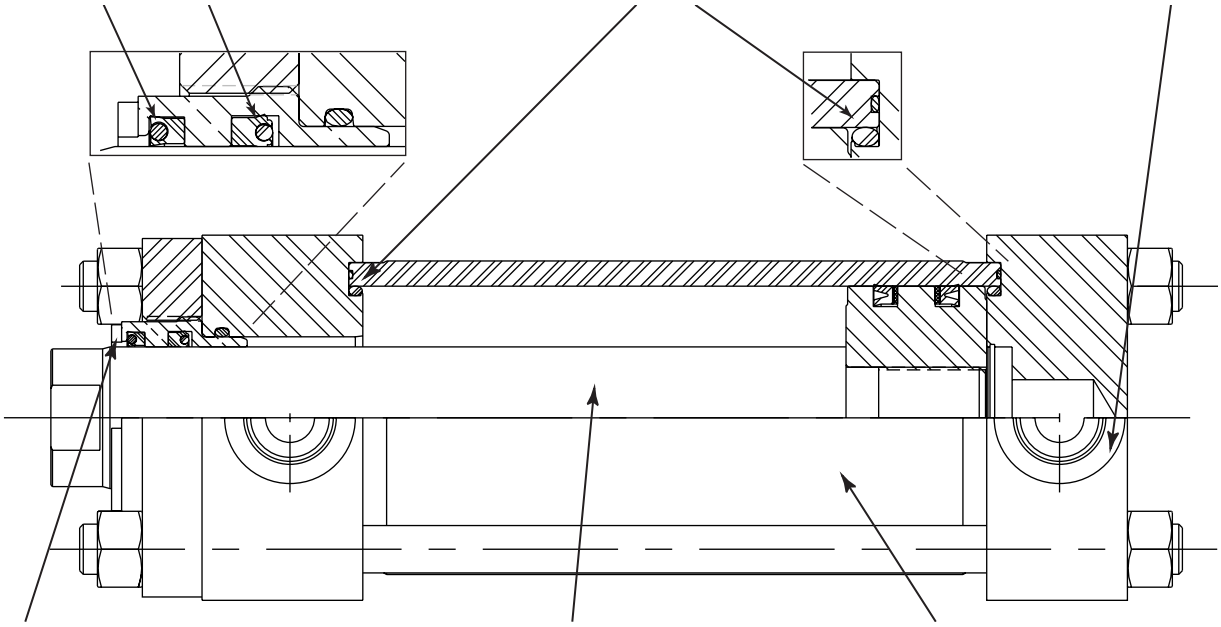
For additional information – call your local Parker Cylinder Distributor.

Water Submersible Option for Series 2H and 3H Hydraulic Cylinders

Polypak Inner and Outer Rod Seals resist internal and external pressure for depths from 25 to 5000 feet

Dual Cylinder Body Seals resist external pressure for depths from 25 to 5000 feet

SAE O-Ring Straight Thread Ports for positive sealing



Bronze Rod Bushing

Heat-Treated, Chrome-Plated, High Tensile Stainless Steel Piston Rod Material resists corrosion.

Multiple Layers of Inorganic Zinc Coating protects and prepares cylinder exterior for final coating. Cylinder is sandblasted for superior coating adhesion.

Features:
- Subsea rod seal package
- Subsea cylinder body seal package
- Chrome Plated Stainless Steel, High Tensile Piston Rod (17-4PH)
- Inorganic Zinc Primer coating
- Heavy-Duty Hydraulic Service - ANSI/(NFPA) T3.6.7R2-1996 Mounting Dimensions

Custom Options available for Special Order:
- All Stainless Steel Construction
- High tensile Stainless Steel tie rods and nuts
- End of Stroke Switches
- Electroless Nickel Plating
- Chrome-plated Interior Cylinder wall

Specifications:
- Submersion Depth: up to 5000 feet
- Cylinder normal pressure rating: 3000 psi
- Coating: 2 Coats Inorganic Zinc primer: Dimetcote 21-5 or equivalent 2-4 mils total.
- Surface Preparation: Sandblast to SP-10
- Operating Temperature: -10° to +160° F
- Consult Cylinder Catalog for Standard Cylinder specifications
- Seals compatible with Water Glycol Fluids
- Extra Thick Chrome Plated Piston Rod

C

For Cylinder Division Plant Locations – See Page II.

Water Submersible Option for Series 2H and 3H Hydraulic Cylinders

How to order:

1. Specify the complete Parker Cylinder Model Number from Table A and from Cylinder Catalog.
2. Put an "S" in the model number to indicate a special cylinder.
3. Include the 5 digit specification code from Table B.
4. For custom options, such as switches, provide a complete description or drawing of your requirements.

Table A — Basic Model Numbers

Bore Size	Cushion Head End	Double Rod	Mounting Style	Mounting Modifi-cation	Series	Piston	Ports	Common Modifi-cations	Special Modifi-cations	Piston Rod Number	Rod End Thread Style	Thread Type	Cushion Cap End	Stroke
4.00	C	—	TC	P	2H	L	T	V	S	1	4	A	C	X24.00
Specify. Consult dimension tables for available bore sizes. Also see current Parker Industrial Cylinder Catalog 0106.	Specify only if cushion Head End is required.	Consult factory for double rod cylinders.	Specify Mounting Style 2H. Consult dimension tables for available mounting styles.	Specify P- for thrust key mounting. ONLY IF REQUIRED.	Specify Series	Use L for Lipseal Piston. Use K for Hi-Load Piston. Use C for ring type piston.	Specify "T" for SAE straight thread ports.	If required specify V = Fluorocar-bon Seals Consult Engineering Section of current Parker Industrial Catalog 0106 for fluid compatability information.	Specify an "S" Submersible Option	Specify rod code number. Consult dimension tables for available rod diameters and Engineering section of the catalog, for rod buckling consider-ations.	Specify Style 4, Small Male. Style 8, Intermediate Male. Style 3, Special. Specify KK, A, LA or W dimension required.	Specify A = UNF W = BSF M = Metric	Specify "C" if cap end cushion is required.	Specify in inches. Show symbol "x" just ahead of stroke length.

Table B: Subsea Code

Feature	Code	Specification
Submersion Depth	1	less than 25 feet (uses conventional 2H rod and body seal design)*
	2	between 25 feet and 5000 feet (uses submersible rod and body seal design)
	3	Other (specify) (advise depth and other requirements)
Cylinder Body	C	Chrome plated interior
	P	Plain interior
Corrosion Protection	1	Standard
	2	Inorganic Zinc primer with Stainless Steel tie rods, nuts & fasteners
	3	Electroless nickel plate exterior with SS tie rods, nuts & fasteners
	4	Other (specify)

Example:

4.00 BB 2HK T S 14 X 24*

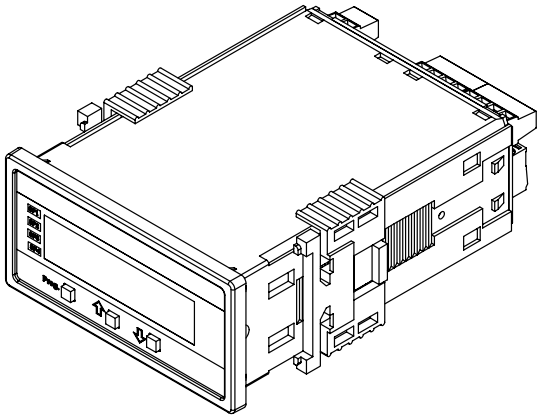
S=Subsea Code: 2-P-1

(describes a 4" x 24" cylinder for submersion up to 5000 feet, with a plain cylinder body wall and standard corrosion protection.)

*Consult current Parker Cylinder Catalog 0106 for complete model number and specifications.

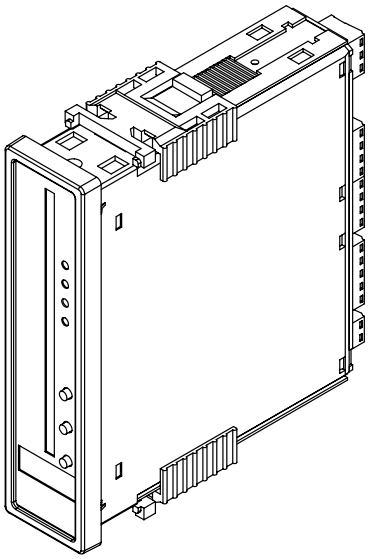
For additional information – call your local Parker Cylinder Distributor.

Parker Introduces the LRTC LRT Controller



Panel Meter Controller

- AC or DC Power Supply
- Analog Output
  - 4-20 mA
  - 0-10 VDC
- Relay Output
  - Single, Dual, or Four 5A Form A Relays

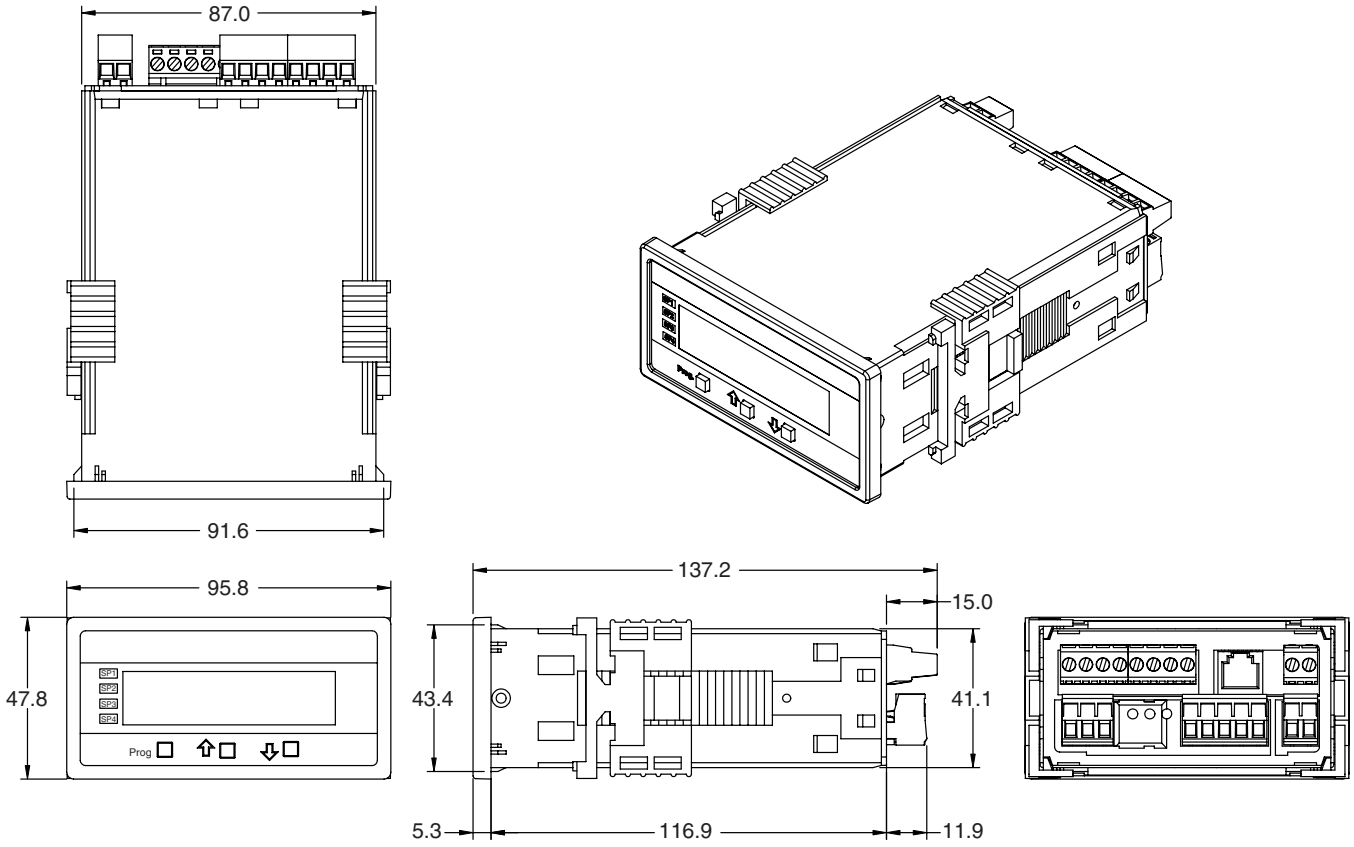


101 Segment Bargraph Controller

- Display – Red or Tricolor LED
- AC or DC Power Supply
- Analog Output
  - 4-20 mA
  - 0-10 VDC
- Relay Output
  - Combinations of 10A Form C and 5A Form A Relays

- Multiple Setpoints
- High Speed Capability
- Simple Installation
- NEMA 4 Rating (with cover)
- Multiple Relays
- 16 Bit Internal Resolution
- Panel Meter or Bargraph Display

For additional information – call your local Parker Cylinder Distributor.

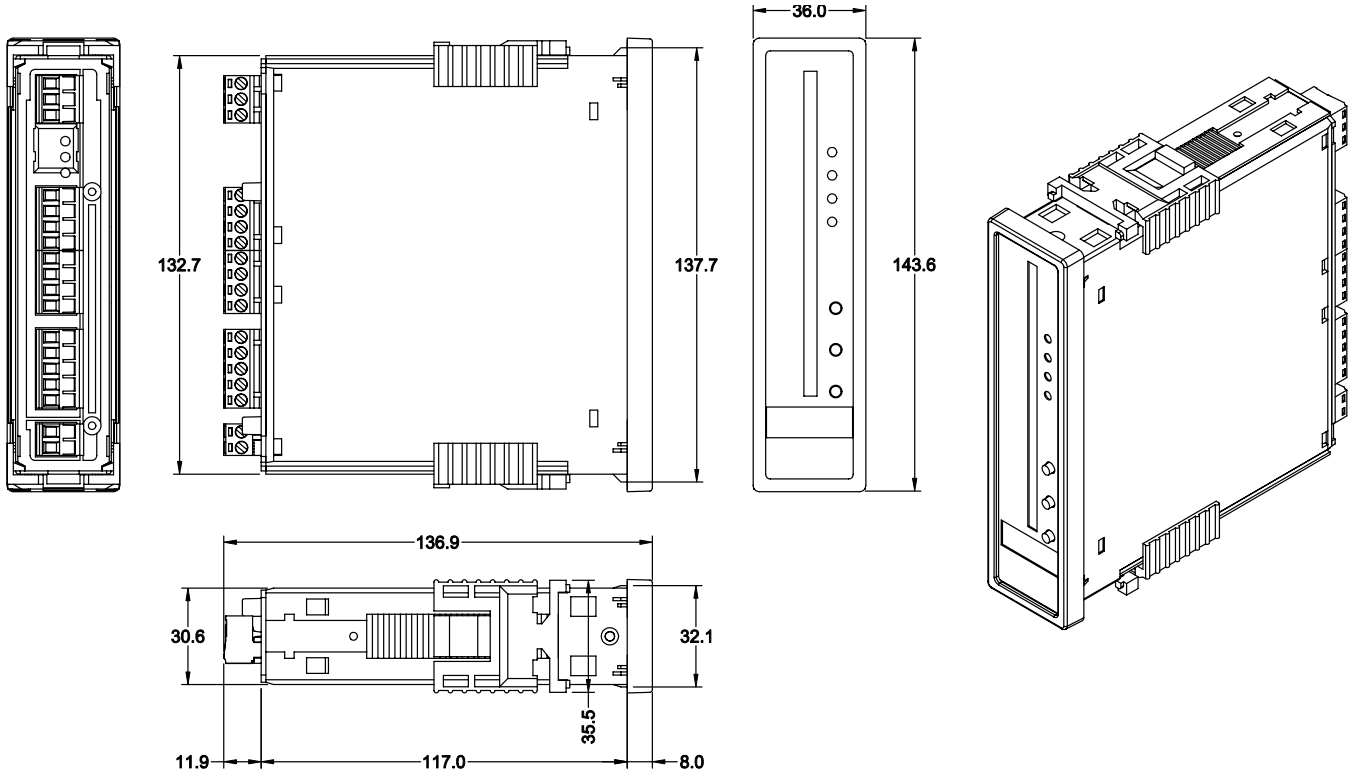


Electrical Specifications, Controller Part #149345

- Power Input Requirements ..... High voltage, 85 – 265 VAC, or 95 – 370 VDC
  Low voltage, 9 – 32 VAC, OR 10 – 60 VDC
- Relay Output Options ..... One 5A Form A Relay
  Dual 5A Form A Relays
  Four 5A Form A Relays
- Analog Output Specification ..... Isolated, 16-bit Current Output; 0 – 20 mA or 4 – 20 mA
  Isolated, 16-bit Voltage Output; 0 – 10 VDC
  Accuracy: 0.02% over Full Scale
  Resolution: 1/45,000
  Update Rate: 7 Readings per second
- Internal Resolution ..... 16 Bits
- Operating Temperature Range ..... 0 – 50°C, +32°F to +122°F
- Warm-up Time ..... 10 Minutes
- Numerical Display ..... Digital, 4 digits
- Display Range ..... -1,999 to +9,999
- Setpoints ..... Setpoint 1 activates Relay 1
  Setpoint 2 activates Relay 2
  Setpoint 3 activates Relay 3
  Setpoint 4 activates Relay 4
- NEMA Rating ..... 4 (with cover, Part #087861000)

For Cylinder Division Plant Locations – See Page II.

Controller Dimensions, Part #149346



Electrical Specifications, Controller Part #149346

- Power Input Requirements ..... High voltage, 85 – 265 VAC, or 95 – 370 VDC
  Low voltage, 9 – 32 VAC, OR 10 – 60 VDC
- Relay Output Options ..... One 5A Form A Relay
  Two 5A Form A Relays
  Dual 10A Form C & Dual 5A Form A Relays
- Analog Output Specification ..... Isolated, 16-bit Current Output; 0 – 20 mA or 4 – 20 mA
  Isolated, 16-bit Voltage Output; 0 – 10 VDC
  Accuracy: 0.02% over Full Scale
  Resolution: 1/45,000
  Update Rate: 7 Readings per second
- Internal Resolution ..... 16 Bits
- Operating Temperature Range ..... 0 – 50°C, +32°F to +122°F
- Warm-up Time ..... 10 Minutes
- Vertical Display ..... VRR – 101 Segment, Red LED Verticle Bar Graphic Display
  VTR – 101 Segment, Tri-color Vertical Bar Graphic Display
- Annunciators ..... Six, red LED's on front panel; one annunciator per setpoint
- Numerical Display ..... Digital, 4 digits
- Display Range ..... -1,999 to +9,999
- Setpoints ..... Setpoint 1 activates Relay 1
  Setpoint 2 activates Relay 2
  Setpoint 3 activates Relay 3
  Setpoint 4 activates Relay 4
- NEMA Rating ..... 4 (with cover, Part #087867000)

For additional information – call your local Parker Cylinder Distributor.

Ordering Code for Panel Meter Controller

Part Number Example: 149345 _ _ _ _ | 1 | C | R | 1 |

Power Supply

1 = 85-265 VAC / 95-370 VDC
2 = 18-48 VAC / 10-72 VDC

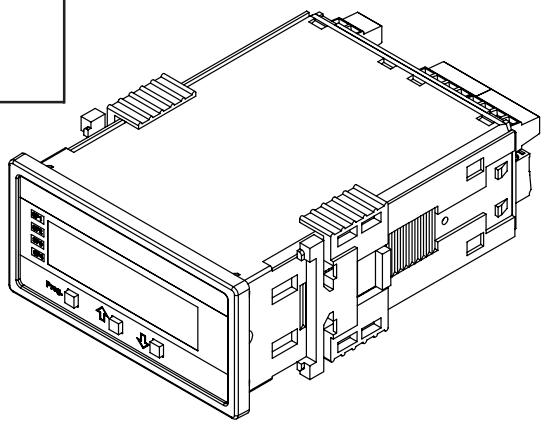
Analog Output

C = Isolated 16-bit Current Output, 4-20 mA
V = Isolated 16-bit Voltage Output, 0-10 VDC

Relay Output

R1 = Single 5A Form A Relay
R2 = Dual 5A Form A Relays
R4 = Four 5A Form A Relays

Note: Input requires a 3-wire potentiometer 1 kOhm min. (0 to 100.0).



Ordering Code for 101 Segment Bargraph Controller

Part Number Example: 149346 _ _ _ _ | R | 1 | C | 2 |

Display

R = Red LED Vertical Bargraph with 4-digit Red DPM
T = Tri-color LED Vertical Bargraph with 4-digit Red DPM

Power Supply

1 = 85-265 VAC / 95-370 VDC
2 = 18-48 VAC / 10-72 VDC

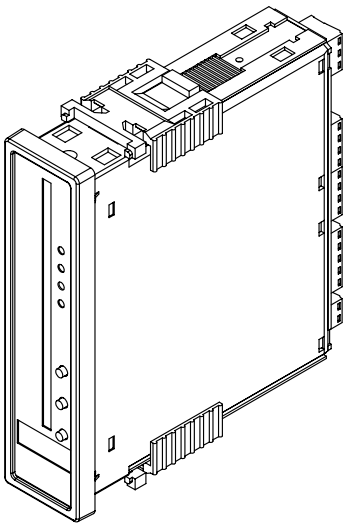
Analog Output

X = No Analog Output
C = Isolated 16-bit Current Output, 4-20 mA
V = Isolated 16-bit Voltage Output, 0-10 VDC

Relay Output

1 = Single 10A Form C Relay
2 = Dual 10A Form C Relays
3 = Dual 10A Form C & Single 5A Form A Relays
4 = Dual 10A Form C & Dual 5A Form A Relays
5 = Single 10A Form C & Dual 5A Form A Relays
6 = Single 10A Form C & Single 5A Form A Relays

Note: Input requires a 3-wire potentiometer 1 kOhm min. (0 to 100.0).



C

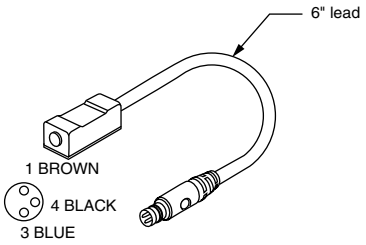
Magnet Actuated Switches with Quick Connect

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)

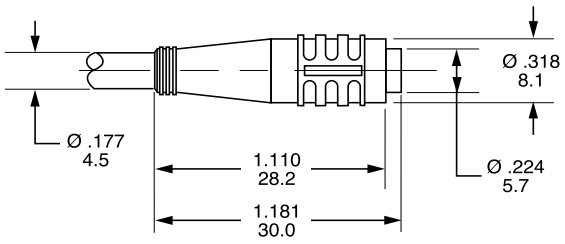
A female connector is available for all switches with the male quick connect option. The male plug will accept a snap-on or threaded connector. Cylinder Division cordset part numbers and other manufacturer's part numbers are listed below:

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

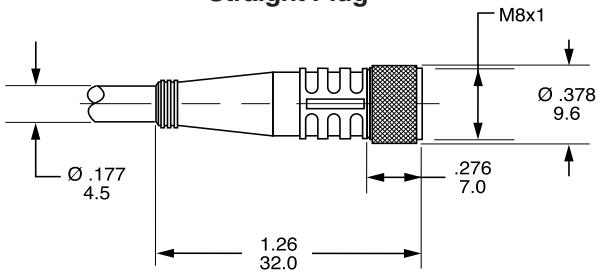
Cordset Specifications:

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

Snap-On Straight Plug



Threaded Straight Plug



For additional information – call your local Parker Cylinder Distributor.

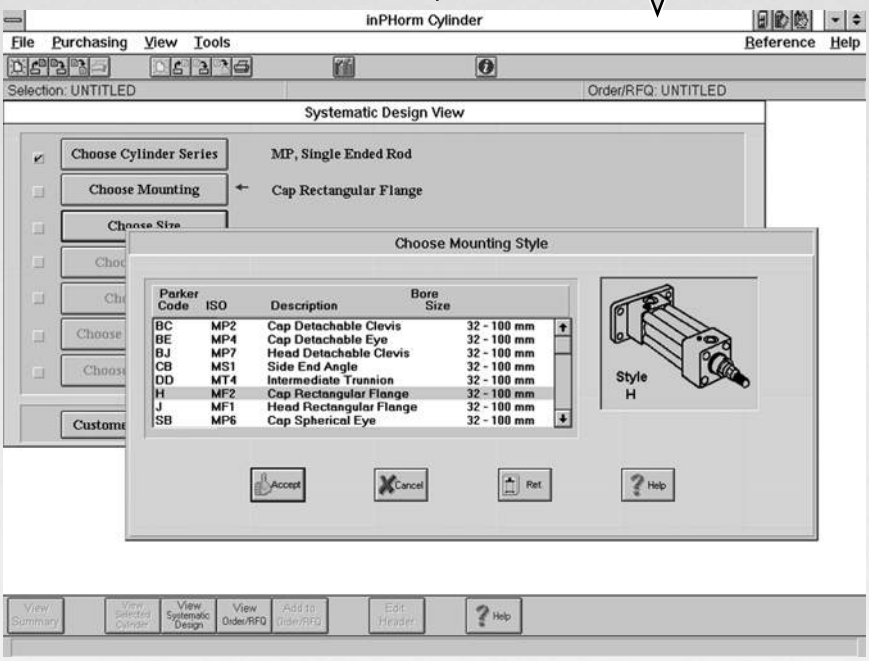
Parker *inPHorm*™ Cylinder Sizing, Selection, and Parametric CAD Software

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.

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

THE UPDATED VERSION 1.5 NOW ON CD



During any portion of the program, reference material can be accessed or printed for future use.

The ***inPHorm*** cylinders sizing, selection and parametric CAD software is designed around the user to assist in the design process and minimize the time required to specify, draw and file your favorite Parker Cylinder product. By working with the Parker ***inPHorm* for Cylinders** software, the design, selection and specification of Parker cylinders becomes easier and faster for the most effective use of your valuable time.

System Highlights

- **Cylinder Sizing and Selection**
- **Parametric Drawing Creation**
- **Windows-based**
- **Input Formats:**
  - **Direct Part Number Entry**
  - **Systematic Design**
- **Available Information Outputs:**
  - **HPGL CAD Drawing**
  - **CAD File (*.dxf)**
  - **Selection Summary Printout**
  - **RFQ/Order Sheet Printout**

For further details, or to purchase your copy of ***inPHorm* for Cylinders**, call your local Parker distributor or 1-800-C-Parker (272-7537). To try ***inPHorm*** visit our web site at www.Parker.com/cylinder.

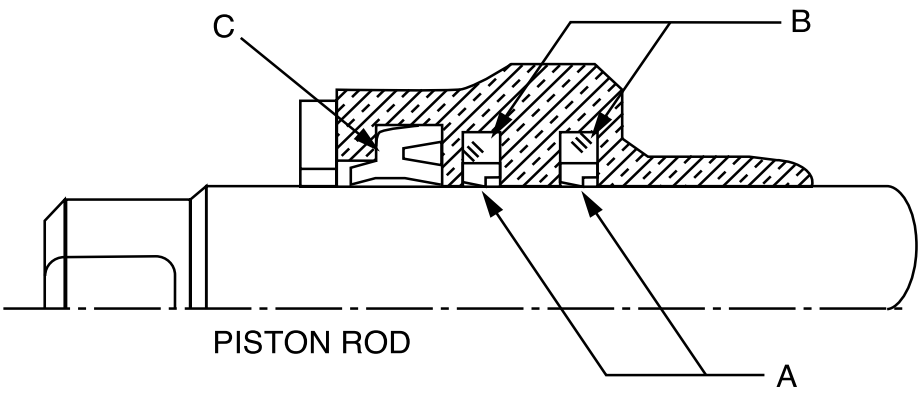
Worldclass Quality Products and Service

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



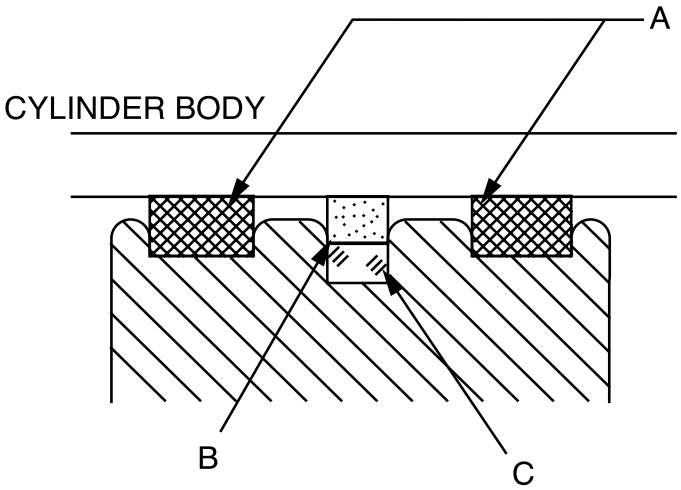
A - Dual step-seal rod seals insure positive sealing and smooth operation up to 3,000 PSI.

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.

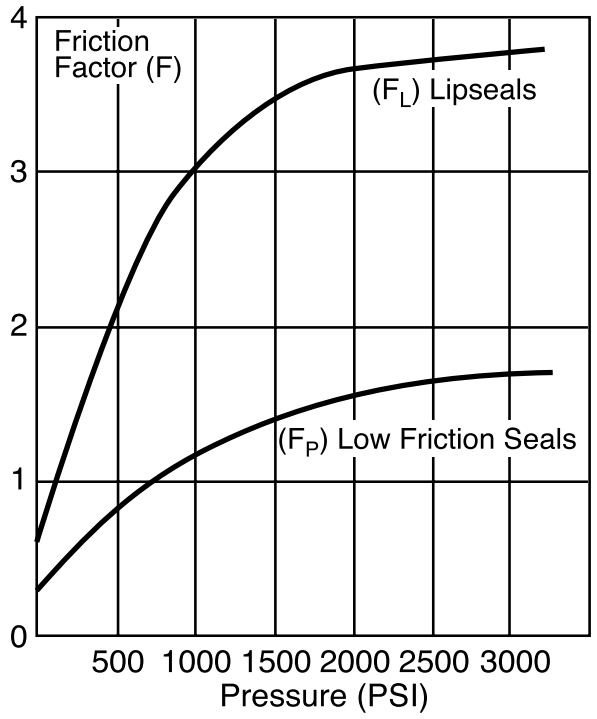
C - Square-ring elastomer expander for pressure compensation

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	$12d + 12F_Ld + 24F_LD$
Lipseal Rod w/Low Friction Piston	$12d + 12F_Ld + 12F_pD$
Low Friction Rod + Piston	$12 + 30F_pd + 6F_pD$

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) $\cong 12d + 30F_pd + 6F_pD$

Friction (lbs. force) $\cong 12\ (1.75) + 30\ (1.3 \times 1.75) + 6\ (1.3 \times 3.25)$

Friction (lbs.force) $\cong 115$

Breakaway Friction Calculation:

$F_p \times 1.0 \cong F_p$

Based on zero pressure:

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

Friction (lbs. force) $\cong 12\ (1.75) + 30\ (.3 \times 1.75) + 6\ (.3 \times 3.25)$

Friction (lbs. force) $\cong 43$

Specifications for Low Friction Option:

Operating Pressure: 0 - 3000 PSI

Operating Temperature: -10°F to +160°F.
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

For Cylinder Division Plant Locations – See Page II.

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.

Other Applications

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 3½" bore x 56" net stroke hydraulic cylinders operating at 1200 PSI (nominal pressure 2000 PSI).

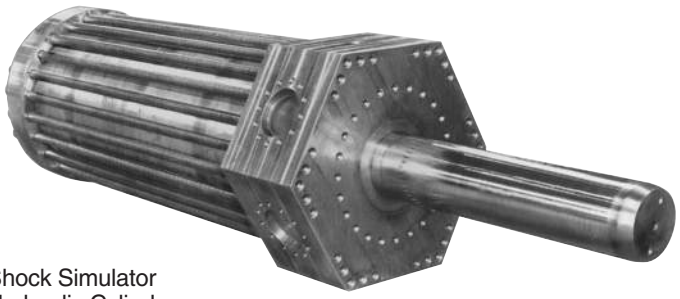
Design features include pressurized hydrostatic bearings for low friction operation, piccolo type cushions for predictable and reliable performance in this critical application and built in transducers in the piston rod to detect platform position.

C

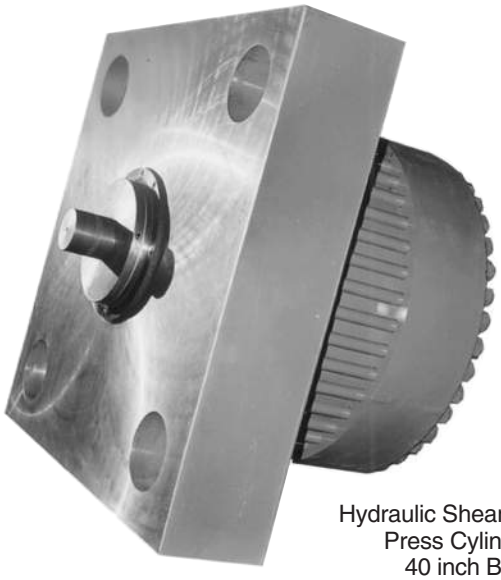
For Cylinder Division Plant Locations – See Page II.

Special Cylinders

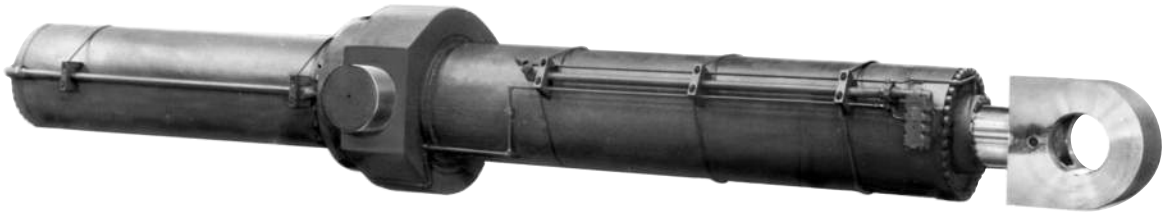
Your imagination and Parker engineering…



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

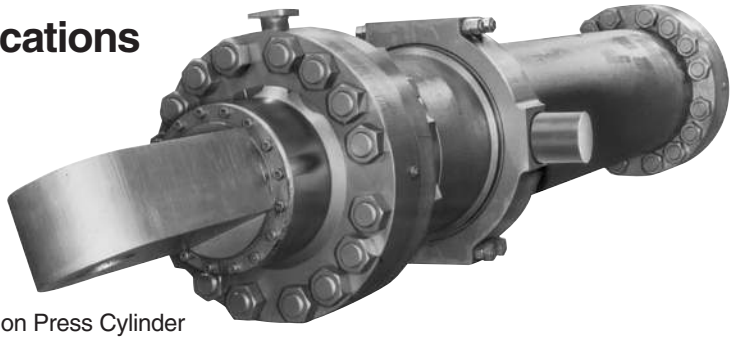
Special 2H Duplex Rotary Hydraulic Cylinder
All Ports Located in Piston Rod
12 inch Bore x 9/16 inch Stroke
8 inch bore x 2 inch Stroke
1000 P.S.I. operating pressure

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

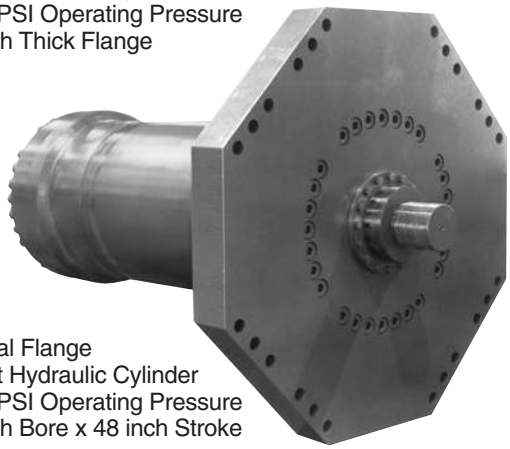
For additional information – call your local Parker Cylinder Distributor.

the keys to unexplored applications

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

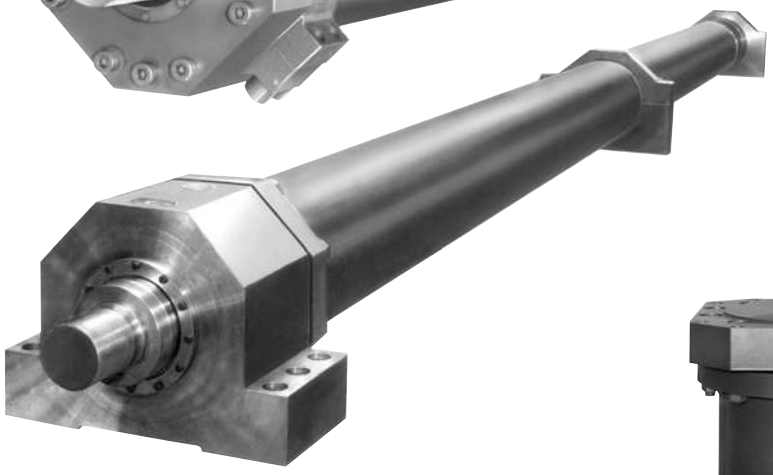


Extrusion Press Cylinder
3000 PSI Operating Pressure
12 inch Thick Flange



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 8½ inch Diameter Rod

JB Mount, Ring Design
Air Cylinder
20 inch Bore x 21⅞ inch Stroke
Cushioned Both Ends

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

C

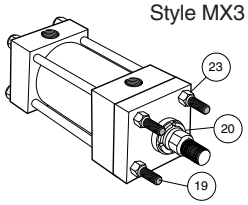
For Cylinder Division Plant Locations – See Page II.

Cylinder Parts Identification and Seal Kit Data

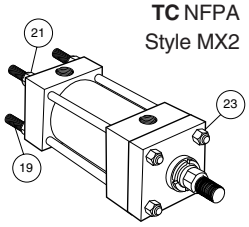
Index Page

For additional information – call your local Parker Cylinder Distributor.

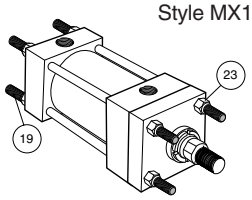
TB NFPA
Style MX3



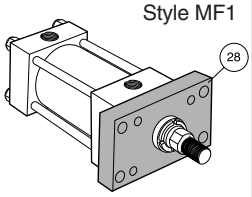
TC NFPA
Style MX2



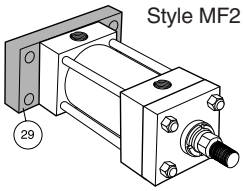
TD NFPA
Style MX1



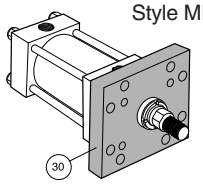
J NFPA
Style MF1



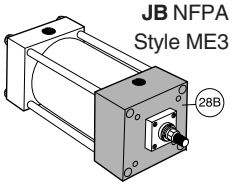
H NFPA
Style MF2



JB NFPA
Style MF5

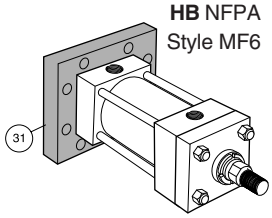


JB NFPA
Style ME3

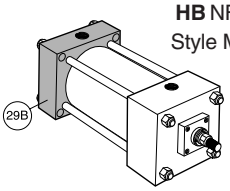


7" thru 14" Series 2A
8" Bore Series 3L

HB NFPA
Style MF6

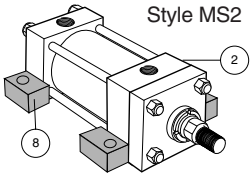


HB NFPA
Style ME4

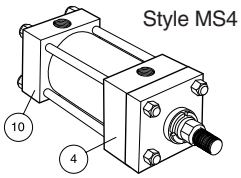


7" thru 14" Series 2A
8" Bore Series 3L

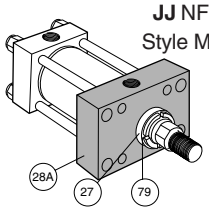
C NFPA
Style MS2



F NFPA
Style MS4

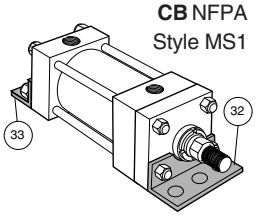


JJ NFPA
Style ME5

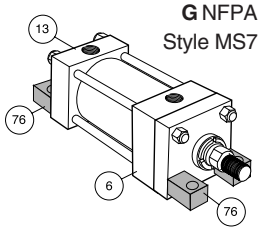


Screws Not Shown

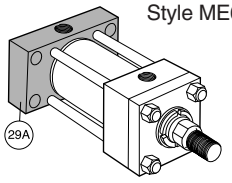
CB NFPA
Style MS1



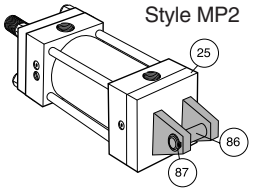
G NFPA
Style MS7



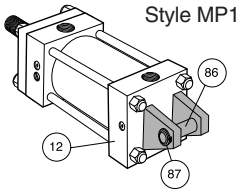
HH NFPA
Style ME6



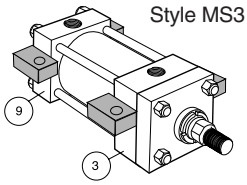
BC NFPA
Style MP2



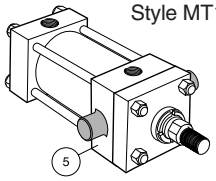
BB NFPA
Style MP1



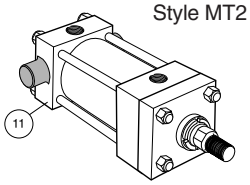
E NFPA
Style MS3



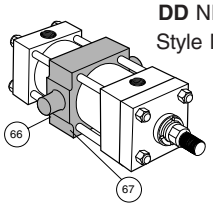
D NFPA
Style MT1



DB NFPA
Style MT2



DD NFPA
Style MT4



Screws Not Shown

Replacement Mountings & Hardware

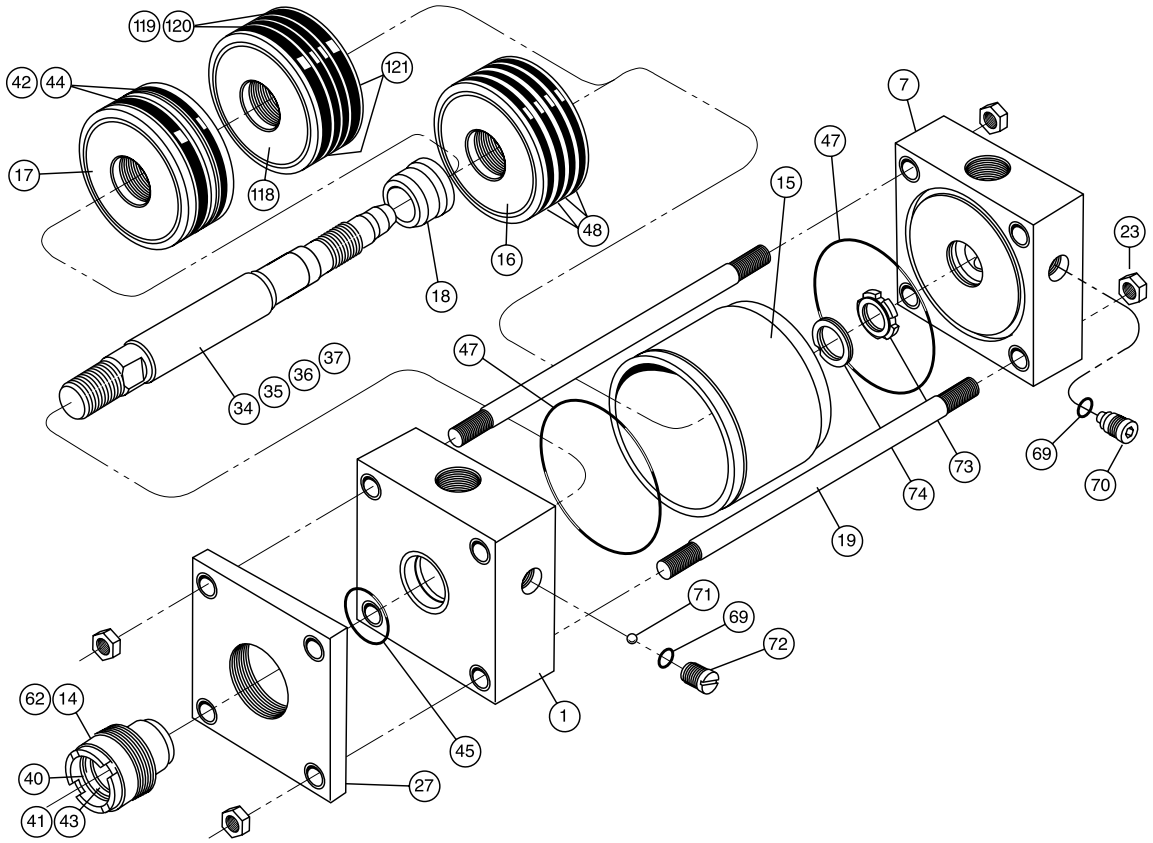
Note: For items not shown see pages 42 and 43.

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 TB
21	Tie rod, cap end mtg. Style TC
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

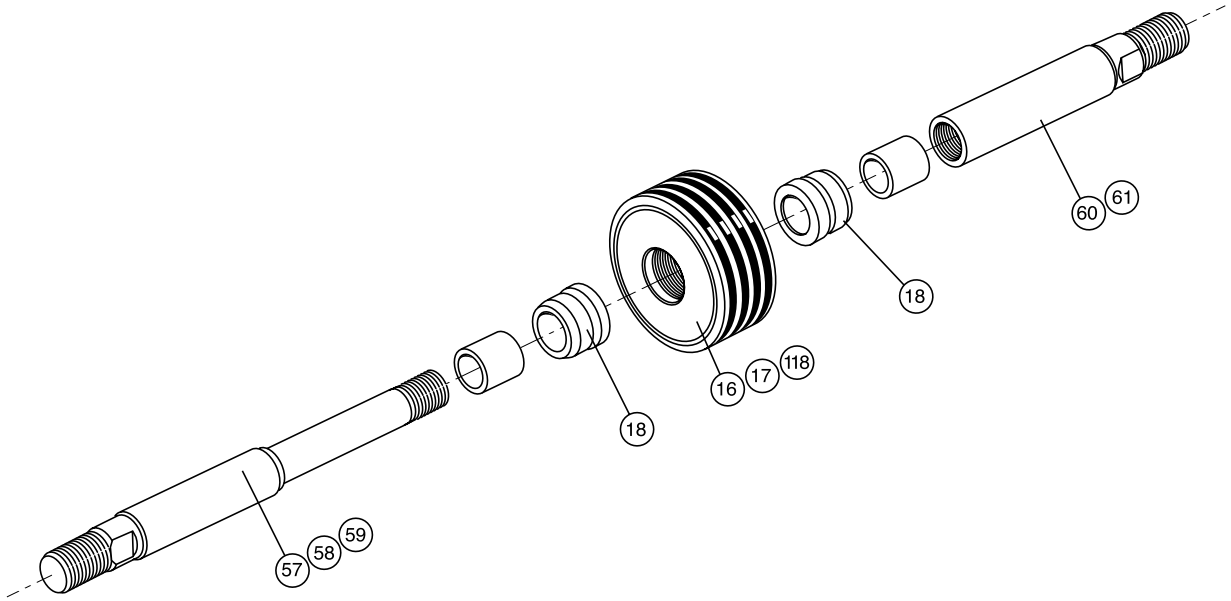
How to Order

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 41.

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

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		

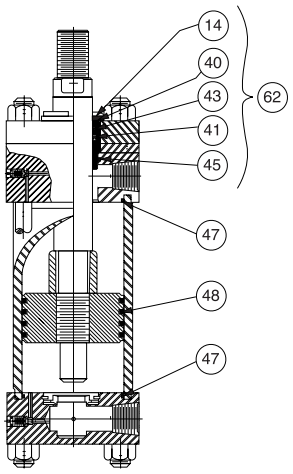
Fluorocarbon Cushion Hardware Kits

*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		

C

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

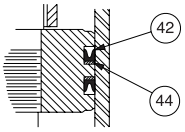


Piston Seal Options

Ring Type Piston

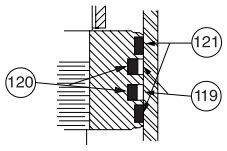
(as shown above)
Supplied as standard on series 2H, 3L & VH hydraulic cylinders.

Lipseal Type Piston



Supplied as standard on series 2A air cylinders. 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 1 & 2 Service
(For Class 1 Hydraulic Service see TS-2000 Seal Kits pg. 50)

Material: Buna-N (Nitrile)

For operating temperature and fluid compatibility see Operating Fluids and Seals page in this section.

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 (Class 1 Series 3L, 2H, VH see TS-2000 page C50)			
	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	–	–	–

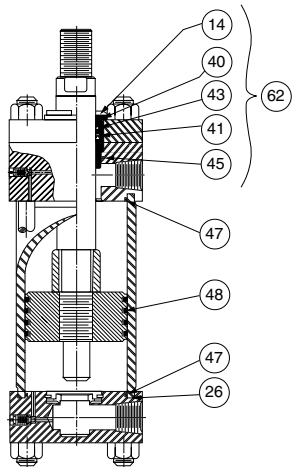
	CB Cylinder Body Seal Kits		Tie Rod Torque Specifications*					
	Series 2A	Series 2H, 3L & VH	Series 2A & 3L				Series 2H & VH	
			Cylinder Body Material					
Bore Size	Contains 2 Ea. Symbol 47	Contains 2 Ea. Symbol 47	Brass		Steel		Fiberglass		Steel	
1	CB102HL001	CB102HL001	12 in.-lbs.	14 cm-kg	35 in.-lbs.	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.

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

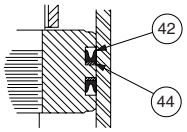


Piston Seal Options

Ring Type Piston

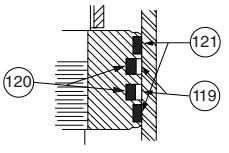
(as shown above)
Supplied as standard on series 2H, 3L & VH hydraulic cylinders.

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

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	011676 0000
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	011678 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	CB CYLINDER BODY SEAL KITS 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	USE (PK) PISTON SEAL KITS FOR THESE SIZES	CB322HL005	18 ft.-lbs. 24 N.m	25 ft.-lbs. 34 N.m	– –	120 ft.-lbs. 163 N.m
4		CB402HL005	18 ft.-lbs. 24 N.m	25 ft.-lbs. 34 N.m	– –	131 ft.-lbs. 178 N.m
5		CB502HL005	44 ft.-lbs. 50 N.m	60 ft.-lbs. 81 N.m	– –	312 ft.-lbs. 423 N.m
6		CB602HL005	44 ft.-lbs. 50 N.m	60 ft.-lbs. 81 N.m	– –	528 ft.-lbs. 716 N.m
7		CB702HL005	– –	90 ft.-lbs. 122 N.m	– –	800 ft.-lbs. 1085 N m
8		CB802HL005	80 ft.-lbs. 108 N.m	110 ft.-lbs. 149 N.m	– –	1168 ft.-lbs. 1584 N m
10		CB902HL005	113 ft.-lbs. 153 N.m	148 ft.-lbs. 201 N.m	78 (ft. lbs.) 106 N.m	– –
12		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	– –

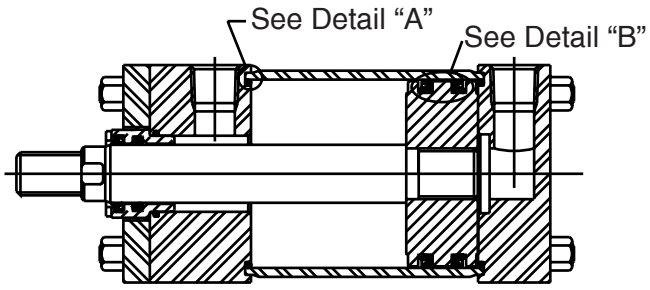
*(-0%, +5% tolerance). When assembling the cylinder, be sure to torque the tie rods evenly.

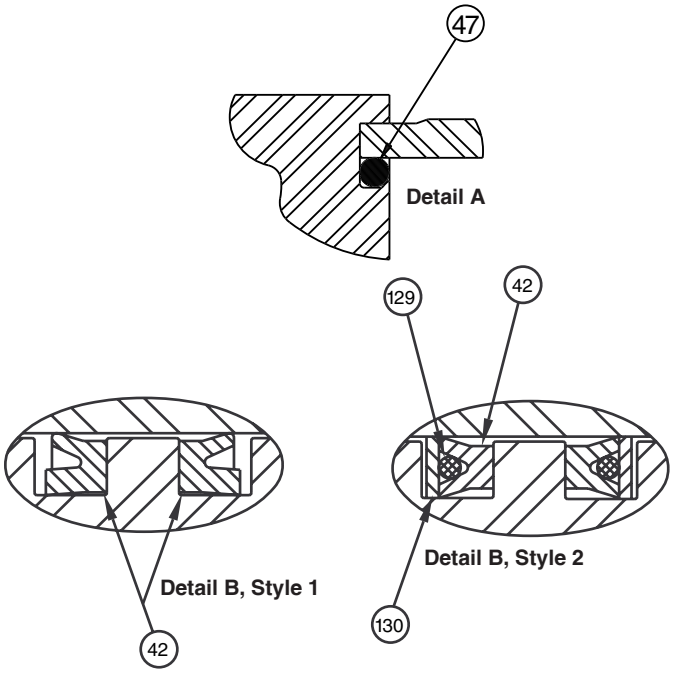
For use with High Water Content Fluids.
Class 6 Service: kit numbers listed above identify Class 5 seals only. To order with Class 6 seals (HWCF) substitute “6” for “5” as last digit of part number.
How to order – individual seals contained in the kits are available separately – however we recommend 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 } 14" bore only (Style 2)
symbol 130, washer }

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 -10°F (-23°C) to +350°F (+177°C). 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 1-1/2 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	CB802A 0001
10"	PK9002 AN01	CB902A 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"	069591 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"	083877 0000	011678 0000
5"	069599 0000	011678 0000
5 1/2"	069600 0000	011678 0000

For additional information – call your local Parker Cylinder Distributor.

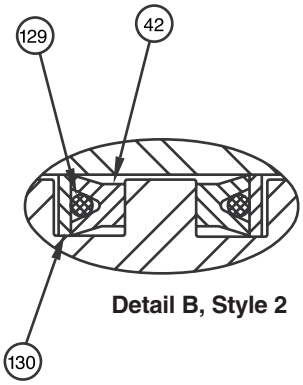
Servicing The Piston Seals

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 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:

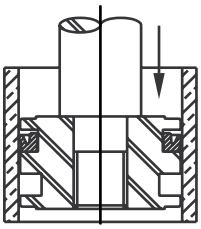


Figure 1

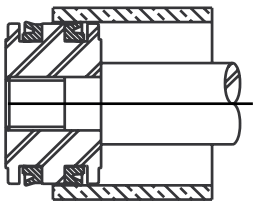


Figure 2

"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.

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, 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

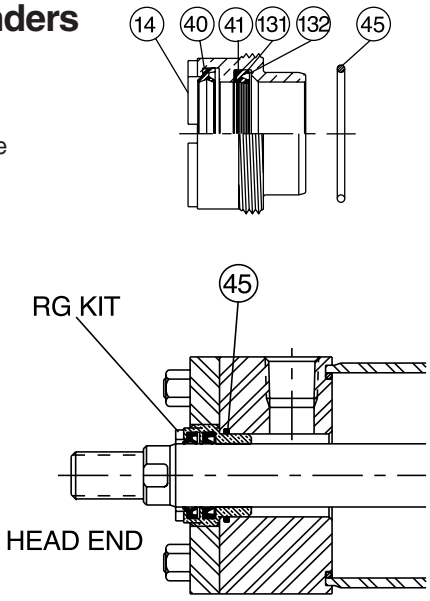
For Series "2AN" Air Cylinders

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 -10°F to +165°F. These seals will function at temperatures up to 200°F 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.

For additional information – call your local Parker Cylinder Distributor.

How To Replace Cylinder Gland Packing

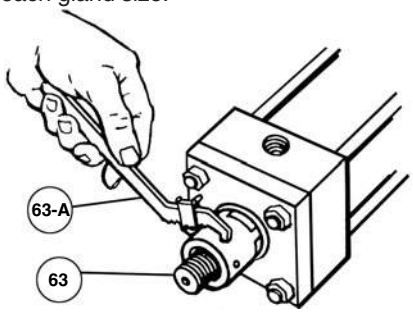
Fluid leakage around piston rod at the gland area will normally indicate a need to replace gland seals. First, remove cylinder from machine to which it is mounted or, if this is not feasible, disconnect the piston rod from rod clevis, knuckle or machine member to which it is fastened.

The Parker Hannifin 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.

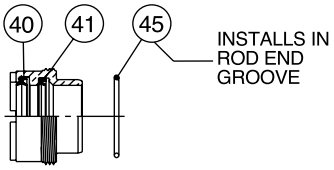
d) Slide the gland off of the piston rod and remove the seals, wicks and washers, if present. Thoroughly clean the gland and seal grooves. Inspect gland bore for wear. If bore is worn, replace – using gland cartridge kit of proper size. (See opposite side.)

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.

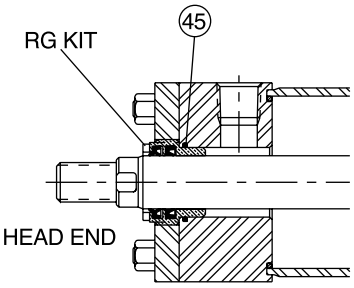


Installation

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 failure.

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.

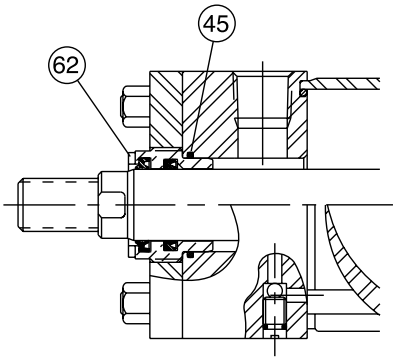
See chart below.

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	

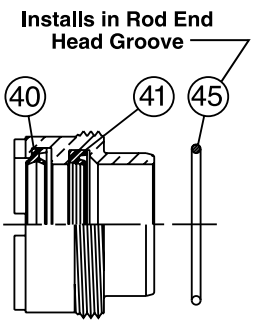
C

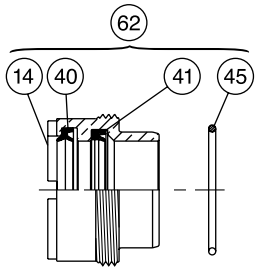
TS-2000 Gland Seal Kits for Hydraulic Cylinders

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



Head End





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 -10°F (-23°C) to +165°F (+74°C).

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

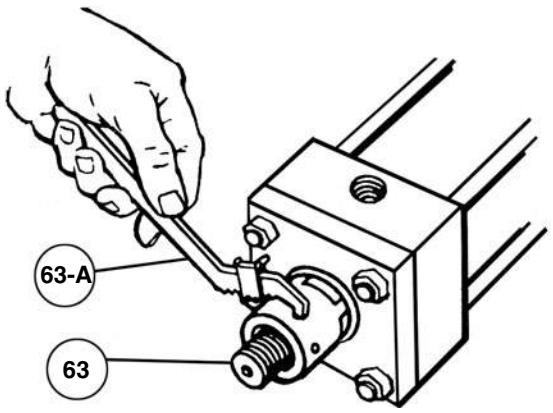
Fluid leakage around piston rod at the gland area will normally indicate a need to replace gland seals. First, remove cylinder from machine to which it is mounted or, if this is not feasible, disconnect the piston rod from rod clevis, knuckle or machine member to which it is fastened.

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



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

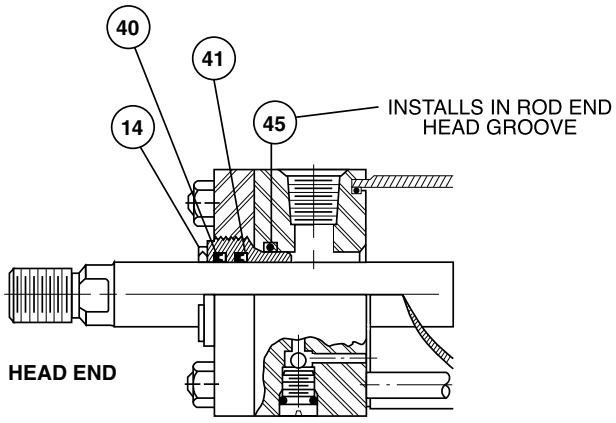
(*-0%, +5%) tolerance.

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.

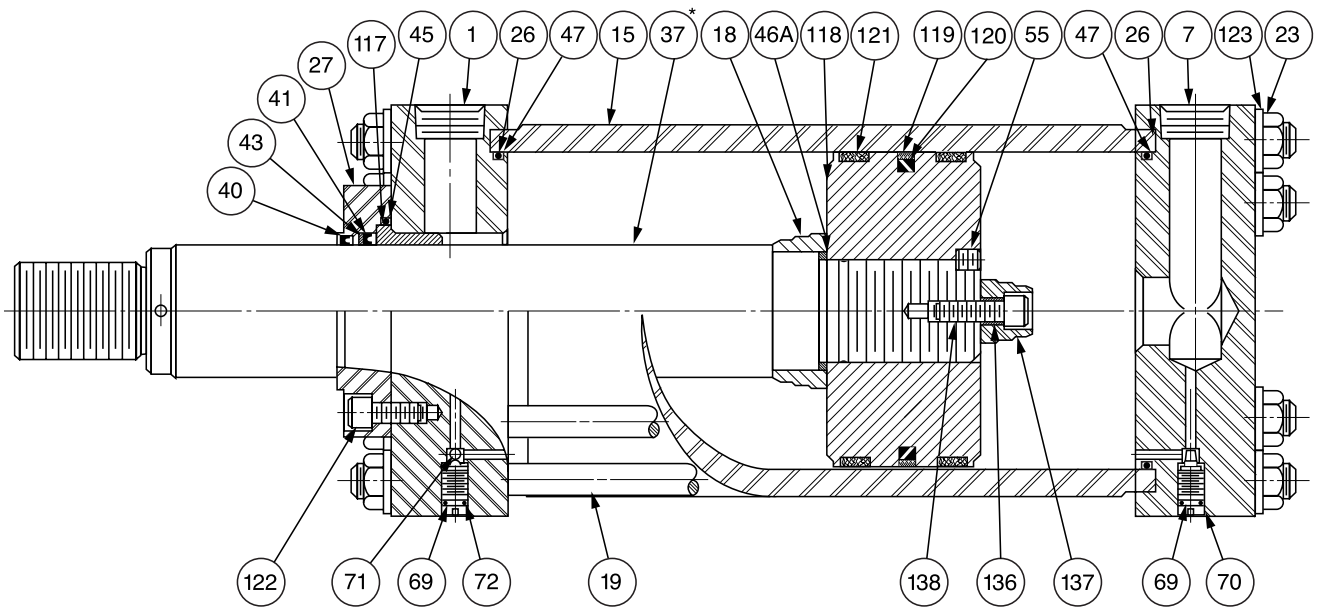
Tie Rod Torque*

Cylinder Bore Size	Cylinder Series			
	L - 2L - 3L		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



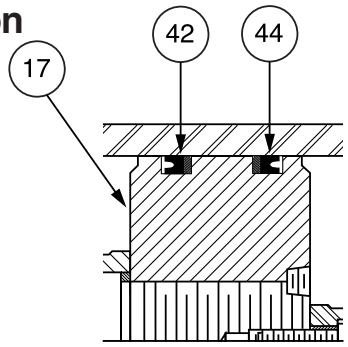
*OR 34, 35, 36

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

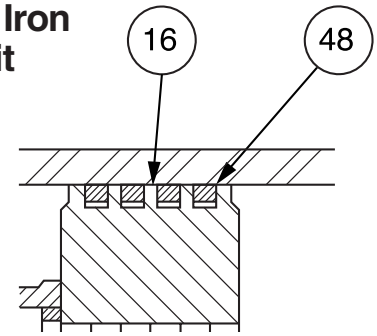
Sym. No.	
43	Back-Up Washer, Polypak
44	Back-Up Washer, Lipseal
45	O-Ring, Gland to Head
46A	Cushion Sealing Ring
47	O-Ring Cylinder Body
48	Piston Ring
55	Piston Lock Pin
57	Piston Rod – Non Cushion K-Type
58	Piston Rod, Cushion One end K-Type
59	Piston Rod, Cushion Both K-Type
60	Extension Rod, Non-Cushion 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 -10°F. (-23°C.) to +165°F (+74°C.).

Fluorocarbon seals

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

When using Fluorocarbon seals for high temperature service or fluid compatibility within a temperature range of -10°F. (-23°C) to +250°F. (+121°C) specify Class 5 seals.

For elevated temperature service above +250°F. (+121°C) 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 +400°F. (+204°C) with reduced service life.

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

		Rod Seal Kits		Rod Seal Kits Including Bearing	
		Contains Symbol 40,41,43,45		Contains Symbol 40,41,43,45 & 117	
Bore	Rod Dia.	Group 1 Kit No.	Group 5 Kit No.	Group 1 Kit No.	Group 5 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	
Bore	Group 1 Kit No.	Group 5 Kit No.	Group 1 Kit No.	Group 5 Kit No.
10	PR9023H001	PR9023H005	PK9023H001	PK9023H005
12	PR9223H001	PR9223H005	PK9223H001	PK9223H005
14	PR9423H001	PR9423H005	PK9423H001	PK9423H005

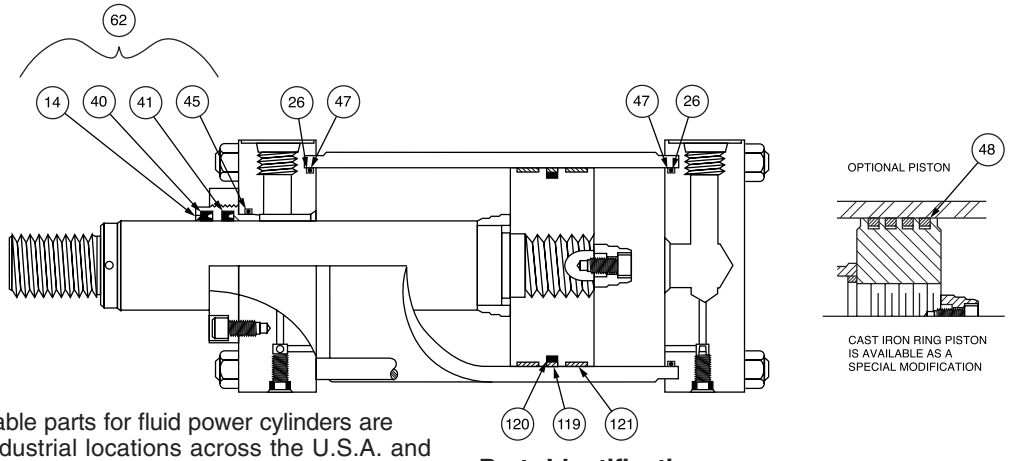
†For 16", 18" and 20" Bore Piston Kits – consult factory.

	Hi Load Piston Seal Kit†		CB Cylinder Body Seal Kit†	
	Contains 2 Ea. Sym. 48, 119, 120, 121, 47 & 26		Contains 2 Ea. Sym. 47 & 26	
Bore	Group 1 Kit No.	Group 5 Kit No.	Group 1 Kit No.	Group 5 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 PTFE, 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 -10°F (-23°C) to +165°F (+74°C).

Fluorocarbon Seals – Class 5 Service Kits contain fluorocarbon seals and are especially suited for elevated temperature service or for some fire resistant fluids (for specific fluids not listed in current catalog consult factory). Fluorocarbon seals (Class 5) should be used for high temperature service within a temperature range of -10°F (-23°C) to +250°F (+121°C). Fluorocarbon seals may be operated to +400°F (+204°C) with limited service life. For temperatures above +250°F (+120°C) the cylinder must be manufactured with a pinned piston to rod connection.

Warning – The piston rod to piston threaded connection is secured with an anaerobic adhesive which is temperature sensitive. Cylinders specified with fluorocarbon seals are assembled with anaerobic adhesive having a maximum operating temperature range of +165°F (+74°C). These temperature limitations are necessary to prevent the possible loosening of the threaded connections. Cylinders originally manufactured with 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 for Class 6 seals is +40°F (+4°C) to +165°F (+74°C).

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	CB703H0001	PR703H0001	PK703HK001
8	CB803H0001	PR803H0001	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.

For additional information – call your local Parker Cylinder Distributor.

To Service Rod Gland Seals – The rod gland cartridge, Symbol 62, is removable without disassembly of the cylinder on all Series 3H 7" & 8" bore hydraulic cylinders. To remove the gland, loosen the retainer screws and remove the gland retainer. It is recommended that the used gland be replaced by a complete gland cartridge kit, 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 PTFE 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 PTFE 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 PTFE outer ring in boiling water and stretch it by hand until it will fit over the O.D. of the wear ring. Push outer ring over the wear ring and into the seal groove. With outer ring in its groove, compress it with ring compressor or use a starting sleeve having an I.D. same size as cylinder bore and tapered at one end.

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

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

Install tie rods in holes provided in cap and thread them into the tapped holes in the head. 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 the table below. Torque the gland retainer screws to the torque level shown in the table below.

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.

C

Service Assemblies and Seal Kits

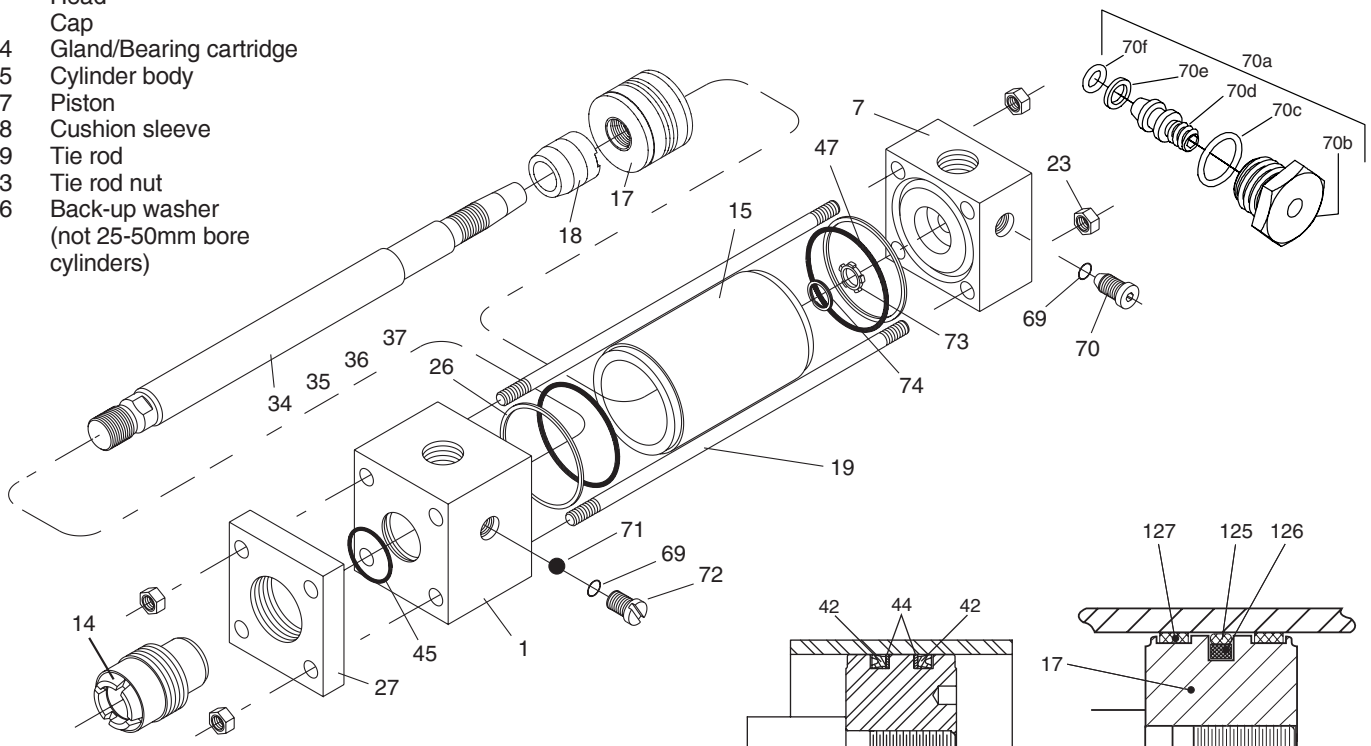
Service Assembly Kits and Seal Kits for HMI cylinders simplify the ordering and maintenance processes. They contain sub-assemblies which are ready for installation, and are supplied with full instructions. When ordering Service Assemblies and Seal Kits, please refer to the identification plate on the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

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

Key to Part Numbers

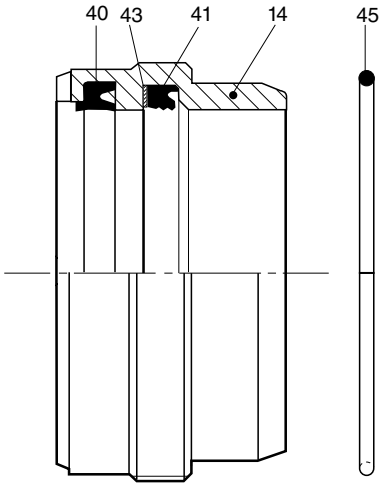
1 Head
7 Cap
14 Gland/Bearing cartridge
15 Cylinder body
17 Piston
18 Cushion sleeve
19 Tie rod
23 Tie rod nut
26 Back-up washer (not 25-50mm bore cylinders)
27 Retainer
34 Piston rod – single rod, no cushion
35 Piston rod – single rod, cushion at head end
36 Piston rod – single rod, cushion at cap end
37 Piston rod – single rod, cushion at both ends
40 Wiperseal – for 14 and 122
41 Lipseal – for 14
42 Lipseal, Piston 25-40mm bores only
43 Back-up washer, bushing lipseal 41 (not Group 1 seals)
44 Back-up washer, piston lipseal
45 O-ring – gland/head
47 O-ring – cylinder body
57[1] Piston rod – double rod, no cushion
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[2] Needle valve, cushion adjustment
70a[2] Needle valve, cushion adjustment – cartridge type
70b Cartridge screw
70c O-ring – cartridge screw
70d Needle screw
70e Back-up washer – needle screw
70f O-ring – needle screw
71 Ball – cushion check valve
72 Cushion check valve screw
73 Floating cushion bushing
74 Retaining ring for cushion bushing
125 Standard piston seal
126 Energizing ring for standard seal 125
127 Wear ring for standard piston

[1]Not illustrated
[2]In some cases, the adjusting screw is installed in a cartridge.



Piston 25mm, 32mm and 40mm bore

Piston 50mm bore and larger



Gland Cartridge and Seals

For additional information – call your local Parker Cylinder Distributor.

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 Ø	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).

Piston Kit

B-Style Piston Kit – (includes Cylinder Body End Seals) Contains two each of items 47, 26 (no backup washer in 25mm-50mm bores), two of item 127 and one each of items 125, 126.

Lipseal Piston Kit – (includes Cylinder Body End Seals) Contains two each of items 42, 44 and 47.

Bore Ø	CB Body Seal Kit*	B-Style Piston Seal Kit*	Piston Lipseal™ Kit†
25	CB025HM001	PF025HM001	PL025HM005*
32	CB032HM001	PF032HM001	PF032HM005*
40	CB040HM001	PF040HM001	PF040HM005*
50	CB050HM001	PF050HM001	N/A
63	CB063HM001	PF063HM001	
80	CB080HM001	PF080HM001	
100	CB100HM001	PF100HM001	
125	CB125HM001	PF125HM001	
160	CB160HM001	PF160HM001	
200	CB200HM001	PF200HM001	

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

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

*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.

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

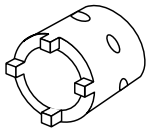
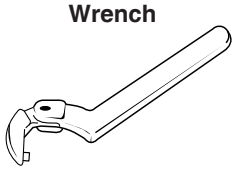
Tie Rod Torques

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

Repairs

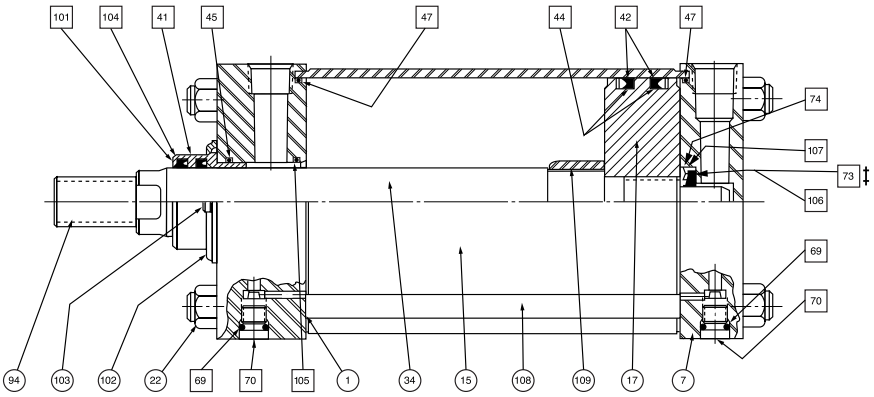
Although HMI cylinders are designed to make on-site maintenance or repairs as easy as possible, some operations can only be carried out in our factory. It is standard policy to fit a cylinder returned to the factory for repair with those replacement parts which are necessary to return it to 'as good 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.

Rod Ø	Gland Cartridge Wrench	Spanner Wrench
		
12	0695900000	0116760000
14	0695900000	0116760000
18	0847650000	0116760000
22	0695910000	0116760000
28	0847660000	0117030000
36	0695920000	0117030000
45	0695930000	0116770000
56	0695950000	0116770000
70	0695960000	0116770000
90	0847680000	0116770000
110	–	–
140	–	–

C

Series MA
NFPA Industrial Air Cylinders



Seal Kits

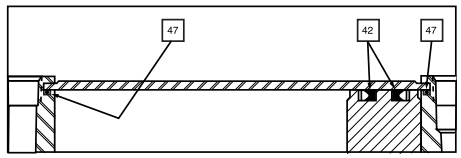
Seals for Series MA cylinders are available in kit form and are stocked in principal industrial locations in the United States. For prompt delivery and complete information, contact the nearest Cylinder Division regional plant, or your local Parker Cylinder distributor.

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 -10°F. to +165°F.

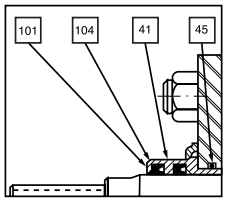
Gland and rod seal replacement parts are identified as Symbol RG – Rod Gland Cartridge Kit. A complete seal kit for noncushion cylinder is identified as Symbol SK – Seal Kit. Cushion kits are available for head or cap end and should be order as required.

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.

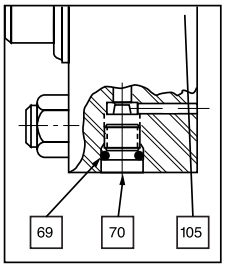
‡on 6" Bore only Sym. 73 is used in place of Sym. 106 and 107.



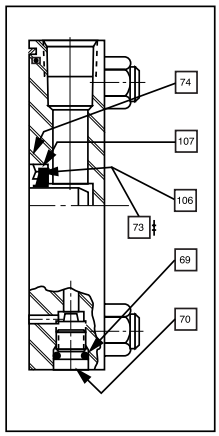
Seal Kit
(Sym. SK)



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

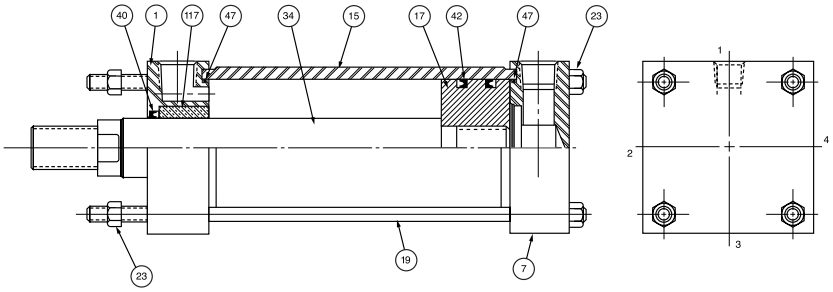
Bore Size	Rod Dia.	Sym. SK** Seal Kit Contains Sym. #41, 42, 44, 45, 47 & 104 Part Number	Sym. RG Rod Gland Cartridge Kit Contains Sym.#41, 45,101 & 104 Part Number	Sym. CH Head End Cushion Kit Contains Sym. #69, 70 & 105 Part Number	Sym. CC Cap End Cushion Kit Contains Sym. #69, 70, 74, 106 & 107 Part 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	SKL7000MA1	RGL6948MA1	CHL7011MA1	CCL7016MA1	60 in.-lbs.	69 cm-kg	20 in.-lbs.	23 cm-kg
2	5/8	SKL7001MA1	RGL6948MA1	CHL7012MA1	CCL7016MA1	11 ft.-lbs.	15 N.m	72 in.-lbs.	83 cm-kg
	1	SKL7002MA1	RGL6949MA1	CHL7013MA1	CCL7016MA1	11 ft.-lbs.	15 N.m	72 in.-lbs.	83 cm-kg
2 1/2	5/8	SKL7003MA1	RGL6948MA1	CHL7012MA1	CCL7016MA1	11 ft.-lbs.	15 N.m	72 in.-lbs.	83 cm-kg
	1	SKL7004MA1	RGL6949MA1	CHL7013MA1	CCL7016MA1	11 ft.-lbs.	15 N.m	72 in.-lbs.	83 cm-kg
3 1/4	1	SKL7005MA1	RGL6949MA1	CHL7014MA1	CCL7017MA1	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
	1 3/8	SKL7006MA1	RGL6950MA1	CHL7015MA1	CCL7017MA1	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
4	1	SKL7007MA1	RGL6949MA1	CHL7014MA1	CCL7017MA1	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
	1 3/8	SKL7008MA1	RGL6950MA1	CHL7015MA1	CCL7017MA1	25 ft.-lbs.	34 N.m	18 ft.-lbs.	24 N.m
5	1	SKL7009MA1	RGL6949MA1	CHL7014MA1	CCL7017MA1	60 ft.-lbs.	81 N.m	37 ft.-lbs.	50 N.m
	1 3/8	SKL7010MA1	RGL6950MA1	CHL7015MA1	CCL7017MA1	60 ft.-lbs.	81 N.m	37 ft.-lbs.	50 N.m
6	1 3/8	SKL7098MA1	RGL6950MA1	CHL7170MA1	CCL7171MA1	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.

Replace "L" with "M" in the seal kit number (i.e. SKM**7003MA1) for cylinders with magnetic piston assemblies. A special piston seal will be furnished in the kit.

For additional information – call your local Parker Cylinder Distributor.

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



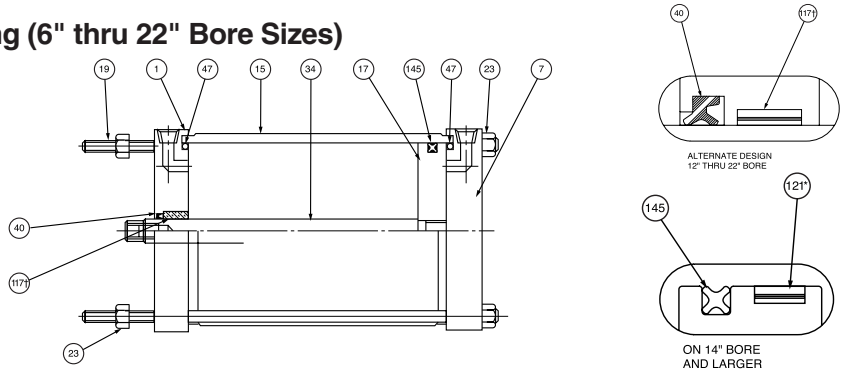
Item	Qty.	Description
1	1	Head
7	1	Cap
15	1	Cylinder Body
17	1	Piston Body
19	4	Tie Rod
23	8	Tie Rod Nut
34	1	Piston Rod
40	1	Rod (Wiper/Lipseal)
42	2	Piston Lipseal
47	2	Cylinder Body O-ring
117	1	Rod Bearing

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.

C

NOTES

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

C

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

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 3 1/4" 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.

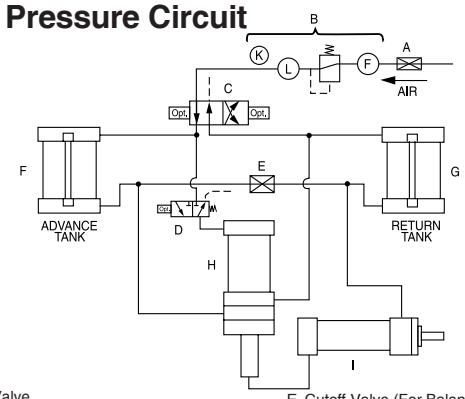
7. Intensifier operation is speeded up by the free flow of fluid in and out of the unobstructed ports. All high-pressure hydraulic ports are SAE straight thread. O-ring type for leak-proof service.

8. Serrated Lipseals™ 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

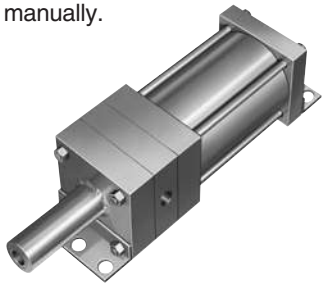
This basic circuit is for a dual pressure system supplying pressure to a double-acting work system. The circuit may be readily

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

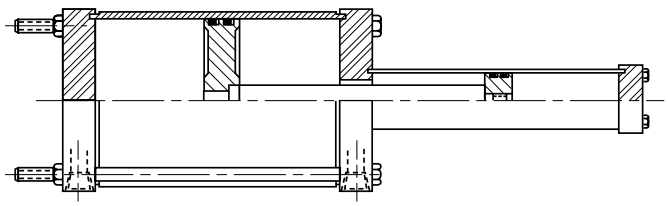
Driving Cylinder		Hydraulic Ram		Intensifier	Theoretical Intensified Hydraulic Pressure (PSI) Using An Input Pressure Of					
Bore	Area	Dia.	Area of Volume Displ. Per in Stroke	Ratio	50	80	100	200	500	1000
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11
3 1/4	8.296	5/8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



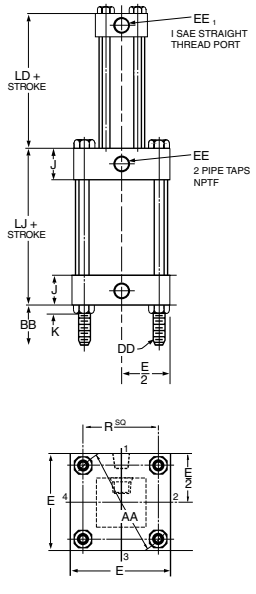
For additional information – call your local Parker Cylinder Distributor.

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	–	–	–	–



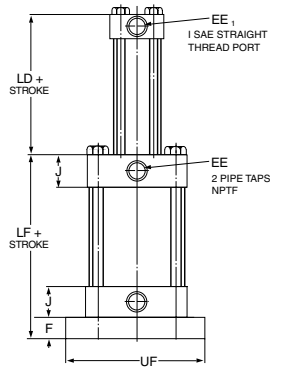
Bore	1 1/2	2	2 1/2	3 1/4	4	5	6	7	8
	Series 2H								
E	2 1/2	3	3 1/2	4 1/2	5	6 1/2	7 1/2	8 1/2	9 1/2
F	3/8	5/8	5/8	3/4	7/8	7/8	1	1	1
J	1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	2	2 1/4	2 1/2
K	21/64	7/16	7/16	35/64	35/64	3/4	55/64	31/32	1 1/16
R	1.63	2.05	2.55	3.25	3.82	4.95	5.73	6.58	7.50
AA	2.3	2.9	3.6	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

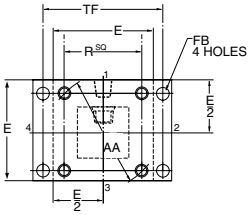
Maximum non-shock pressure rating for Series "3L" and "2H" can be found on page 106.

Mounting Style 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

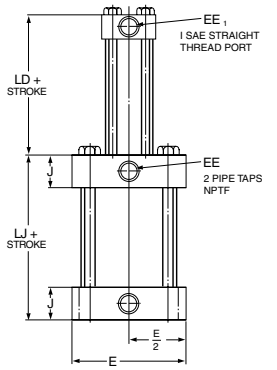


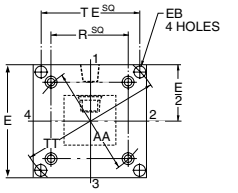


Mounting Style H
Cap Rectangular Flange

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

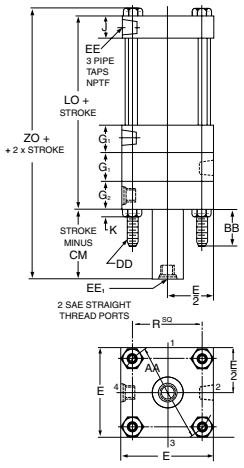
This mounting available in driving cylinder bore sizes 8-inches through 14-inches.

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

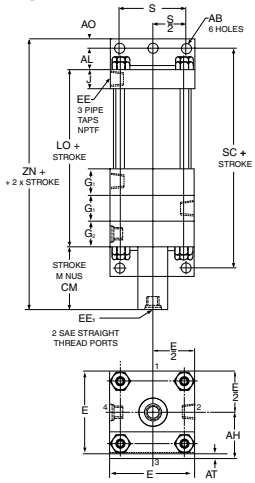
C

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.

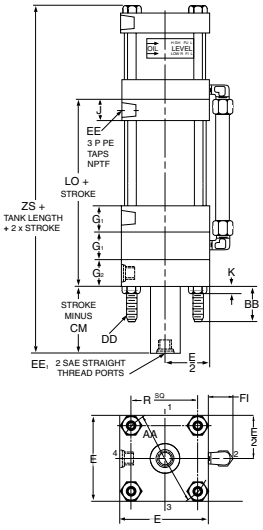


Mounting Style TB
Head Tie Rods Extended

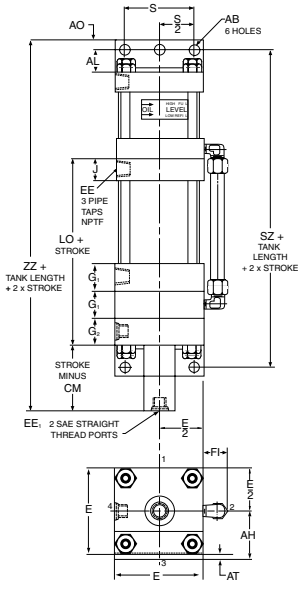


Mounting Style CB –
End Angles

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



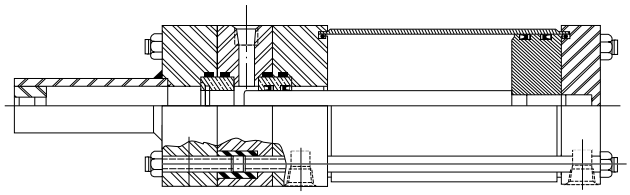
Mounting Style TB
Head Tie Rods Extended with Integral Air-Oil Tank



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	10 5/16	10 15/16	11 11/64	13 41/64	14 9/64	16 1/4
ZZ	10 1/8	10 7/8	11 7/8	12 1/2	13 1/8	16	16 1/2	19

Dimensions Dependent on Ram Size

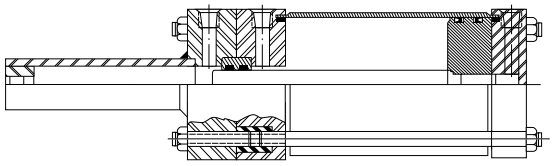
Bore	3 1/4	4	5	6	8	10	12	14
	Series 2A & 3L					Series 2A Only		
						Ram Sizes		
					1 3/8		2, 2 1/2	2 1/2, 3
					1 3/4, 2	1 3/4, 2	3, 3 1/2, 4	3 1/2, 4
G_2	–	–	–	–	2	2	2 1/4	2 1/4
CM	–	–	–	–	1 1/2	1 5/8	1 7/8	2 1/8
LO	–	–	–	–	9 1/8	10 5/8	11 3/8	13 1/8
SC	–	–	–	–	10 3/4	12 7/8	13 3/8	15 3/4
SZ	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

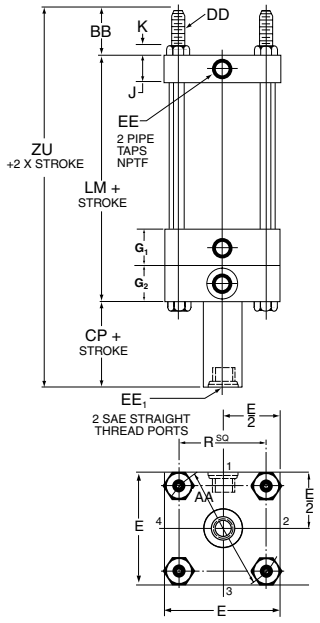


Dimensions Independent of Ram Size

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

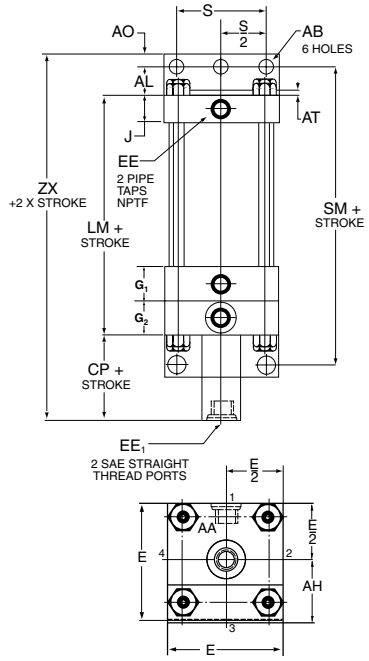
Dimensions Dependent on Ram Size

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



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

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 3L (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:
-10°F to +165°F (-23°C) to (+74°C).

For additional information – call your local Parker Cylinder Distributor.

Hydraulic and Pneumatic Cylinder
Appendix Application Engineering Data

Index Page

C

For Cylinder Division Plant Locations – See Page II.

Parker Cylinder

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.

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

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.

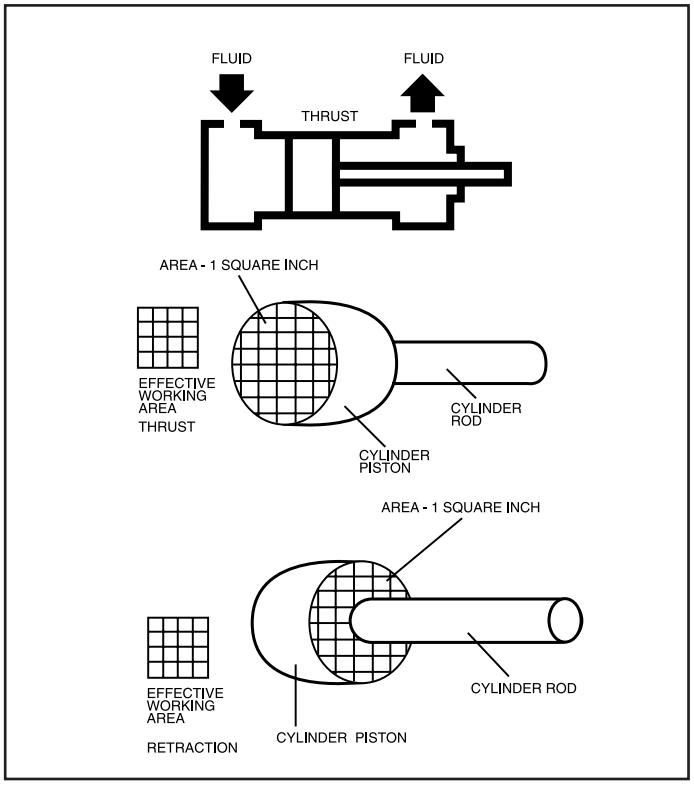
Basic Construction

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 fluorocarbon elastomers, polyurethane, leather or PTFE. 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.

STANDARD DOUBLE ACTING

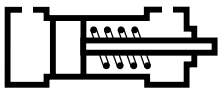
Single-Acting Cylinders
When thrust is needed in only one direction, a single-acting cylinder may be used. The inactive end is vented to atmosphere through a breather/filter for pneumatic applications, or vented to reservoir below the oil level in hydraulic application.

SINGLE ACTING

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.

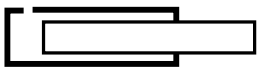
DOUBLE ROD

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.



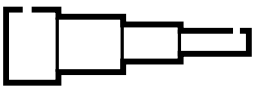
SPRING RETURN

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.



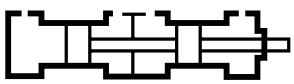
RAM TYPE

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.



TELESCOPE

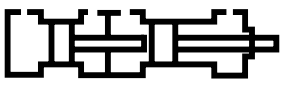
Tandem Cylinders
A tandem cylinder is made up of two cylinders mounted in line with pistons connected by a common piston rod and rod seals installed between the cylinders to permit double acting operation of each. Tandem cylinders allow increased output force when mounting width or height are restricted.



Reduced operating pressure is required for this construction. Contact factory.

TANDEM

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.



Reduced operating pressure is required for this construction. Contact factory.

DUPLEX

C

For Cylinder Division Plant Locations – See Page II.

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.

For additional information – call your local Parker Cylinder Distributor.

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 except 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. Note: Certain fluids may react adversely with Class 4 seals compared to Class 1 seals.

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 PTFE 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 PTFE and compatible with all conditions and fluids listed on this page. However, carbon filled PTFE 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 fluorocarbon 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 PTFE dynamic seal with an elastomer expander. A piston seal assembly consists of one seal assembly in the middle of the piston with a filled PTFE wear ring on each side of the piston. The piston rod seal assembly consists of two seal assemblies and an elastomer wiper seal. The filled PTFE 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 fluorocarbon seals are specified. In those cases the expanders and wiper will be E.P.R. and fluorocarbon 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 $10in^3$/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 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; electroless nickel-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 on the next page. 3L, 2H and 3H Series hydraulic cylinders can also be modified for water operation and supplied with chrome-plated cylinder bore; electroless nickel-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	-10°F (-23°C) to +165°F (+74°C)
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	-10°F (-23°C) to +165°F (+74°C)
3 Special (E.P.R.) (At extra cost) Note: (E.P.R.) seals are not compatible with Hydraulic Oil	Some Phosphate Ester Fluids Skydrol 500, 7000	-10°F (-23°C) to +130°F (+54°C)
4 Special (Nitrile) (At extra cost)	Low Temperature Air or Hydraulic Oil	-50°F (-46°C) to +150°F (+66°C)
5 Optional (At extra cost) (Fluorocarbon Seals) Note: Fluorocarbon seals are not suitable for use with Skydrol fluid, but can be used with hydraulic oil if desired	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.
6 Optional (HWCF) (At extra cost)	Houghton, Hydrolubric 120B Sonsol Lubrizol, for other HWCF — consult factory.	+40°F (+4°C) to +120°F (+49°C)

C

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	1900
	2	5/8	1900
1 1/2	1	5/8	2000
	2	1	2300
2	1	5/8	1100
	3	1	2000
	2	1 3/8	2000
2 1/2	7	5/8	700
	1	1	1400
	3	1 3/8	1400
	2	1 3/4	1400
3 1/4	1	1	1300
	3	1 3/8	1300
	4	1 3/4	1300
	2	2	1300
4	7	1	900
	1	1 3/8	900
	3	1 3/4	900
	4	2	900
	2	2 1/2	900
5	7	1	600
	8	1 3/8	950
	1	1 3/4	950
	3	2	950
	4	2 1/2	950
	5	3	950
	2	3 1/2	950
6	7	1 3/8	700
	1	1 3/4	700
	3	2	700
	4	2 1/2	700
	5	3	700
	6	3 1/2	700
	2	4	700
8	7	1 3/8	400
	8	1 3/4	650
	1	2	650
	3	2 1/2	650
	4	3	650
	5	3 1/2	650
	6	4	650
	9	4 1/2	650
	0	5	650
	2	5 1/2	650

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

For additional information – call your local Parker Cylinder Distributor.

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)

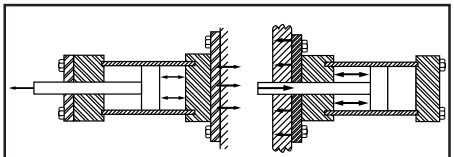
Cylinders with fixed mounts (Group 1) which absorb the force on centerline are considered the best for straight line force transfer. Tie rods extended, flange or centerline lug mounts are symmetrical and allow the thrust or tension forces of the piston rod to be distributed uniformly about the cylinder 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.

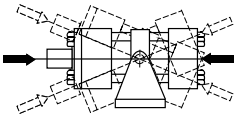
Tie rod mount cylinders may be used to provide thrust or tension forces at full rated pressures.

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.

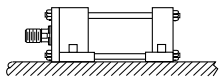
Flange Mount cylinders are also considered to be centerline mount type and thus are among the best mounts for use on straight line force transfer applications. The machine designer has a choice of three mounting styles at each end, such as head rectangular flange (Style J), head square flange (Style 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).



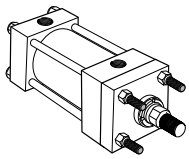
Group 1



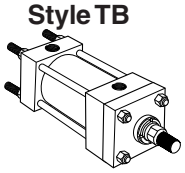
Group 2



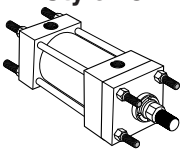
Group 3



Tie rods extended head end, Style TB

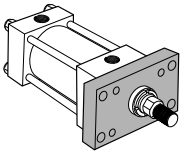


Tie rods extended cap end, Style TC

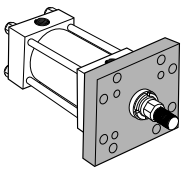


Tie rods extended both ends, Style TD

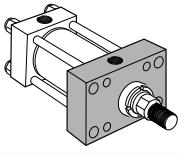
J



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)

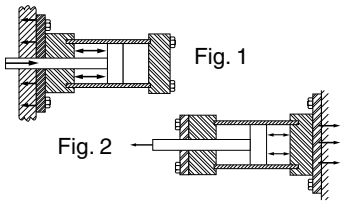
Centerline Lug Mount cylinders are considered fixed mount types which absorb force on centerline and are used on straight line force transfer applications. They are least popular of the fixed mount type cylinders. When used at higher pressures or under shock conditions, the lugs should be dowel-pinned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

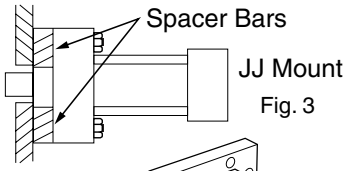
Side Mount cylinders are considered to be fixed mounts which do not absorb force on their centerline. Cylinders of this group have mounting lugs connected to the ends, and one style has side tapped holes for flush mounting. The plane of their mounting surfaces is not through the centerline of the cylinder, 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.

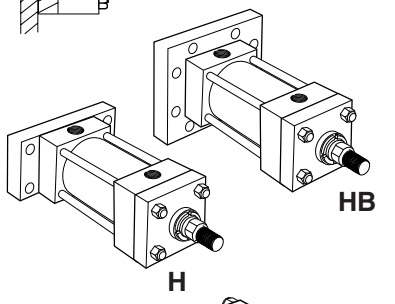
Shorter stroke, large bore cylinders tend to sway on their mountings when subjected to heavy loads, especially side end lug or side and angle mounts. (Fig. 5)

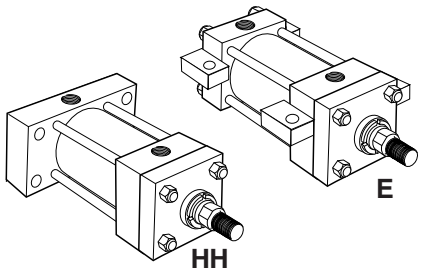
Side mount cylinders are available in several mounting styles, such as side lug (Style C), Side tapped (Style F), side end lug (Style G) and side end angle (Style CB). Of these, the side lug mount its the most popular and reliable, since the mounting lugs are welded to head and cap to form an integral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

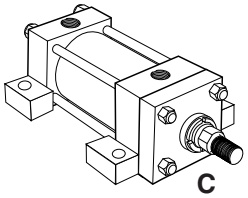
Side tapped mount is the choice when cylinders must be mounted side by side at minimum center-to-center distance. Another narrow side mount style is the side end lug mount which has lugs threaded to the tie rods. Thus the end lugs serve a dual function of holding the cylinder together and act as a means 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.

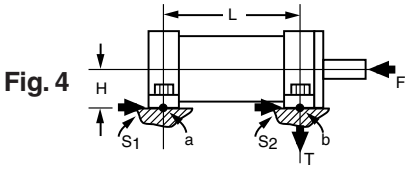


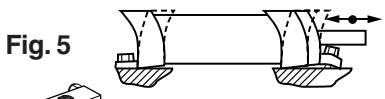


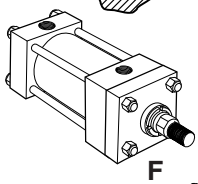


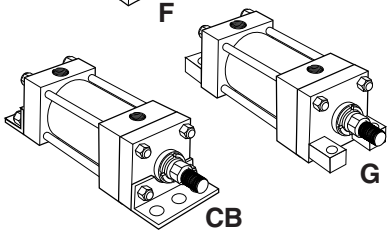












The side end angle mount is also a narrow mount type, but is the weakest of the side mount styles. Its use should be limited to a maximum pressure of 500 psi and minimum stroke length of two times the bore size. For pressure rating of longer strokes, consult the cylinder manufacturer.

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 achieve additional stability in the 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 3° 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 pressure ratings. Consult cylinder manufacturer's product catalog.

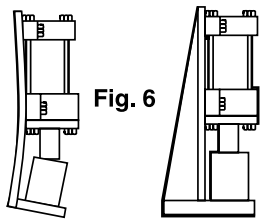


Fig. 6

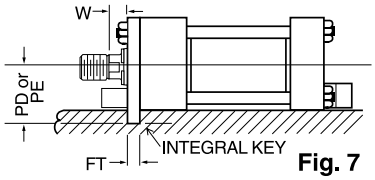


Fig. 7

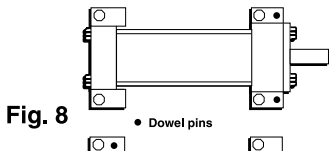


Fig. 8 • Dowel pins

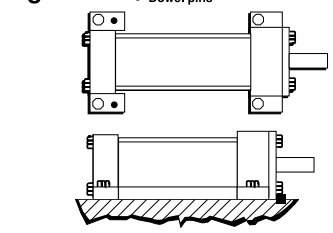
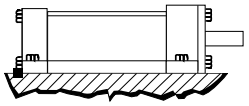


Fig. 9 MAJOR LOAD IN TENSION ■ Shear key

RIGHT



MAJOR LOAD IN THRUST

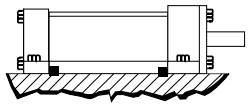
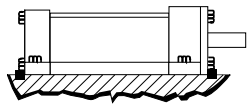
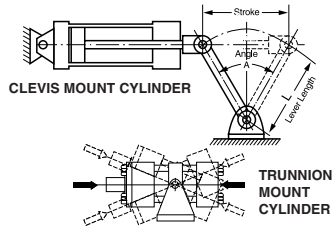
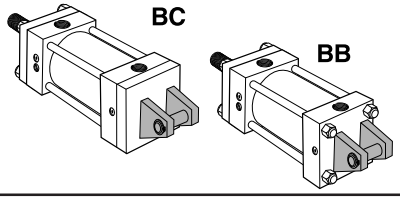


Fig. 10 ■ Shear key

WRONG







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 the Piston Rod-Stroke Selection Chart. 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.

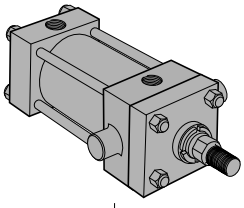
Intermediate fixed trunnion mount is the best of the trunnion mount types. The trunnion can be located so as to balance the weight of the cylinder, or it can be located at any point between the head or cap to suit the application. It is of fixed design, and the location of the trunnion must be specified (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

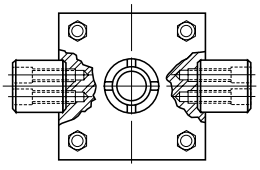
Rod clevises or rod knuckles are available for use with either fixed or pivot mount cylinders. Such accessories are usually specified with pivot mount cylinders and are used with pivot pin centerline in same axis as pivot pin centerline on cylinder. Pivot pins for accessories must be ordered separately.

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 1-1/2" 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

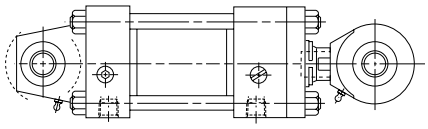
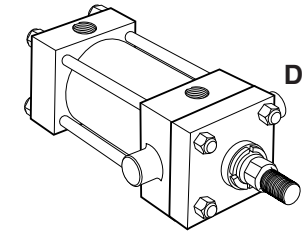
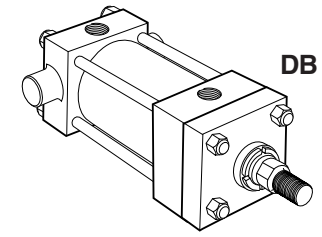
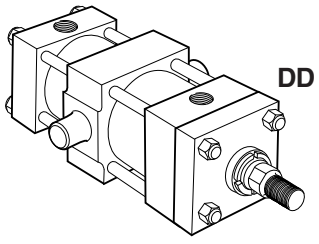


Fig. 11







Clevis Mount Cylinder

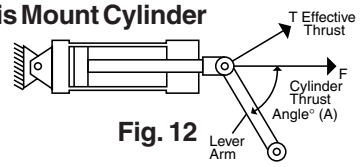


Fig. 12

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

For additional information – call your local Parker Cylinder Distributor.

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 90° or 180° 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

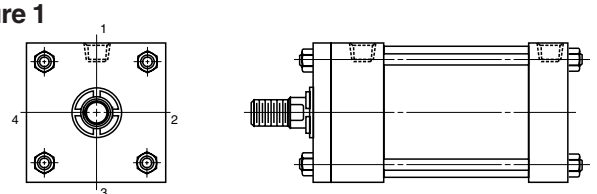


Table A

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-115.

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-115.

Option "Y" ISO-6149-1 Metric Straight Thread Port. Recommended for all hydraulic applications designed per ISO standards. See Figure Y on pg. C-115.

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.

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 2A and 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	3/4	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 2 rods

For Cylinder Division Plant Locations – See Page II.

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 C111. 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)

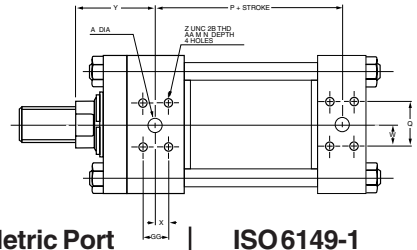
SAE 4 Bolt Flange Ports for 2H, 3H (7"-8"), HD

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	2.77	.75	3.47	1.87	.94	.44
	2		3.14					
	3		3.02					
4†	1	12	3.02	.75	3.72	1.87	.94	.44
	2		3.39					
	3		3.14					
5†	1	12	3.14	.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	3.77	1.25	5.47	2.31	1.16	.59
8	All	24	3.91	1.50	6.19	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

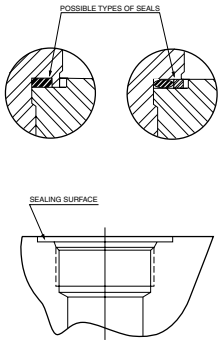


Figure R-G

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

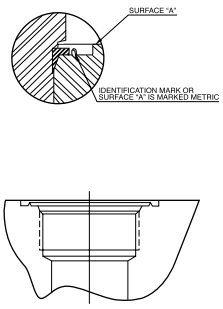


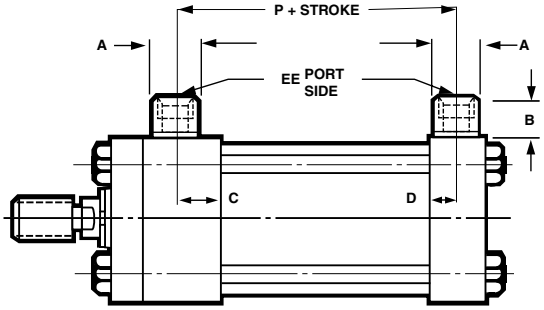
Figure Y

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

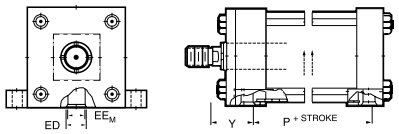
Series 2H, 3H (7" & 8"), HD Cylinders

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 1/8
3 1/4	16	1 3/4	1 3/16	7/8	7/8	3 9/16
4	16	1 3/4	1 3/16	7/8	7/8	3 13/16
5	16	1 3/4	1 3/16	7/8	7/8	4 5/16
6	20**	**	**	**	**	5 3/16
7	24**	**	**	**	**	5 5/8
8	NA	**	**	**	**	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 or WF (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 x A)	Thread Dia. & Pitch (CC)	Length (= 2 x 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 KK; A; LA, LAF, W, or WF. 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 90° or 180° 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.”

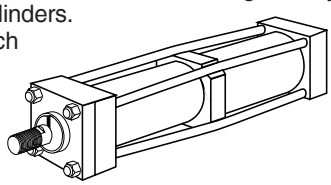
On longer stroke spring-returned cylinders, it is recommended that tie rod extensions be specified on the cylinder end in which the spring is located so that the cap or head against which the spring is acting can be “backed-off” slowly until compression of the spring is relieved. In such cases it should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

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.

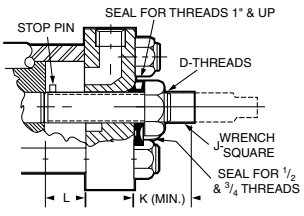
Number of Supports Required	Stroke (Inches)												
	Bore	36	48	60	72	84	96	108	120	132	144	156	168
	1	—	1	1	1	2	Consult Factory						
	1 1/2	—	—	1	1	1	2	2	2	3	3	3	4
	2	—	—	—	1	1	1	1	2	2	2	2	3
	2 1/2	—	—	—	—	—	1	1	1	1	1	2	2
	3 1/4	—	—	—	—	—	—	—	1	1	1	1	1
	4	—	—	—	—	—	—	—	—	—	1	1	1

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	5/16	5
2 1/2, 3 1/4, 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



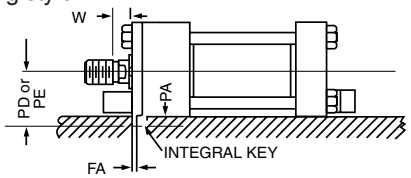
Here a "retracting stroke adjuster" must be called for in specifications, and the length *of the adjustment must be specified*.

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

*Infrequent is defined by positioning the retract stroke in a couple of attempts at original machine set up. The frequent stroke adjuster is recommended for adjustments required after the original equipment has been adjusted by the original machine manufacturer.

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

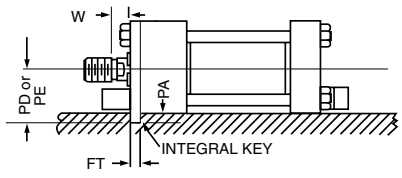
†GP Mtg. not available in 1" Bore.

*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

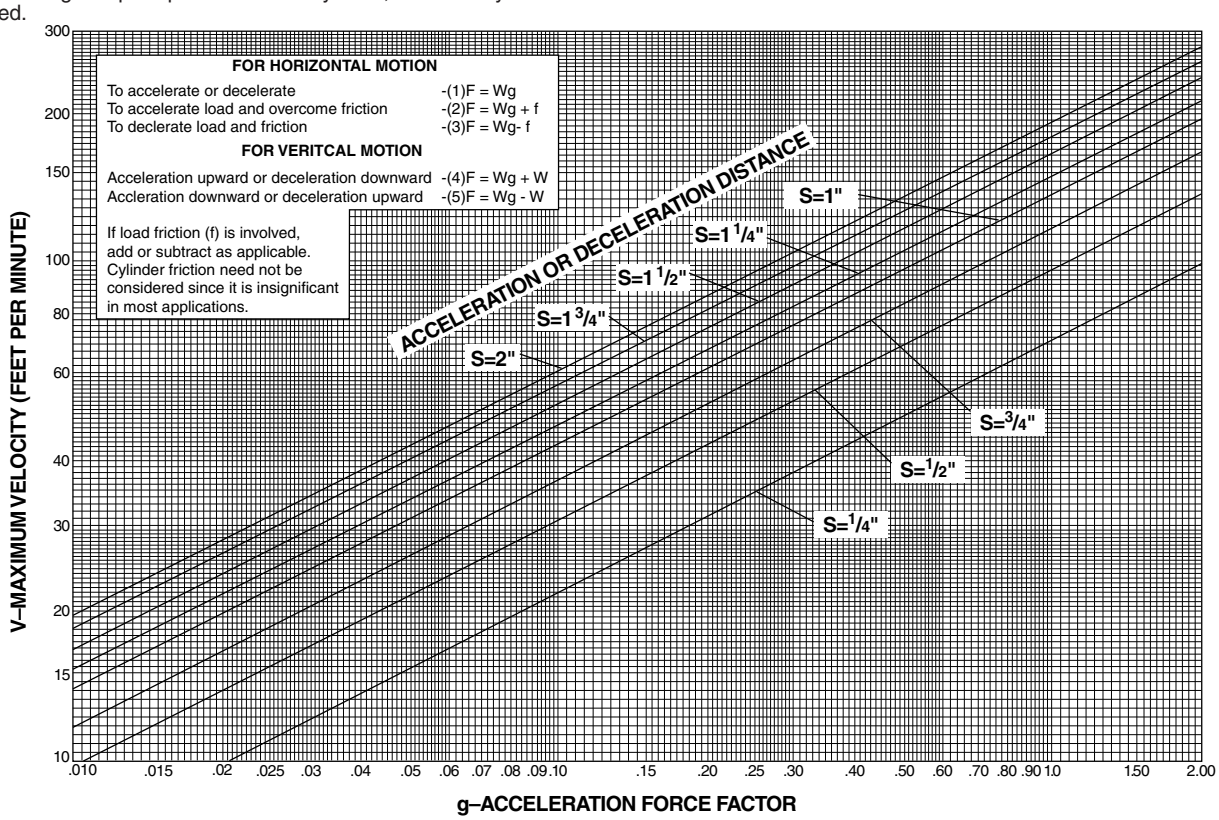
Use formula (3) F = Wg - f

(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.

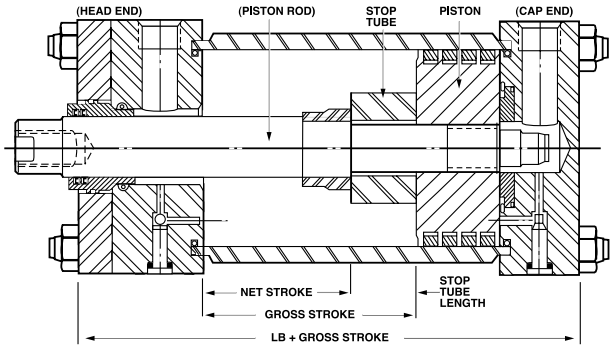


For additional information – call your local Parker Cylinder Distributor.

Stop Tubing

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

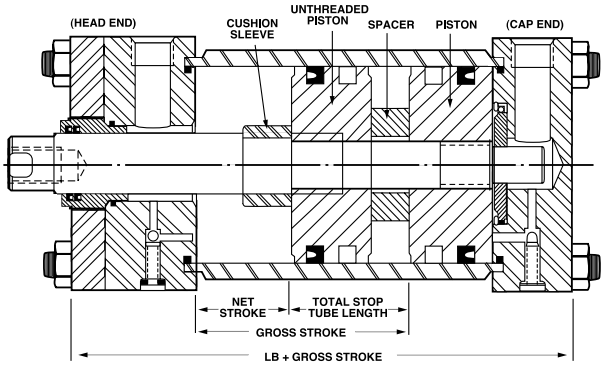
Drawing A



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.

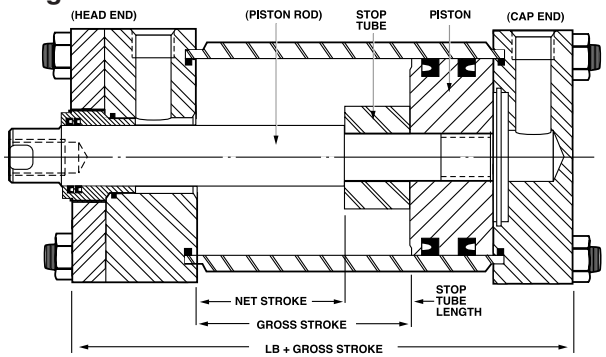
Refer to piston rod/stroke selection chart to determine stop tube length.

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

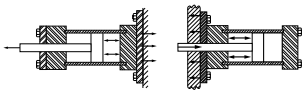
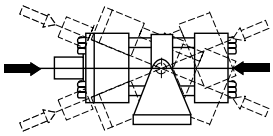
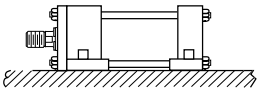
Standard mountings for fluid power cylinders fall into three basic groups. The groups can be summarized as follows:

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.

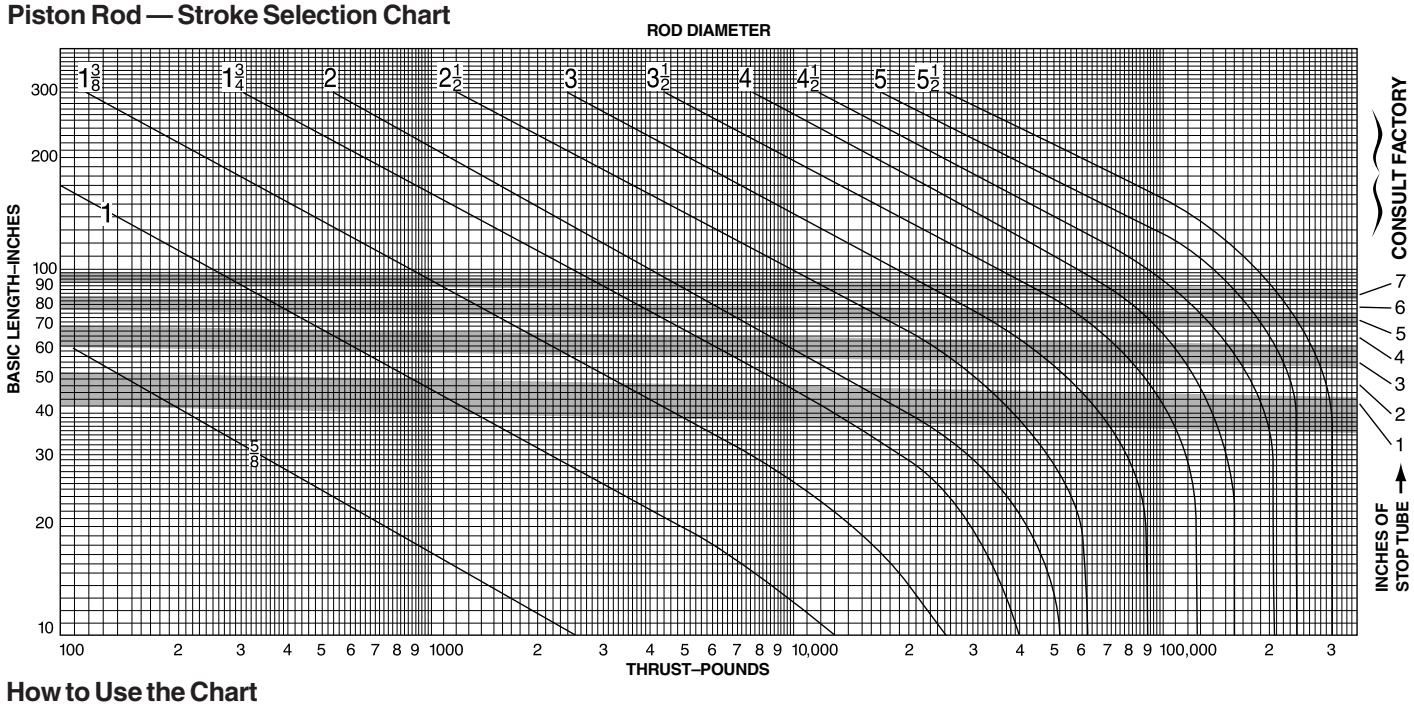
Because a cylinder's mounting directly affects the maximum pressure at which the cylinder can be used, the chart below should be helpful in selection of the proper mounting combination for your application. Stroke length, piston rod connection to load, extra piston rod length over standard, etc., should 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:

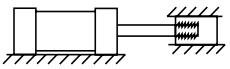
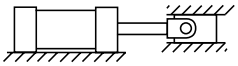
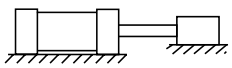
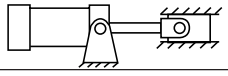
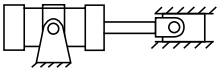
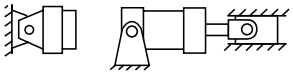
1. Determine the type of cylinder mounting style and rod end connection to be used. Then consult the chart below and find the "stroke factor" that corresponds to the conditions used.
2. Using this stroke factor, determine the "basic length" from the equation:

   Basic Length = Actual 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 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

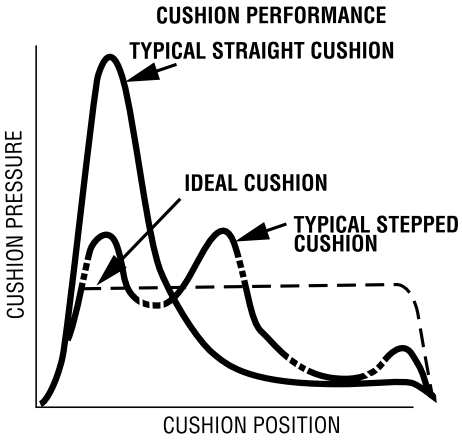
For additional information – call your local Parker Cylinder Distributor.

An Introduction to Cushioning

Cushioning is recommended as a means of controlling the deceleration of masses, or for applications where piston speed is in excess of 4 in/sec and the piston will make 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 a 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, 2H/3H cylinders are supplied with profiled cushioning as standard. Final speed may be adjusted using the cushion screw. 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 following pages.

Note: Cushion performance will be affected by the use of water or high water based fluids. Please consult factory for details.

Cushion Length

Where specified, 2H/3H cylinder incorporates the longest cushion sleeve and spear that can be accommodated within the standard envelope without reducing the rod bearing and piston bearing length. See cushion lengths on the next page. Cushions are adjustable via recessed needle valves.

Cushion Calculation

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 cylinder. The charts are valid for piston velocities within a range of 0.33 to 1 ft/s. For velocities between 1ft/s and 1.64 ft/s the energy values derived from the charts should be reduced by 25%. For velocities less than 0.33 ft/s where large masses are involved, and for velocities greater than 1.60 ft/s, a special cushion profile may be required. Please consult the factory for details.

The cushion capacity of the head end is less than 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 $E=(1/2)\ mv^2$ for horizontal applications. For inclined or vertically downward or upward applications, this is modified to:

$E = (1/2)mv^2 + mg(L/12) \times \sin(\theta)$
(for inclined or vertically downward direction of mass)

$E = (1/2)mv^2 - mg(L/12) \times \sin(\theta)$
(for inclined vertically upward direction of mass)

where:

E = energy absorbed in ft-lb

g = acceleration due to gravity = 32.2 ft/s^2

v = velocity in ft/s

L = length of cushion in inches

m = mass of load in slug (including piston, rod and rod end accessories.

θ = angle to the horizontal in degrees

p = pressure in psi

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 diameter are already appropriate for the application. The effects of friction on the cylinder and load have been ignored.

Selected bore/rod 6" bore x 2 1/2" rod (No. 1 rod)

Cushion at the cap end.

Pressure = 2,500 psi

Mass = 685 slugs = weight in lb / (32.2 ft/s^2)

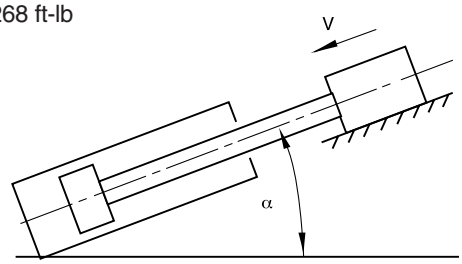
Velocity = 1.3 ft/s

Cushion length = 1.313 inch

$\theta = 45°$

$\sin(\theta) = 0.70$

$E = (1/2)mv2 + mgl/12 \times \sin(\theta)$
$= (1/2) \times 685 \times 1.3^2 + 685 \times 32.2 \times 1.313/12 \times 0.70$
$= 2{,}268$ ft-lb



Note: In the above example velocity is greater than 1 ft./s. Therefore, a de-rating factor of 0.75 must be applied to the calculated value of E. Applying this correction factor will increase the energy value to 3024 ft.-lb. (2268/0.75 = 3024 ft.-lb.). A review of the graph for the cap end cushion of a 6 inch bore x 2½" rod cylinder operating at 2500 psi indicates that it can absorb approximately 3200 ft.-lb. maximum of energy. Since 3024 ft.-lbs. is less than the maximum allowable of 3200 ft.-lbs., the cylinder can be applied as indicated. If the calculated energy exceeds the value shown on the curve, select a larger bore cylinder and/or reduce the operating pressure and recalculate the energy. Compare the newly calculated energy value to the appropriate curve to ensure it does not exceed the maximum allowable energy.

C

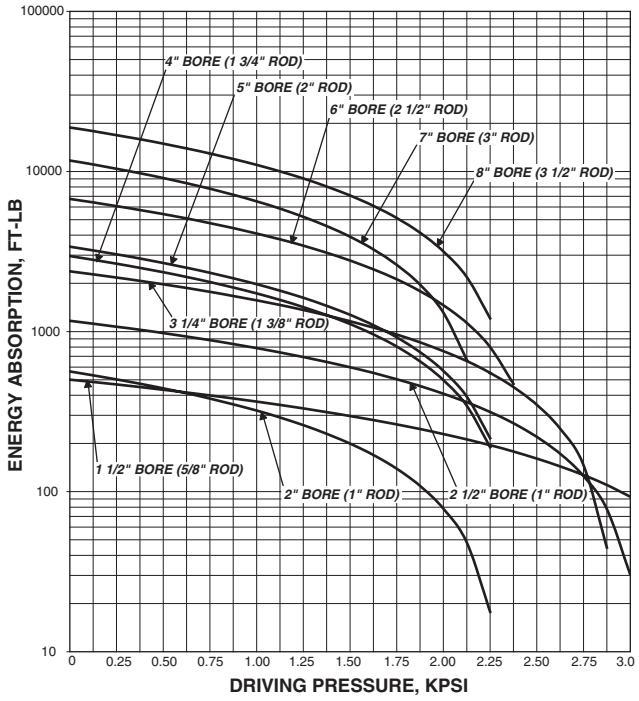
BORE	ROD NO.	ROD DIA.	CUSHION LENGTH (MINIMUM)	
			HEAD	CAP
1.5	1	0.625	0.924	1.000
	2	1.000	0.927	1.000
2	1	1.000	0.927	0.938
	2	1.375	0.925	0.938
2.5	1	1.000	0.927	0.938
	2	1.750	0.928	0.938
	3	1.375	0.925	0.938
3.25	1	1.375	1.175	1.125
	2	2.000	0.862	1.125
	3	1.750	1.178	1.125
4	1	1.750	1.178	1.063
	2	2.500	0.869	1.063
	3	2.000	0.862	1.063
5	1	2.000	0.862	0.938
	2	3.500	0.869	0.938
	3	2.500	0.869	0.938
	4	3.000	0.869	0.938
6	1	2.500	1.119	1.313
	2	4.000	1.119	1.313
	3	3.000	1.119	1.313
	4	3.500	0.869	1.313
7	1	3.000	1.619	1.750
	2	5.000	1.496	1.750
	3	3.500	1.619	1.750
	4	4.000	1.119	1.750
	5	4.500	1.496	1.750
8	1	3.500	1.869	1.813
	2	5.500	1.745	1.813
	3	4.000	1.119	1.813
	4	4.500	1.496	1.813
	5	5.000	1.496	1.813

Cushion Energy Absorption Capacity Data

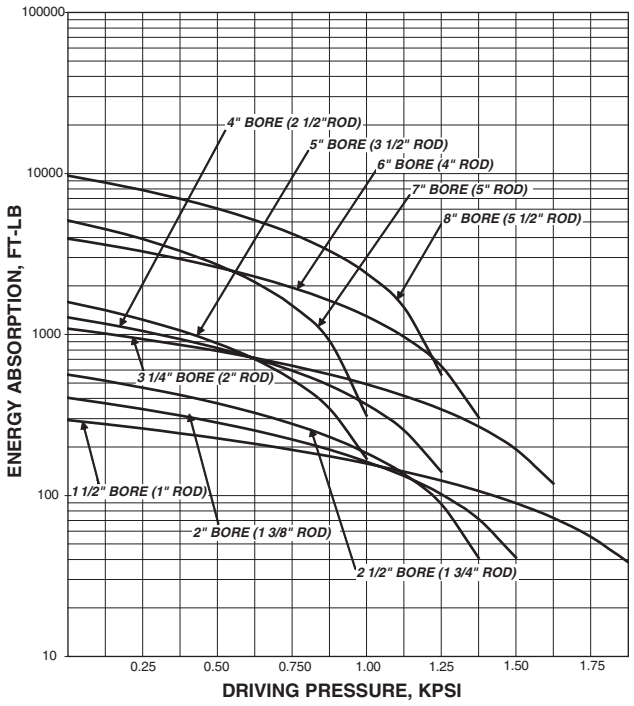
The cushion energy absorption data shown below is based on the maximum fatigue-free pressure developed in the tube. For application with a life cycle of less than 10^6 cycles, greater energy absorption figures can be applied. Please consult the factory if further information is required.

Head End

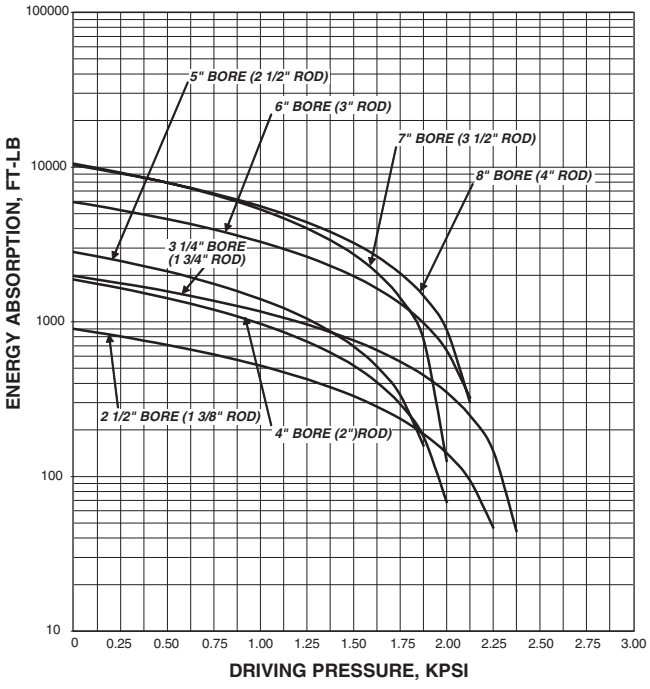
ROD NO.1



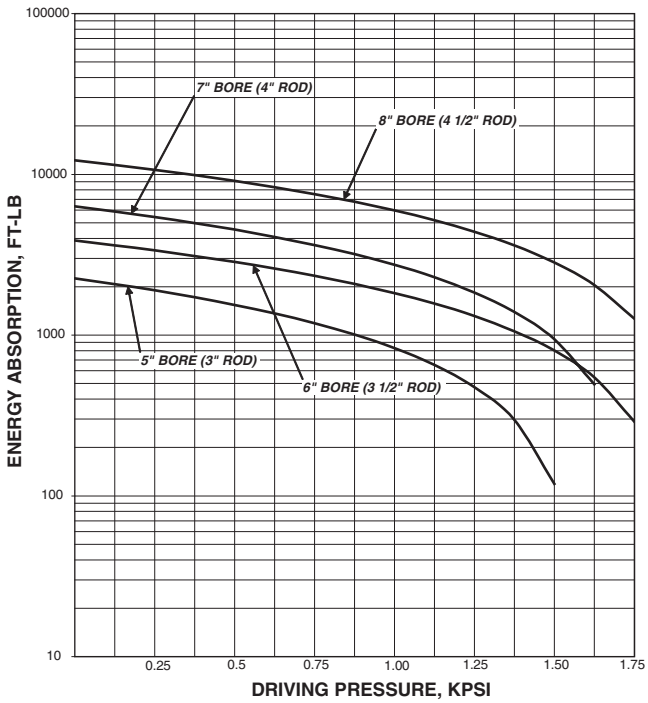
ROD NO. 2



ROD NO. 3



ROD NO.4

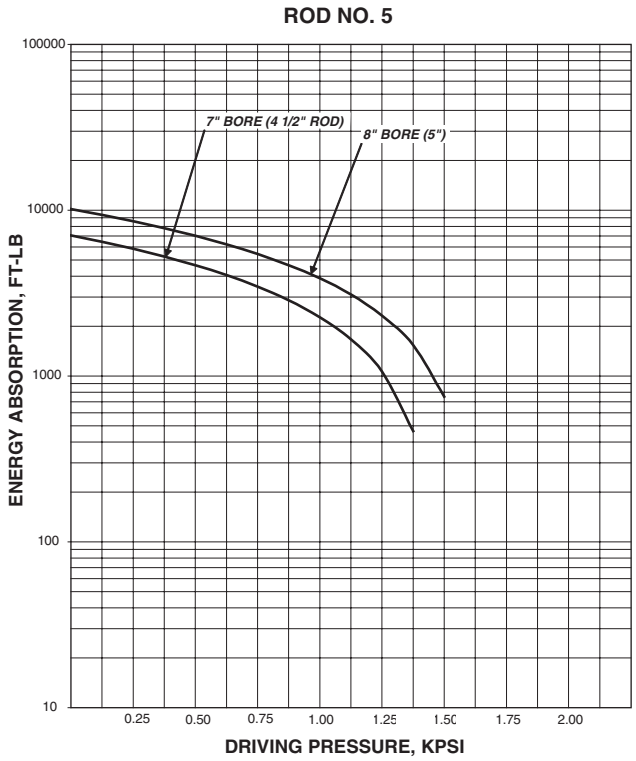


C

Cushion Energy Absorption Capacity Data

The cushion energy absorption data shown below is based on the maximum fatigue-free pressure developed in the tube. For application 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

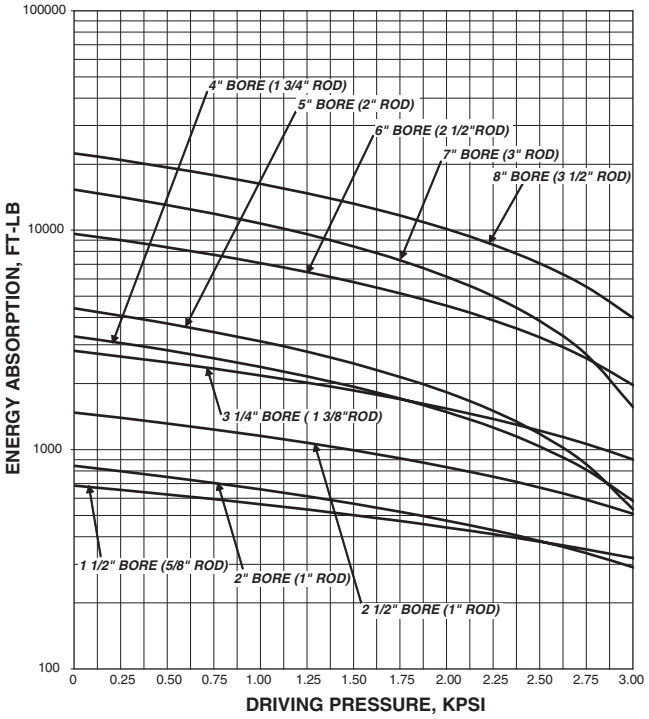


Cushion Energy Absorption Capacity Data

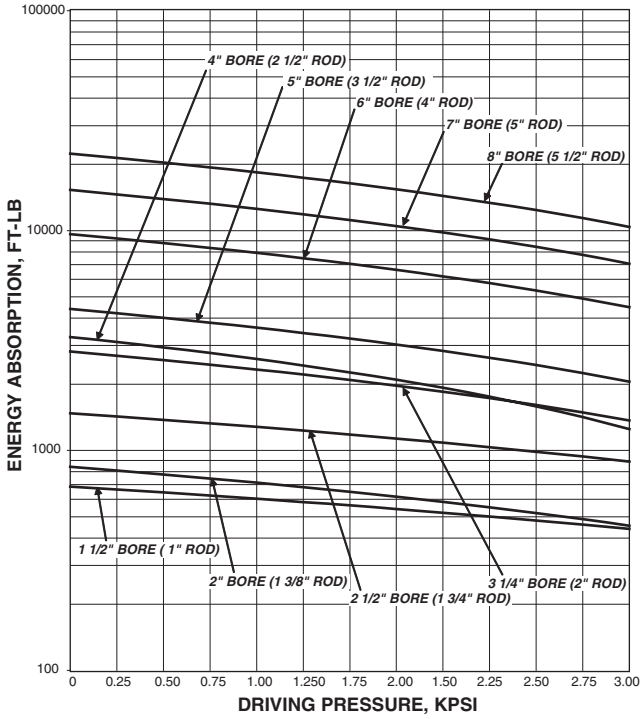
The cushion energy absorption data shown below is based on the maximum fatigue-free pressure developed in the tube. For application with a life cycle of less than 10^6 cycles, greater energy absorption figures can be applied. Please consult the factory if further information is required.

Cap End

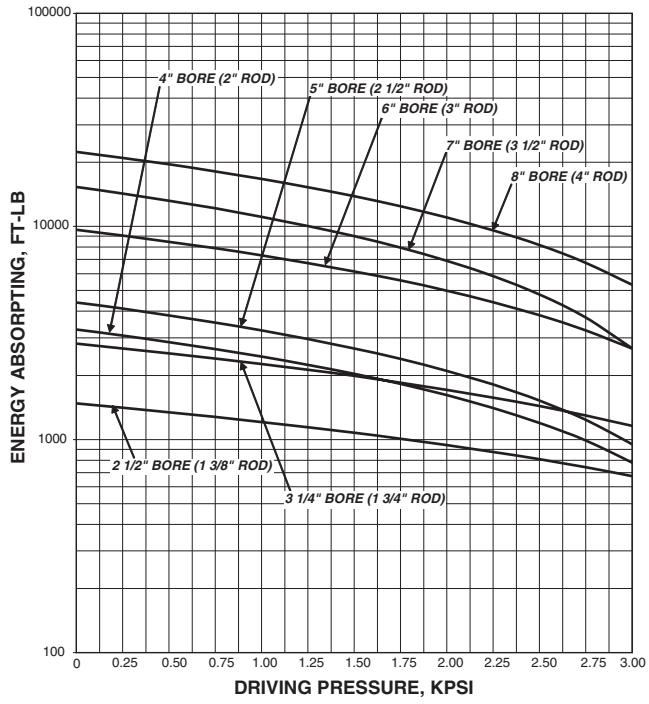
ROD NO. 1



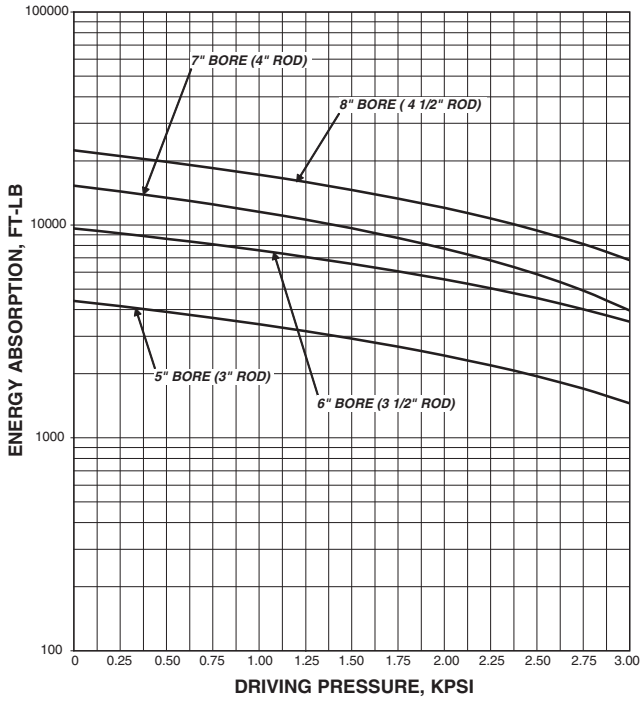
ROD NO. 2



ROD NO. 3



ROD NO. 4

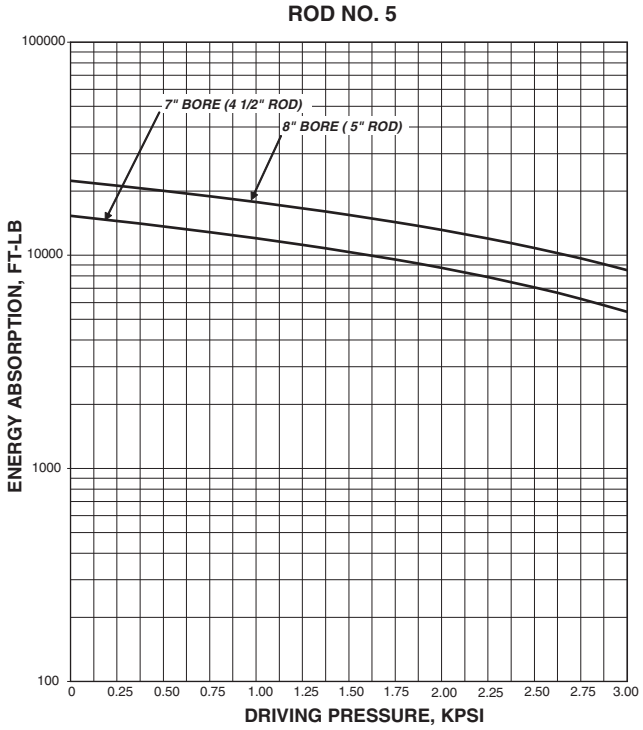


C

Cushion Energy Absorption Capacity Data

The cushion energy absorption data shown below is based on the maximum fatigue-free pressure developed in the tube. For application 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.

Cap End



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	—

For additional information – call your local Parker Cylinder Distributor.

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

C

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.

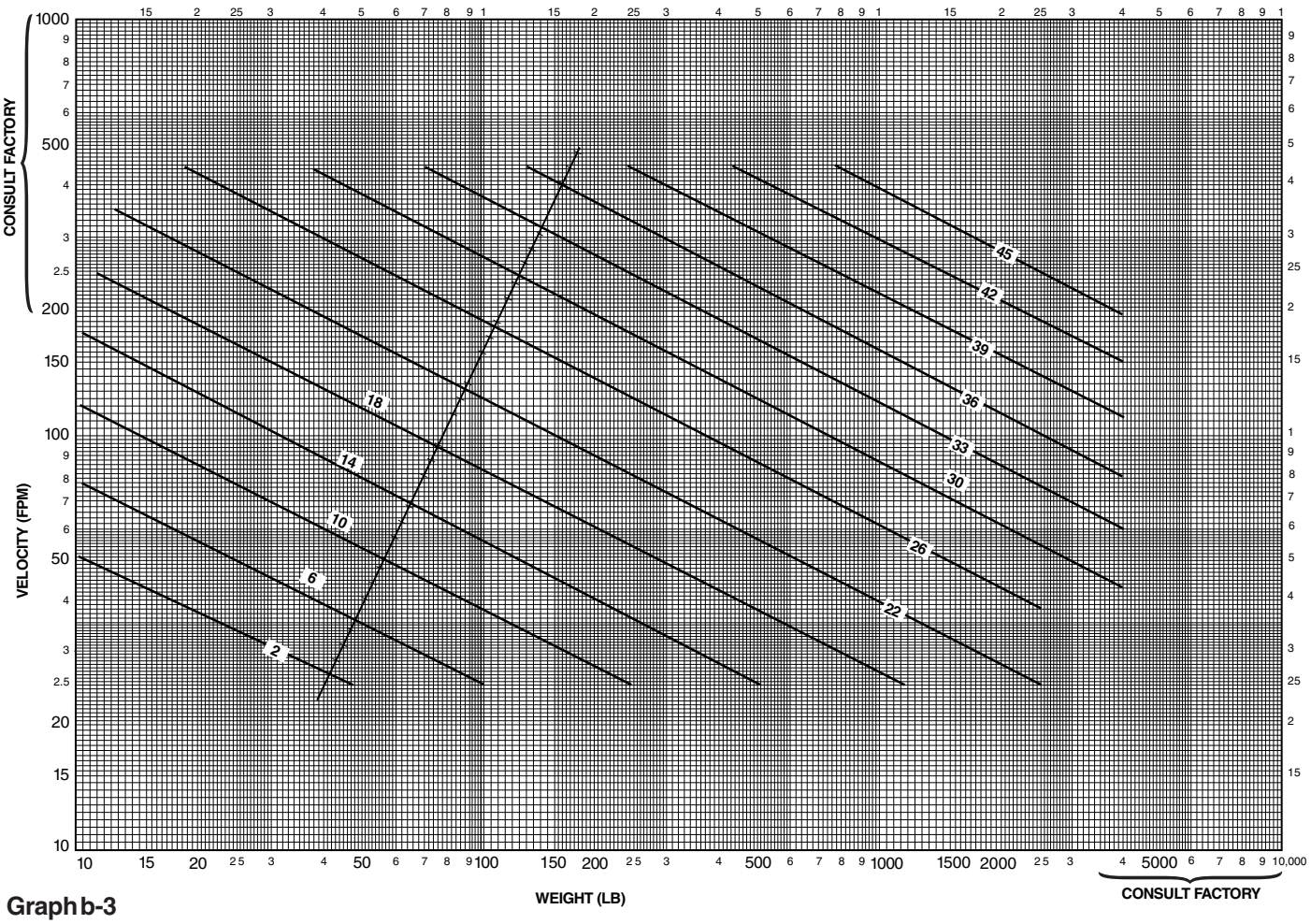
Weight Table

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

For additional information – call your local Parker Cylinder Distributor.

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

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.

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

Where: V = Cylinder volume, cu. in.
L = Cylinder stroke length, in.
D = Internal diameter of cylinder in.
C = Air required, cfm
f = 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.

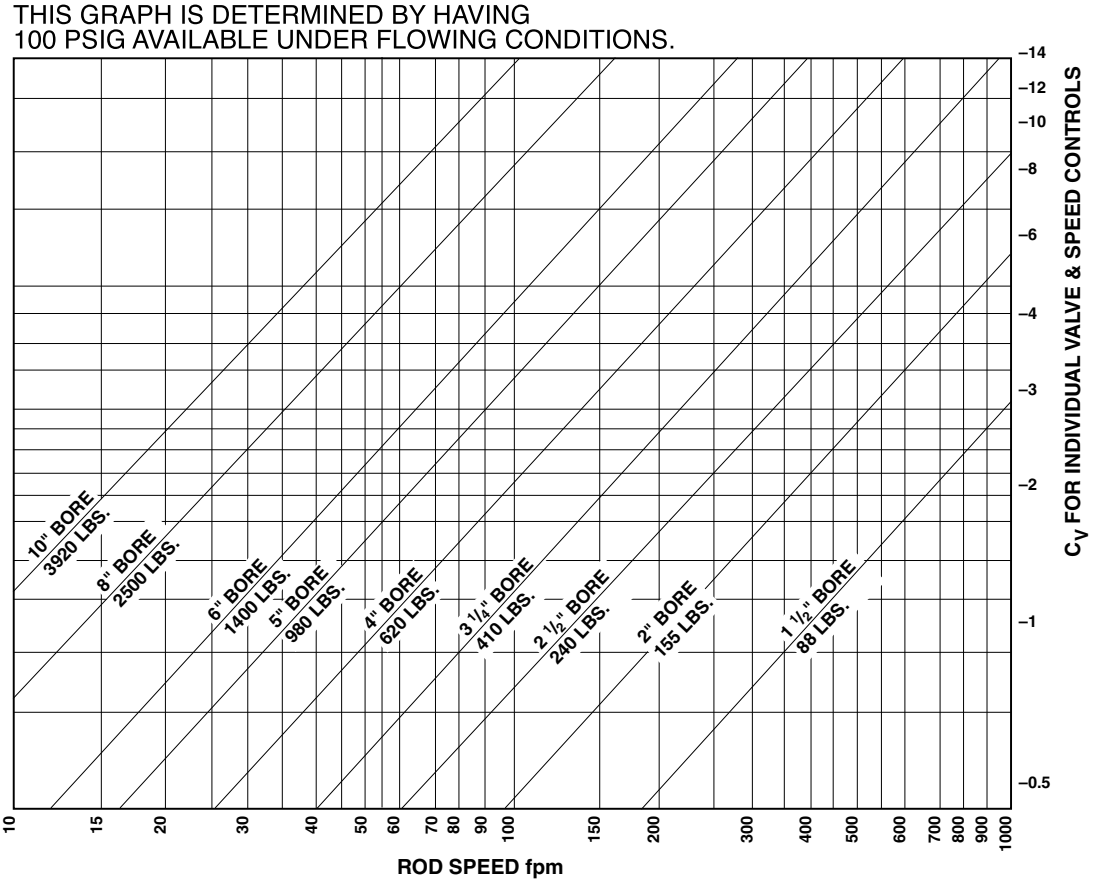
Note: *That on the "out" stroke the air pressure is working on the entire piston area but on the "in" stroke the air pressure works on the piston area less the rod area.*

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

For additional information – call your local Parker Cylinder Distributor.

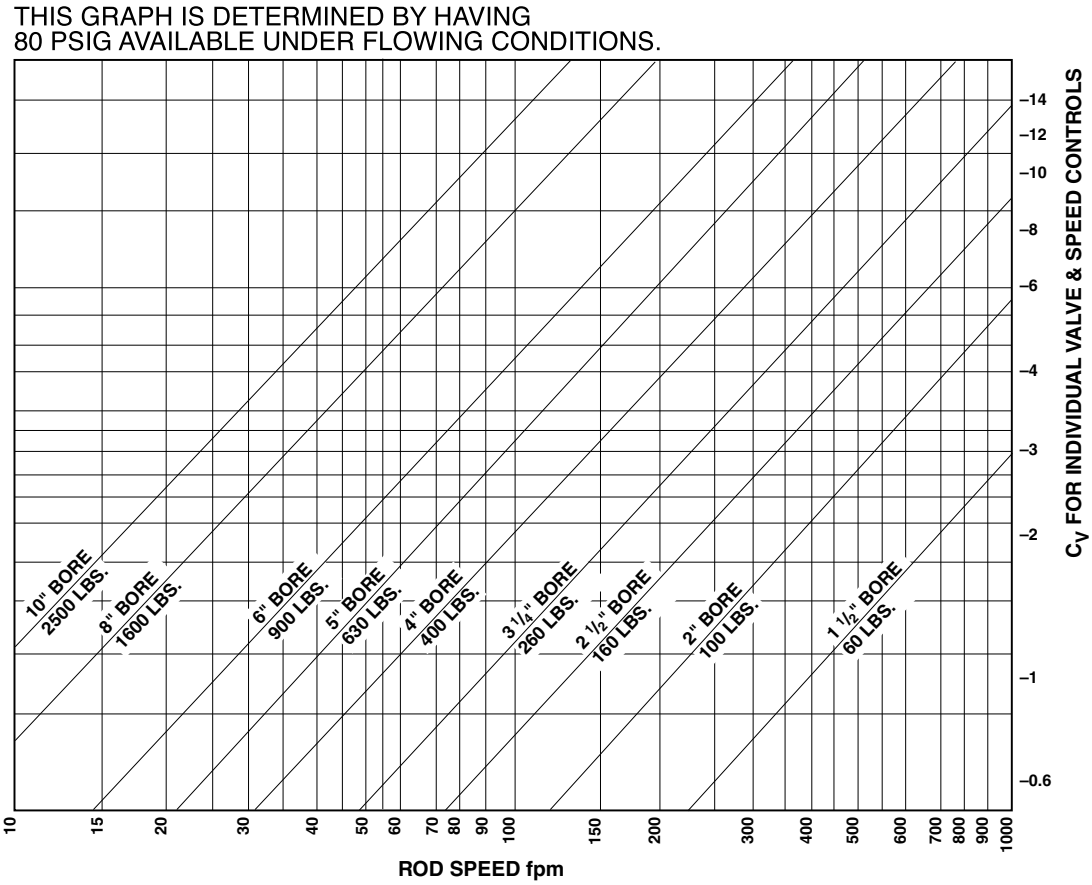
3. Read upward on appropriate rod speed line to intersection with diagonal cylinder bore line. Read right from intersection point to determine the required C_v of the valve and the speed controls. Both the valve and speed controls must have this C_v.

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.*



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

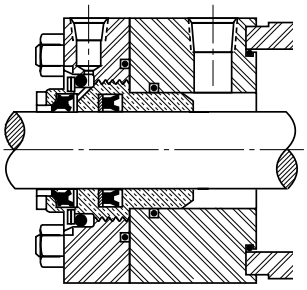
When specified metallic rod wipers can be supplied instead of the standard synthetic rubber wiperseal. Recommended in applications where contaminants tend to cling to the extended piston rod and would damage the synthetic rubber wiperseal. Installation of metallic rod wiper does not affect cylinder dimensions. 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.

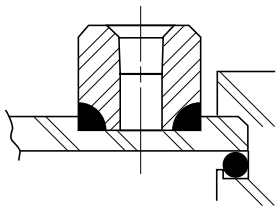


On 1 1/2" bore size Series 2H cyls., the drain port is located in the head adjacent to the port and on code 2 rod, the retainer thickness increases to 5/8". On 2" thru 8" bore sizes the drain port is located in the retainer as shown.

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.

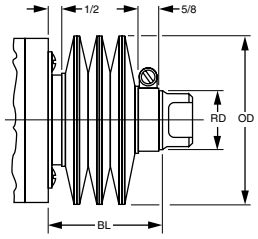
LF	.13	.13	.13	.13	.13	.13	.13	.10	.10	.10	.10	.10
OD	2 1/4	2 1/4	2 5/8	3	3 3/8	3 3/4	4 3/8	5 1/8	5 5/8	6 1/4	7	7 1/2
RD	1/2	5/8	1	1 3/8	1 3/4	2	2 1/2	3	3 1/2	4	5	5 1/2

To determine extra length of piston rod required to accommodate boot, calculate

BL = Stroke x LF + 1 1/8"

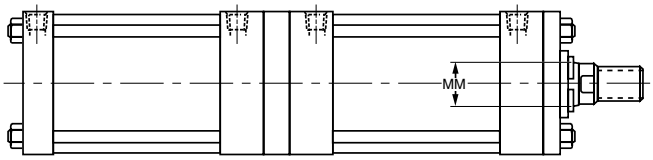
BL + Std. LA = length of piston rod to extend beyond the retainer.

NOTE: Check all Boot O.D's against std. "E" dimension from catalog. This may be critical on foot mounted cylinders.



Tandem Cylinders

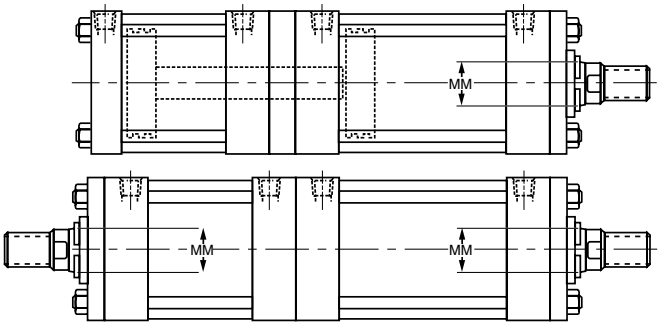
A tandem cylinder is made up of two cylinders mounted in line with pistons connected by a common piston rod and rod seals installed between the cylinders to permit double acting operation of each. Tandem cylinders allow increased output force when mounting width or height are restricted.



Reduced operating pressure is required for this construction. Contact factory.

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.



Reduced operating pressure is required for this construction. Contact factory.

For additional information – call your local Parker Cylinder Distributor.

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

C

For Cylinder Division Plant Locations – See Page II.

Mounting Styles

General guidance for the selection of ISO mounting styles can be found in the HMI content of Section B. The notes which follow provide information for use in specific applications and should be read in conjunction with that information.

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. Trunnion position is 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.

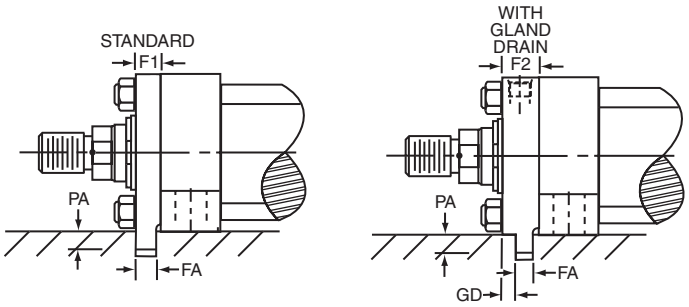
Foot Mountings and Thrust Keys

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 positive cylinder location.

Thrust key mountings eliminate the need for fitted bolts or external keys on Style C side mounted cylinders. The gland retainer plate of 25mm & 32mm bore cylinders is extended below the nominal mounting surface to fit into a keyway milled into the mounting surface of the machine member. To order a key retainer plate in 25mm & 32mm bores, specify P in the Mounting Modification field of the model code.

Bore Ø	Rod Ø	Nominal		FA -0.075	GD	PA -0.2
		F1 Standard	F2 w/Gland Drain			
25	All	10	10[1]	8	–	5
32	14	10	10[1]	8	–	5
	22	10	16	8	6	5

[1] Gland drain is in the head. See page 123 for additional details about gland drain ports.

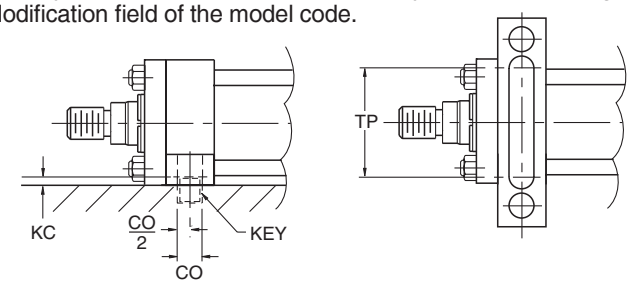


Profile of thrust key extension (with gland drain in retainer) for bore and rod combination 32mm x 22mm.

Integral Key – 25mm & 32mm Bores

All dimensions are in millimeters unless otherwise stated.

Cylinders 40mm to 200mm bore utilize a keyway milled into the Style C head on the mounting lug side. A key (supplied) fits into the cylinder keyway and a corresponding keyway in the mounting surface of the machine member. To order the milled keyway and key in 40mm to 200mm bores, specify K in the Mounting Modification field of the model code.



Milled Keyway – 40mm to 200mm Bore

Bore Ø	CO N9	KC +0.5	TP[2] min
40	12	4	55
50	12	4.5	70
63	16	4.5	80
80	16	5	105
100	16	6	120
125	20	6	155
160	32	8	190
200	40	8	220

[2] Suggested Key Length

Key				
Bore Ø	Width	Height	Length	Part No.
40	12	8	55	0941540040
50	12	8	70	0941540050
63	16	10	80	0941540063
80	16	10	105	0941540080
100	16	10	120	0941540100
125	20	12	155	0941540125
160	32[3]	18	190	0941540160
200	40	22	220	0941540200

[3] Not to ISO6020/2.

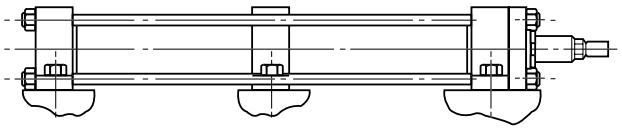
Mounting Bolts and Nuts

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.

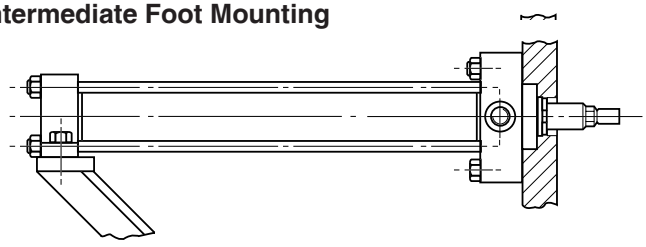
Bore ϕ	Tie Rod Torque Nm
25	4.5-5.0
32	7.6-9.0
40	19.0-20.5
50	68-71
63	68-71
80	160-165
100	160-165
125	450-455
160	815-830
200	1140-1155

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

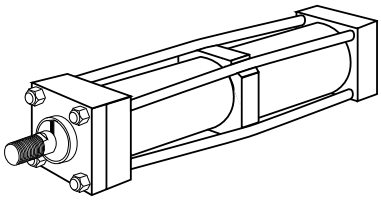
Maximum Stroke Lengths of Unsupported Cylinders (in mm)

Bore ϕ	Intermediate Mounting	End Support Mounting
25, 32, 40	1500	1000
50, 63, 80	2000	1500
100, 125	3000	2000
160, 200	3500	2500

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 ZB SS	±2 max ±1.25
D (MT1)	XG ZB	±2 max
DB (MT2)	XJ ZB	±1.25 max
DD (MT4)	XV ZB	±2 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 labeled '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.

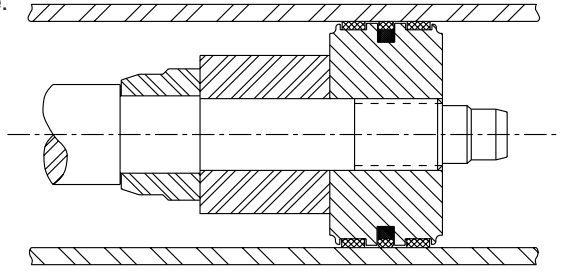
When specifying a cylinder with a stop tube, state the **gross** stroke of the cylinder and the length of the stop tube. The gross stroke is equal to the net (working) stroke of the cylinder plus the stop tube length. See the example below:

Ex. 80-JJ-HMI-R-E-S-14-M1375M1100

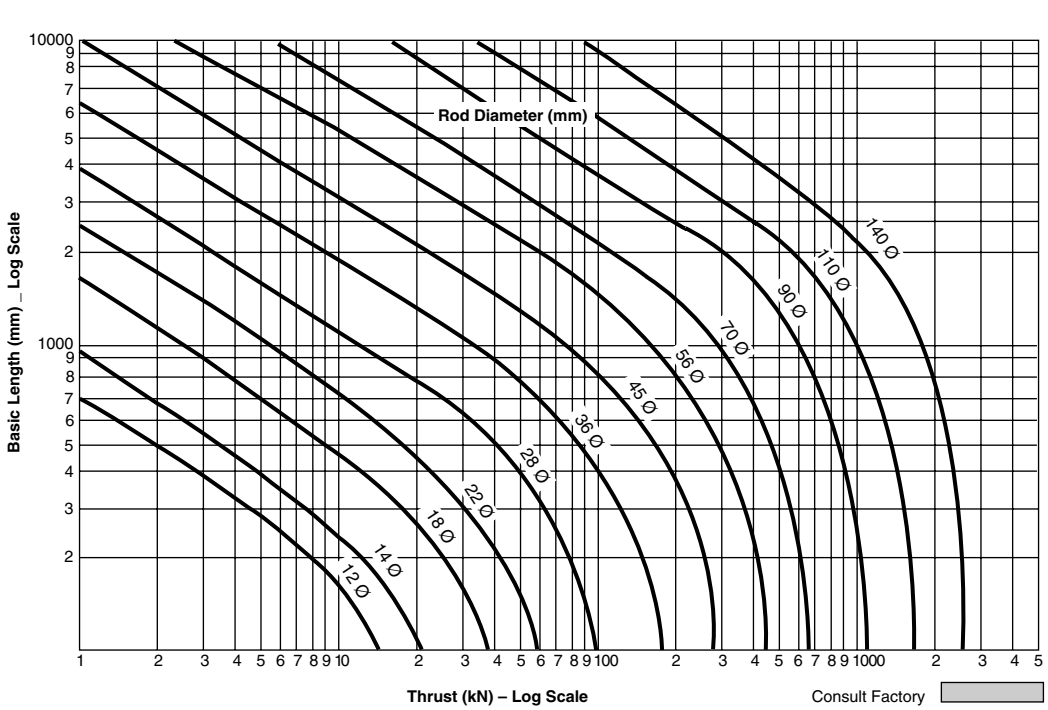
1) Stop tube = 175

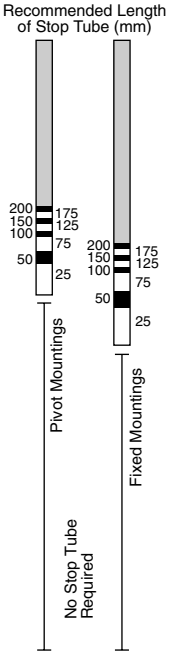
2) Net stroke = 1200

– the cylinder net stroke will be 1200mm with 175mm of stop tube.



Piston Rod Selection Chart

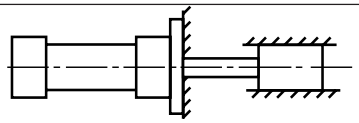
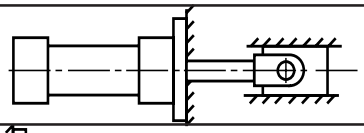
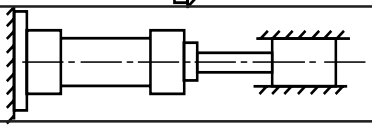
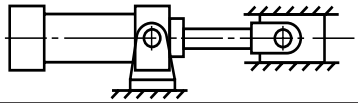
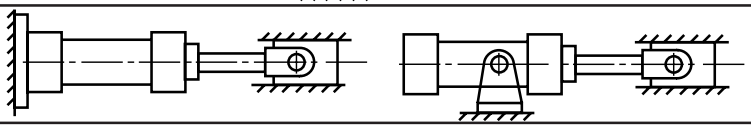
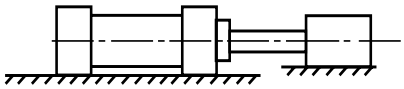
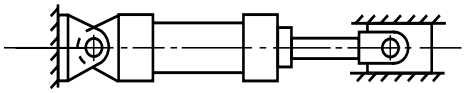
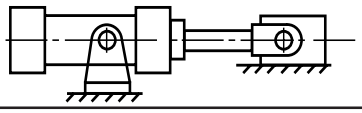




C

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.

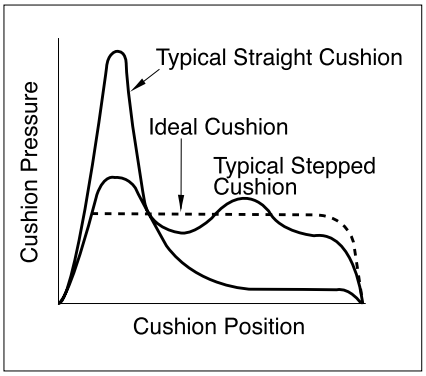
An Introduction to Cushioning

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 119. 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)

$E = {}^1/_2mv^2 - mgl \times 10^{-3} \times \sin\alpha$

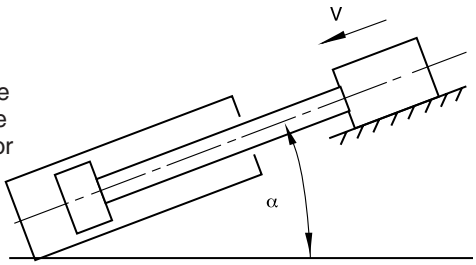
(for inclined or vertically upward direction of mass)

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	=	45°
$\sin\alpha$	=	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:

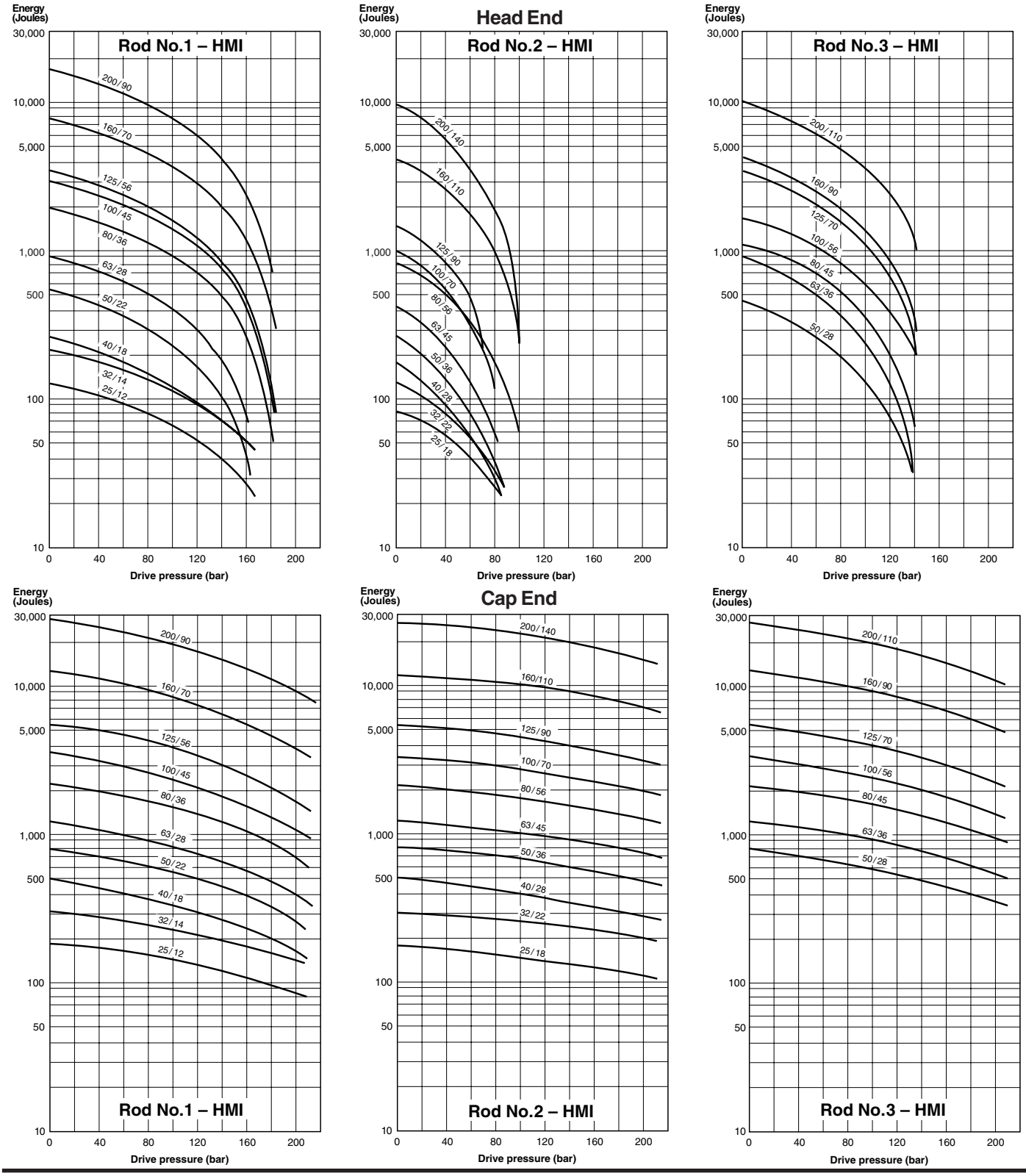
$$\frac{3615}{0.75} = 4820 \text{ Joules}$$

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.



Cushion Length, Piston and Rod Mass

Bore ϕ	Rod No.	Rod ϕ	Cushion Length - ISO				ISO		Piston & Rod Zero Stroke	Rod Only per 10mm Stroke
			Rod No. 1		Rod No. 2		Rod No. 3			
			Head	Cap	Head	Cap	Head	Cap	kg	kg
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.

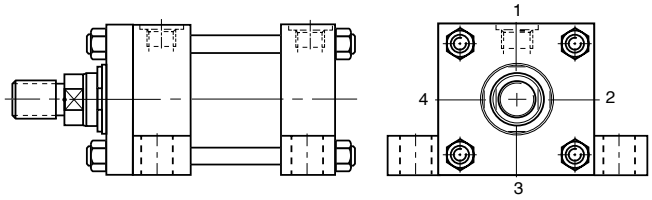
Speed Limitations
Where large masses are involved, or piston speeds exceed 0.1m/s and the piston will make a full stroke, cushions are recommended – see cushion information. For cylinders with oversize ports and with a flow exceeding 8m/s into the cap end, a 'non-floating cushion' should be specified. 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 ∅	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 ∅	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[2,3]	10	23.5	0.80
32	3/8[2]	M18x1.5[2,3]	10	23.5	0.48
40	1/2	M22x1.5[3]	13	40	0.53
50	3/4	M27x2[3]	15	53	0.45
63	3/4	M27x2[3]	15	53	0.28
80[4]	1	M33x2	19	85	0.28
100[4]	1	M33x2	19	85	0.18
125[4]	1 1/4	M42x2	24	136	0.18
160[4]	1 1/4	M42x2	24	136	0.11
200[4]	1 1/2	M48x2	30	212	0.11

[1]Not to DIN 24 554
[2]20mm high port bosses fitted at cap end
[3]ISO 6149 ports are not available on some bore/rod combinations
[4]Consult factory – not normally available on these bore sizes
Not recommended for JJ mountings at pressures above 100 bar



Ports at position 2 or 4 in 25mm to 100mm bore sizes of mounting style C are offset toward position 1 and are not available in the head of 25mm and 32mm bores with number 2 rods. 25mm and 32mm bore heads will not be elongated 5mm toward position 2 or 4 when a port is specified at either of those two locations (the 5mm elongation at position 1 will remain). Contact the factory for the offset dimension.

Positions of Ports and Cushion Screws in Head and Cap		Mounting Styles: TB, TC and TD				JJ				HH				C[5]			B and BB				SB				D		DB				DD			
Head	Port	1	2	3	4	1	2	3	4	1	2	3	4	1	2	4	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	4	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	2	4	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	4	2	2	3	4	1	2	3	4	1	3	4	1	2	3	1	3	4	1	2

[5]Ports at position 2 or 4 in 25mm to 100mm bores are offset toward position 1.

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 Ø	"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

BSPP Port for Series HMI

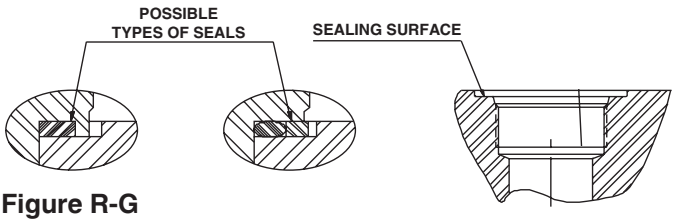


Figure R-G

ISO 6149-1 Port for Series HMI

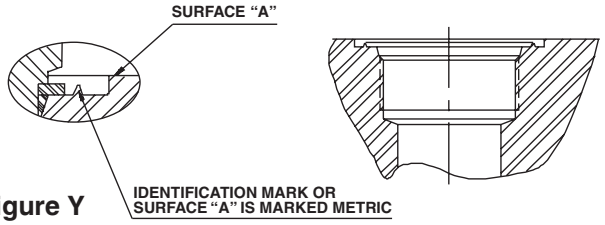


Figure Y

Weights – Series HMI Cylinders

Bore Ø	Rod Ø	Mounting Styles – Weight at Zero Stroke						Weight per 10mm Stroke
		TB, TC TD	C	JJ, HH	B,BB, SB	D, DB	DD	
		kg	kg	kg	kg	kg	kg	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

Bore Ø	Rod Ø	Mounting Styles – Weight at Zero Stroke						Weight per 10mm Stroke
		TB, TC TD	C	JJ, HH	B,BB, SB	D, DB	DD	
		kg	kg	kg	kg	kg	kg	kg
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

All dimensions are in millimeters unless otherwise stated.

C

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	-20°C to + 80°C
5	Fluorocarbon elastomer (FPM) Fluorocarbon, 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.	-20°C to + 150°C

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 -20°C and +80°C. 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.

Water Service

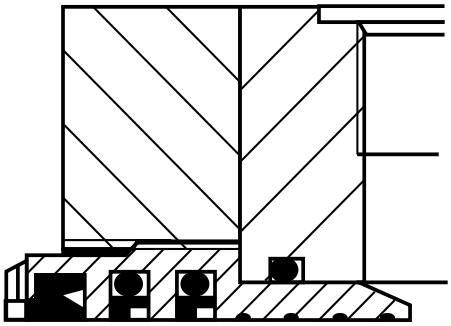
Special cylinders are available for use with water as the fluid medium. Modifications include a stainless steel piston rod with lipseal piston, and plating of internal surfaces. When ordering, please specify the maximum operating pressure or load/speed conditions.

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.

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.



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.

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.

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 is provided in the retainer, except in mounting style JJ, style D in 100mm to 200mm bores, and regardless of mounting style, 25mm bore with all rod numbers, and 32mm to 40mm bores with number 1 rod. In these cases the drain port is located in the head. When the gland drain port in 25mm to 40mm bores is in the head of all mounting styles except JJ, it must be in the same position as the port (on the 5mm elongated side for 25mm & 32mm bores) and when specified in 25mm and 32mm bores of mounting style C it must be in position 1. On JJ mounting styles in 25mm and 32mm bores the drain port can be in position 2 or 4 and is not available in position 3. When the gland drain port is provided in the retainer, the thickness of the retainer is increased by 6mm in 32mm and 40mm bores with number 2 rod and by 4mm in 63mm bore cylinders with number 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 Port Location & Position Availability

Bore Ø	Rod Ø	Head (H) or Retainer (R) Location / Position			
		TB, TC, TD, HH, B, BB, SB, DB, DD	C	D	JJ
25	All	H / 1, 2, 3, 4	H / 1	H / 1, 3	H / 2, 4
32	14	H / 1, 2, 3, 4	H / 1	H / 1, 3	H / 2, 4
	22	R / 1, 2, 3, 4	R / 1, 2, 3*, 4	R / 1, 2, 3, 4	H / 2, 4
40	18	H / 1, 2, 3, 4	H / 1	H / 1, 3	H / 2, 3, 4
	28	R / 1, 2, 3, 4	R / 1, 2, 3*, 4	R / 1, 2, 3, 4	H / 2, 3, 4
50	All	R / 1, 2, 3, 4	R / 1, 2, 3*, 4	R / 1, 2, 3, 4	H / 2, 3, 4
63	All	R / 1, 2, 3, 4	R / 1, 2, 3*, 4	R / 1, 2, 3, 4	H / 2, 3, 4
80	All	R / 1, 2, 3, 4	R / 1, 2, 3*, 4	R / 1, 2, 3, 4	H / 2, 3, 4
100	All	R / 1, 2, 3, 4	R / 1, 2, 3*, 4	H / 1, 3	H / 2, 3, 4
125	All	R / 1, 2, 3, 4	R / 1, 2, 3*, 4	H / 1, 3	H / 2, 3, 4
160	All	R / 1, 2, 3, 4	R / 1, 2, 3*, 4	H / 1, 3	H / 2, 3, 4
200	All	R / 1, 2, 3, 4	R / 1, 2, 3*, 4	H / 1, 3	H / 2, 3, 4

*Gland drain is not available in position 3 when key plate is specified in these bore and rod combinations.

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

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.

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

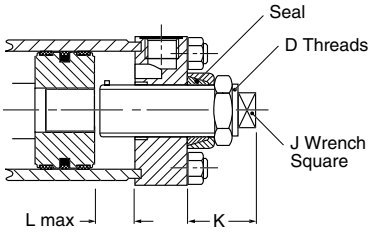
A tandem cylinder is made up of two cylinders mounted in line with pistons connected by a common piston rod and rod seals installed between the cylinders to permit double acting operation of each. Tandem cylinders allow increased output force when mounting width or height are restricted.

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.

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 Ø	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



All dimensions are in millimeters unless otherwise stated.

*Infrequent is defined by positioning the retract stroke in a couple of attempts at original machine set up. The frequent stroke adjuster is recommended for adjustments required after the original equipment has been adjusted by the original machine manufacturer.

C

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.

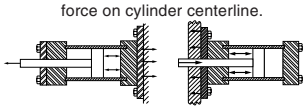
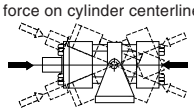
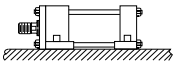
Mounting Classes

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 90° or 180° 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	4 1/2	2720	3000
12	5 1/2	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.

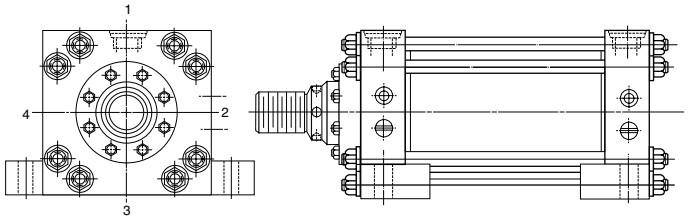
Series "3H" cylinders are recommended for pressures to 3000 p.s.i. for heavy-duty service with hydraulic oil. The 4:1 design factor ratings shown are based on tensile strength of material and are for code 1 rod dia. only. Design factors at other pressures can be calculated from this rating. In addition, 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 SAE straight O-ring boss 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, Series 3H Large Bore Cylinders. 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 90° or 180° 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.

NPTF Tapered Pipe Threads The NPTF ports are available at no extra charge upon request.

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 1/8" 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 electroless nickel-plated, non-wearing internal surface; fluorocarbon 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.)

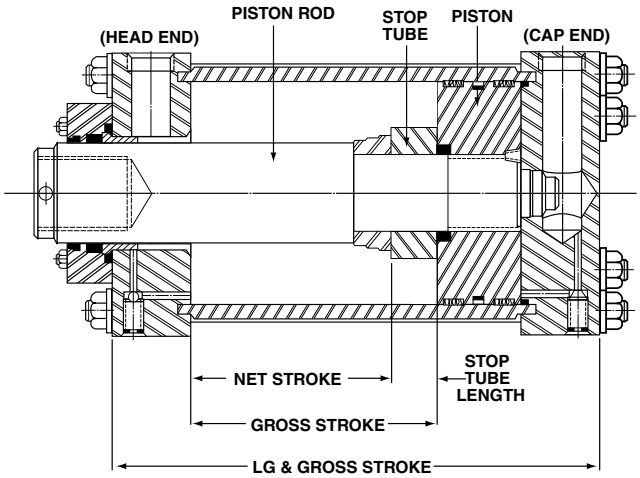
Warranty Parker will warrant Series 3H cylinders modified for water service to be free of defects in materials or workmanship. However, Parker cannot accept responsibility for premature failure of cylinder function, where failure is caused by corrosion, electrolysis or mineral deposits within the cylinder.

Fire-Resistant Fluids

See Section C, Operating Fluids and Seals for further data and information.

Stop Tubing

Stop tube is recommended to lengthen the distance between the gland and piston to reduce bearing loads when the cylinder is fully extended. This is especially true of horizontally mounted and long stroke cylinders. Long stroke cylinders achieve additional stability through the use of a stop tube. 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 3H Piston Rod-Stroke Selection Chart at the end of this 3H section 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.

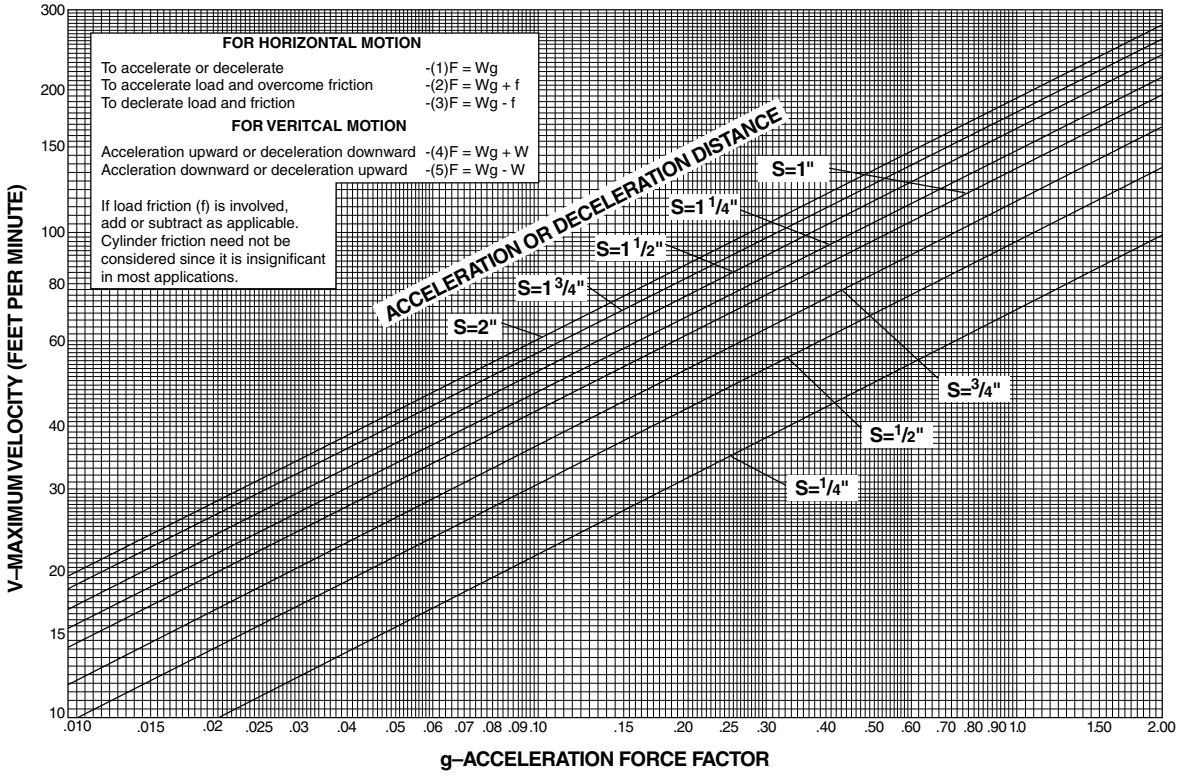
Assuming a maximum available pump pressure of 750 psi, a 10" bore cylinder should be selected, operating on push stroke at approximately 500 psi pressure at the cylinder.

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.

Series 3H Large Bore
High Pressure Hydraulic Cylinders

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 1/2	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 100°F — 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 Thick-ness	I.D. Area	5		7		10		15		20		25		30		Tee			Elbow		
						Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.	Loss	Gal. Min.				Std.	Sq.	45°
Inches		Inches	Inches	Inch	Sq. In.																				
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					Double Rod Cylinders	
			Basic Wt. Zero Stroke				Add Per In. of Stroke	Basic Wt. Zero Stroke Add to All Mtg. Styles	Add Per In. of of Stroke
			D, DB	DD, JJ, HH	JB, HB	BB, C, E			
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
			JJ, HH		JB, HB	BB			
16	8	1	2073		2257	2226	35	149	49
	9	3	2122		2305	2275	39	198	57
	10	4	2181		2364	2334	43	257	65
18	9	1	3165		3256	3330	45	198	63
	10	3	3224		3315	3390	50	257	72
20	10	1	4231		4406	4551	57	257	79

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.

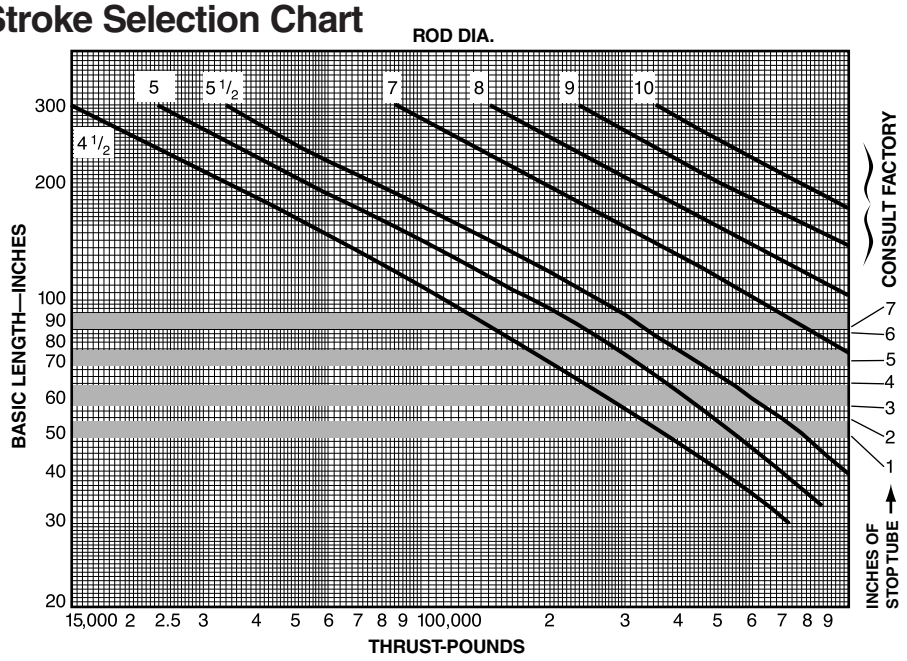
Extra weight for longer than standard rod extensions can be calculated from table below.

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

C

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.

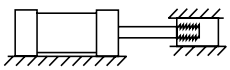
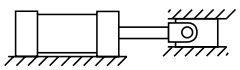
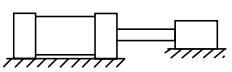
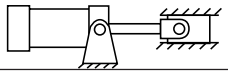
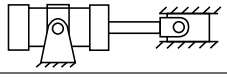
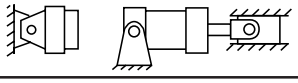
B) The required length of stop tube is read from the right of the graph by following the shaded band in which the point of intersection lies.

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. This will also minimize seal damage.
3. Port protector plugs should be left in the cylinder until the time of installation.
4. If a cylinder is stored full of hydraulic fluid, expansion of the fluid due to temperature changes must be considered. Installing a check valve with free flow out of the cylinder is one method.

Installation
1. Cleanliness is an important consideration, and Parker Hannifin 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. On fixed mounting cylinders attaching the piston rod while the rod is retracted will help in achieving proper alignment.

Mounting Recommendations
1. Always mount cylinders using the largest possible high tensile alloy steel socket head screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.
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. Nuts used for this mounting style should be torqued to the same value as the tie rods for that bore size.
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 bearing blocks with minimum bearing clearances. Bearing blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to axis of the trunnion pins.
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 or brittle, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with seal material, which is compatible with these fluids. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165°F. (+74°C). Shield the cylinder from the heat source to limit temperature to 350°F. (+177°C.) and replace with fluorocarbon seals.
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. Excessive pressure can also result in cylinder body seal leak. Determine if the pressure rating of the cylinder has been exceeded. If so, bring the operating pressure down to the rating of the cylinder and have the tie rods replaced.

   Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and 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.

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 static leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.
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. Bring the operating conditions of the cylinder to the attention of our engineering department and have our factory repair the cylinder.

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.

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

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

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

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

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

1.0 General Instructions

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

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

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

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

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

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

2.0 Cylinder and Accessories Selection

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The rod end pressure is approximately equal to:

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

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

3.0 Cylinder and Accessories Installation and Mounting

3.1 Installation

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

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

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

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

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

3.2 Mounting Recommendations

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

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

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

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

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

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

4.0 Cylinder and Accessories Maintenance, Troubleshooting and Replacement

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

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

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

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

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

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

4.2 Cylinder Trouble Shooting

4.2.1 – External Leakage

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

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

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

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

Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and 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.

4.2.2 – Internal Leakage

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

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

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

4.2.3 – Cylinder Fails to Move the Load

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

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

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

4.3 Erratic or Chatter Operation

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

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

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

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

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

C

For Cylinder Division Plant Locations – See Page II.

Training Courses

Involvement Training

- Industrial Hydraulic Technology 1
- Industrial Hydraulic Technology 2
- Hydraulic Component Sizing
- Hydraulic Maintenance Technology
- Hydraulic Pumps & Controls
- Introduction to Electrohydraulics
- Electrohydraulic Feedback Systems
- Cartridge Valve Systems
- Mobile Hydraulic Technology
- Basic Pneumatic Technology
- Pneumatic Technology

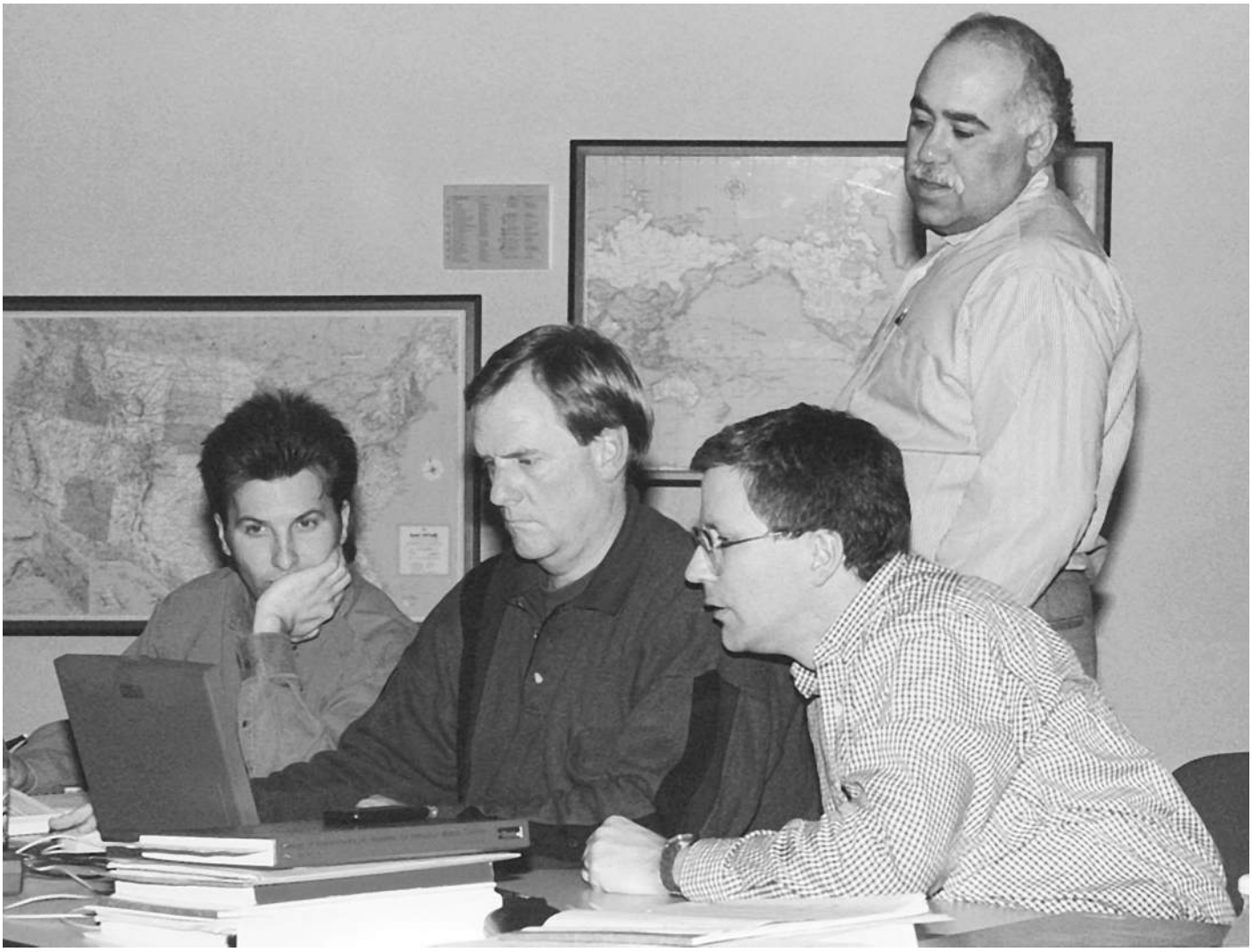
Video Tape Programs, CD-ROMs

- Hydraulic & Pneumatic Video Tapes & CDs

Motion Control Training Materials

Portable Hydraulic Trainer Stand

- Operates on 115 volt AC
- Standard Industrial Components
- No loose components to misplace
- Easy to move
- Quiet operation



For more information contact the Motion Control Training Dept., phone 216-896-2495, fax 216-514-6738, e-mail mctrain@parker.com

Parker Cylinder

What is Involvement Training?

The Motion Control Training Department was established in the early seventies. It was at this time that the department's charter was written. In this document it was stated that the general area of activity would include all phases of technical training for the hydraulic and pneumatic industries. This training would be noncommercial, involving state of the art technology.

The Parker approach is one of involvement training. In its full scope, involvement training is active participation. This participation results in excellent student retention, plus a very comfortable way of learning. It has been received with great enthusiasm.

Our present efforts involve eleven continually running courses. They are:

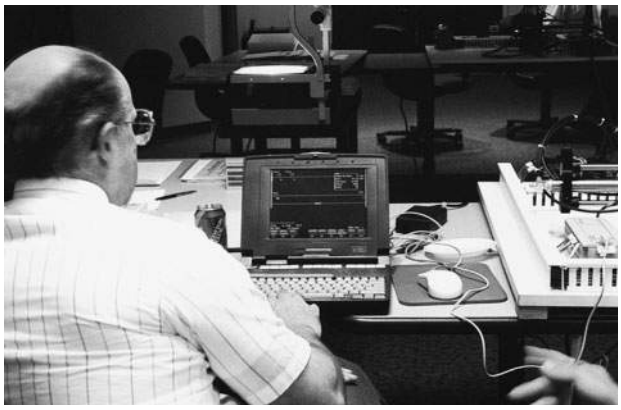
- Industrial Hydraulic Technology 1
- Industrial Hydraulic Technology 2
- Hydraulic Component Sizing
- Hydraulic Maintenance Technology
- Hydraulic Pumps and Controls
- Mobile Hydraulic Technology
- Introduction to Electrohydraulics
- Electrohydraulic Feedback Systems
- Cartridge Valve Systems
- Basic Pneumatic Technology
- Pneumatic Circuitry

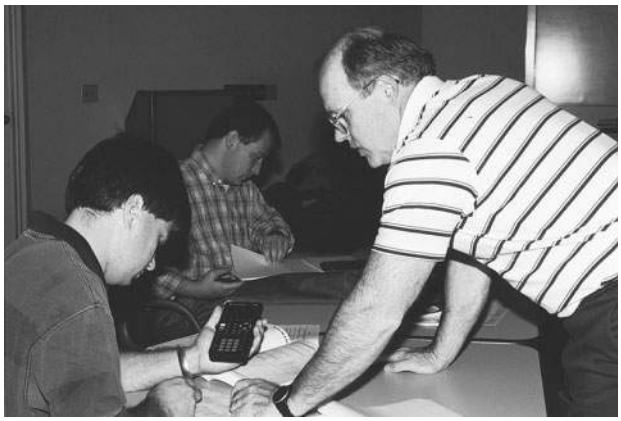
All the above courses have associated texts or visual aids. Also, sets of video tapes and CD-ROMs are available.

The success of any training endeavor is difficult to measure. However, a few concrete statistics will show that involvement training is working. For one, customer enrollment has our class registration backlogged. In addition, 500 colleges, universities and technical institutions are using our text materials; educational institutions such as Ohio State University, Purdue University and Maine Maritime Academy.

Many corporations and government agencies have adopted our courses to be used in plant to train their ever changing work force. Names like Chrysler, General Motors, Ford, IBM, and Virginia Department of Highways have all used these programs successfully.

If you feel that any of the training materials and/or training developed here at Parker could be of use to you, we welcome your inquiry. We stand ready to become INVOLVED WITH YOU.





For more information contact the Motion Control Training Dept., phone 216-896-2495, fax 216-514-6738, e-mail mctrain@parker.com

Parker Involvement Training Courses

Industrial Hydraulic Technology 1 and 2

Parker Hannifin's **Industrial Hydraulic Technology 1 and 2** (IHT1) are completely integrated 3-day programs during which you discuss and work with fundamental fluid power principles and formulas, and actually experience the functional characteristics of the complete spectrum of hydraulic components.

You will be studying and using pumps, flow valves, pressure valves, directional valves, hydraulic motors, filters, cylinders and accumulators. And, because its divisions actually manufacture and market all of these products, Parker Hannifin is uniquely qualified to give you an in-depth practical knowledge of how to best use them in your field. You will receive the broadest and deepest exposure possible during a five-day period.

At least 25% of the time you will be working at the Parker Hannifin Portable Hydraulic Trainer Stands. These units were designed and built by Parker Hannifin expressly for this program. They supply you with all the necessary components – valves, pumps, motor, cylinders, filters, power unit, hoses and gauges – to hook up to working hydraulic circuits and then check flows, pressure and velocity. Unlike most other training apparatus, the Parker Hannifin stands operate at pressures up to 500 psi so that you can closely simulate real system conditions.

The balance of your time will be devoted to classroom sessions. But, these are designed for maximum interest and involvement. There is plenty of lively discussion, questions, answers and practical problem solving.

The **Industrial Hydraulic Technology 1 and 2** courses are conducted at these Parker Hannifin locations: Elyria, OH; Irvine, CA; Troy, MI; Milton, ONT, Canada and Calgary, AB, Canada. The course fee includes the textbooks and use of special equipment. Your meals, transportation and lodging are not included. However, Parker Hannifin will be glad to assist you with lodging arrangements.

Further information can be obtained by contacting the Parker Hannifin Motion Control Training Dept., 6035 Parkland Blvd., Cleveland, OH 44124-4141 (216) 896-2495, or visit our website at www.parker.com/training.

Hydraulic Component Sizing

Hydraulic Component Sizing (HCS) is ideally suited for the new designer and the maintenance and service individual who needs that important step beyond fundamental circuit design; that step that provides a more comprehensive understanding of efficient power transmission.

This program, using standard catalog data and standard formulas creates a benchmark that allows the student to objectively analyze the quality of the circuit in terms of efficiency and energy conservation. You will learn how to overcome problem areas and also become aware of the proper conditions for selecting components such as pressure compensated valves and fixed vs. compensated pumps.

Parker Hannifin has written a special textbook for this course, which you will use during the program as the basis for your discussions and practical problem solving.

Since **Hydraulic Component Sizing** is an analytical course, we want to ensure that all participants have a solid, relatively equal background in basic fluid power technology. Completion of Parker's **Industrial Hydraulic Technology 1 and 2** courses are an ideal foundation for understanding and further pursuing the maximum energy savings approach that is key to the **Hydraulic Component Sizing** subject matter.

The Hydraulic Component Sizing course is conducted at these Parker Hannifin locations: Elyria, OH; Troy, MI; Irvine, CA; and Milton, ONT, Canada.

Further information can be obtained by contacting the Parker Hannifin Motion Control Training Dept., 6035 Parkland Blvd., Cleveland, OH 44124-4141 (216) 896-2495, or visit our website at www.parker.com/training.

Hydraulic Maintenance Technology

Hydraulic Maintenance Technology (HMT) is ideally suited for maintenance personnel, engineers, first-line supervisors and anyone desiring an in-depth understanding and appreciation of hydraulic system component operation and troubleshooting techniques. Participants should have completed the **Industrial Hydraulic Technology 1 and 2** courses or equivalent.

The topics covered in this four-day program are graphic symbols of hydraulic components, in which we utilize the International Standards Organization (ISO) System; troubleshooting common hydraulic components such as pumps, cylinders, valves, rotary actuators, hydraulic motors; hose and tube fittings maintenance and assembly; and maintenance of fluid power systems.

The **Hydraulic Maintenance Technology** course is conducted at the Parker Hannifin location in Elyria, OH. The course fee includes the textbook, template and use of special equipment. Your meals, transportation and lodging are not included. However, Parker Hannifin will be glad to assist you with lodging arrangements.

For more information contact the Motion Control Training Dept., phone 216-896-2495, fax 216-514-6738, e-mail mctrain@parker.com

Parker Cylinder

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Hydraulic Pumps and Controls

In **Hydraulic Pumps and Controls** (HPC) the students learn a logical procedure for designing circuits, not just from the standpoint to make them work, but to make them work efficiently. This is done by approaching the entire design with a view toward power transmission and ultimate circuit efficiency. This is accomplished by concentrating on the power unit. That is, the various variable volume pressure compensated pumps and numerous pump controls are examined in detail.

An important result of this new Parker design method is that the student can always obtain a very efficient circuit. Therefore, it is possible for a group of designers to develop very similar circuits for each set of mechanical requirements. The only variance will be in the sequential logic and the appearance, which depends upon which components are selected.

System design is aided by Parker's hands-on approach to learning. The course attendees will receive ample opportunity to practice their newly acquired skills. Approximately 40% of the class time is spent in the training lab using the Parker hydraulic power units and trainer stands. This familiarization with typical styles of variable volume pressure compensated pumps and their controls, ties together the lecture material and the design problem. This practical approach to efficient hydraulic systems is easily followed by the attendees as the instructor presents the course text material. The instructor supplements this material with many years of fluid power industrial involvement. Your final benefit is in economy. As we proceed in **Hydraulic Pumps and Controls**, we demonstrate that circuits designed with the new method are less expensive to operate and maintain. Also included is the Parker *Design Engineers Handbook*.

To get the most from this course, it is necessary to establish prerequisites for attendance. This assures that everyone participating has approximately equal knowledge of fluid power and can work at a compatible pace. You should have a working knowledge in the fluid power field and have previously completed Parker's **Hydraulic Component Sizing** course.

The **Hydraulic Pumps and Controls** course is conducted at the Elyria, OH; and Irvine, CA locations. The course fee includes class manual, textbook and use of special equipment. Your meals, transportation and lodging are not included. However, Parker Hannifin will assist you with lodging arrangements.

Further information can be obtained by contact the Parker Hannifin Motion Control Training Dept., 6035 Parkland Blvd., Cleveland, OH 44124-4141 (216) 896-2495, or visit our website at www.parker.com/training.

Introduction to Electrohydraulics

The **Introduction to Electrohydraulics** (EHD) course is designed for the individual who requires an increased understanding of the rapidly emerging field of electrohydraulic proportional control valves and the electronics used to operate these valves. The individual must have completed the **Industrial Hydraulic Technology** and the **Hydraulic Component Sizing** courses or equivalent. Basic DC theory knowledge is helpful but not necessary, as the topic is covered in the course.

In this five-day course we present fundamental electronic theory applicable to electrohydraulic proportional valves; help participants understand how electrohydraulic proportional valves operate; examine in detail a typical circuit board used with a typical electrohydraulic proportional valve.

Approximately 50% of the class time is spent in the lab where the individual is familiarized with lab instrumentation and various circuits on the printed circuit board are examined in detail.

The **Introduction to Electrohydraulics** course is conducted at the Elyria, OH; and Irvine, CA, locations. The course fee includes the textbook and use of special equipment. Your meals, transportation and lodging are not included. However, Parker Hannifin will assist you with lodging arrangements.

Further information can be obtained by contacting the Parker Hannifin Motion Control Training Dept., 6035 Parkland Blvd., Cleveland, OH 44124-4141 (216) 896-2495, or visit our website at www.parker.com/training.

Electrohydraulic Feedback Systems

Electrohydraulic Feedback Systems (EFS) course is designed for engineering oriented individuals requiring an in-depth understanding of electrohydraulic feedback control systems. Attendees should have completed the Parker Introduction to Electrohydraulics prior to attending this advanced course.

The following topics are covered in this course: servo valve sizing, basic positional servo valve systems, position transducers, speed transducers, frequency response curves, transfer functions and speed control loops.

For more information contact the Motion Control Training Dept., phone 216-896-2495, fax 216-514-6738, e-mail mctrain@parker.com

Approximately 50% of the class time is spent in the lab working with various feedback control systems to gain a better understanding of their operating characteristics.

The **Electrohydraulic Feedback Systems** course is conducted at the Parker Hannifin locations in Elyria, OH; and Irvine, CA. The course fee includes the textbook and use of special equipment. Your meals, transportation and lodging are not included. Parker Hannifin will be glad to assist you with lodging arrangements.

Further information can be obtained by contacting the Parker Hannifin Motion Control Training Dept., 6035 Parkland Blvd., Cleveland, OH 44124-4141 (216) 896-2495, or visit our website at www.parker.com/training.

Cartridge Valve Systems

Cartridge Valve Systems (CVS) course is an integrated three-day course where the student will work with and discuss the principles, applications, formulas and functional characteristics of "insert" or "DIN" style cartridge valves.

The student will learn the practical aspects of "insert" and "screw-in" style cartridge valves as they apply to industrial machinery. Principles of operation, functional characteristics, and typical applications for these valves are presented. The student also uses performance characteristics and fluid power formulas in realistic design problems. Valves studied include spool and poppet types, pilot operated valves, direct acting types, and multistage valves, as well as proportional types.

Cartridge Valve Systems is recommended for maintenance personnel, technicians and engineering personnel. It is also suitable for sales and non-technical personnel who want to increase their knowledge and understanding of cartridge valve systems.

Parker's **Cartridge Valve Systems** course integrates classroom sessions with lab activities to give the student practical knowledge and skills that can be used in a workplace setting. In the labs students get hands-on experience with typical valves, and the circuits which use them.

The **Cartridge Valve Systems** course is conducted at the Parker Hannifin location in Elyria, OH. The course fee includes class manual and use of special equipment. Your meals, transportation and lodging are not included. Parker Hannifin will be glad to assist you with lodging arrangements.

Further information can be obtained by contacting the Parker Hannifin Motion Control Training Dept., 6035 Parkland Blvd., Cleveland, OH 44124-4141 (216) 896-2495, or visit our website at www.parker.com/training.

Mobile Hydraulic Technology

Mobile Hydraulic Technology (MHT) is a new course being developed. Please contact us for details and class availability at Parker Hannifin Corporation, Motion Control Training Dept., 6035 Parkland Blvd., Cleveland, OH 44124-4141 (216) 896-2495, or visit our website at www.parker.com/training.

Basic Pneumatic Technology

Parker Hannifin's **Basic Pneumatic Technology** (IPT) course is a completely integrated three-day program during which you discuss and work with fundamental fluid power principles and formulas, and actually experience the functional characteristics of the complete spectrum of pneumatic components.

You will learn about dryers, air receivers, flow valves, filters, pressure valves, regulators, lubricators, directional valves, silencers, quick exhaust valves, and actuators. And because Parker Hannifin divisions actually manufacture and market most of these products, it is uniquely qualified to give you an in-depth, practical knowledge of how to best use them in your field. You will receive the broadest and deepest exposure possible during a three-day period.

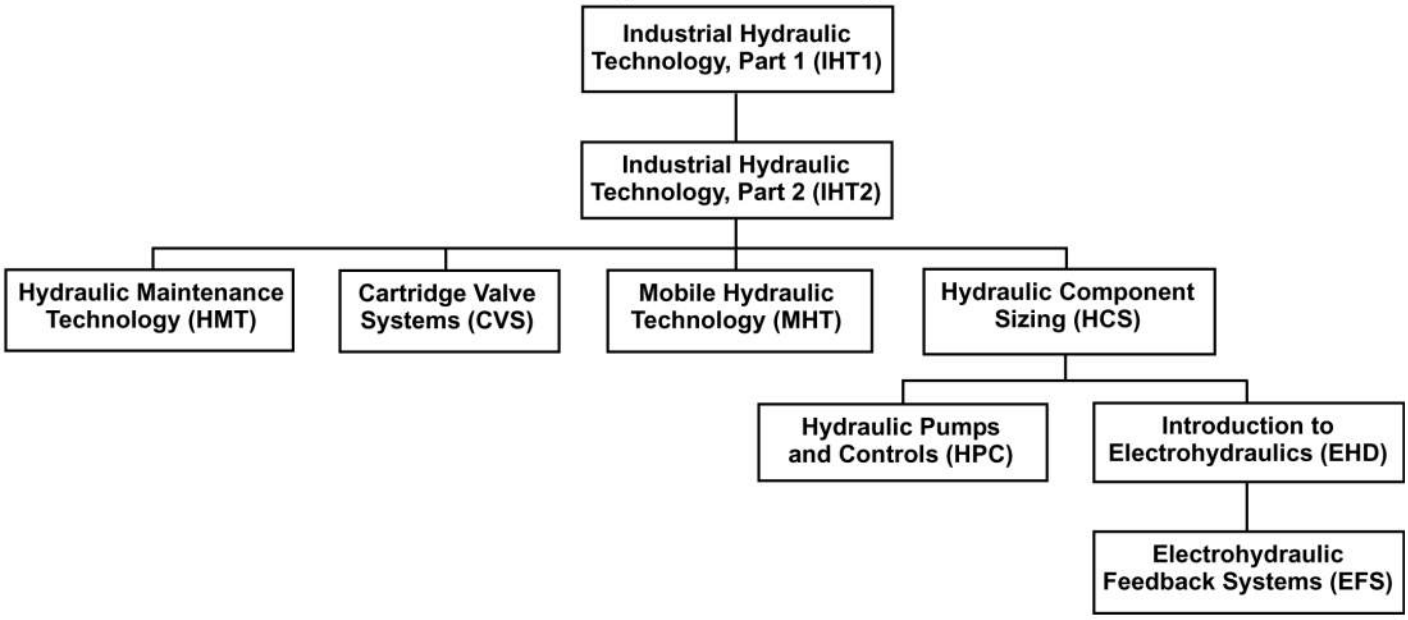
At least 25% of the time you will be working at the Parker Hannifin pneumatic trainer boards. These units were developed and built by Parker Hannifin expressly for this program. They supply you with all the necessary components to hook up working pneumatic circuits.

The balance of your time will be devoted to classroom sessions. But these too are designed for maximum interest and involvement. There is plenty of lively discussion, questions, answers and practical problem solving.

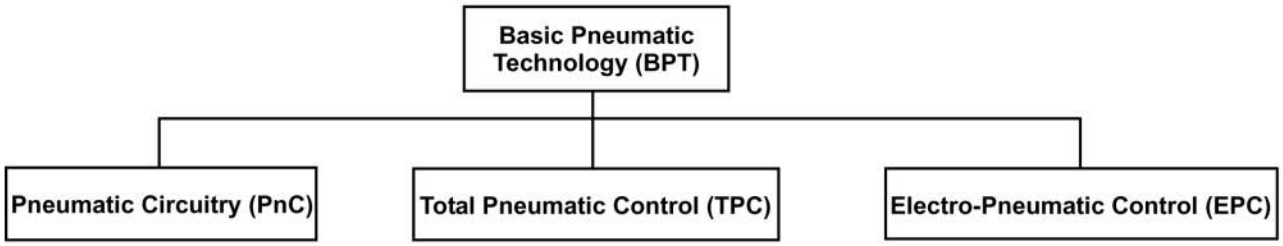
The **Basic Pneumatic Technology** is conducted at these Parker Hannifin locations: Troy, MI; Atlanta, GA; Irvine, CA; Toronto, Canada.

For further information please contact the Motion Control Training Dept., 6035 Parkland Blvd., Cleveland, OH 44124-4141 (216) 896-2495 or visit our website at www.parker.com/training.

Hydraulic Training



Automation Training



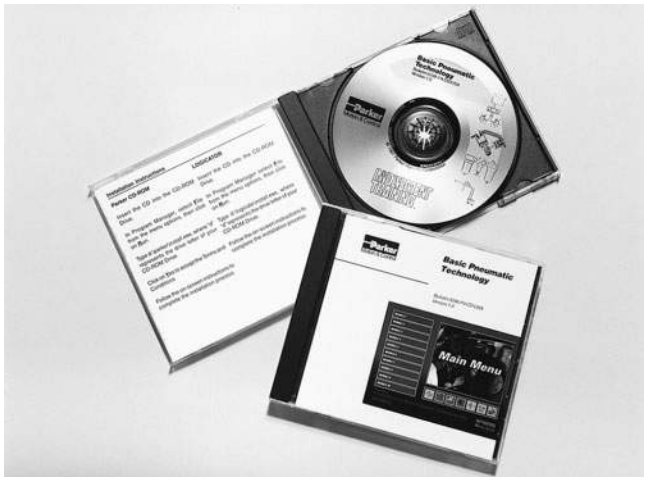
For more information contact the Motion Control Training Dept., phone 216-896-2495, fax 216-514-6738, e-mail mctrain@parker.com

Video Tape Instruction and CD-ROMs

Industrial Hydraulic Technology

14 Video Tapes, 1 Textbook, 1 Instructor's Guide
Bulletin 0299-T1

The Industrial Hydraulic Technology course material is available using an audio-visual tape training method. The various tapes aid in the instruction of basic hydraulics. With all the training information stored on the cassette tapes, the training sessions can be repeated as often as necessary, allowing each student to acquire technical knowledge at his or her own pace. Tapes are available as a set or individually.



Basic Pneumatic Technology CD-ROM

Bulletin 0298-P4

With years of product expertise and worldwide resources, Parker has developed the Basic Pneumatic Technology CD. It is the equivalent of countless textbooks, videos and classroom lectures covering the subject of basic pneumatic components and systems technology. Using the latest computer based training techniques, along with state-of-the-art animated and video motion visuals, Basic Pneumatic Technology is designed to maximize information retention while reducing student's time and related educational expenses. This CD is also available in Spanish and German.

Industrial Pneumatic Technology Video Training Library

Bulletin 0299-T7

The pneumatic Video Training Library consists of 4 video tapes on pneumatic systems, compressed air, air preparation and pneumatic directional control valves. Available as a set or individually.

IHT Computer Transparencies

Bulletin 0232-B3/CD

All graphics from the Industrial Hydraulic Technology textbook, Bul. 0232-B1, have been placed on one convenient, easy to use CD-ROM.

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For more information contact the Motion Control Training Dept., phone 216-896-2495, fax 216-514-6738, e-mail mctrain@parker.com

Parker Cylinder

When the pressure is on, increase personnel productivity with

Parker Motion Control Training Materials.

Order these free publications –

Catalog 0200 – a detailed 32-page description of classes and training materials. These training materials include textbooks, instructor's guides, video tapes, CD-ROMs and computer software.

Bul. 0203 Portable Hydraulic Trainer Stand – details on Parker hydraulic training equipment.

How to obtain your free publications:

- Contact your nearby fluid power distributor
- Write to Parker Hannifin Corp., MC Training Dept. W3MC01, 6035 Parkland Blvd., Cleveland, OH 44124-4141
- Fax your request to 216/514-6738
- E-mail your request to mctrain@parker.com

For more information contact the Motion Control Training Dept., phone 216-896-2495, fax 216-514-6738, e-mail mctrain@parker.com

Portable Hydraulic Trainer Stand

General Description – The Parker Portable Hydraulic Trainer Stand is designed to be a tool for learning hydraulic technology principles and circuitry. It has been engineered for ruggedness, portability and ease of operation. For detailed information, request Bulletin 0203.

Features	Benefits
• Self-contained stand	• All necessary components readily accessible
• Operates on 115 volt AC	• Plugs into standard 110 volt outlet
• Standard industrial components	• Familiarization with “real world” components
• Rugged construction	• Long, trouble-free operation
• Vertical panel	• Allows easy access to components
• Quick hose disconnects	• Facilitates faster circuit hook up; no tools required
• 0-500 psi (0-34 bar) operation	• Safe operating pressure
• 3000 psi (207 bar) rated components	• Safer operation, longer component life
• Hose storage rack	• Safe, convenient storage
• Components panel mounted	• No loose components to misplace
• Quiet operation	• Great for classroom learning
• Ball valve	• Can simulate sound of cavitation
• Needle valve	• Can simulate sound of aeration
• Parker filtration	• 2 year warranty on hydraulic components
• CE Compliant conversion available	• CE compliant version available

Offer of Sale

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

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5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 60 days after delivery or, in the case of an alleged breach of warranty, within 30 days after the date within the warranty period on which the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for any amount due to Seller from Buyer) must be commenced within thirteen months from the date of tender of delivery by Seller or, for a cause of action based upon an alleged breach of warranty, within thirteen months from the date within the warranty period on which the defect is or should have been discovered by Buyer.

6. LIMITATION OF LIABILITY. UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, NC DENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.

7. Contingencies. Seller shall not be liable for any default or delay in performance if caused by circumstances beyond the reasonable control of Seller.

8. User Responsibility. The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

9. Loss to Buyer's Property. Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

10. Special Tooling. A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

11. Buyer's Obligation; Rights of Seller. To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest. Seller shall have a security interest in, and lien upon, any property of Buyer in Seller's possession as security for the payment of any amounts owed to Seller by Buyer.

12. Improper Use and Indemnity. Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

13. Cancellations and Changes. Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

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

15. Entire Agreement. This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of the agreement. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

16. Waiver and Severability. Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

17. Termination. This agreement may be terminated by Seller for any reason and at any time by giving Buyer thirty (30) days written notice of termination. In addition, Seller may by written notice immediately terminate this agreement for the following: (a) Buyer commits a breach of any provision of this agreement (b) the appointment of a trustee, receiver or custodian for all or any part of Buyer's property (c) the filing of a petition for relief in bankruptcy of the other Party on its own behalf, or by a third party (d) an assignment for the benefit of creditors, or (e) the dissolution or liquidation of the Buyer.

18. Governing Law. This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement. Disputes between the parties shall not be settled by arbitration unless, after a dispute has arisen, both parties expressly agree in writing to arbitrate the dispute.

19. Indemnity for Infringement of Intellectual Property Rights. Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

20. Taxes. Unless otherwise indicated, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of Products.

21. Equal Opportunity Clause. For the performance of government contracts and where dollar value of the Products exceed $10,000, the equal employment opportunity clauses in Executive Order 11246, VEVRAA, and 41 C.F.R. §§ 60-1.4(a), 60-741.5(a), and 60-250.4, are hereby incorporated.

For Cylinder Division Plant Locations – See Page II.

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Cylinder

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