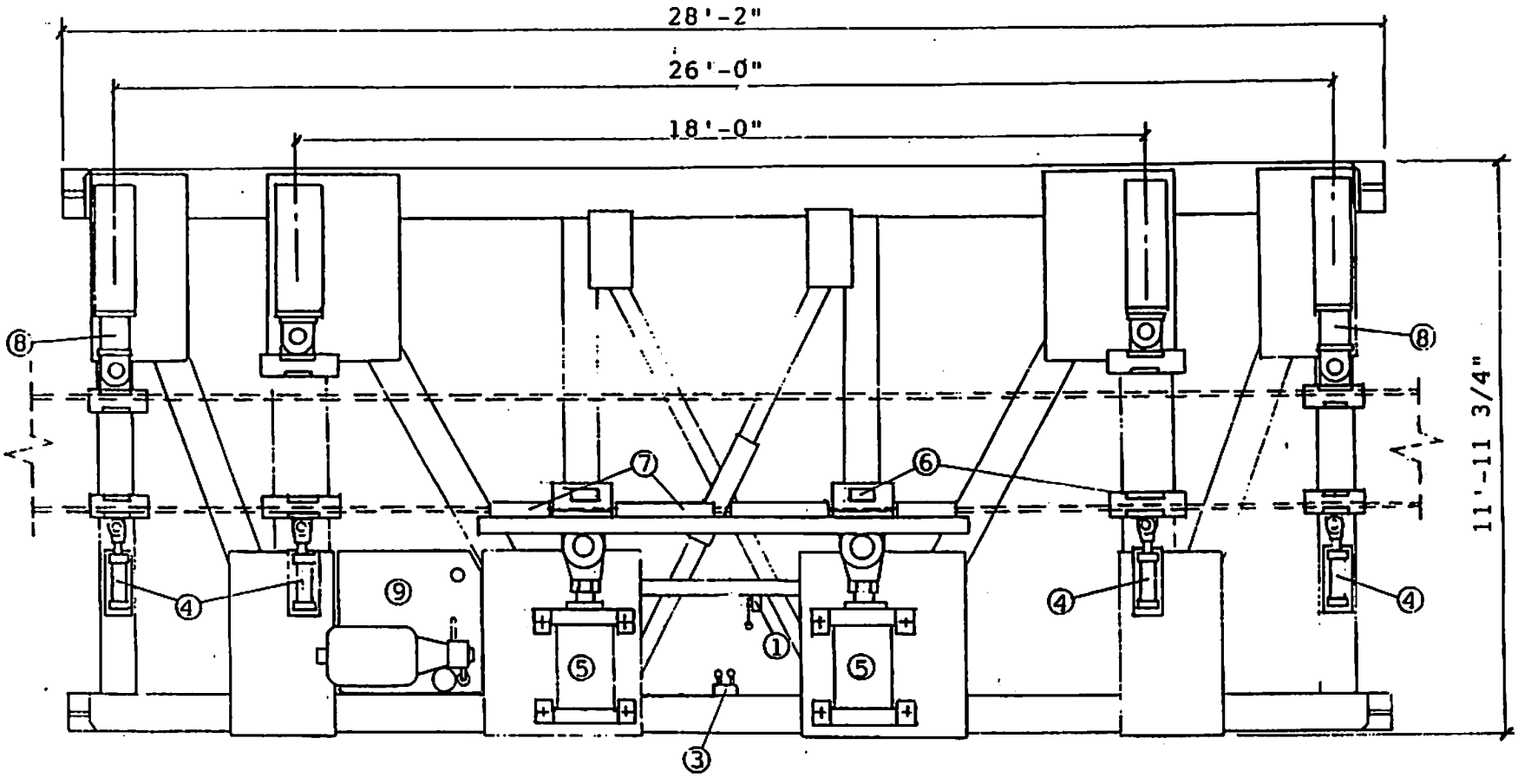
CAMBCO, Inc.
P. 0. Box 37305
Houston, Texas 77237-7305
713-781-9702

MODEL 1700
CAMBERING MACHINE
OPERATING AND MAINTENANCE
INSTRUCTIONS
06/07/06



PLAN VIEW

(Shown using outer supports.)

LEGEND

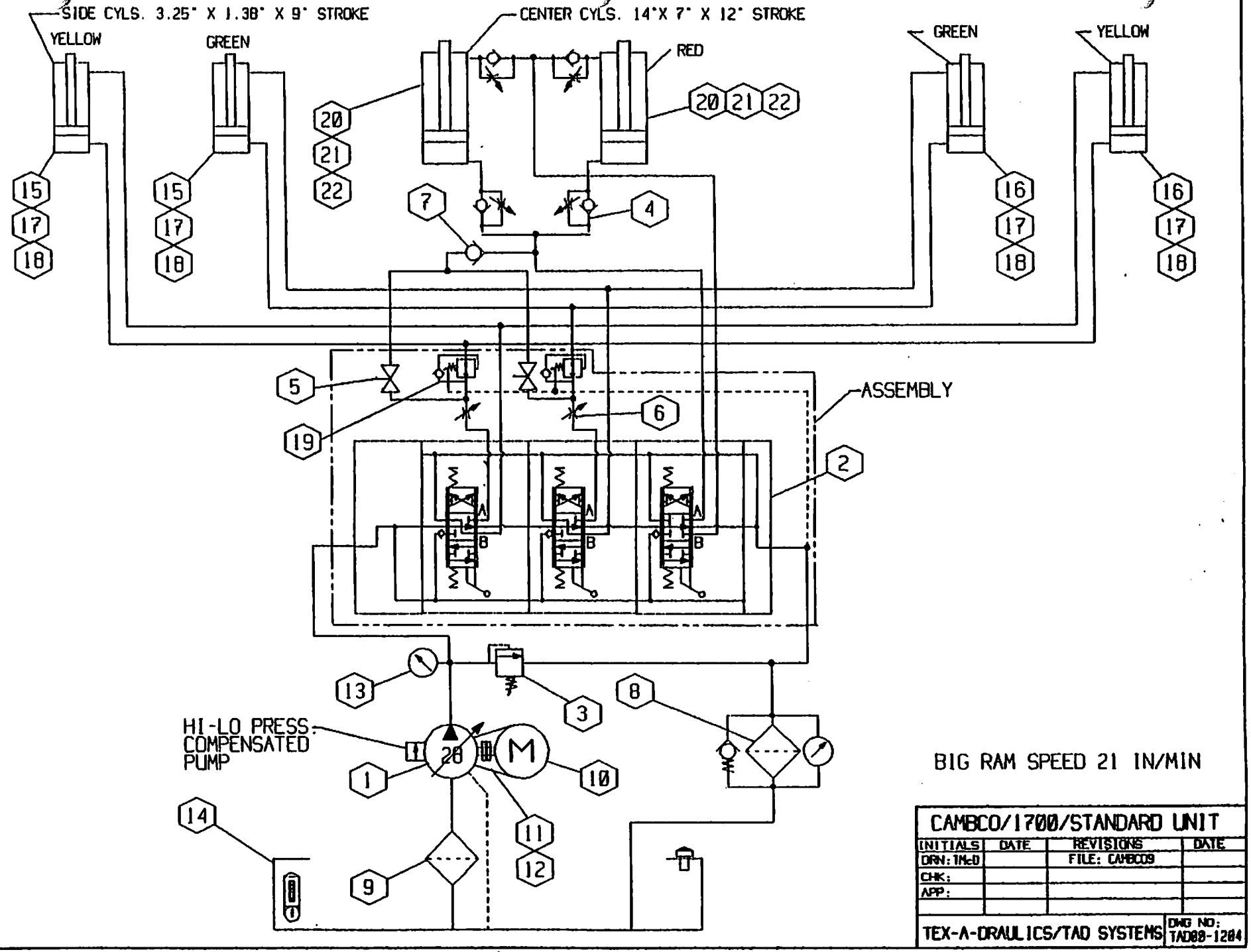
Mark	Description
1	Ball valve
3	Directional valve
4	Small cylinder
5	Large Cylinder
6	Beam support
7	Support angle
8	Spacer
9	Power unit

Cambco, Inc.
Model 1700 (5000 psi)
Hydraulic Components

Mark*	Qty	Description	Part No.
20	2	Parker Hydraulic cylinder, 14" bore, series 3H, "S" = ¾" NPT ports pos "1" B/E, KK=4-12M, A=4.00, LAF = 7.187	14"E3HKUS13AX12"
15	2	Parker Hydraulic cylinder, 3 ¼" Bore, series 2H, Ports position "2" B/E, studded rod end	3.25"C2HLUS14Ax9"
`6	2	Parker Hydraulic cylinder, 3 ¼" Bore, series 2H, Ports position "4" B/E, studded rod end	3.25"C2HLUS14Ax9"
21	2	Parker knuckle, 4-12.	73438
22	6**	Pivot Pin Assembly 4" (w/cotter pins)	73547
17	4	Parker Rod Clevis 1-14	50944
18	4	Pivot Pin Assy, 1" w/snap rings	68370
2	1	Parker 3 section bank valve.	TADVML17001M2CYL
5	2	Stauff ball valve.	BBV20060001M
4	4	Parker Flow control valve ¾" NPT	F1200S
7	1	Parker Line mounted Check valve, 3/8" NPT	C600S
5	2	Parker line mounted needle valve, ½" NPT	N800S
19	2	Parker pressure reducing valve, reverse check, 100-5000 psi, SAE-8, Adjust to 4000 psi.	PRCH101S50-8T
1,2,3,9 ,10,11, 12,13, 14	1	Hydradyne-TAD power unit, w/ motor starter, 40hp, 1800 RPM, 230/460/3/60, ODP, C-face w/feet, electric motor, Parker piston pump w/ Hi-Lo control, PHP60502RHLMP, Hayes coupling, Parker RAH101 relief valve, gauge, suction strainer, LHA return filter, and 90 Gal. Reservoir. Test and set relief valve to 5000 psi. Paint polyurethane enamel	NA

* Refer to hydraulic schematic
** 2 are used at main cylinders, 4 are used at supports.

6/06/06



CAMBCO MODEL 1700
CAMBERING MACHINE
OPERATING AND MAINTENANCE
INSTRUCTIONS

General

The CAMBCO Model 1700 cambering machine is an electrically powered hydraulic system that cambers beams with forces developed by hydraulic cylinders powered by an electric motor driven pump operating at pressures up to 5000 psi. Refer to Figure 1 for the location of component parts.

Electrical Connection

Connect the machine to a proper electrical power source for the 3 phase 40 HP motor. All circuits must be installed and protected by properly sized fuses or circuit breakers in accordance with the National Electric Code and local ordinances.

After proper electrical connection is made, jog the motor by pressing the start button, and check to be sure it is rotating in the proper direction. If not, change the connections so it does rotate properly.

Start-up

Before start-up the reservoir must be filled with hydraulic oil. In general, ISO viscosity grade 32 petroleum based anti-wear fluids such as EXXON Univis-N-32, Chevron AW-32 or Shell Oil 32 (T32 for better low temperature performance) would be satisfactory for normal operating temperatures. Critical fluid temperatures using ISO grade 32 fluid are as follows:

Minimum start up temperature	10° F
Minimum temperature for full speed and pressure	58° F
Optimum temperature for maximum life	102° F
Maximum operating temperature	158° F

If it is found that these temperatures cannot be met then it may be desirable to add a reservoir heater.

Using a general purpose grease, lubricate the ways of the beam supports to insure smooth operation and long life.

Operation

The Model 1700 cambering machine is capable of cambering beams which range in size from a W8x10 to a W40x397. See Table 1 for the maximum sized beams for various **actual** yield strengths that can be cambered. In order to cover such a wide range of sizes two separate support spans are provided, 18 ft. and 26 ft. on center, as shown in Figure 1. The inner supports are normally used when cambering lighter beams, i.e. those weighing under 75 pounds per foot. The outer supports are normally used when cambering heavier sections;

however, occasionally the inner supports may be used for heavier sections when it is necessary to induce bending near the end of the beam. The absolute maximum sized sections which may possibly be cambered on the inner supports is a W40x244, Grade 50. Care must be taken when cambering heavier sections on the inner supports to be sure that the web of the beam is not damaged at the bearing points.

As shown in the hydraulic schematic diagram, Figure 2, the three pairs of hydraulic cylinders are controlled by a three section directional valve. The levers actuate the cylinders as follows:

1. Outer pair of small cylinders.
2. Inner pair of small cylinders.
3. Main cambering cylinders.

It is suggested that the levers and the cylinders be coded with colored tape to assist the operator in selecting the proper control.

Flow control valves are provided at each end of the large cylinders. These are used to "tune" the cylinders to insure that they extend and retract in unison.

The operation of the inner and outer pairs of small cylinders varies depending on whether the inner or outer supports are being used for cambering. Two needle valves are provided to control their extension and retraction speed. When using the outer supports for cambering larger beams, the outer small cylinders are activated to position and clamp the beam. Then, using their separate control, the inner pair of small cylinders is extended until the bearing plate bears on the beam. The control lever for these cylinders should then be returned to the center position. By virtue of a by-pass circuit, they will then move in unison with the large cylinders to provide support to the beam flange and to assist in the cambering effort. At the same time pressure is maintained on the outer cylinders to insure that the clamping force is maintained. Two ball valves, shown as Item 5 on the schematic, are provided to activate or de-activate this by-pass circuit to each pair of cylinders as required. A check valve is provided in this circuit to prevent back feeding when the small cylinders are operated independently from the large ones.

When using the inner supports, the two outer small cylinders are deactivated completely, and the inner small cylinders are used to position and clamp the beam. The valve for the inner pair is normally left open at all times and that for the outer pair is closed when using the inner supports to camber. Both may be closed when using only the large cylinders such as when cambering short beams or straightening.

Cambering

The first step in the cambering process is to select and install the appropriate pair of spacers at the support points. The corresponding beam depth is marked on each spacer. These should be installed as shown in Figure 3. Before beginning the cambering process all cylinders must be fully retracted. Next, raise the retainer angles at the small cylinders and adjust the support angles between the large cylinders so that they will clear the flange of the beam to be cambered. Remove these support angles entirely if the flange width exceeds 14".

The beam to be cambered should be placed into the machine by whatever handling system is available. It may be advisable to install rollers to assist in progressively advancing large beams through the machine when multiple "hits" are required to conform to a camber diagram. This has the added benefit of supporting the beam in a level position throughout its length to avoid inducing sweep or buckling.

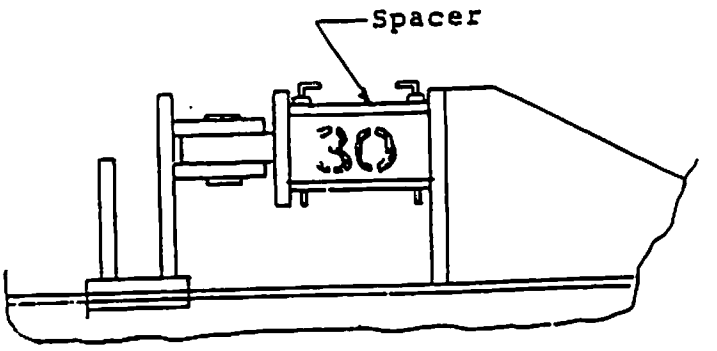
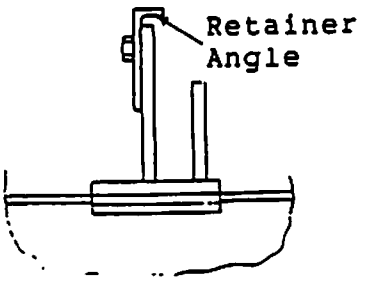


Figure 3

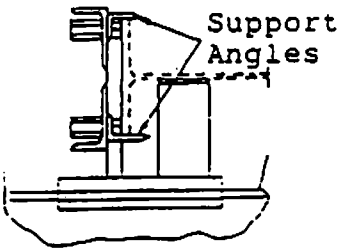
Once the beam is in the machine, cambering can begin. Extend the small cylinders at the support points so that the bearing plates are tight against the beam flanges. Then, adjust the retainer angles to within approximately ¼" of the flange as shown in Figure 4 and tighten the attachment bolts securely. If the outer supports are being used extend the inner small cylinders until the bearing plate is in firm contact with the beam flange and return the control lever to the center position.

Now, extend the bearing plates at the large cylinders until they are in full contact with the beam flange. Adjust the support angles shown in Figure 5 so that they are **tight** against the beam flange above and below the beam and tighten them securely. These angles must be turned as required to fit different flange widths and should be removed entirely if the flange width exceeds 14". They are provided to prevent lateral buckling of the compression flange and are particularly required for beams having narrower flange widths. Experience may show that they can be omitted entirely on certain larger sizes.



(a)

Figure 4



(b)

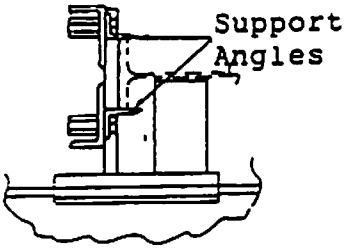


Figure 5

Be sure to recheck to be sure that the cylinders are properly set for the supports that are being used. Remember that the small outside cylinders are deactivated and the small inner cylinders are used to clamp the beam when utilizing the inner supports. When using the outer supports the small outer cylinders are activated to clamp the beam, and the small inner cylinders operate in unison with the large cylinders as discussed above.

Be sure that long beams are supported outside of the machine so that they are level throughout their entire length. Severe buckling is likely to result if the ends of the beam outside of the machine are allowed to droop.

Cambering can now begin. First, extend the bearing plates at the large cylinders so that they just contact the flange of the beam and note the reading on the extension gage. Next, extend the plates to bend the beam a trial amount, and note the extension gage

reading. Then, retract them until all pressure is released from the beam. Check the residual camber by stretching a line from one end of the beam to the other on the inside of the flange that is farthest from the cylinders. If the beam is not cambered enough, repeat the process pushing the beam a little farther each time until the required camber is obtained. Note the reading on the extension gage on each trial. If too much camber is induced the beam can be turned over and straightened by the same process. Check the job specifications to be sure that the appropriate tolerance is being observed. For beams 50 feet long and shorter the normal camber tolerance is minus zero, plus one-half inch.

During this process care must be taken to insure that the ends of long beams are not being unduly restrained from moving as this could lead to incorrect camber measurements. Again, the ends of long beams must be supported to maintain the beam in a level position. Otherwise buckling or sweep may be induced during the cambering operation.

Once the required camber is obtained, the beam can be removed and another of the same size can be placed into the machine leaving all adjustments intact. If this beam is identical to the previous one, the trial and error process can usually be omitted. Merely push the beam to the same extension as the previous beam and check the resulting camber. Unless there is a significant difference in the steel in the two beams, the camber will be very close to identical. Obviously, efficiency can be improved by grouping identical beams as much as possible.

When doing the trial and error process for the first time for a particular set-up, it is very important to extend the cylinders in small increments and to check closely for possible damage to the web of the beam at the bearing points.

Care must be taken when retracting the large cylinders after cambering a beam which has thick flanges and a large amount of camber. In some cases the beam supports on the slides at the large cylinders can catch on the inside of the flange and damage them. To prevent this it is necessary to retract the clamping cylinders immediately after the pressure from the large cylinders is released from the beam. The large cylinders can then be retracted completely.

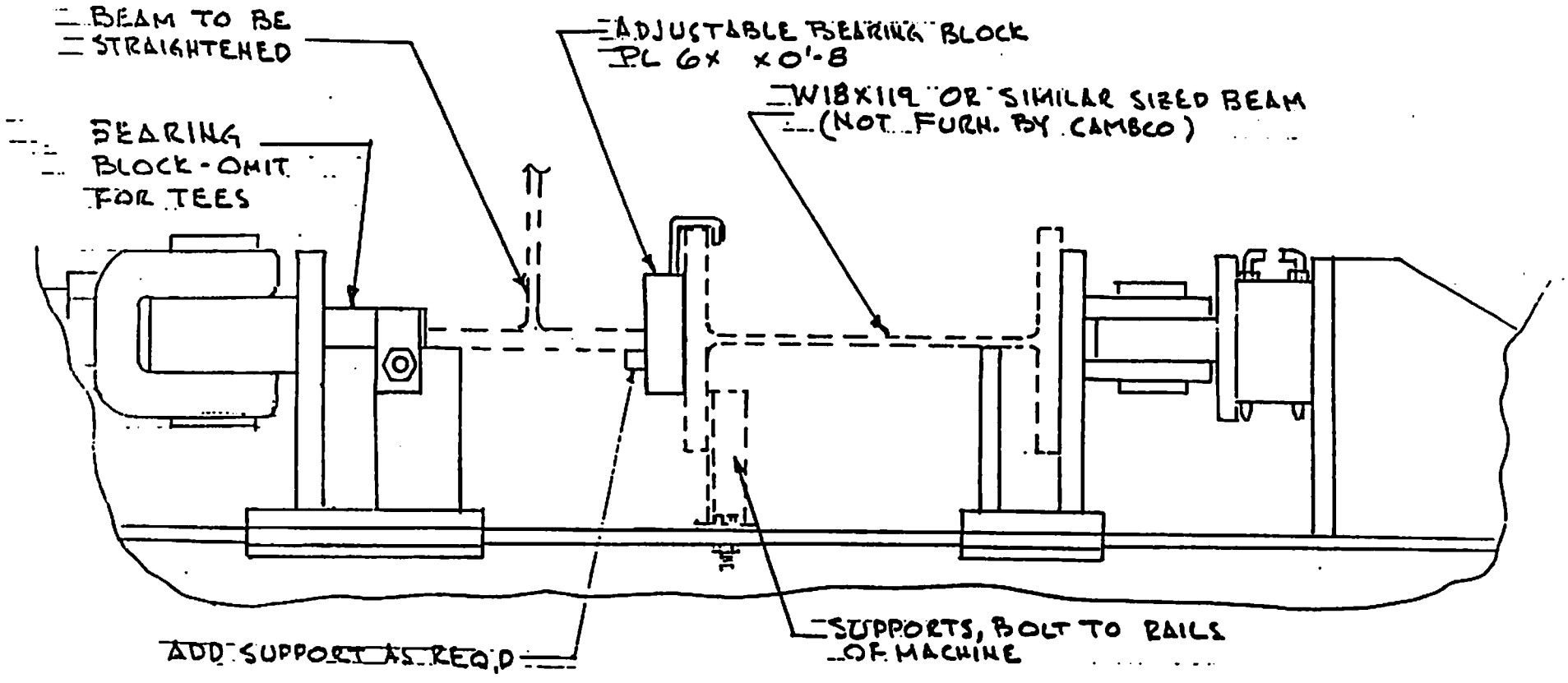
Maintenance

Refer to the enclosed literature from component manufacturers for specific information about maintenance and general care.

The pressure relief valve on the power unit is factory pre-set to maintain a maximum operating pressure of 5000 psi on the main cambering cylinders. Pressure reducing valves are included to reduce this to 4000 psi on the small cylinders. These maximum pressures should be checked periodically by extending the cylinders completely.
It is recommended that the ways be kept greased and that the pins and bearing blocks be oiled periodically. Retighten the cylinder mounting bolts periodically (after every 200 beams maximum).

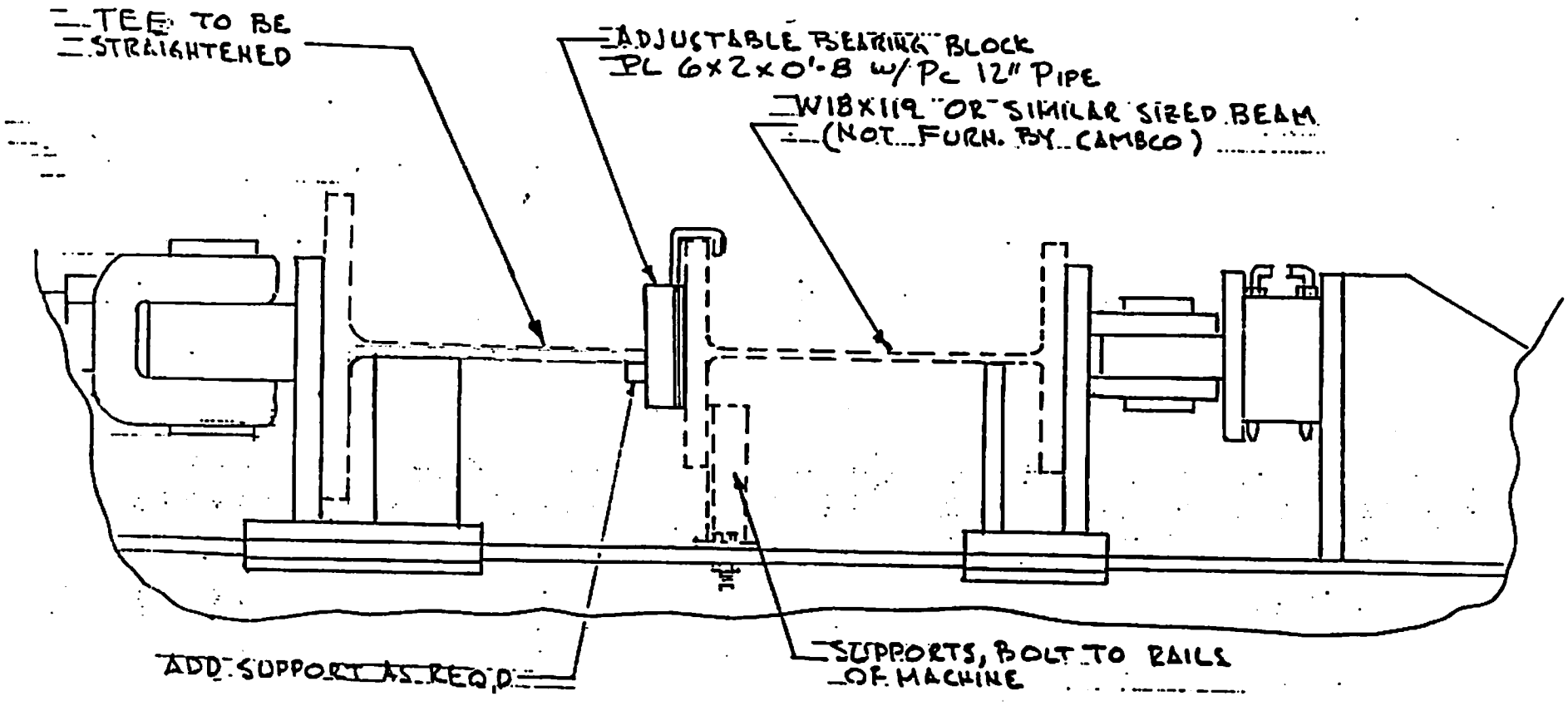
Other Applications

Figures 6 and 6A show a set-up involving a "back up beam" (Not by CAMBCO) that can be used for straightening or inducing sweep into beams or to straighten tees after splitting. Figure 7 shows a similar set-up for cambering short beams.



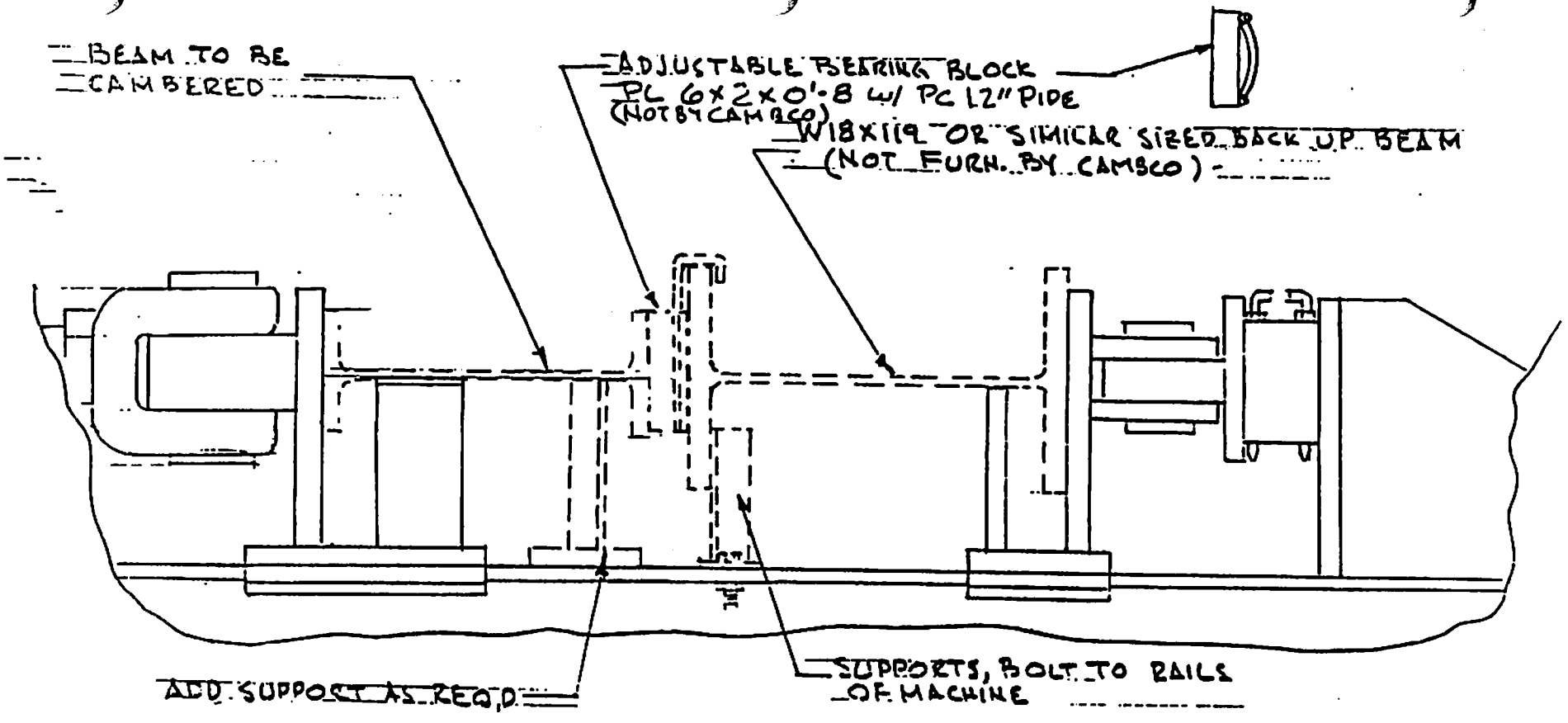
FIXTURES FOR STRAIGHTENING FLANGES

FIGURE 6



FIXTURES FOR STRAIGHTENING TEES

FIGURE 6A



FIXTURES FOR CAMBERING SHORT BEAMS

FIGURE 7

RBM 11/8/57

TABLE 1
CAMBCO MODEL 1700
CAMBERING CAPACITIES
FOR
VARIOUS ACTUAL YIELD STRENGTHS
06/07/06

SECTION	ACTUAL YIELD STRENGTH		
	50 KSI	55 KSI	60 KSI
W40x480	N	N	N
W40x436	?	N	N
W40x397	Y	?	?
W40X362	Y	Y	?
W40X328	Y	Y	Y
W36X485	?	N	N
W36X439	Y	?	N
W36X393	Y	Y	?
W36X359	Y	Y	Y
W33X515	?	N	N
W33X468	?	?	N
W33X424	Y	Y	?
W33X387	Y	Y	Y
W30X581	?	N	N
W30X526	?	?	N
W30X477	Y	?	?
W30X433	Y	Y	?
W27X539	?	?	N
W27X494	Y	?	?
W27X448	Y	Y	Y
W24x492	Y	Y	Y

Y = Should camber.
? = Borderline—May require multiple hits.
N = Will not camber.

Note: These maximum sizes are when using the outer supports, i.e. 26 ft. span

CAMBCO, Inc. THE ORIGINAL CAMBERING MACHINE-SINCE 1984
P.O. Box 37305 HOUSTON, TX 77237-7305 TEL:713-781-9702 FAX:713-781-0193

PRACTICAL EXAMPLES-MODEL 1700

A. DETERMINE THE MAXIMUM SIZE GRADE 50 BEAM THAT CAN BE CAMBERED WITH THE MODEL 1700 CAMBERING MACHINE.

The Model 1700 cambering machine is capable of inducing a bending moment of 7,830 ft-kips into the beam being cambered, and the maximum size beam that the machine will camber is determined by the actual, as received, yield strength shown on the mill test report. For the purpose of this example, assume that the actual yield strength of the beam is 57.5 ksi. Therefore, the modified capacity of the Model 1700 due to increased yield is:

Modified M_{cap} = 7,830 x 50/57.5 = 6,808.7 ft-kips.

From the 9th edition of the AISC manual, page 2-16, read the maximum beam sizes:

W40x362, M_p = 6,790 ft-kips*

B. ESTIMATE THE COST OF CAMBERING 15 EACH W16x26 BEAMS, 32'-0" LONG.

Handling beams to and from machine, 2 men, 45 minutes:	1.5 M.H.
Set up machine, 2 men 15 minutes:	0.5 M.H.
First beam , 2 men, 15 minutes:	0.5 M.H.
14 beams @ 3 minutes each:	1.4 M.H.
Total:	3.9 M.H.

Total direct labor plus overhead @ $30.00 per M.H. = 3.9 x 30 = $117.00

Cost per beam = $117.00/15 = $7.80

Cost per ton = $117.00 x 2000/(15 x 26 x 32) = $18.75

*Somewhat heavier beams (10% or so) can actually be cambered, but multiple pushes may be required. Also, even heavier sections can be cambered by adding heat to the beam while applying force with the machine.

CAMBCO, Inc. THE ORIGINAL CAMBERING MACHINE-SINCE 1984

P.O. BOX 37305 HOUSTON, TEXAS 77237-7305 TEL. & FAX: (713) 781-9702

CAMBERING MAN-HOURS

USING A CAMBCO CAMBERING MACHINE

PROBLEM

Determine the man-hours required to camber fifteen W18x50 beams 35 feet long using a two man crew. Each beam is to have 1 ¼" camber. Note: Handling time to transport beams to and from cambering machine is not included.

SOLUTION

1. Time required to change spacers and flange support angles for new beam size = 20 min.

2. Time required, by trial and error on first beam, to determine total piston rod extension required to produce desired camber = 15 min.

3. Time required to camber remaining fourteen beams, i.e. picking a beam up off of one stack, placing it in the machine, extending piston rod to the amount determined in step 2, and then removing the beam from the machine and placing it onto a second stack @ 3 min. per beam = 3 x 14 = 42 min.

4. Total time required = 20 + 15 + 42 = 77 min.

5. Total man-hours = 2 x 77 / 60 = 2.57 M.H.

6. Direct cost per beam @ $30.00 per M.H. = 2.57 x $30.00 / 15 = $5.13.

7. Direct cost per ton = ($5.13 x 15) / (15 x 35 x 50 / 2000) = $5.86 per ton.

02/04/00

CAMBCO, Inc. THE ORIGINAL CAMBERING MACHINE-SINCE 1984
P.O. Box 37305 HOUSTON, TX 77237-7305 TEL:713-781-9702 FAX:713-781-0193

Typical Cambering Costs

Heat Cambering

Labor Cost

According to a major mid-west fabricator, two men heat cambered an average of fifteen W16x36 beams, 35 ft. long in a ten hour day.

Man Hours = 2 x 10/15 = 1.33 M.H. per beam

Wages	= $30.00 per M.H.
Overhead, benefits, etc.	= $15.00 per M.H.
Total direct hourly cost	= $45.00 per M.H.

Total direct labor cost per beam = 1.33 x $45.00 = **$60.00**

Gas & Oxygen Cost

A #15 Victor tip can burn 300 cubic feet of HPG and 700 cubic feet of oxygen per hour. Typical bulk costs are $12.00 per 100 cubic feet of HPG, and $1.50 per 100 cubic feet of oxygen.

Gas Cost = (3 x $12.00) + (7 x $1.50) = $46.50 per burning hour
Assuming that each torch burns only 75% of the time,
Gas cost per beam = 1.33 x .75 x $46.50 = **$46.38**

Total Cost

Total Cost per beam = $60.00 + 46.38 = **$106.38**
Cost per ton = $106.38 x 2000 / 36 / 35 = **$168.86**

Contract Cambering

Cost per ton = $75.00
Cost per beam = $75.00 x 36 x 35/2000 = **$47.25**

CAMBCO Cold Cambering

One man cambers fifty beams in an eight hour day.

Cost per beam = 8 x $45.00/50 = **$7.20**
Cost per ton = $7.20 x 2000/36/35 = **$11.43**

The figures shown are intended to serve as typical examples only and must be adjusted to fit any particular condition.

04/28/05

Table of Contents

Page

Introduction 1

Description 1

Preparation for Use 2

- Unpacking and Checking
- Storage
- Removing from Shipping Skids

Installation 2

- Locating Power Unit
- Service Connections
- Supply and Return Connections
- Reservoir Inspection
- Reservoir Filling
- Coupling Alignment

Start Up Procedure 5

Special Tools 6

General Maintenance 6

Recommended Spare Parts 6

Reference Data 6

- Filter Service
- Maintaining Oil Temperature
- Troubleshooting

"JIC" Reservoir Replacement Parts (Fig. 1.) 16

"L" Reservoir Replacement Parts (Fig. 2.) 17

Pump/Motor Coupling Installation (Fig. 3.) 18

Appendicies 19

- Power Unit Parts List
- Component Maintenance and Service Literature
- Certified Drawings (if required)

Introduction

This manual provides descriptive information, operation and maintenance instructions for standard Hydraulic Power Units manufactured by the Power Unit Division of Parker Hannifin Corporation, Orrville, Ohio 44667. Any additional information may be obtained from the Power Unit Division by referencing to the Unit's Model Number and Serial Number stamped on the Reservoir Nameplate, or by contacting your authorized Parker Distributor.

Some of the information in this manual may not apply to your power unit, and information on more custom units may require obtaining service and application information from other sources.

Warning
It is imperative that personnel involved in the installation, service, and operation of the power unit be familiar with how the equipment is to be used, the limitations of the system and it's component parts, and have knowledge of good hydraulic practices in terms of safety, installation, and maintenance.

Description

The standard Hydraulic Power Unit usually consists of a JIC reservoir (see figure 1), or "L" shaped reservoir (see figure 2) both of which incorporate a baffle, clean-out access, 3/4 NPT sump drain, oil level gage, filter/breather assembly and spare return connections.

The pump will be coupled to the motor using a flexible shaft coupling and will be mounted using a bell housing (requires NEMA "C" Motor) or will be foot mounted requiring a pump foot bracket, coupling guard, and pump/motor mounting plate. Also included on most standard units is a Pump Suction Filter (or Suction Strainer), Relief Valve, and a Pressure Gauge with Shut-Off Valve.

More custom type power units may have heat exchangers for oil cooling; pressure or return filters, oil immersion heaters, directional valves, and other pressure and flow control valves, or monitoring instrumentation.

Preparation For Use

Unpacking and Checking

The Power Unit is mounted on skids and carefully packed for shipment. Do not remove it from skid until it has been carefully checked for damage that may have occurred in transit. Report all damage immediateiy to the carrier and send a copy

to the vendor. All open ports on the Power Unit were plugged at the factory to prevent the entry of contamination. These plugs must not be removed until just before piping connections are made to the unit.

Storage

If the Power Unit is not going to be installed immediately, it should be stored indoors, covered with plastic sheet, and all open ports plugged. If long term storage is expected (6 months or more) we recommend filling the reservoir completely with clean hydraulic fluid to prevent the entry of moisture.

Removing from Shipping Skids

Small JIC style Power Units should be moved with a fork-lift truck, with 2X4 boards under the reservoir belly, to distribute and steady the load. Larger JIC style Power Units have lifting holes in the reservoir end plates. Extra heavy 1 1/2 pipes can be inserted into the lifting holes for allowing movement with a fork-lift truck. L-shaped reservoirs are provided with clearance and cross braces under the base plate for movement with a fork-lift truck.

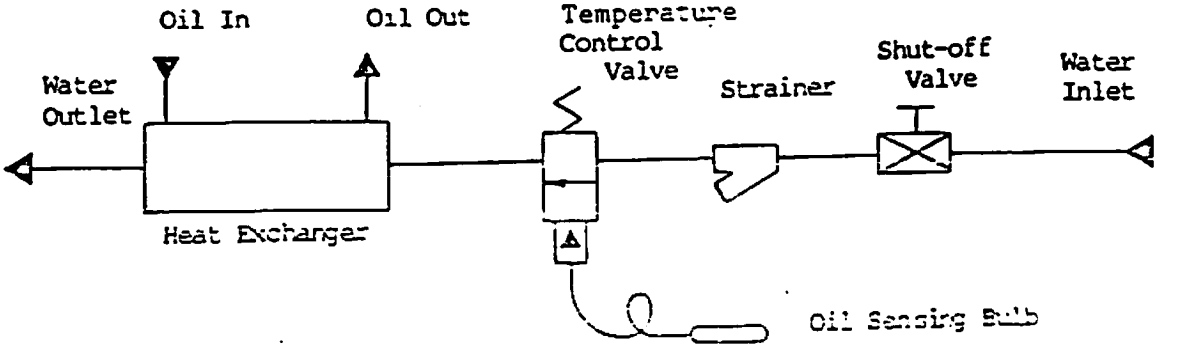
Installation

Locating Power Unit

The unit should be installed indoors, and preferably in a clean dry environment with an ambient temperature of 60 to 100°F. The unit can be installed outdoors if the reservoir was provided with optional weatherproof construction, and provisions were made for extreme temperature conditions. The reservoir can be secured to the floor or base using the four mounting holes located on the reservoir legs.

Service Connections

Water (If water cooled heat exchanger has been provided) Connect the water supply to the inlet of the heat exchanger, with a shut-off valve and strainer (if not supplied by Parker). If a Temperature Control Valve (Model WTC-**) has been provided, it also should be installed on the inlet side. The outlet of the hear exchanger should be connected directly to the facility drain system. On single pass heat exchangers the water connections should be installed as shown below. On multi-pass heat exchanger the water flow direction is not important.



Electrical Connect the pump motor to the facility power source following good practices as outlined in the National Electric Code and any local codes which may apply. Verify that the available voltage is the same as the voltage identified on the motor nameplate. Most motors have dual voltage ratings, so verify that the leads in the conduit box have been connected together as defined on the motor nameplate to match the facility power source available.

If Solenoid valves, pressure/temperature switches, or oil immersion heaters have been provided on the power unit, refer to the component nametag or other service information in this manual for operating voltage and ratings.

Supply and Return Connections

Complete all necessary interconnecting piping between the power unit and hydraulic actuators. The line sizes should be determined based on oil flow, operating pressure and allowable pressure drop between the power unit and actuator.

Warning
Check to insure that the proper rated hose or pipe is used on pressure lines.

One of the key ingredients for good service and long life from a hydraulic system is cleanliness, and since it has been our experience that most dirt infiltrates a hydraulic system during installation, we recommend the following rules be adhered to:

a) All open ports on the power unit, cylinders, etc. must remain plugged with tape or plastic plugs until just before the hydraulic connections are made.

b) All interconnecting tubing, pipe, or hose should be clean, and free of rust, scale and dirt. The ends of all connectors should be plugged until just before they are to be installed in the system.

c) All openings in the reservoir such as the filler breather or access end covers holes must remain closed during installation.

d) If Teflon tape, or pipe dope is used, be sure it doesn't extend beyond the first thread of the pipe fitting.

Reservoir Inspection

The reservoir has been thoroughly cleaned and sprayed with rust inhibitor at Parker prior to shipping. It is suggested, however, to remove the reservoir access covers and re-inspect the tank for cleanliness. JIC reservoirs are provided with a removable baffle for greater access for cleaning.

Note

On JIC reservoirs it is important for the baffle to be centered in the tank, and for the sealing gaskets to take a good set if the end covers are to seal properly. Reinstall end covers as follows:

a) Locate the baffle in the center of the tank.

b) Install end covers hand tight, being careful not to move the baffle.

c) Torque one cover a small amount, and then torque the opposite end cover a small amount more. Continue going back and forth between the covers until both are torqued equally. (See figure 1 for proper torque value.)

Reservoir Filling

The reservoir must be filled with clean fluid thru the filler cap on the reservoir. The type of fluid must be compatible with the seals used on the power unit, and must comply with the recommendations of the manufacturers of the component parts.

Refer to the component manufacturer's catalog for fluid requirements.
The cleanliness of the fluid going into the reservoir is very important, and in some cases, even new oil out of the drum is not adequate. We recommend that any fluid being transferred into the reservoir be done with a transfer pump with a 10 micron filter installed. A Parker filter cart is available for this purpose.

Coupling Alignment

It is possible for pump/motor shaft alignment to be incorrect because of shock incurred during shipping. The alignment should be re-checked before start-up.
If the pump/motor assembly has been foot mounted, the coupling alignment should be checked using the coupling installation instructions provided in the appendices of this manual. If re-aligning is required, the motor mounting bolts should be loosened, and shims inserted. Note, see figure 3 for Lovejoy or Magnaloy couplings.

If the pump/motor assembly has been mounted with a bell-housing, the only check required is to verify that the coupling halves have adequate clearance, and that the coupling set-screws are tight. A slot is provided in the bell housing for this purpose.

Start-Up Procedure

1) Open any ball or gate valve (if applicable) located in the pump suction line.

2) Back the system relief valve and/or pump pressure compensator adjustment knob out, so that the pressure will be near zero during the initial start.

Note

If the power unit has been provided with a variable displacement pump or any piston pump, the pump case should be filled with clean oil prior to priming. In most cases this can be accomplished by disconnecting the pump case drain line and pouring the oil into the pump case drain port.

3) If the system has been provided with an open center directional valve, the oil during start-up will flow directly back to tank. If the system has a closed centered valve, it may be necessary to loosen a fitting momentarily at the pump discharge, to bleed any air in the pump during the priming operation.

4) Jog the pump motor once, and verify that the pump is rotating in the same direction as the arrow tag on the pump case. If the direction is incorrect, reverse two (2) of the three (3) motor leads, and recheck the rotation.

5) Jog the pump motor (3) to (6) times to prime the pump and allow the pump to run for several minutes at zero pressure. Check the piping for any leaks and correct immediately. (Leaks in fittings and tubing can be the result of vibration during shipping.)

6) Begin adjusting the relief valve and/or pump compensator to increase the pressure gradually. Note; on systems with open center directional valves, it will be necessary to actuate the valve to build pressure.

7) Continue increasing pressure until normal operating pressure is obtained, and recheck system for leaks. Lock adjustment screws in place.

Note

If the system has been provided with a pressure compensated pump and a relief valve, adjust the relief valve approximately 10% higher than the compensator so that excessive heat is not generated by the relief valve.

8) During the start-up sequence, all filters should be monitored closely. Replace any filters element immediately, as soon as they begin to go into by-pass as indicated on the visual indicator.

9) After the entire system has been wetted with fluid, refill the reservoir to the normal operating level.

10) Verify that the cooling water to the heat exchanger (if applicable) is flowing. If the power unit has been provided with a water control valve (Model WTC-**), and the oil temperature is exceeding 135°F, adjust the valve to increase the water flow

Special Tools

All normal service and maintenance on standard power units can be accomplished with standard handtools. No special tools are required.

General Maintenance

Electric Motors - Lubricate as recommended by the motor manufacturer.

Filters - Change or clean as required or as indicated on filters supplied with visual indicators.

Suction Strainers - Should be cleaned after 10 hours operation and 100 hours thereafter. See appendicies for cleaning instructions.

Reservoirs - Maintain oil level at all times. The oil should be checked after the first 100 hours and verify that the class of oil meet the requirements of the pump being used. Change the oil every 1000 to 2000 hours depending on the application and operation environment.

Components - See component literature in appedicies.

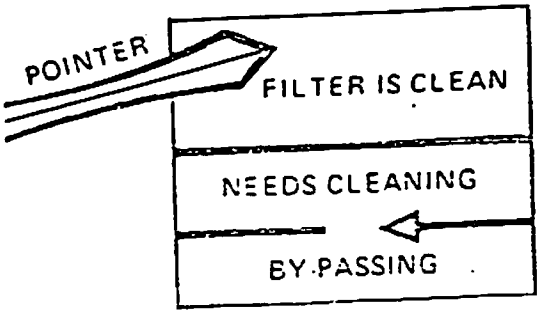
Recommended Spare Parts

Spare filter elements should be purchased with the power unit, and be available during the start-up operation. Other spare parts may be required, and are a function of the duty cycle of the hydraulic system, operation environment, and the acceptable down time of the equipment.

Preventive Maintenance

Filter Service

Filters must be maintained. The key to good filtration is filter maintenance. A machine may be equipped with the best filters available and they may be positioned in the system where they do the most good; but, if the filters are not taken care of and cleaned when dirty, the money spent fot the filters and their installation has been wasted. A filter which gets dirty after one day of service and is cleaned 29 days later gives 29 days of non-filtered fluid. A filter can be no better than the maintenance afforded it.



Maintenance Suggestions

1) Set up a filter maintenance schedule and follow it dilligently.
2) Inspect filter elements that have been removed from the system for signs of failure which may indicate that the service interval should be shortenend and of impending system problems.
3) Do not return to the system any fluid which has leaked out.
4) Always keep the supply of fresh fluid covered tightly.
5) Use clean containers hoses, and funnels when filling the reservoir. Use of a filter cart when adding oil is highly recommended.
6) Use common sense precautions to prevent entry of dirt into components that have been temporarily removed from the circuit.
7) Make sure that all clean-out holes, filler caps, and breather cap filters on the reservoir are properly fastened.
8) Do not run the system unless all normally provided filtration devices are in place.
9) Make certain that the fluid used in the system is of a type recommended by the manufacturers of the system or components.
10) Before changing from one type of fluid to another (e.g., from petroleum base oil to a fire resistant fluid), consult component and filter manufacturers in selection of the fluid and the filters that should be used. Also consult the publication **"Recommended Practice for the use of Fire Resistant Fluids for Fluid Power Systems"** published by the National Fluid Power Association.
11) Parker offers an oil sampling kit which can be used to ascertain the condition of the system fluid.

Maintaining Proper Oil Temperature

Hot oil in your equipment's hydraulic system is one of the primary causes of poor operation, component failure and downtime. Here are some pointers on maintaining proper oil temperature.

The oil in your hydraulic system was designed for operation within a specified temperature range. You may be able to run it at hotter temperatures for short periods of time, intermittently, without bad effects. If you run continuously with oil that's too hot, however, your equipment will operate poorly, and eventually key components will fail and halt your machine.

How Hot Is "Too Hot"?

"Hot oil" is a relative term. In most cases, 120°F. at the reservoir is considered an ideal operating temperature. Always take an oil temperature reading at the reservoir, not at a component or any of the piping.

Some hydraulic systems are designed to operate at 130°F. or higher. If you don't know the maximum operating temperature for your equipment, check your component manual for temperature and viscosity limitations.

Measuring Oil Temperature

There are several ways to check the temperature of the oil. The best, most accurate method is by means of a thermometer. On some machines, this is mounted on the reservoir. Make it a habit to check the thermometer periodically, after the equipment has been running for more than an hour.

If your machine doesn't have a reservoir thermometer, use the "palm test." First check the tank with your fingertip; if it's not too hot to touch, place your palm on the tank. You'll be able to hold it there without discomfort if the oil temperature is about 130°F. or below.

Isolating Trouble-Spots

To determine which components are "running hot" and overheating the oil, feel the outlet fittings and lines at the valves, pumps and motors. If the oil is normal going into a component but hot coming out-that could be one of the trouble-makers.

A sticking valve can cause excessive heat. If a spool does not return promptly to the neutral position, the pump flow will be dumped continuously. This builds up heat rapidly.

If a relief valve is set too low, part of the oil will be dumped across the valve with every cycle. This too, generates excessive heat. Even when all valves are set properly, they may not be operating well because of worn orifices or seals.

Always remove and check the hot components first, before the others.

Look, Smell and Feel

Checking oil temperature periodically is good preventive maintenance. So too is the practice of periodically siphoning an oil sample from the reservoir, and comparing it with a sample of clean, new oil.

Oil that has been running too hot will look darker and feel thinner than new oil. It will also smell burned. Chances are, it will contain more contaminants, because hot oil leads to accelerated wear of component parts.

Preventive Measures

How can you keep your equipment's hydraulic system from running too hot?

1) Set up a regular schedule for checking the oil temperature, appearance, smell and feel. Change oil as recommended by the equipment manufacturer.
2) Be prompt about removing, checking and repairing or replacing valves, pumps or other components that are running hot.
3) If relief or flow-control valves are running hot, check and adjust their settings. Follow your equipment owner's manual.
4) Break in new components gradually. New, close-fittings parts expand at different rates, and are especially prone to seize when they get too hot.
5) Start a cold pump or motor on hot oil by jogging just enough to draw the hot oil into the component. Then wait a few minutes to allow the temperature to equalize in all the pump's parts. Repeat until the temperature on the outside of the pump is the same as that on the piping.
6) **Keep your equipment clean.** A thick layer of dirt acts as insulation. It will prevent the hydraulic system from getting rid of heat.
7) On hot days, and in hot climates, check and change the oil more frequently. Be sure to use an oil recommended for hot-weather operation by the equipment manufacturer or oil supplier.

Troubleshooting

Troubleshooting Areas

Dirty oil

1) Components not properly cleaned after servicing.
2) Inadequate screening in fill pipe.
3) Air breather left off. (No air breather provided... inadequate unit provided... insufficient protection of air breather.)
4) Tank not properly gasketed.
5) Pipe lines not properly covered while servicing machine.
6) Improper tank baffles not providing settling basin for heavy materials.
7) Filter dirty or ruptured.

Fire resistant fluids

1) Incorrect seals cause binding spools.
2) Paint, varnish or enamel in contact with fluids can cause sludge deposits on filters and around seal areas.

3) Electrolytic action is possible with some metals. Usually zinc or cadmium.

4) Improper mixtures can cause heavy sludge formations.

5) High temperatures adversely affect some of the fluids, particularly the water base fluids.

6) Adequate indentificaiton of tanks containing these fluids should be provided so that they will be refilled with the proper media.

7) As with mineral base oils, nuisance leaks should be remedied at once.

8) Make certain replacement parts are compatible with fluid media.

Foaming oil

1) Return of tank line not below fluid level. Broken pipe, line left out between a bulkhead coupling and the bottom of the tank after cleaning tank.

2) Inadequate baffles in reservoir.

3) Fluid contaminated with imcompatible foreign matter.

4) Suction leak to pump aerating oil.

5) Lack of anti-foaming additives.

Moisture in oils

1) Cooling coils not below fluid level.

2) Cold water lines fastened directly against hot tank causing condensation within tank.

3) Soluble oil solution splashing into poorly gasketed tanks or fill pipes left open.

4) Moisture in cans used to replace fluid in tanks.

5) Extreme temperature differential in certain geographical locations.

6) Drain not provided at lowest point in tank to remove water collected over possibly long operating periods.

Overheating of system

1) Water shut off or heat exchanger clogged.

2) Continuous operation at relief setting.
   a. Stalling under load, etc.
   b. Fluid viscosity too high or too low.

3) Excessive slippage or internal leakage.
   a. Check stall leakage past pump, motors and cylinders
   b. Fluid viscosity too low.

4) Reservoir sized too small.

5) Reservoir assembled without baffling or sufficient baffling.

6) Case drain line from pressure compensated pump returning oil too close to suction line.
   a. Repipe case drain line to opposite side of reservoir baffling.

7) Pipe, tube or hose I.D. too small causing high velocity.

8) Valving too small, causing high velocity.

9) Improper air circulation around reservoir.

10) System relief valve set too high.

11) Power unit operating in direct sunlight or ambient temperature is too high.

Foreign matter sources in the circuit

1) Pipe scale not properly removed.

2) Sealing compound (pipe dope, teflon tape allowed to get inside fittings.

3) Improperly screened fill pipes and air breathers.

4) Burrs inside piping.

5) Tag ends of packing coming loose.

6) Seal extrusions from pressure higher than compatible with the seal or gasket.

7) Human element... not protecting components while being repaired and open lines left unprotected.

8) Wipers or boots not provided on cylinders or rams where necessary.

9) Repair parts and replacement components not properly protected while stored in repair depot. (Rust and other contaminants.)

Troubleshooting Pumps

Pump makes excessive noise

1) Check for vacuum leaks in the suction line. (Such as leak in fitting or damaged suction line.

2) Check for vacuum leaks in the pump shaft seal if the pump is internally drained. Flooding connections with the fluid being pumped may cause the noise to stop or abate momentarily. This will locate the point of air entry.

3) Check alignment with drive mechanism. Misalignment will cause wear and subsequent high noise level in operation.

4) Check manufacturers specifications relative to wear possibilities and identification of indications of wear as high operating noise level, etc.

5) Check compatibility of fluid being pumped against manufacturers recommendations.

6) Relief or unloading valve set too high. Use reliable gauge to check operating pressure. Relief valve may have been set too high with a damaged pressure gauge. Check various unloading devices to see that they are properly controlling the pump delivery.

7) Aeration of fluid in reservoir (return lines above fluid level).

8) Worn or sticking vanes (vane type pump).

9) Worn cam ring (vane type pump).

10) Worn or damaged gears and housing (gear pump).

11) Worn or faulty bearing.

12) Reversed rotation.

13) Cartridge installed backwards or improperly.

14) Plugged or restricted suction line or suction strainer.

15) Plugged reservoir filter breather.

16) Oil viscosity too high or operating temperature too low.

17) Oil pour point too high.

18) Air leak in suction line or fittings also causing irregular movement of control circuit.

19) Loose or worn pump parts.

20) Pump being driven in excess of rated speed.

21) Air leak at pump shaft seal.

22) Oil level too low and drawing air in through inlet pipe opening.

23) Air bubbles in intake oil.

24) Suction filter too small or too dirty.

25) Suction line too small or too long.

26) Pump housing bolts loose or not properly torqued.

Pump failure to deliver fluid

1) Low fluid level in reservoir.

2) Oil intake pipe suction strainer plugged.

3) Air leak in suction line and preventing priming.

4) Pump shaft turning too slowly.

5) Oil viscosity too high.

6) Oil lift too high.
7) Wrong shaft rotation.
8) Pump shaft or parts broken.
9) Dirt in pump.
10) Variable delivery pumps. (Improper stroke.)

Oil leakage around pump.

1) Shaft seal worn.
2) Head of oil on suction pipe connection-connection leaking.
3) Pump housing bolts loose or improperly torqued.
4) Case drain line too small or restricted. (Shaft seal leaking.)

Excessive pump wear

1) Abrasive dirt in the hydraulic oil being circulated through the system.
2) Oil viscosity too low.
3) System pressure exceeds pump rating.
4) Pump misalignment or belt drive too tight.
5) Air being drawn in through inlet of pump.

Pump parts inside housing broken

1) Seizure due to lack of oil.
2) Excessive system pressure above maximum pump rating.
3) Excessive torquing of housing bolts.
4) Solid matter being drawn in from reservoir and wedged in pump.

Troubleshooting Solenoid Valves

Solenoid failures

1) Voltage too low. If voltage will not complete the stroke of alternating current (AC) solenoid it will burn out the coil.
2) Signal to both solenoids of a double solenoid valve simultaneously. One or both of the solenoids will be unable to complete their stroke and will burn out. (Make certain the electrical signal is interlocked so that this condition cannot exist.)
3) Mechanical damage to leads. (Short circuit, open connections, etc.)

4) Tight spool or other mechanical parts of the valve being actuated can prevent the solenoid from completing its stroke and subsequently burning out.

5) Replacement springs too heavy in valve. Overloads solenoid and shortens life.

6) Wrong voltage or frequency will either prevent operation because of inadequate capacity to handle the load with the lower voltage or burn out the coil because of improper winding and excessive voltage.

7) Dirty contacts may not supply sufficient current to solenoid to satisfy inrush demands.

8) Low voltage direct current solenoids may be affected by low battery capacity on cold mornings directly after starting cold engine.

9) Long feed lines to low voltage solenoids may cause sufficient voltage drop to cause erratic operation.

Solenoid valve fails to operate

1) Is there an electrical signal to the solenoid or operating device? Is the voltage too low? (Check with voltmeter... test light in emergency.)

2) If the supply to the pilot body is orificed, is the orifice restricted? (Remove orifice and check for foreign matter. Flushing is sometimes necessary because of floating impediment.)

3) Has foreign matter jammed the main spool? (Remove end caps and see that main spool is free in its movement... remember that there will be a quantity of fluid escaping when the cap is removed and provide a container to catch it.)

4) Is pilot pressure available? Is the pilot pressure adequate? (Check with gauge on main pressure input port for internally piloted types and in the supply line to the externally piloted type.)

5) Is pilot drain restricted? (Remove pilot drain and let the fluid pour into an open container while the machine is again tried for normal operation. Small lines are often crushed by machine parts banging against them causing a subsequent restriction to fluid flow.)

6) Is pilot tank port connected to main tank port where pressures are high enough to neutralize pilot input pressure? (Combine pilot drain and pilot tand port and check for operation with the combined flow draining into an open container... block line to main tank form pilot valve... if this corrects the situation, reroute pilot drain and tank line.)

7) Are solenoids improperly interlocked so that a signal is provided to both units simultaneously? (Put test light on each solenoid lead in parallel and watch for simultaneous lighting... check electrical interlock. This condition probably burns out more solenoids than any other factor.)

8) Has mounting pad been warped from external heating? (Loosen mounting bolts slightly and see if valve functions. End caps can also be removed and check for tight spool.)

9) Is fluid media excessively hot? (Check for localized heating which may indicate an internal leak... check reservoir temperature and see if it is within machine specifications.)

10) Is there foreign matter in the fluid media causing gummy deposits? (Check for contamination... make certain seals and plumbing are compatible with the type of fluid being used.)

11) Is an adequate supply of fluid being delivered to actuate the load? (Many times there is sufficient pressure to shift the valve but not enough to actuate the work load. Check pump supply pressure and volume if necessary... physical measurement of flow through relief valve with units blocked may be necessary.)

12) Check circuit for possible interlocks on pressure sources to valve or to pilot.

Starters and Enclosed Product

Open & enclosed pre-wired starters and enclosed contactors for any application

In addition to selling "open" components, Sprecher + Schuh also offers a full array of preassembled and enclosed products ready to install when they reach your dock.

Standard or customized

The cataloged product in this section comprises Sprecher + Schuh's standard offering. In most cases, engineering drawings and bills-of-material have already been created and assembly procedures have been standardized. Generally speaking, lead times are shorter on these standard items.

- Enclosed contactors
- Magnetic motor starters
- KWIKstarters
- Combination starters
- Explosion-proof starters
- Multi-speed starters
- Reduced voltage starters
- Pump controllers
- Softstarters (see Section D)

Your sales representative and our Engineering department will also work with you to customize any of our standard pre-assembled or enclosed products to suit your exact specifications. Any combination of enclosure types, pilot devices, control power transformers, meters and other modifications can be combined to provide exactly the panel you need.

UL/CSA approved shop

Sprecher + Schuh's assembly operations in the US and Canada are UL Approved UL508 shops. Our Canadian shop is also CSA certified. This means, upon customer request, we can build UL 508 Listed panels that satisfy the most rigorous UL inspection. Regardless of whether your panel has a UL508 Listing, panels built by Sprecher + Schuh adhere to UL mandated design and wiring standards.

Built with quality and pride

Every panel built by Sprecher + Schuh is meticulously designed and constructed. Where possible, all panels are laid out with generous wiring space. Control wiring is neatly bundled and tied to the backpan. Outsourced components are industrial control quality from namebrand manufacturers. Control wiring and device function is electrically tested before the panel leaves our facility.

Configuration

Contactor
Starter
Starter (Single Phase)

Reversing Contactor
Reversing Contactor (Single Phase)
Reversing Starter
Reversing Starter (Single Phase)

Multispeed-Two Wind. (Const/Var TQ)
Multispeed-Two Wind. (Const HP)
Multispeed-One Wind. (Const/Var TQ)
Multispeed-One Wind. (Const HP)

Autotransformer Starter
Wye-Delta Starter
Part Winding Starter

Contactor Series

Series CA7 ❶ Series CA6 ❶

Series CA5

Coil Code

AC DC

No Coil

(CA5 contactors only)

Control Transformer

Code	Primary	Secondary
	208	120
	240	120
	480	120
	575	120
	240	24
	480	24
	380	110

For additional **Control Transformer Codes**, refer to Modifications page in this section.

Overload Relay Selection

CA7-9 thru CA7-85

CEP7 O/L Relay, 3Ø, Class 10, man. reset
CEP7 O/L Relay, 3Ø, Class 20, man. reset
CEP7 O/L Relay, 3Ø, Class 10, auto. reset
CEP7 O/L Relay, 3Ø, Class 20, auto. reset
CEP7 O/L Relay, 1Ø, Class 10, man. reset
CEP7 O/L Relay, 1Ø, Class 20, man. reset
CEP7 O/L Relay, 1Ø, Class 10, auto. reset
CEP7 O/L Relay, 1Ø, Class 20, auto. reset
CT7 O/L Relay, 1Ø & 3Ø, Class 10, manual or automatic reset

CA6-85 thru CA6-170-EI

CT6 O/L Relay, 1Ø & 3Ø Class 10, manual or automatic reset

CA6-85 thru CA6-420-EI

CEF1 Electronic Motor Protector 3Ø, Class 10...30, manual automatic or remote reset

CA5-700 thru CA5-1200

Contact Factory

Starters & Enclosed Prod.

CA7-20 42E MG B50 E

Motor Circuit Protector

3 Amp
7 Amp
15 Amp
30 Amp
50 Amp
100 Amp
150 Amp
225 Amp
400 Amp
600 Amp

None

Fusible Disconnect

250V/30A
250V/60A
250V/100A
250V/200A
250V/400A
250V/600A

600V/30A
600V/60A
600V/100A
600V/200A
600V/400A
600V/600A

None

Non Fusible Disconnect

600V/30A
600V/60A
600V/100A
600V/200A
600V/400A
600V/600A

None

Enclosure

General Purpose (M1)
Dusttight (M12)
Watertight (M4)
Watertight Corrosion Resistant (F4)
Raintight (M3R)
Explosionproof (M7)
Open Device

Enclosure Cover Control

Non-Reversing
Pilot Light Only
Pilot Lights(2) Only
"Start-Stop" PB
"On-Off" PB
"Hand-Auto" S/S
"Off-On" S/S
"Hand-Off-Auto" S/S
None

Reversing
Pilot Lights(2) Only
"For-Stop-Rev" PB
"Up-Stop-Down" PB
"Open-Stop-Close" PB
"For-Off-Rev" S/S
"Up-Off-Down" S/S
"Open-Off-Close" S/S
None

Multi-Speed
Pilot Lights(2) Only
"High-Stop-Low" PB
"Fast-Stop-Slow" PB
"High-Off-Low" S/S
"Fast-Off-Slow" S/S
None

For additional Cover Control Codes, refer to Modifications page in this section

Options

For complete listing of Options Codes, refer to Modifications page in this section

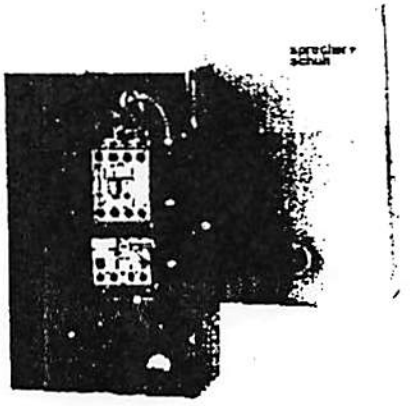
This illustration is for reference only.
Turn to the appropriate page in this catalog to determine specific catalog number and pricing.

❶ (C) & (D) suffix designates DC contactors
❷ (-Eb suffix indicates electronic coil. Optional on CA6-105 & 140, standard on CA6-170...420

Open and Enclosed Magnetic Motor Starters

Built to your specifications and ready to install

Sprecher + Schuh magnetic motor starters are intended to eliminate the purchase and assembly of a separate contactor, overload relay and associated wiring. When purchased with an enclosure, the starters are mounted and ready to install on receipt.



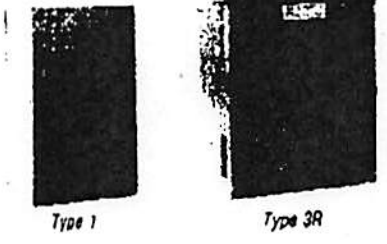
Starting with the best

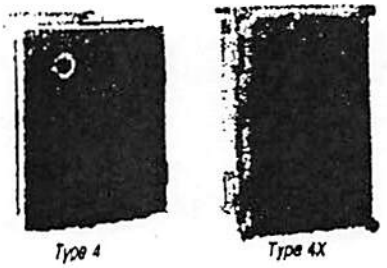
At the heart of all magnetic starters is the Sprecher + Schuh CAT7, CAT6 and CAT5 line of motor starters. These starters are compact and offer intermediate sizes to better match specific motor requirements. This equates to generous wiring space and less wasted horsepower capacity.

Top line protection...

Magnetic starters (with CA7 contactors) are equipped with Sprecher + Schuh's new CEP7 solid state overload relay. Unlike traditional overload relays that indirectly sense motor current through heater elements, CEP7 solid state overload relays measure motor current *directly* through integrated current transformers and on board electronics. The electronics provide numerous advantages over electromechanical relays.

Our quality CT6 Series thermal overload relays are provided with CAT6-85...170 starters. These overloads provide *full motor overload protection*, including ambient temperature compensation, exact ampere settings and single phase protection. CAT6-210...420 starters are provided with the sophisticated CEF1 Electronic Motor Protector.





The right enclosure... whatever the application

Sprecher + Schuh's broad line of IEC style starters can be purchased preinstalled in a variety of standard enclosures. Cataloged enclosures include:

M1	General Purpose
M12	Industrial Dusttight
M3	Industrial Dusttight (outdoor)
M4	Watertight
F4	Watertight, Corrosion Resistant

Even though these are the most popular enclosure types for most industrial applications, we can house any starter in a custom enclosure of your choosing.

Quality enclosures ensure the highest confidence

Sprecher + Schuh only sources enclosures from name brand manufacturers, ensuring the highest quality. We primarily use enclosures that meet UL Standards, i.e., Type 1, Type 3R, etc., however, we can also source IEC-type enclosures at your request. Enclosures are sized first to accommodate the depth of the contactor and offer sufficient electrical clearances to satisfy UL.

Add a variety of modifications

If you need a larger enclosure than what is specified in our catalog, your sales representative and our Engineering department will work with you to customize any of our enclosed products to suit your exact specifications. Any combination of enclosure types, sizes, pilot devices, meters and other modifications can be combined to provide exactly the panel you need.

Three Phase, Non-Reversing CAT7, CAT6 & CAT5 (Open, M1 & M12 / M3)

Maximum Horsepower Three Phase				Auxiliary Contacts per Contactor ❶		Open Type ❷		M1 General Purpose		DIM ❶	M12 (M3 ❸) Industrial Dusttight		DIM ❶
200V	230V	460V	575V	NO	NC	Catalog Number		Catalog Number			Catalog Number		
2	2	5	7 1/2	1	0	CAT7-9-✱-◆	128	CAT7-9-✱-◆-G0	161	A	CAT7-9-✱-◆-D0	226	L
3	3	7 1/2	10	1	0	CAT7-12-✱-◆	148	CAT7-12-✱-◆-G0	201	A	CAT7-12-✱-◆-D0	256	L
5	5	10	15	1	0	CAT7-16-✱-◆	168	CAT7-16-✱-◆-G0	213	A	CAT7-16-✱-◆-D0	268	L
5	7 1/2	15	15	1	0	CAT7-23-✱-◆	170	CAT7-23-✱-◆-G0	225	A	CAT7-23-✱-◆-D0	280	L
7 1/2	10	20	25	1	0	CAT7-30-✱-◆	198	CAT7-30-✱-◆-G0	251	A	CAT7-30-✱-◆-D0	306	L
10	10	25	30	1	0	CAT7-37-✱-◆	283	CAT7-37-✱-◆-G0	363	A	CAT7-37-✱-◆-D0	528	L
10	15	30	30	1	0	CAT7-43-✱-◆	275	CAT7-43-✱-◆-G0	375	B	CAT7-43-✱-◆-D0	540	M
15	20	40	50	1	0	CAT7-60-✱-◆	318	CAT7-60-✱-◆-G0	418	B	CAT7-60-✱-◆-D0	583	O
20	25	50	60	1	0	CAT7-72-✱-◆	352	CAT7-72-✱-◆-G0	502	B	CAT7-72-✱-◆-D0	657	O
25	30	60	60	1	0	CAT7-85-✱-◆	388	CAT7-85-✱-◆-G0	536	B	CAT7-86-✱-◆-D0	701	O
25	30	60	75	1	1	CAT6-85-✱-◆	640	CAT6-85-✱-◆-G0	960	E	CAT6-86-✱-◆-D0	1160	O
40	40	75	100	1	1	CAT6-105-✱-◆ ❹	715	CAT6-105-✱-◆-G0 ❹	1038	E	CAT6-106-✱-◆-D0 ❹	1385	R
40	50	100	125	1	1	CAT6-140-✱-◆ ❹	1000	CAT6-140-✱-◆-G0 ❹	1320	F	CAT6-140-✱-◆-D0 ❹	1820	T
50	60	150	150	1	1	CAT6-170-EI-✱-◆	1326	CAT6-170-EI-✱-◆-G0	1870	F	CAT6-170-EI-✱-◆-D0	2145	T
60	75	150	200	1	1	CAT6-210-EI-✱-◆	2316	CAT6-210-EI-✱-◆-G0	3300	F	CAT6-210-EI-✱-◆-D0	3300	T
75	100	200	250	1	1	CAT6-250-EI-✱-◆	2540	CAT6-250-EI-✱-◆-G0	3600	I	CAT6-250-EI-✱-◆-D0	3500	I
100	125	250	300	1	1	CAT6-300-EI-✱-◆	2680	CAT6-300-EI-✱-◆-G0	3650	I	CAT6-300-EI-✱-◆-D0	3650	I
150	150	350	400	1	1	CAT6-420-EI-✱-◆	3775	CAT6-420-EI-✱-◆-G0	4750	I	CAT6-420-EI-✱-◆-D0	4825	I
200	250	500	500	2	2	CAT5-700-✱-◆	R/F	CAT5-700-✱-◆-G0	R/F	-	CAT5-700-✱-◆-D0	R/F	-
250	300	600	600	2	2	CAT5-860-✱-◆	R/F	CAT5-860-✱-◆-G0	R/F	-	CAT5-860-✱-◆-D0	R/F	-
				1	2	CAT5-1000-✱-◆ ❽	R/F	CAT5-1000-✱-◆-G0 ❽	R/F	-	CAT5-1000-✱-◆-D0 ❽	R/F	-
450	450	900	900	1	2	CAT5-1200-✱-◆	R/F	CAT5-1200-✱-◆-G0	R/F	-	CAT5-1200-✱-◆-D0	R/F	-

NOTE: Catalog numbers, list prices and enclosure dimensions reflect contactors with AC coils. For DC coils, select Coil Code from the DC Coil Code table on page C51 and follow the instructions for modifying catalog numbers and list prices.

❶ Refer to page C72-73 for dimensional information

❷ For M3 outdoor applications, replace "D" in catalog number with an "R". Price remains the same, dimensions may change. Example: CAT7-23-✱-◆-D0 becomes CAT7-23-✱-◆-R0.

❸ Contactors are equipped with number and type of auxiliaries indicated. See Modification Section to order additional or different auxiliary contacts.

❹ CAT6-105 and CAT6-140 starters available with electronic interface coil. Change catalog number to include "-EI". Example: CAT6-105-✱-◆ becomes CAT6-105-EI-✱-◆. Add $200 to list price.

❺ CAT5-1000 HP ratings per IEC utilization category AC-3, not UL Approved

❻ CAT6 and CAT5 "Open Type" starters include terminal screws only. If lugs are required, see "Accessories" for CA6 and CA5 contactors in Section A of this catalog.

Ordering Instructions

- Specify Catalog Number
- Replace (✱) With Coil Code — See page C51
- Replace (◆) With O/L Relay Code — See pages C62-63

Prices are in US$. For Canadian pricing refer to Canadian Catalog, CD or contact Canadian sales office

Three Phase, Non-Reversing CAT7, CAT6 & CAT5 (M4 & F4)

Maximum Horsepower Three Phase				Auxiliary Contacts per Contactor ❶		M4 Watertight		DIM ❷	F4 Watertight Corrosion Resistant		DIM ❷
200V	230V	460V	575V	NO	NC	Catalog Number			Catalog Number		
2	2	5	7 1/2	1	0	CAT7-❶-✱-◆-W0	288	N	CAT7-❶-✱-◆-C0	198	S1
3	3	7 1/2	10	1	0	CAT7-12-✱-◆-W0	294	N	CAT7-12-✱-◆-C0	219	S1
5	5	10	15	1	0	CAT7-16-✱-◆-W0	314	N	CAT7-16-✱-◆-C0	235	S1
5	7 1/2	15	15	1	0	CAT7-23-✱-◆-W0	334	N	CAT7-23-✱-◆-C0	274	S1
7 1/2	10	20	25	1	0	CAT7-30-✱-◆-W0	391	N	CAT7-30-✱-◆-C0	307	U1
10	10	25	30	1	0	CAT7-37-✱-◆-W0	618	N	CAT7-37-✱-◆-C0	482	U1
10	15	30	30	1	0	CAT7-43-✱-◆-W0	638	N	CAT7-43-✱-◆-C0	506	U1
15	20	40	60	1	0	CAT7-60-✱-◆-W0	829	O	CAT7-60-✱-◆-C0	535	U1
20	25	50	60	1	0	CAT7-72-✱-◆-W0	919	O	CAT7-72-✱-◆-C0	594	U1
25	30	60	60	1	0	CAT7-85-✱-◆-W0	963	O	CAT7-85-✱-◆-C0	628	U1
25	30	60	75	1	1	CAT6-85-✱-◆-W0	1188	Q	CAT6-85-✱-◆-C0	1115	W2
40	40	75	100	1	1	CAT6-105-✱-◆-W0 ❸	1780	R	CAT6-105-✱-◆-C0 ❸	1415	W2
40	50	100	125	1	1	CAT6-140-✱-◆-W0 ❸	2500	T	CAT6-140-✱-◆-C0 ❸	2500	X1
50	60	150	150	1	1	CAT6-170-EI-✱-◆-W0	2865	T	CAT6-170-EI-✱-◆-C0	2675	X1
60	75	150	200	1	1	CAT6-210-EI-✱-◆-W0	3540	T	CAT6-210-EI-✱-◆-C0	4360	X1
75	100	200	250	1	1	CAT6-250-EI-✱-◆-W0	3760	J	CAT6-250-EI-✱-◆-C0	4625	X1
100	125	250	300	1	1	CAT6-300-EI-✱-◆-W0	3960	J	CAT6-300-EI-✱-◆-C0	4900	Y
150	150	350	400	1	1	CAT6-420-EI-✱-◆-W0	5600	J	CAT6-420-EI-✱-◆-C0	6300	Y
200	250	500	500	2	2	CAT6-700-✱-◆-W0	R/F	-	CAT5-700-✱-◆-C0	R/F	
250	300	600	600	2	2	CAT5-860-✱-◆-W0	R/F	-	CAT5-860-✱-◆-C0	R/F	-
			[illegible]	1	2	CAT5-1000-✱-◆-W0 ❹	R/F	-	CAT5-1000-✱-◆-C0 ❹	R/F	-
450	450	900	900	1	2	CAT5-1200-✱-◆-W0	R/F	-	CAT5-1200-✱-◆-C0	R/F	-

NOTE: Catalog numbers, list prices and enclosure dimensions reflect contactors with AC coils. For DC coils, select Coil Code from the DC Coil Code table on page C51 and follow the instructions for modifying catalog numbers and list prices.

Ordering Instructions

- Specify Catalog Number
- Replace (✱) With Coil Code — See page C51
- Replace (◆) With O/L Relay Code — See pages C52-53

❶ Refer to page C72-73 for dime[illegible]al information
❷ Contactors are equipped with [illegible]er and type of auxiliaries indicated. See Modification Section to order a[illegible]nal or different auxiliary contacts.
❸ CAT6-105 and CAT6-140 starters [illegible]available with electronic interface coil "EI." Change catalog number to inc[illegible]-EI". Example: CAT6-105-✱-◆-W0 becomes CAT6-105-EI-✱-◆-W0. Add $2[illegible] to list price.
❹ CAT5-1000 HP ratings per IEC [illegible]ation category AC-3, not UL Approved.

TOSHIBA/HOUSTON
INTERNATIONAL CORPORATION

OPEN DRIP PROOF - EPACT
LOW VOLTAGE MOTORS
FRAME 143T-505UZ

EPACT EFFICIENCY SPECIFICATIONS

Efficiency data has been determined using IEEE Test Standard 112, Method B with Segregation of Losses and correction of Stray-Load Loss in accordance with NEMA MG 1-12 and CSA Standard C390.

Motors UL listed under E133052 (1 to 200 hp).

All motors CSA certified and labeled.

3-Phase, Squirrel Cage	
Horizontal Foot Mounting	
Frame:	143T-505UZ
Insulation:	Class F
Ambient Temperature:	40° C
Service Factor:	1.15
Duty Rating:	Continuous
Voltage and Frequency:	230/460-60 Hz / 460-60 Hz or 575-60 Hz
Speed:	3600, 1800, 1200 rpm
Bearings:	Anti-Friction, Grease Lube

MANUFACTURING FACILITY AT
13131 WEST LITTLE YORK RD, HOUSTON, TEXAS 77041
TELEPHONE (713) 466-0277 / (800) 231-1412
FAX (713) 466-8773

TOSHIBA/HOUSTON
INTERNATIONAL CORPORATION

INDUSTRIAL DIVISION / HOUSTON MOTOR PLANT

REV. LEVEL: 2

OPEN DRIP-PROOF

O. D. P.

PERFORMANCE DATA

SHEET: 2 of 3

HP	FULL LOAD RPM	NEMA FRAME	CURRENT AT 460V			TORQUE			EFFICIENCY			POWER FACTOR				TEMPERATURE RISE BY RESISTANCE METHOD (°C)	
			IDLE (A)	FULL LOAD (A)	LOCKED ROTOR (A)	FULL LOAD (LB-FT)	LOCKED ROTOR (%)	BREAK DOWN (%)	FULL LOAD (%)	3/4 LOAD (%)	1/2 LOAD (%)	FULL LOAD (%)	3/4 LOAD (%)	1/2 LOAD (%)		1.0	1.15
10	3476	213T	4.5	12.5	73.0	15.1	179	298	88.5	89.5	89.6	85.8	82.3	74.1		47	68
	1744	215T	4.3	12.5	80.0	30.2	224	298	89.7	90.9	91.0	85.4	81.7	72.7		53	67
	1170	256T	6.9	13.2	77.0	45.0	190	265	90.8	91.5	91.1	78.1	72.9	61.9		37	47
15	3484	215T	6.0	18.3	113	22.7	173	274	89.5	90.5	90.6	85.6	82.1	73.9		47	67
	1768	254T	7.0	19.0	110	44.6	230	220	91.2	92.1	92.4	81.0	78.3	71.1		50	79
	1175	284T	8.8	20.5	102	67.0	218	223	90.8	91.4	91.1	77.1	71.9	61.2		29	38
20	3516	254T	5.2	23.0	138	29.8	148	245	90.7	91.8	92.2	90.9	90.3	87.1		40	57
	1760	256T	7.8	24.5	135	59.8	205	215	91.3	92.3	92.6	83.9	81.1	73.6		46	72
	1176	286T	12.0	26.5	141	89.6	220	220	91.2	91.8	91.5	77.4	72.2	61.5		37	47
25	3515	256T	5.6	29.0	180	37.5	150	250	91.3	92.4	92.9	91.6	90.7	87.5		41	59
	1769	284T	12.0	30.5	178	74.4	205	225	92.5	92.5	92.3	80.3	77.0	68.0		22	28
	1175	324T	12.3	31.2	179	112	236	230	92.2	92.5	91.2	81.4	77.5	68.8		29	38
30	3510	284TS	9.4	33.0	186	44.8	180	235	91.4	91.9	91.7	85.3	80.8	83.1		30	38
	1771	286T	14.0	37.6	215	89.3	206	230	93.0	93.5	93.3	80.3	76.5	67.0		27	34
	1177	326T	15.5	38.0	204	134	223	234	92.4	93.1	93.0	79.9	75.3	65.6		31	44
40	3524	286TS	14.0	47.1	280	59.8	205	230	92.0	92.5	92.3	86.5	84.0	77.0		32	40
	1770	324T	15.0	48.2	290	119	190	200	93.0	93.5	93.4	83.5	79.5	70.9		33	44
	1180	364T	20.0	50.5	260	178	200	225	93.2	93.3	92.4	79.9	75.8	66.1		50	62
50	3535	324TS	16.9	59.5	356	74.0	209	270	92.4	93.0	93.0	85.5	83.8	78.6		30	35
	1768	326T	22.0	60.4	350	149	200	212	93.2	94.0	94.2	83.1	80.1	72.2		33	44
	1181	365T	27.3	63.9	323	222	216	230	93.9	94.3	94.1	77.8	73.1	62.7		44	56

ALL DATA SUBJECT TO CHANGE WITHOUT NOTICE

1. CONFIDENTIAL TO TOSHIBA INTERNATIONAL CORPORATION
2. DATA SHOWN BASED ON AVERAGES OF TEST DATA DO NOT USE AS GUARANTEED

Performance Information Series PHP60 Pressure Compensated, Variable Volume, Piston Pumps

Features

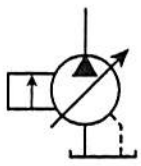
- High Strength Cast-Iron Housing for Reliability and Quiet Operation
- Replaceable Bronze Port Plate to Allow Easy Field Serviceability
- Replaceable Piston Slipper Plate
- Thru-Shaft Capability SAE A, B and C Pilots Available
- Low Noise Levels
- Fast Response Times
- Metric Pilot, Shaft, and Ports Available
- Low Control Pressures for Reduced Power Draw (Energy Efficient)

Controls

- Pressure Compensation
- Remote Pressure Compensation
- Load Sensing
- Hi/Lo Torque (Horsepower) Limiting
- Adjustable Maximum Volume Stop
- Low Pressure Standby

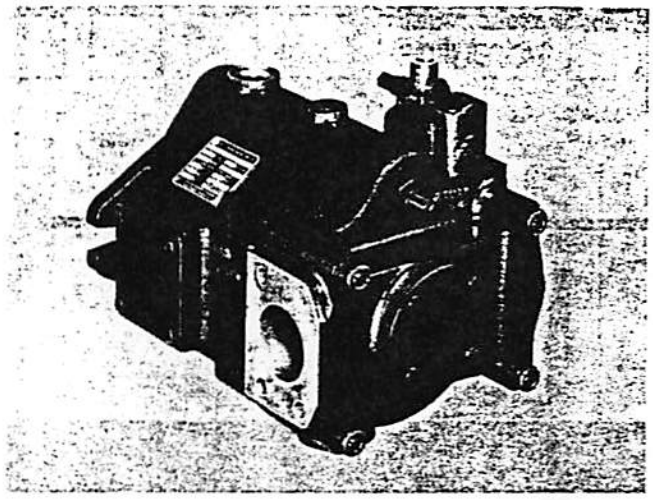
Schematic Symbol

(Basic Pump)



Special Installation or Fluids

Consult your Parker representative on applications requiring higher than rated pressure, over-speed conditions, indirect drive, fluids other than mineral base fluid, and operation at temperatures above 160°F (71°C).



Specifications

Pressure Ratings

Outlet Port: 5000 PSI (345 bar) Continuous (P1)
5500 PSI (380 bar) Peak (P3)

Inlet Port: 10 PSI (0.69 bar) Maximum
5 In. Hg. Minimum @ 1800 RPM

Case Drain: 5 PSI Maximum Differential over Inlet Port. 15 PSI Maximum.

Speed Ratings: 600 to 2200 RPM

Operating Temperature Range: – 40°F to 160°F
(– 40°C to 71°C)

Housing Material: Cast-Iron

Filtration: ISO 16/13 Recommended,
ISO 18/15 Maximum

Mounting: SAE "C" 2-Bolt or Metric

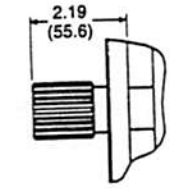
Installation Data:
See "Installation Information" on page A244 of Catalog 2600-102-1/USA for specific recommendations pertaining to system cleanliness, fluids, start-up, inlet conditions, shaft alignment, drain line restrictions and other important factors relative to the proper installation and use of these pumps.

Quick Reference Data Chart

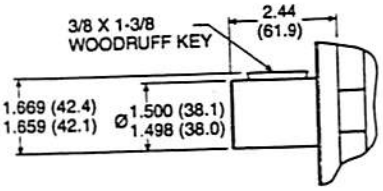
Pump Model	Displacement cc/rev (in³/rev)	Pump Delivery @ 100 PSI (7 bar) in GPM (LPM)		*Approx. Noise Levels dB(A) @ Full Flow 1800 RPM (1200 RPM)						Horsepower At 1800 RPM, Max. Displacement & 5000 PSI
		1200 RPM	1800 RPM	500 PSI (34 bar)	1000 PSI (69 bar)	2000 PSI (138 bar)	3000 PSI (207 bar)	4000 PSI (275bar)	5000 PSI (345 bar)	
PHP60	60 (3.66)	19.5 (73.8)	28.2 (106.7)	72 (68)	73 (69)	75 (70)	77 (70)	81 (76)	81 (80)	92.0

* Since many variables such as mounting, tank style, plant layout, etc., effect noise levels, it cannot be assumed that the above readings will be equal to those in the field. The above values are for guidance in selecting the proper pump. Noise levels are A-weighted, mean sound pressure levels at 1 meter from the pump, measured and recorded in accordance with applicable ISO and NFPA standards.

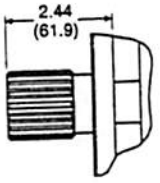
Dimensions - Standard Pressure Compensator Pump



SHAFT OPTION "B" (SAE "C")
14 TOOTH 12/24 PITCH
30° INVOLUTE SPLINE
(MAX TORQUE = 5680 IN LBS)



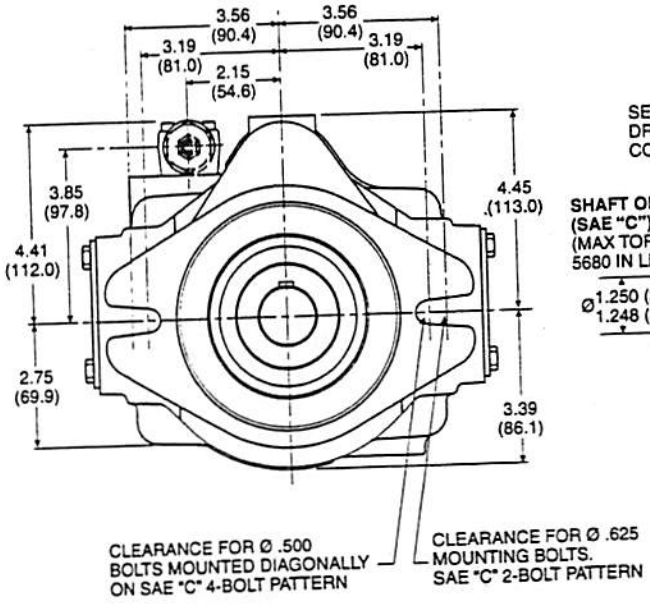
SHAFT OPTION "C" (SAE "C-C")
(MAX TORQUE = 10,780 IN LBS)



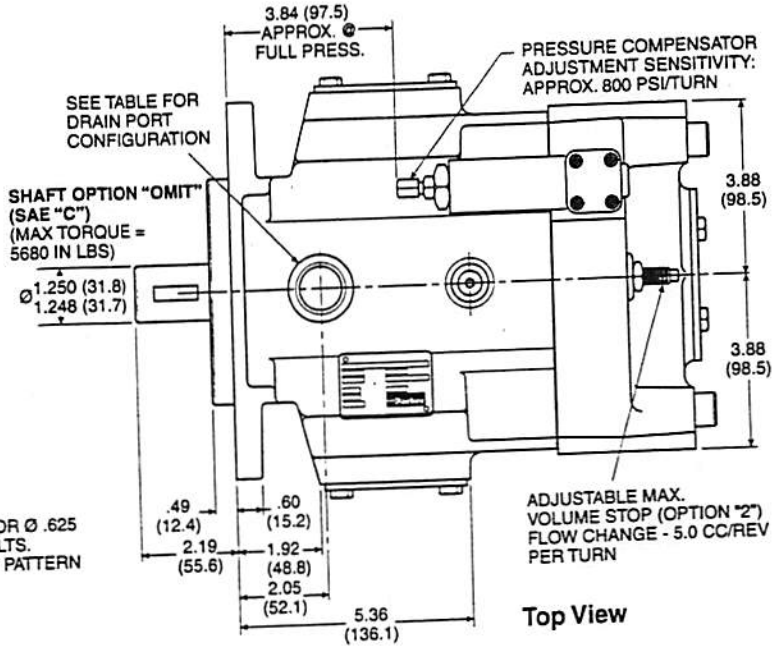
SHAFT OPTION "D" (SAE "CC")
17 TOOTH 12/24 PITCH
30° INVOLUTE SPLINE
(MAX TORQUE = 10,780 IN LBS)

Drain Port Table

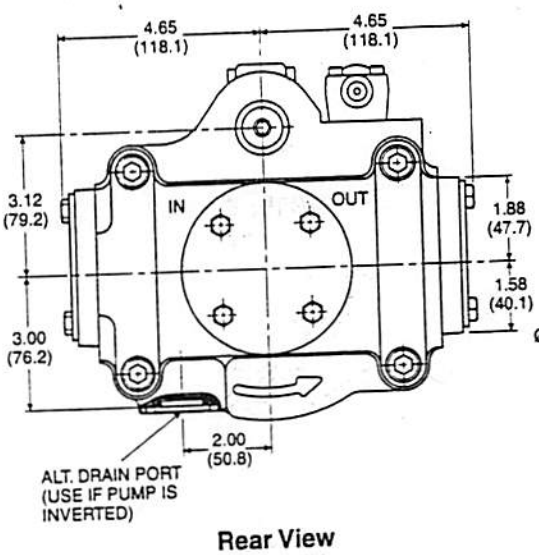
Port Option	Drain Port Configuration
2	Straight Thread O-Ring SAE -12 (1-1/16-12 UN)
8	Straight Thread O-Ring ISO 6149-12 (M27 X 2.0)



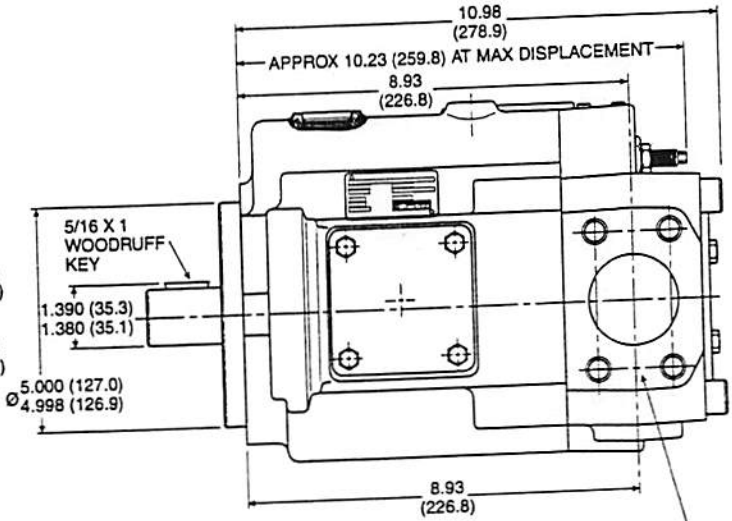
Front View



Top View

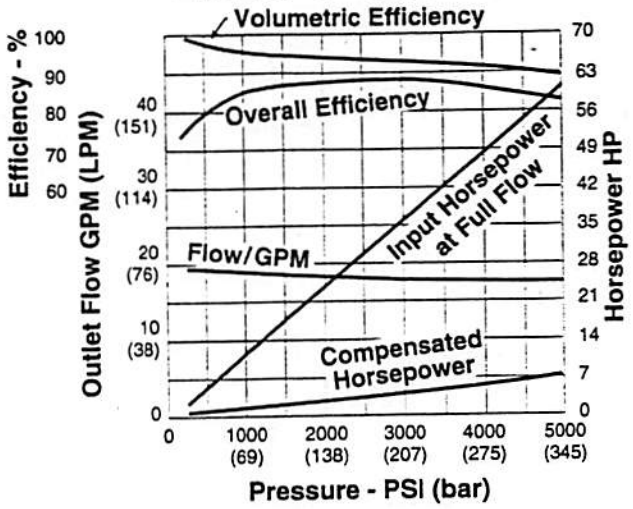


Rear View

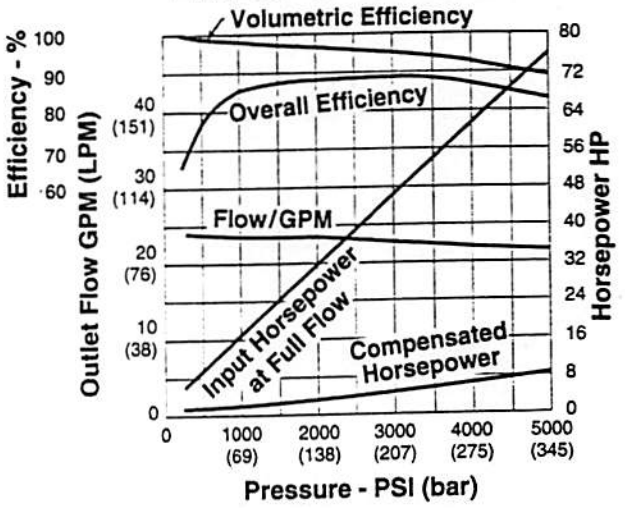


Side View

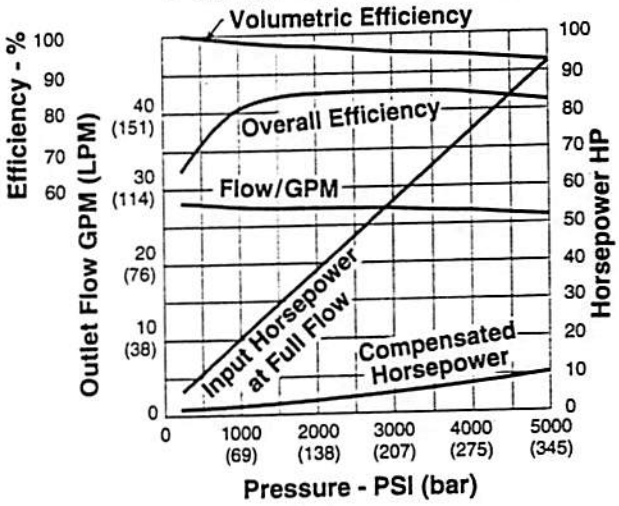
PHP60 @ 1200 RPM



PHP60 @ 1500 RPM



PHP60 @ 1800 RPM

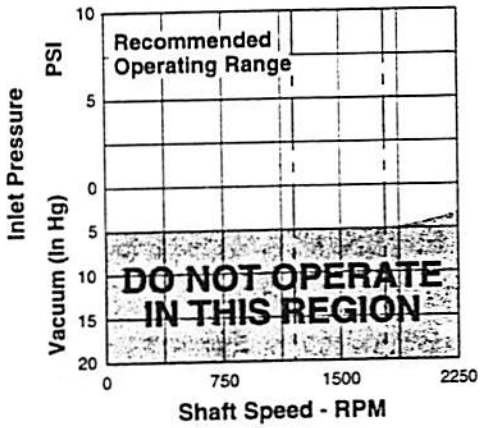


Note: Compensated horsepower curves are shown for the standard pressure compensator option. For remote type compensators the compensated horsepowers will be 10-15% higher.

Note: The efficiencies and data in the graphs are accurate for pumps running at speeds shown and maximum stroke. To calculate approximate horsepower for other conditions, use the following formula...

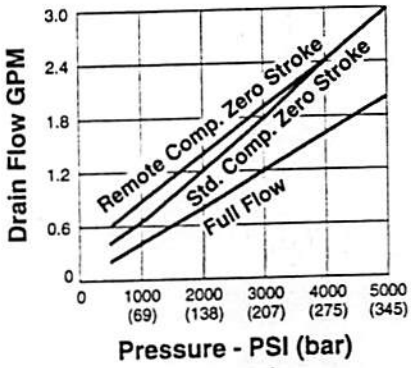
$$HP = \left[\frac{Q \times (PSI)}{1714}\right] + \text{Compensated HP}$$

PHP60 Inlet Characteristics



Nominal Case Drain Flow

1800 RPM



Ordering Information

Variable Volume Piston Pumps
Series PHP60

	PHP	60											
Multiple Pumps	Pump Variable Piston	Series & Size	Pressure Range	Shaft	Port Location	Rotation	Volume Stop Option	Thru-Shaft Threads	Thru-Shaft Option	Control Option	Seals	Paint	Multiple Pumps

Code	Pressure Range
50	350-5000 PSI*

* Minimum value of pressure range only applies on control option "omit" code.

Code	Maximum Displacement CC's/REV. (Cu.In's/Rev.)
60	60 (3.7)

Code	Multiple Pumps
Omit	Single Pump
—	Factory Mounted To Rear Of Another Pump

Code	Shaft	Pilot
Omit	1-1/4" Keyed (SAE C) x 2.19" Lg.	SAE C
B	14T Spline (SAE C)	SAE C
C	1-1/2" Keyed (SAE CC) x 2.44" Lg.	SAE C
D	17T Spline (SAE CC)	SAE C
K*	32mm Keyed	Metric

* Available with 8 port option only.

Code	Port Location	Port Type
2	Side - Flange (Inch Thds.)	SAE
8	Side - Flange (Metric Thds.)	ISO 6149

Rotation *	
R	CW
L	CCW

* As viewed from shaft end.

Code	Vol. Stop Option
Omit	No Volume Stop
2	Adj. Max. Vol. Stop

Code	Thru-Shaft Threads
Omit	No Thru-Shaft
6*	UNC
9**	Metric

* Available with 2 port option only.

** Available with 8 port option only.

Code	Thru-Shaft Option
Omit	No Thru-Shaft
A4	SAE A Pilot/SAE A 9T Spline
B3	SAE B Pilot/SAE B 13T Spline
B4	SAE B Pilot/SAE BB 15T Spline
C3	SAE C Pilot/SAE C 14T Spline

Code	Control Options
Omit	Press. Compensated
M	Remote Pressure (Int.)
ME	Remote Pressure (Ext.)
A	Pressure and Flow
HLM	Remote Pressure & HI/Lo HP
HLA	Pressure, Flow & HI/Lo HP

Code	Seals
Omit	Buna N
V	Fluoroelastomers*

* "FLUOROELASTOMERS are available under various registered trademarks, including VITON (a registered trademark of DuPont) and FLUOREL (a registered trademark of 3M)."

Code	Paint Option
Omit	Not Painted
P	Painted

Code	Multiple Pumps
Omit	Single Pump
—	Pump Factory Mounted On Rear

General Description

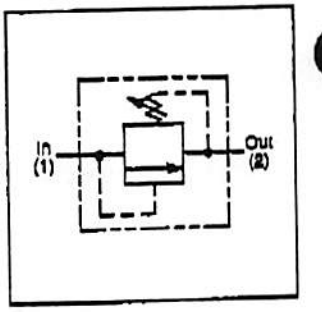
The RAH101 Series, Pilot Operated, Spool-Type Relief Valves are suited for continuous duty applications and are primarily used to limit main system pressure.

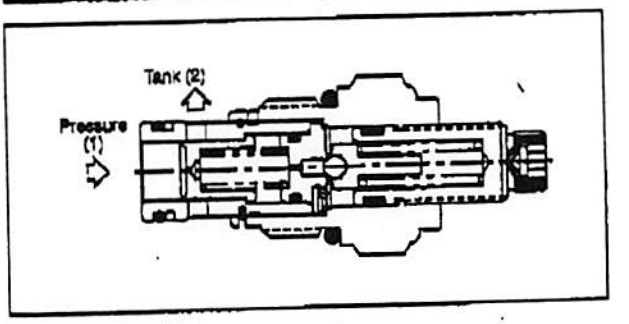
Operation

When inlet pressure exceeds the valve setting, the pilot section opens. This pilot flow creates a pressure imbalance across the main section causing the valve to open, permitting relief flow to tank.

Features

- Low override curve
- Ball-type pilot for added stability
- High accuracy - pilot operated design
- Hardened, precision ground parts for durability
- Compact size for reduced space requirements
- All external parts have yellow zinc dichromate. This coating allows them to withstand a 200 hour salt spray test.



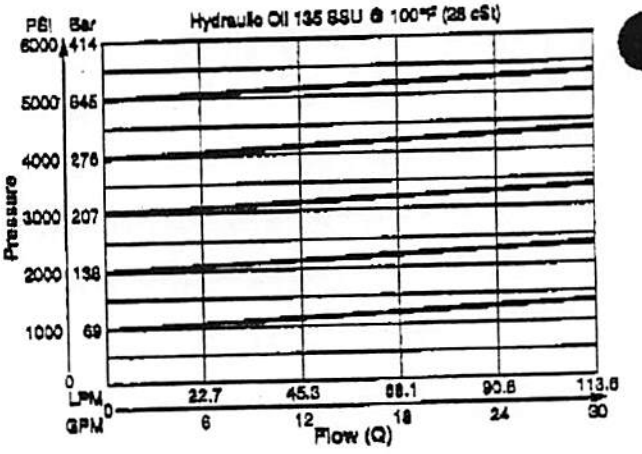


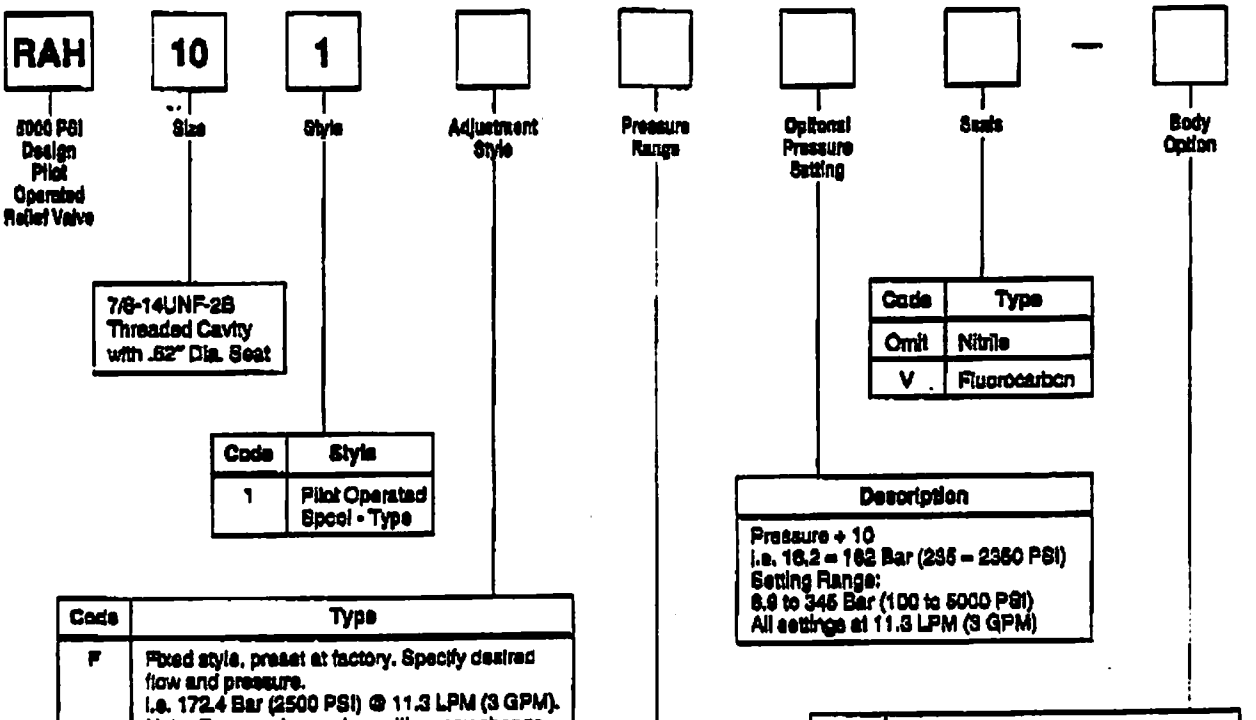
Specifications

Rated Flow	112.5 LPM (30 GPM)
Maximum Inlet Pressure	380 Bar (5500 PSI) - Steel 210 Bar (3000 PSI) - Aluminum
Maximum Setting Pressure	345 Bar (5000 PSI) - Steel 210 Bar (3000 PSI) - Aluminum
Reseat Pressure (Valve returns to non-relieving mode)	80% of crack pressure
Operating Temp. Range (Ambient)	-40°C to +93.3°C (Nitrile) (-40°F to +200°F) -31.7°C to +121.1°C (Fluorocarbon) (-25°F to +250°F)
Cartridge Material	All parts steel. All operating parts hardened steel.
Body Material	Steel or Aluminum
Filtration	ISO Code 16/13, SAE Class 4 or better
Mounting	No restrictions
Cavity	Common Cavity No. C10-2

Performance Curve

Flow vs. Inlet Pressure
(Pressure rise through cartridge only)





7/8-14UNF-2B Threaded Cavity with .62" Dia. Seat

Code	Style
1	Pilot Operated Spool - Type

Code	Type
Omit	Nitrile
V	Fluorocarbon

Description
Pressure ÷ 10 i.e. 16.2 = 162 Bar (235 = 2350 PSI) Setting Range: 6.9 to 345 Bar (100 to 5000 PSI) All settings at 11.3 LPM (3 GPM)

Code	Type
F	Fixed style, preset at factory. Specify desired flow and pressure. i.e. 172.4 Bar (2500 PSI) @ 11.3 LPM (3 GPM). Note: For any given valve setting, any change in flow will cause a change in pressure.
K	Knob Adjust
S	Screw Adjust
T	Tamper Resistant Cap

Code	Type
10	6.9 - 69 Bar (100 - 1000 PSI) Standard Setting: 34.5 Bar (500 PSI) @ 11.3 LPM (3 GPM)
20	6.9 - 138 Bar (100 - 2000 PSI) Standard Setting: 69 Bar (1000 PSI) @ 11.3 LPM (3 GPM)
30	6.9 - 207 Bar (100 - 3000 PSI) Standard Setting: 103.5 Bar (1500 PSI) @ 11.3 LPM (3 GPM)
50	6.9 - 345 Bar (100 - 5000 PSI) Standard Setting: 172.4 Bar (2500 PSI) @ 11.3 LPM (3 GPM)

Code	Port Size & Material	
Omit	Cartridge Only	
4P	1/4" NPTF (B10-2-4P)	Steel
A4P	1/4" NPTF (B10-2-A4P)	Aluminum
6P	3/8" NPTF (B10-2-6P)	Steel
A6P	3/8" NPTF (B10-2-A6P)	Aluminum
8P	1/2" NPTF (B10-2-8P)	Steel
A8P	1/2" NPTF (B10-2-A8P)	Aluminum
6T	SAE-6 (B10-2-6T)	Steel
A6T	SAE-6 (B10-2-A6T)	Aluminum
8T	SAE-8 (B10-2-8T)	Steel
A8T	SAE-8 (B10-2-A8T)	Aluminum
4B	1/4" BSPG (B10-2-4B)	Steel
A4B	1/4" BSPG (B10-2-A4B)	Aluminum
6B	3/8" BSPG (B10-2-6B)	Steel
A6B	3/8" BSPG (B10-2-A6B)	Aluminum
8B	1/2" BSPG (B10-2-8B)	Steel
A8B	1/2" BSPG (B10-2-A8B)	Aluminum

NOTE:
If system pressure does not exceed 210 Bar (3000 PSI), aluminum bodies can be used. Higher pressures require steel bodies.

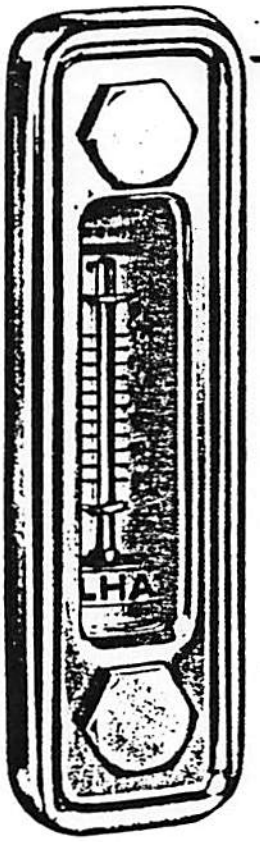
SERVICE PARTS
Knob Option: 852605 & 852634
(To convert screw adjust to knob adjust)
Nitrile Seal Kit: SK10-2
Fluorocarbon Seal Kit: SK10-2V

Shipping Weight
Cartridge Only .23 kg (.50 lbs.)
Cartridge in Body .68 kg (1.5 lbs.)

LHA

Fluid Level Gauges

GASKET MOUNTED



FEATURES

- Gasket mount style
- With or without thermometer
- 2x magnifier lens
- Centigrade and Farenheit scale thermometer
- 5" Mounting bolt centres (maximum ½" wall thickness)

SPECIFICATIONS

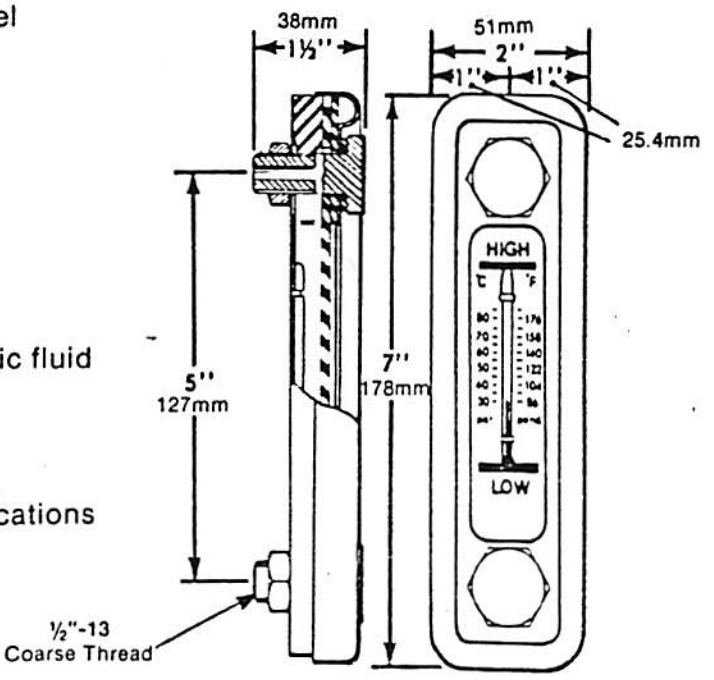
MATERIAL

FRONT PLATE Chrome plated steel

LENS: Acrylic

BOLTS: Aluminum

SEALS: Buna 'N'



COMPATIBILITY:
Mineral & petroleum base hydraulic fluid

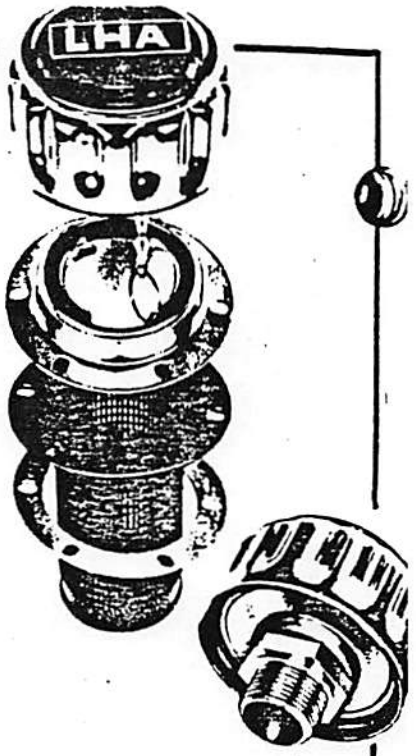
RECOMMENDED FOR:

UCC, Hydrocraft replacement applications

Ordering Information

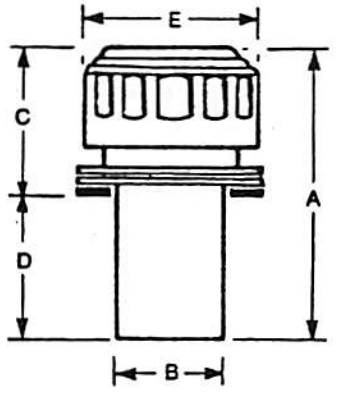
Part Number	Temperature Option	Mounting Bolt Spacing
LHA-121	No	5" 127mm
LHA-121T	Yes	5" 127mm

LHA Filler Breathers

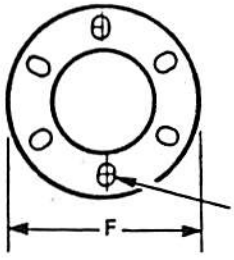


SPECIFICATIONS:

- Chrome plated steel cap
- 30 Mesh synthetic filler basket
- Cork impregnated rubber gaskets
- Self-tapping screws for flange mount

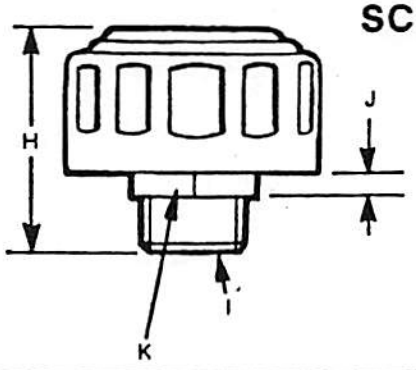


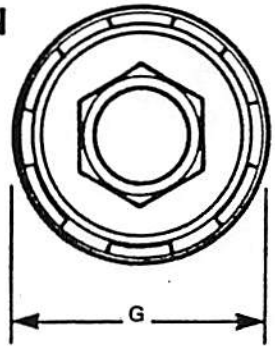
BAYONET FLANGE TYPE



6- #10-32 Tapping Screws on a 2.8" Bolt Circle

SCREW-IN





Technical and Dimensional Details

Mounting Style	Air Filtration Nominal Level	Media	Air Flow Capacity	Oil Transfer Rate	Bayonet Flange A	B	C	D	E	F	Screw-In G	H	I	J	K
ABB, ABS, PBB	40 Micron	Foam	25 CFM	192 GPM	6.1	1.9	2.3	3.8	3.0	3.25	3"	2.6	1/2"	3"	1.38
ABB, ABS, PBS	40 Micron	Foam	15 CPM	175 GPM	6.1	1.9	2.3	3.8	3.0	3.25	3"	2.6	1/2"	3"	1.38
ABM	40 Micron	Foam	10 CFM	72 GPM							1.8	2.2	1/2"	3"	0.6
ABM	10 Micron	Foam	5 CFM	36 GPM							1.8	2.2	1/2"	3"	0.6

Ordering Information

AB B — 40 — N

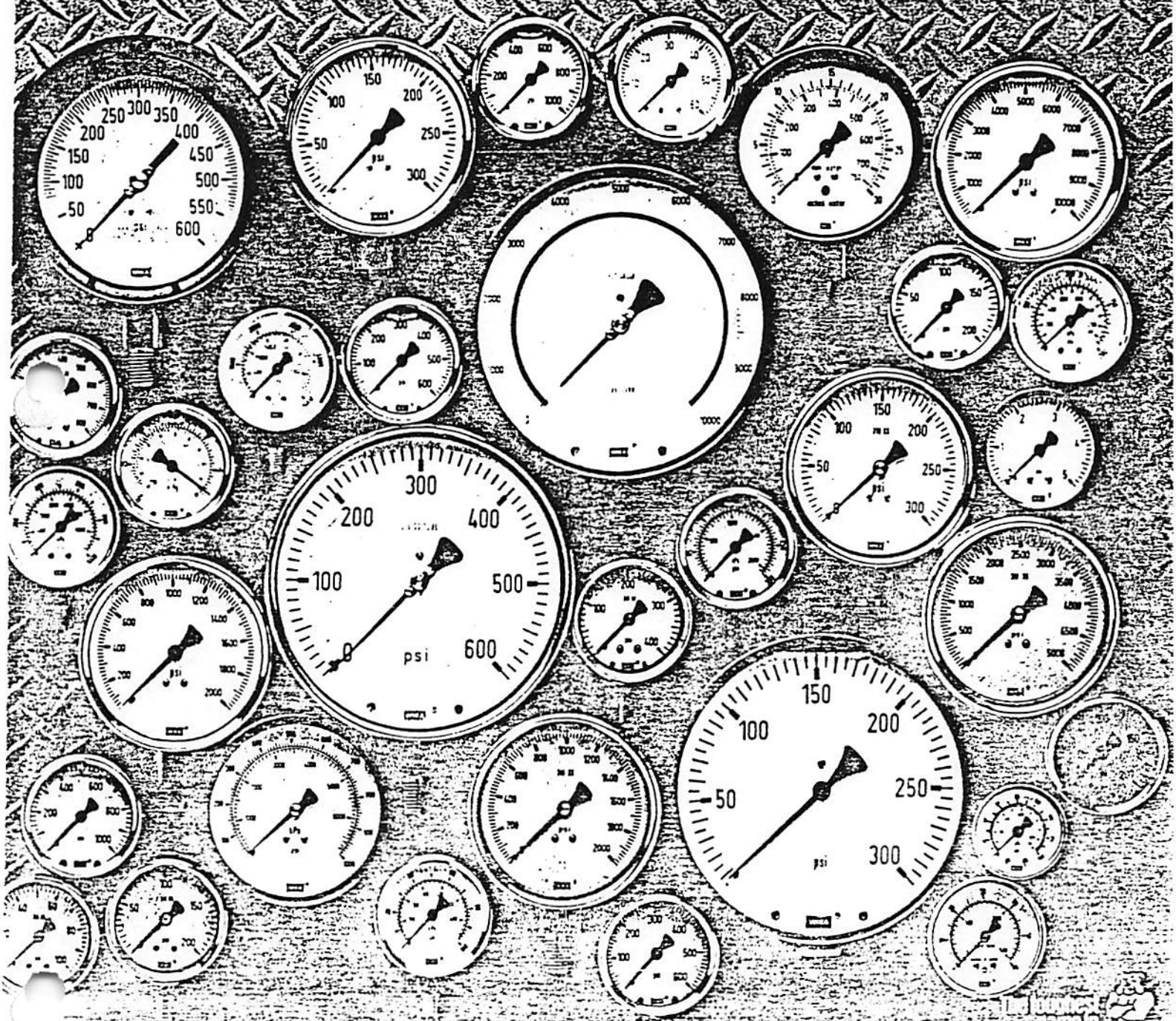
Mounting Style	
PB	Bayonet
SB	Screw-In
M	Mini

Micron Rating	
40	40 Micron
10	10 Micron

Bayonet Style Basket	
N	3.8 Nylon
BS	4 Stainless Steel
AS	3 Stainless Steel
ABS	3 Stainless Steel

WIKA

Specifier's Guide



Parker
Fluidpower

Parker Spin-On Filters

Types 12AT and 50AT

Bulletin 2319, June, 1985

For In-Line Filtration up to 10 bar (150 psi) Rated Static Pressure.

- Spin-On disposable canister.
- Full-flow filtration up to bypass valve cracking pressure.
- Flow rates up to 190 lpm (50 gpm).
- Available with or without bypass valve.
- Adaptor kits allow canisters to be used as reservoir filter/breathers.

Types 12AT and 50AT Spin-On Filters

Low Cost Protection

Parker Spin-On Filters provide economical protection of hydraulic systems by removing particles as small as three micrometres from the fluid. They consist of a die-cast aluminum head and mass-produced spin-on canister to keep costs low. The risk of fluid contaminants causing component failure is dramatically reduced with the addition of a Model AT Filter on your equipment. Reservoir adaptor kits allow canisters to be used as filter/breathers, removing particles as small as one micron from air.

Applications

Parker Spin-On Filters may be used with most hydraulic and lubricating fluids. Since they are equipped with only buna nitrile seals, **these filters cannot be used with phosphate ester type fluids.** Consult the factory for further information on fluid compatibility.

Return lines are a common application for Parker Spin-On Filters. Depending on filter selected and fluid conditions, they can handle flow up to 50 gpm. For these applications either the 15 psid or 25 psid bypass valve is selected as determined by allowable return line pressure.

Caution: Be sure to consider the maximum flow rate of oil discharging to the reservoir. Hydraulic cylinders with large piston-to-rod area ratios can cause return flow to be 2-5 times the maximum pump flow. Spin-On Filters may be damaged by such flow surges.

Suction line filtration using a Model AT Filter provides last chance protection for the pump. For such applications, the 3 psid bypass is used for most open loop systems.

Caution: To avoid possible damage to your pump, observe the manufacturer's recommendation for maximum safe inlet pressure drop.

Hydrostatic transmissions frequently use Parker Spin-Ons for charge pump inlet filtration. Equipped with the 10C element and no-bypass type valve, our filters meet the recommendations of most hydrostatic transmission manufacturers for charge pump filtration.

Reservoir filter/breathers are important contaminant control devices for hydraulic and lube oil systems.

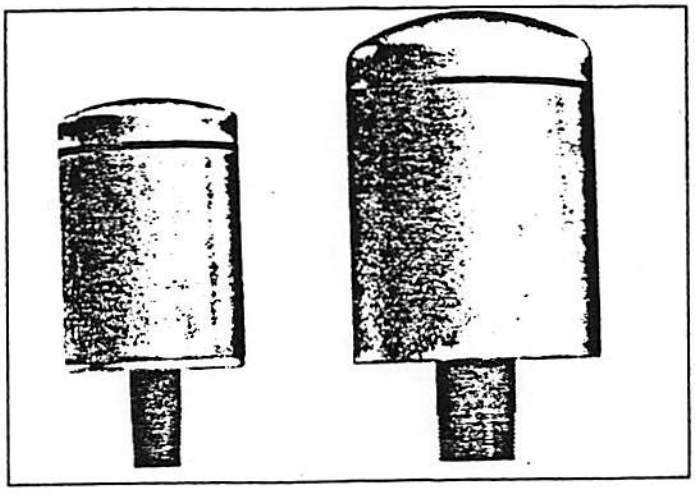


Figure 1. Typical Breather Application

They reduce the amount of airborn contaminants entering the reservoir, keep the fluid cleaner, and cut down on element replacement for hydraulic system filters.

Model AT Canisters can be used as filter/breathers by using the Parker Breather Adaptor Kit described on page seven. As a filter/breather, the Parker 03C Spin-On Canister is 99% efficient removing airborn particles, one micrometre and larger.

Case drains are often overlooked, and return highly contaminated fluid to the reservoir. Variable displacement pumps deserve special consideration. In the fully compensated mode (zero system flow), variable pumps return up to 10% of rated flow back to tank with wear debris contamination. Further, no filtration is taking place in other system filters during zero flow conditions. This allows contaminant to build up rapidly in the reservoir leading to premature pump failure.

Spin-On Filters are an inexpensive solution to this problem. Equipped with a 3 psid bypass valve, they limit case drain back pressure to a safe value. (Most pump manufacturers allow up to 10 psid back pressure.) Since pump wear debris has a relatively large number of small particles, Parker recommends either the 10C or 03C media for such applications.

How to order filters

Types 12-AT and 50-AT

Select the feature you want from each of the eight boxes below. Put the selected symbol for each feature you want, in proper order, to develop a model code number. See the example below.

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9 (Assigned By Parker)
	50	AT	10C	N	15	DD	LI	

BOX 1: SEALS

Symbol	Description
None	Buna (Standard)

BOX 2: SIZE

Symbol	Approx. Flow
50	190 lpm (50 gpm)
12	76 lpm (20 gpm)

BOX 3: TYPE

Symbol	Description
AT	Spin-On

BOX 4: ELEMENTS

Symbol	Beta (10) Ratio*
03C	23.00
10C	2.00
25C	1.10

*See Table 1 for B_x 2/20/75 ratings.

BOX 5: INDICATOR

Symbol	Description
N	None

(See accessories for indicator gage and switches.)

BOX 6: BYPASS SETTING

Symbol	Description
25	25 psid (for return lines)
15	15 psid (optional)
3	3 psid (for suction lines)
X	No-bypass (for hydrostatic charge pump inlet)

BOX 7: PORTS

Symbol	Description
50AT	
DD	1-1/4" NPTF
OO	SAE-20
12AT	
BB	3/4" NPTF
MM	SAE-12

REPLACEMENT ELEMENTS

Symbol	Canister Part No.
50AT-03C	926541
50AT-10C	926169
50AT-25C	926170
12AT-03C	926543
12AT-10C	921999
12AT-25C	925023

Note: Parker canisters may be used to replace many different brands. See Parker Filter Element Interchange Chart 2303-INT. Request a copy from your Parker Representative.

BOX 8: MODIFICATIONS

(Gage port location, looking from inlet towards outlet.)

Symbol	Description
N	None
LI	Left Side, Inlet (Standard Option)
LO	Left Side, Outlet (Optional with purchase of 100 or more units.)
RI	Right Side, Inlet (Optional with purchase of 100 or more units.)
RO	Right Side, Outlet (Optional with purchase of 100 or more units.)

BOX 9: DESIGN NUMBER

Assigned by Parker. Use full model code when ordering parts.

ACCESSORIES: (See pages 6 & 7 for specifications, dimensions, etc.)

INDICATOR GAGE	923472
PRESSURE SWITCH	926923
VACUUM SWITCH	926949
50AT BREATHER ADAPTOR KIT	926875
12AT BREATHER ADAPTOR KIT	926876

ker Hannifin Corp.
r Division
)d10 Fulton County Road #2
Metamora, Ohio 43540
(419) 644-4311

Parker Fluidpower

Specifications

Flow Capacity:
- 12-AT ..... 68 lpm (18 gpm)
- 50-AT ..... 190 lpm (50 gpm)

Rated Static Pressure ..... 10 bar (150 psi)

Operating Temperatures ....-40° C (-40° F) to 107° C (225° F)

Approximate Weights:

Complete Filter:
- 12-AT ..... 1.0 kg (2.2 lbs.)
- 50-AT ..... 2.8 kg (6.2 lbs.)

Canister Only:
- 12-AT ..... 0.5 kg (1.1 lb.)
- 50-AT ..... 0.9 kg (2.0 lb.)

lia .... Phenolic Impregnated Cellulose (See Table 1 for β_x = 2/20/75 rating)

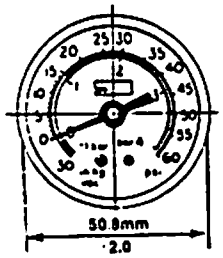
s ..... Buna N, 70 DUR.

Gage (Optional) ..... Compound Type, -30" Hg/0/60 psi

Pressure Switch (Optional) ..... Trips at 30 ± 3 psi. Contacts rated 12VDC, 1.0 amp.

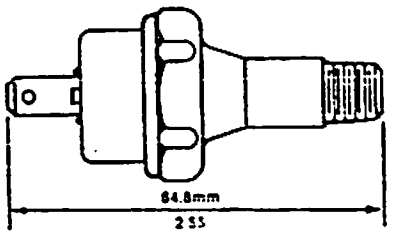
Vacuum Switch (Optional) ..... Trips at 5" ± 1" Hg. Contacts rated 12VDC, 1.0 amp.

Tolerances	± 3.0 mm / ± 0.12
Linear Measure -	Millimetre / Inch



INDICATOR GAGE DETAIL

PRESSURE/VACUUM SWITCH DETAIL



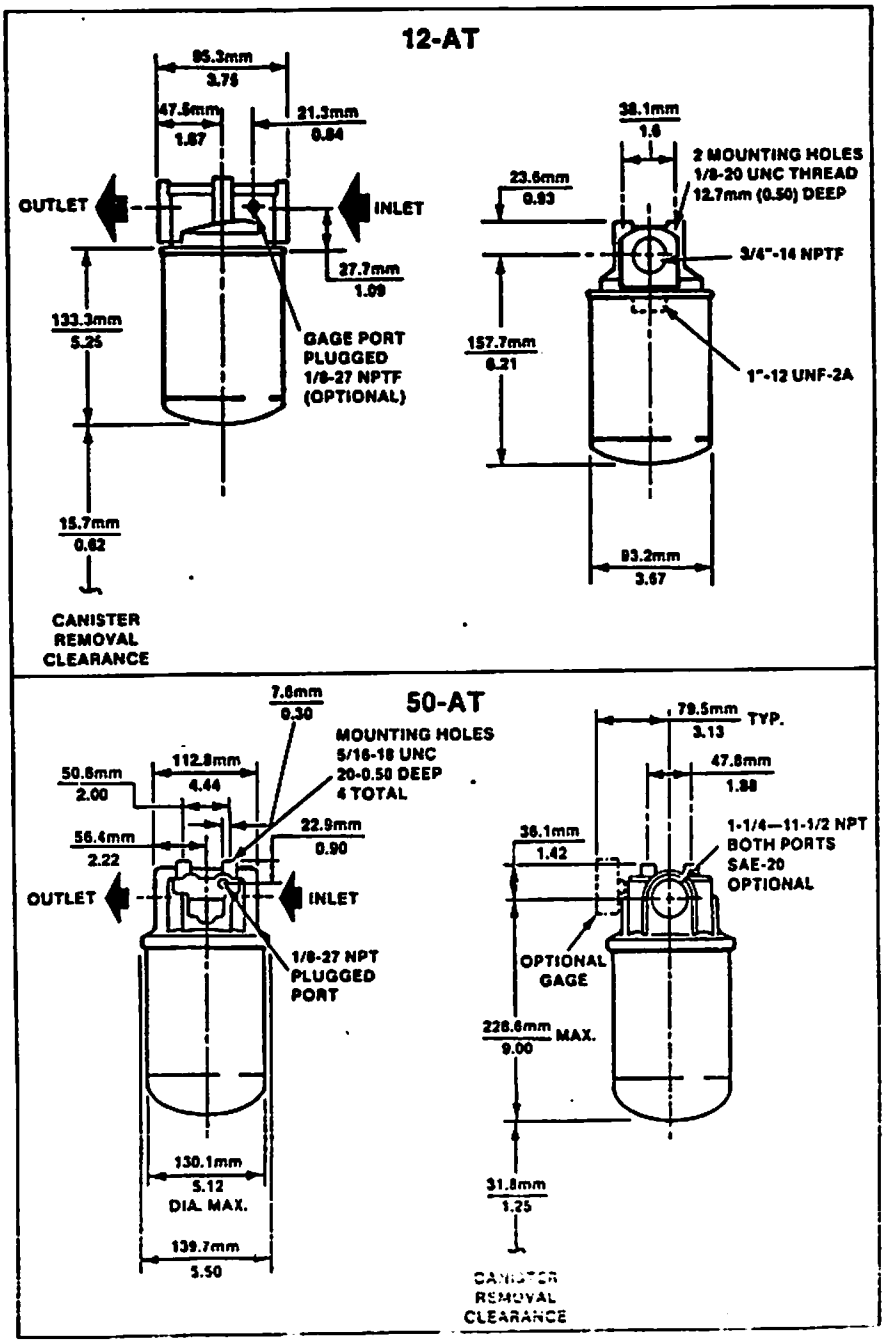
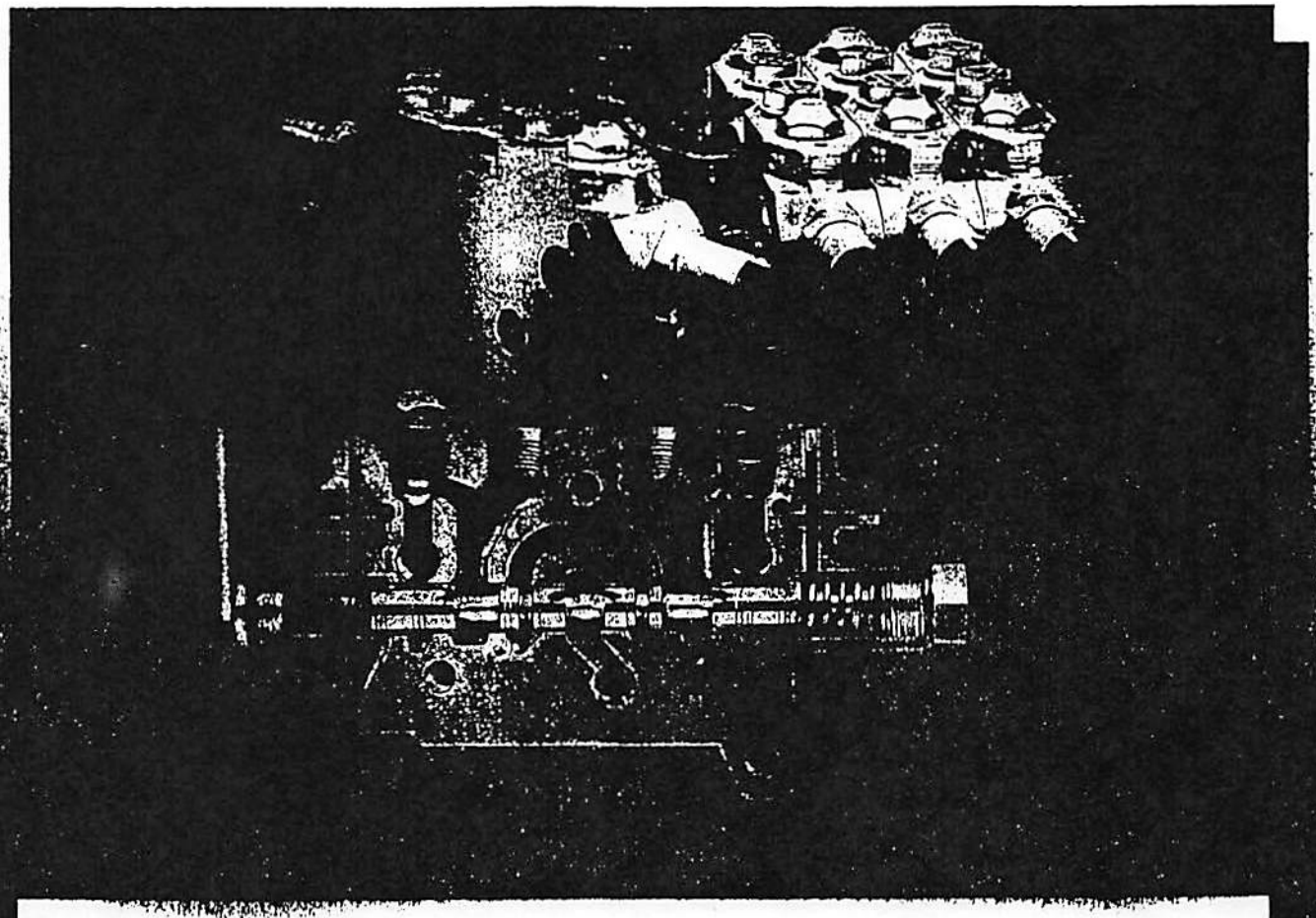


Figure 3. Installation Dimensions

MANUAL DIRECTIONAL CONTROL VALVE



MODEL: VML SERIES

Manual Directional Control Valve

This non-compensated manual control valve is fully combinable with today's VPL Series products. Combination stacks are available combining VPL with VP/VPO Series products.

FEATURES

- Interchangeable spools.
- Relief with anticavitation check.
- 3 position detent.
- Interchangeability with existing compensated VPL Series product.
- Infinite position friction lock.
- Adjustable flow stops.
- Manifold port options available.
- Integral load sense logic.

BENEFITS

- Allows for reduced product inventory.
- Provides manual proportional control.
- Allows for shock and over pressure protection.
- Provides flexibility for a more cost effective application.
- Provides greater control of flow.
- Product flexibility offers unlimited possibilities.
- Compatible with any pump type; fixed or variable.
- Stackable with VPL Series product.
- Lower cost manual control.

VML SERIES MANUAL WORKING SEGMENT (NON-COMPENSATED)

V M L * * * * - * * * * - * * * * *

Spool Operation
Manual Control

Spool Flow Rating
A - 1.5 GPM/5,6 LPM
1 - 2.5 GPM/9,5 LPM
2 - 4.5 GPM/17,0 LPM
3 - 9.0 GPM/34,0 LPM
4 - 14.0 GPM/53,0 LPM
5 - 26.0 GPM/98,5 LPM

For different C1/C2 flows — Consult Factory

Cylinder Port Configuration
2 - Closed cylinder ports (CC)
3 - C1 port closed, C2 port (VOC)
4 - Open cylinder ports (OC-Motor)
7 - Vented open cylinder ports (VOC)

Flow Directions
3 - 3 way, C1 flow
4 - 4 way, C1 and C2 flow

Spool Positions*
1 - 2 Pos., Flow Adjustment on C1
2 - 2 Pos., No Flow Adjustments
3 - 3 Pos., No Flow Adjustments
4 - 3 Pos., Flow Adjustments on C1 and C2
5 - 3 Pos., Flow Adjustment on C1
6 - 3 Pos., Flow Adjustment on C2
A - 3 Pos., Detent C1, C2, and Center***
B - Infinite Position Friction w/Center Detent

Pilot Control
0 - None

Section Pressure Compensator
1 - Non-compensated

Manual Override
3 - Manual Operator Shaft only
4 - Manual Operator with Adapter & 6" handle
5 - Manual Operator with Adapter only
6 - Marine Adapter only
7 - Marine Adapter with 6" handle

Design Level
4 - SAE ports
5 - BSPP ports
6 - JIS-G ports
7 - Manifold Mount**

C1 Cylinder Port Option
0 - None, no port cavity
2 - Relief w/anticavitation
3 - Anticavitation Check
6 - Defeat Plug

C2 Cylinder Port Option
0 - None, no port cavity
2 - Relief w/anticavitation
3 - Anticavitation Check
6 - Defeat Plug

C1 Pressure (see table)

C2 Pressure (see table)

Packaging
(blank) - segment subassembly
P - package

RELIEF VALVES ARE NON-ADJUSTABLE

PRESSURE SETTING TABLE

CODE	PSI	BAR	CODE	PSI	BAR
A	750	50	L	3050	210
B	950	63	M	3350	230
C	1150	80	N	3650	250
D	1450	100	P	4050	280
F	1850	125	R	4350	300
G	2050	140	S	4650	320
H	2350	160	T	5050	350
J	2550	175	O	N/A	N/A
K	2750	190			

* Flow adjustments may be used to override main spool
** Consult Factory for Bolt-On Manifolds
*** Not available with flow adjustment options

For additional stacking information refer to VPL Technical Brochure, PMF 1018 REV 12-97

NOTE: Consistent with our policy of continuing product improvement, we reserve the right to change this information without notice or obligation

DISTRIBUTED BY:

AS9003 ISO 9001
Fluid Power Systems

Fluid Power Systems
595 Scheiter Road
Lincolnshire, Illinois 60090
847/821-9478 Fax: 847/821-9621
a division of Fluid Power Industries, Inc.

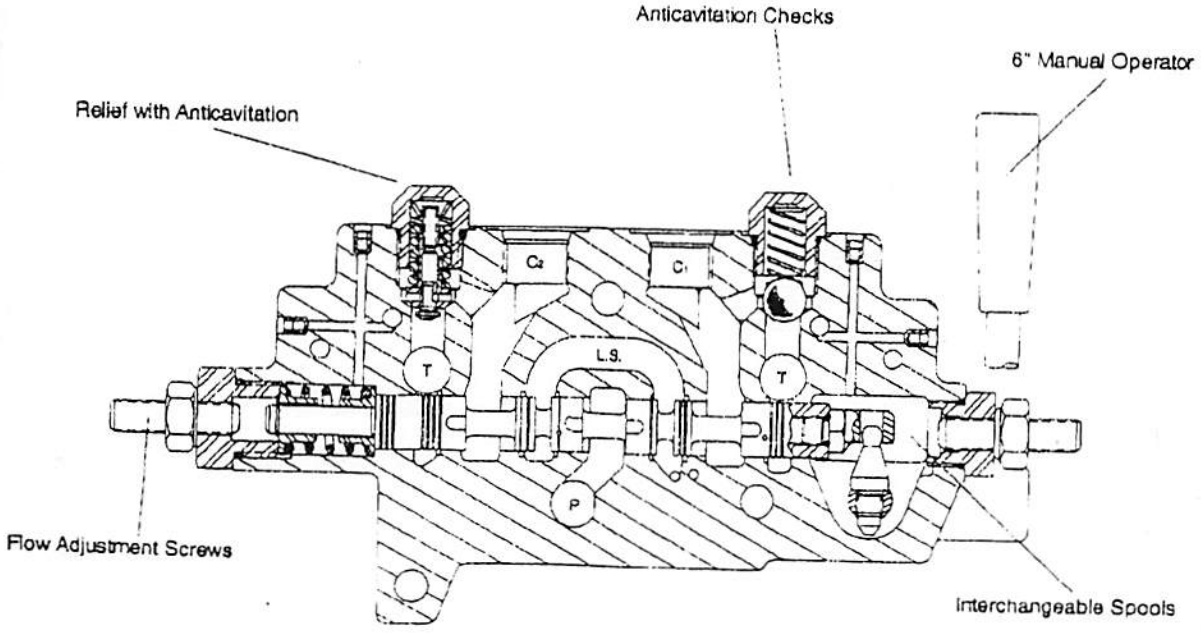
Fluid Power Systems

VML General Specifications

Operation pressure:

Pressure supply port	5000 psi (350,0 bar).
Cylinder ports	5800 psi (400,0 bar).
Tank ports	200 psi (14,0 bar).
Maximum inlet flow	50 gpm (190 L/min).
Spool flow ratings	1.5, 2.5, 4.5, 9, 14, 26 gpm (5.7, 9.5, 17, 34, 53, 98 L/min).
Spool/cylinder port configuration	Closed, vented-open, open (motor).
Spool deadband	25% of stroke.
C_1 C_2 leakage (per section)	0.006 gpm (20 ml/min) at 1000 psi (69,0 bar) 150 SUS (30 cSt).
Recommended filtration	SAE Class 5 (17/14 - ISO 4406).
Fluid temperature range	-40°F to 195°F (-40°C to 90°C).
Maximum fluid temperature	250°F (121°C).
Ambient temperature range	-40°F to 190°F (-40°C to 88°C).
Fluid viscosity range	1500 to 30 SUS (323 to 1.1 cSt).
Seal material	Buna-N.
Mounting attitude	Unrestricted.
Weight (approximate)	10.0 lbs. (4.5 kg) work segment.

VML Manual Valve – Options

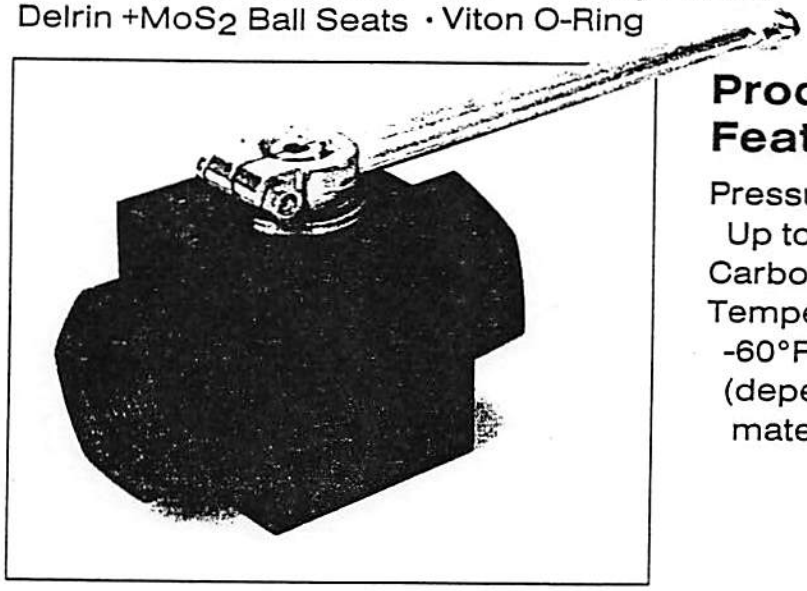


STAUFF® Two-Way Valves

BLOCK BODY, THREADED CONNECTORS

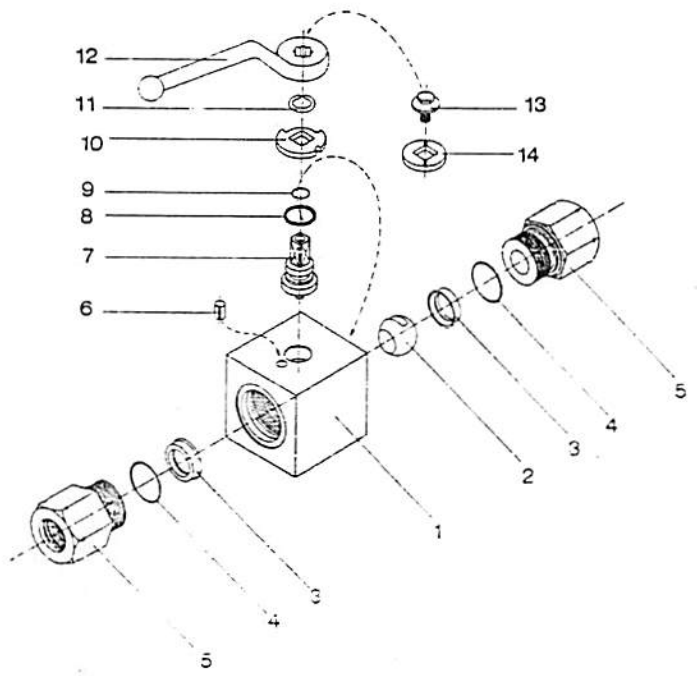
Description

Two-Way Shut off Valve • 1/8" - 1" Fully Ported • NPT OR SAE 'O' Ring Connectors
Delrin +MoS_2 Ball Seats • Viton O-Ring



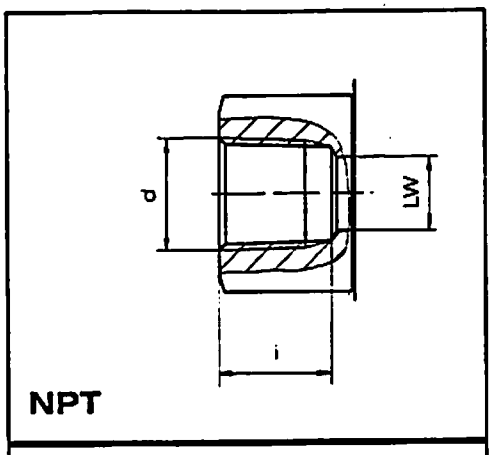
Product Features

Pressure Range:
Up to 9100 PSI
Carbon Steel Construction
Temperature Range:
-60°F to 400°F
(depending on
material combinations)

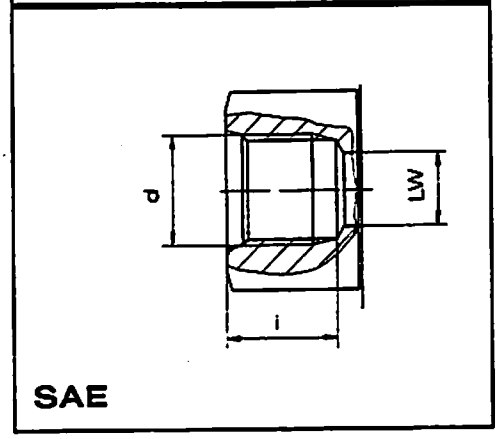


Item Number	Quantity	Description
1	1	Housing
2	1	Ball
3*	2	Seat
4*	2	Connector O - Ring
5	2	Connector
6	1	Stop Pin
7	1	Stem
8*	1	Thrust Ring
9*	1	Stem O - Ring
10	1	Cam Plate
11	1	Snap Ring
12	1	Handle
13	1	Stem Screw
14	1	Flow Indicator

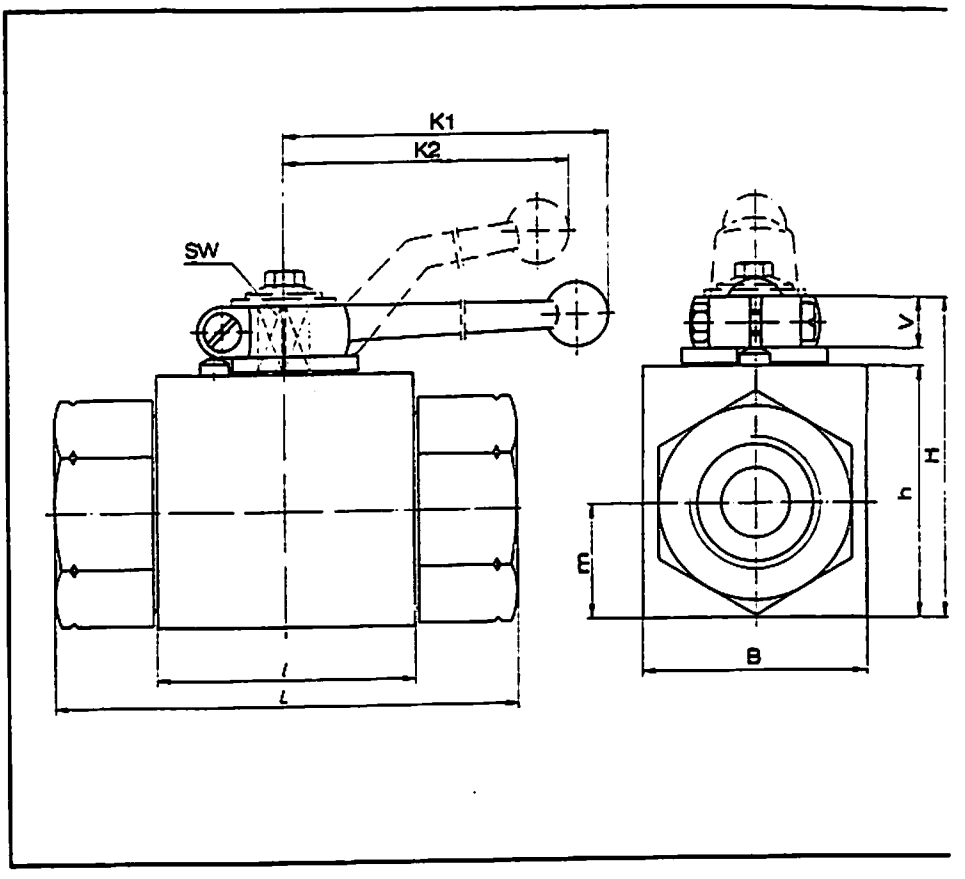
*Included in Seal Kit



NPT



SAE



Dimension

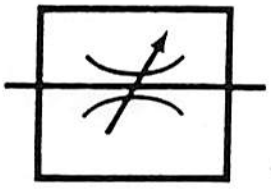
Size	d NPT	d SAE	i NPT	i SAE	L NPT	L SAE	l	B	H	h	m	V	SW (mm)	K_1	K_2	Weigh (Lbs)
1/8"	1/8-27	-	0.51	-	2.72	-	1.57	1.02	1.85	1.30	0.53	0.43	7	5.91	4.53	0.50
1/4"	1/4-18	7/16-20	0.67	0.67	2.72	2.72	1.57	1.02	1.85	1.30	0.53	0.43	9	5.91	4.53	0.66
3/8"	3/8-18	9/16-18	0.69	0.61	3.07	2.83	1.69	1.02	2.05	1.50	0.69	0.43	9	5.91	4.53	1.10
1/2"	1/2-14	3/4-16	0.93	0.69	4.09	3.27	1.89	1.38	2.13	1.57	0.75	0.55	9	5.91	4.53	1.65
3/4"	3/4-14	11/16-12	0.91	0.91	4.02	3.74	2.44	1.93	2.95	2.24	0.9	0.55	14	7.87	6.81	3.65
1"	1-11 1/2	15/16-12	1.09	0.91	4.69	4.45	2.60	2.28	3.27	2.56	1.15	0.55	14	7.87	6.81	5.06

SIZE		PART NUMBER	MAXIMUM WORKING PRESSURE	ACTUATOR CODE * DA	SR
1/8"	NPT	BBV20020001M	9100 PSI	A	B
	SAE	BBV21020001M	9100 PSI	A	B
1/4"	NPT	BBV20040001M	9100 PSI	A	B
	SAE	BBV21040001M	9100 PSI	A	B
3/8"	NPT	BBV20060001M	7250 PSI	A	B
	SAE	BBV21060001M	7250 PSI	A	B
1/2"	NPT	BBV20080001M	7250 PSI	A	B
	SAE	BBV21080001M	7250 PSI	A	B
3/4"	NPT	BBV20120001M	5000 PSI	B	C
	SAE	BBV21120001M	5000 PSI	B	C
1"	NPT	BBV20160001M	5000 PSI	B	C
	SAE	BBV21160001M	5000 PSI	B	C

* See Actuator Code on Page 39

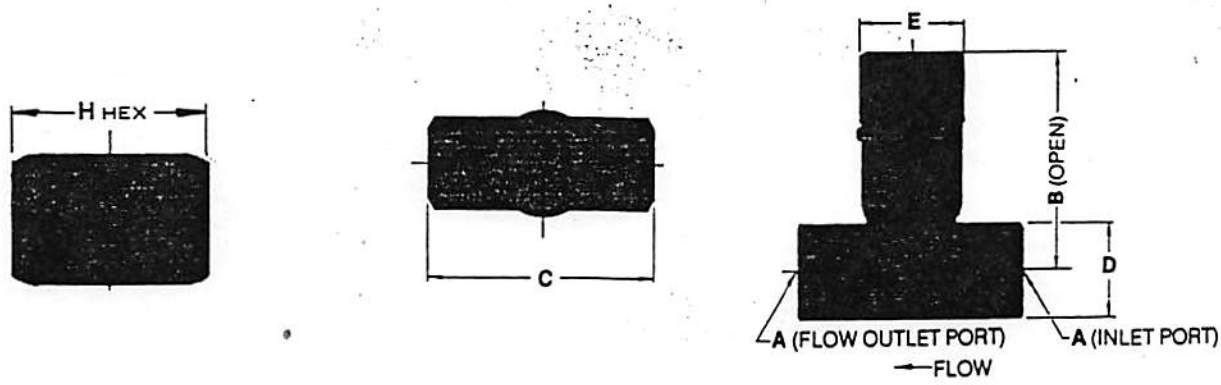
SERIES N

Series N Needle Valves



MODEL NUMBER	MAX. FLOW GPM	*L/M*	DIMENSIONS — Inch *(mm)* A	B	C	D	E
N 200	3	*(11)*	1/8-27 NPTF	1.54 *(39.1)*	1.500 *(38.1)*	.625 *(15.9)*	.75 *(19.1)* †
N 400	5	*(19)*	1/4-18 NPTF	1.79 *(45.5)*	2.000 *(50.8)*	.812 *(20.6)*	.81 *(20.6)* †
N 620	5	*(19)*	#6 SAE 9/16-18 UNF	1.84 *(46.3)*	2.375 *(60.3)*	1.000 *(25.4)*	.81 *(20.6)* †
N 600	8	*(30)*	3/8-18 NPTF	2.18 *(55.4)*	2.500 *(63.5)*	1.000 *(25.4)*	1.00 *(25.4)* †
N 820	8	*(30)*	#8 SAE 3/4-16 UNF	2.24 *(56.2)*	3.000 *(76.2)*	1.125 *(28.6)*	1.00 *(25.4)* †
N 800	15	*(57)*	1/2-14 NPTF	2.70 *(68.6)*	2.625 *(66.7)*	1.250 *(31.8)*	1.19 *(30.2)* †
N 1020	15	*(57)*	#10 SAE 7/8-14 UNF	2.68 *(68.1)*	3.500 *(88.9)*	1.250 *(31.8)*	1.19 *(30.2)* †
N 1200	25	*(95)*	3/4-14 NPTF	3.38 *(85.9)*	3.250 *(82.6)*	1.500 *(38.1)*	1.38 *(35.1)* †
N 1220	25	*(95)*	#12 SAE 1-1/16-12 UN	3.38 *(85.9)*	4.000 *(101.6)*	1.500 *(38.1)*	1.38 *(35.1)* †
N 1600	40	*(151)*	1-11-1/2 NPTF	4.87 *(123.7)*	4.250 *(108.0)*	1.750 *(44.5)*	1.88 *(47.8)* ‡
N 1620	40	*(151)*	#16 SAE 1-5/16-12 UN	5.14 *(130.6)*	4.250 *(108.0)*	2.250 *(57.2)*	1.88 *(47.8)* ‡
N 2000	70	*(265)*	1-1/4-11-1/2 NPTF	5.12 *(130.0)*	4.250 *(108.0)*	2.250 *(57.2)*	1.88 *(47.8)* ‡
N 2020	70	*(265)*	#20 SAE 1-5/8-12 UN	5.51 *(140.0)*	4.500 *(114.3)*	2.750 *(69.9)*	1.88 *(47.8)* ‡

† Diameter
‡ Hexagon



Ideal as speed controls on hydraulic and pneumatic systems where a reverse flow check valve is not needed. They provide excellent control and reliable shutoff in a very small envelope.

The two-step needle provides fine adjustment for low flows with the first three turns of the knob, with full-open needle position and conventional throttling with the final three turns. An optional (#4) needle is available for fine metering applications.

Exclusive "Colorflow" color-coded reference scale on the adjusting knob simplifies setting, resetting, adjusting, and quick return to a previous speed setting.

A tamperproof option feature is also available to prevent accidental or intentional adjustment of flow setting.

Maximum Operating Pressure:
Brass: 2000 PSI (140 Bar); except N 1600 Brass is 500 PSI (35 Bar).
Steel: 5000 PSI (345 Bar) for 200 thru 1220; 3000 PSI (207 Bar) for all other sizes.

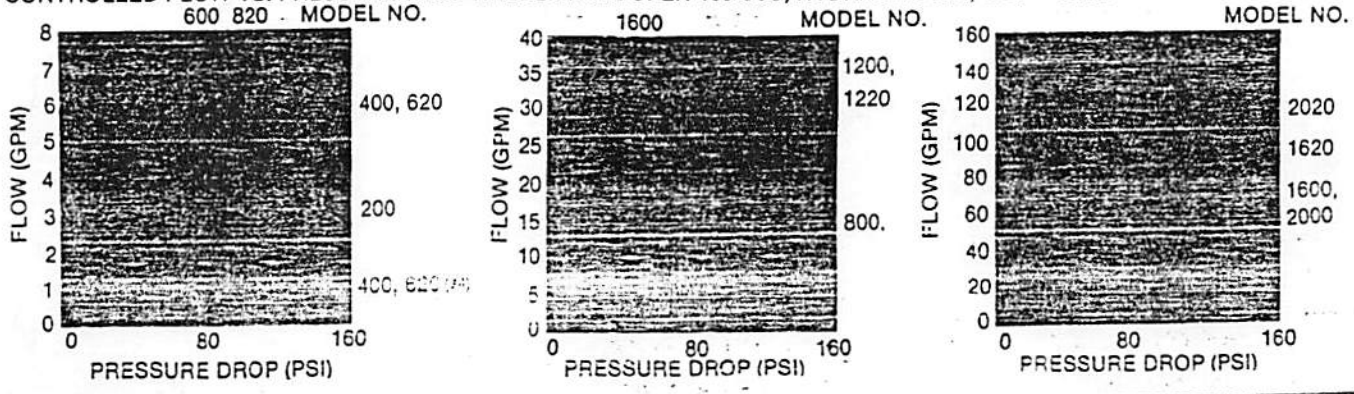
Ordering Information

N	400	S	4	T	V
Series	**Size**	**Material**	**Needle Option**	**Other Options**	**Seal Compound**
N	*200 *400 620 *600 820 *800 1020 *1200 1220 *1600 1620 2000 2020	B = Brass S = Steel Series N Brass Valves can be used for both air and oil service.	Omit = Standard #4 = Fine Metering (200, 400, 620 sizes)	Omit = Standard Knob T = Tamperproof F = Finger Screw	Omit = Nitrile (Standard) V = Viton® (Optional)

*Sizes available in brass

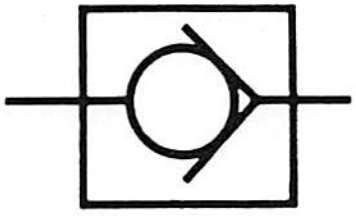
Typical Ordering Nomenclature:
N 400 SV means N Series, Size 400, Steel, Viton®

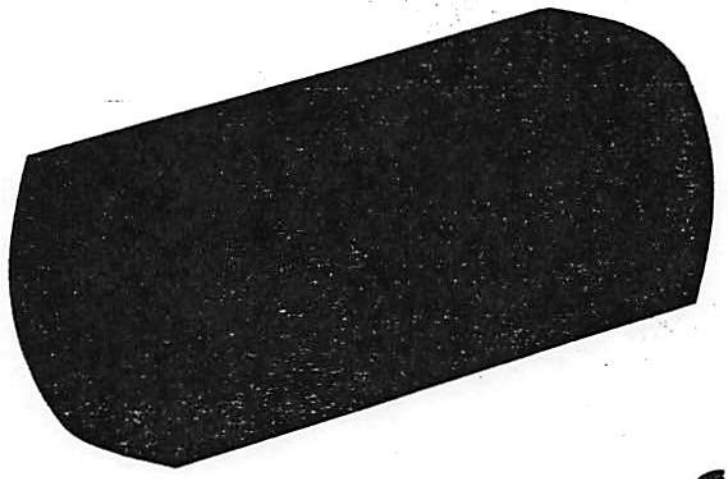
CONTROLLED FLOW VS. PRESSURE DROP NEEDLE FULL OPEN 100 SSU, HYDRAULIC OIL, S.G. = 0.857



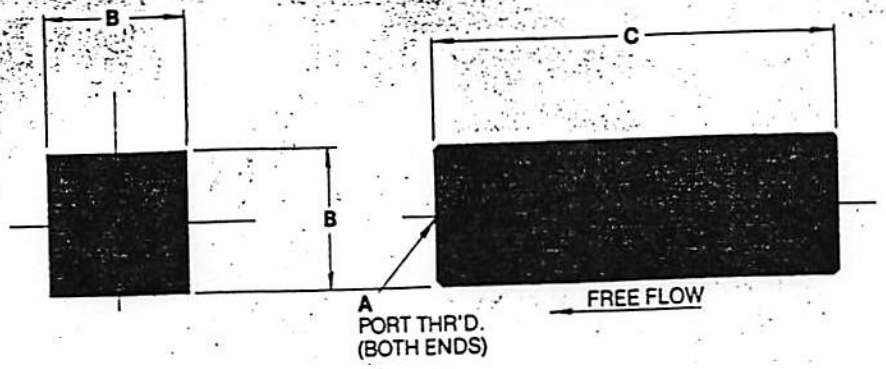
SERIES **C**

Series C Check Valves





MODEL NUMBER	MAX. FLOW GPM	*L/M*	A	DIMENSIONS — Inch *(mm)* B	C
C 200	3	*(11)*	1/8-27 NPTF	.625 *(15.9)*	2.000 *(50.8)*
C 400	5	*(19)*	1/4-18 NPTF	.812 *(20.6)*	2.625 *(66.7)*
C 620	5	*(19)*	#6 SAE 9/16-18 UNF	1.000 *(25.4)*	3.125 *(79.4)*
C 600	8	*(30)*	3/8-18 NPTF	1.000 *(25.4)*	2.750 *(69.9)*
C 820	8	*(30)*	#8 SAE 3/4-16 UNF	1.125 *(28.6)*	3.500 *(88.9)*
C 800	15	*(57)*	1/2-14 NPTF	1.250 *(31.8)*	3.438 *(87.3)*
C 1020	15	*(57)*	#10 SAE 7/8-14 UNF	1.250 *(31.8)*	4.000 *(101.6)*
C 1200	25	*(95)*	3/4-14 NPTF	1.500 *(38.1)*	3.875 *(98.4)*
C 1220	25	*(95)*	#12 SAE 1-1/16-12 UN	1.500 *(38.1)*	4.625 *(117.5)*
C 1600	40	*(151)*	1-11-1/2 NPTF	1.750 *(44.5)*	5.000 *(127.0)*
C 1620	40	*(151)*	#16 SAE 1-5/16-12 UN	2.250 *(57.2)*	5.625 *(142.9)*
C 2000	70	*(265)*	1-1/4-11-1/2 NPTF	2.250 *(57.2)*	5.625 *(142.9)*
C 2020	70	*(265)*	#20 SAE 1-5/8-12 UN	2.750 *(69.9)*	6.500 *(165.1)*
C 2400	100	*(379)*	1-1/2-11-1/2 NPTF	2.750 *(69.9)*	5.625 *(142.9)*
C 2420	100	*(379)*	#24 SAE 1-7/8-12 UN	3.000 *(76.2)*	7.250 *(184.2)*
C 3200	150	*(569)*	2-11-1/2 NPTF	3.500 *(88.9)*	6.500 *(165.1)*
C 3220	150	*(569)*	#32 SAE 2-1/2-12 UN	4.000 *(101.6)*	9.000 *(228.6)*



Colorflow Series C Check Valves provide free flow in one direction and dependable shutoff in the opposite direction.

To assure the dependable shutoff necessary on air lines, a 416 stainless-steel poppet with molded-in-place soft-rubber seal is used in brass check valves from 1/8" through 1/2". Standard solid 416 stainless-steel poppets provide dependable shutoff for the 3/4" through 2" check valves.

For hydraulic lines, soft seals are acceptable on 1/8" — 1/2" valves. Steel check valves above 1/2" should have all-metal poppets Several nominal cracking pressures are offered: 5 PSI is nominal standard; 65 PSI is optional.

Parker-developed triangular retainer acts as a straight guide for the poppet and also holds the valve spring firmly in place under even the severest shock and velocity conditions.

Maximum Pressures:
Brass: 2000 PSI (140 Bar); except C 1600 Brass is 500 PSI (35 Bar).
Steel: 5000 PSI (345 Bar) for 200 thru 1220; 3000 PSI (207 Bar) for all other sizes and styles.

Ordering Information

C 200 S 65 V

Series
C

Size
*200, 820, *1600, 2400
*400, *800, 1620, 2420
620, 1020, 2000, 3200
*600, *1200, 2020, 3220
1220

Material
B = Brass
S = Steel
Series C Brass Valves can be used for both air and oil service.

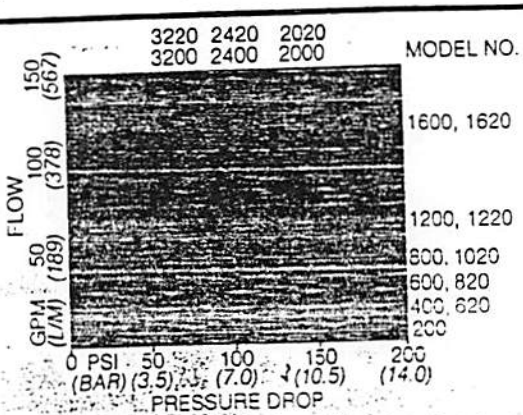
Cracking Pressure (nominal)
Omit = Standard 5 PSI (0.4 Bar)
65 = 65 PSI (4.5 Bar)

Seal Compound
Omit = Nitrile (Standard)
V = Viton® (Optional)

*Sizes available in Brass.

Typical Ordering Nomenclature:
C 200 S 65 V means C Series, Size 200. Steel, 65 PSI (4.5 Bar) Cracking Pressure, Viton®

Pressure Drop vs. Flow



BRASS VALVE - PARTS LIST

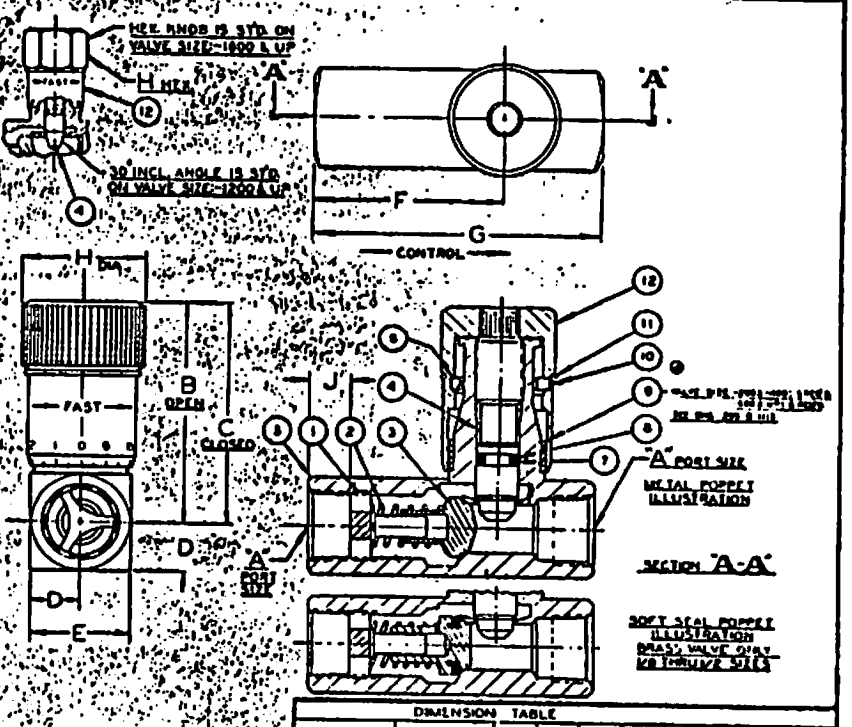
ITEM NO.	DESCRIPTION	QTY PER ASSY	F-200-B-10	F-400-B-10	F-600-B-10	F-800-B-10	F-1200-B-10	F-1600-B-10
1	SPRING	1	13-B-154-3	1-B-491-3	4-B-375-3	7-A-301-3	10-B-324-3	25-B-300-3
2	STEM	1	13-A-154-5	1-A-316-5	4-A-394-5	7-A-310-5	10-A-311-5	25-A-314-5
3	SEAT	1	13-B-210-3	1-B-311-3	4-B-311-3	7-B-311-3	10-B-312-3	25-B-313-3
4	BALL	1	13-B-2-3	1-B-2-3	4-B-2-3	7-B-2-3	10-B-2-3	25-B-3-3
5	BODY	1	13-B-153-1	1-B-483-1	4-B-371-1	7-B-298-1	10-B-331-1	25-B-298-1
6	BALL RETAINING RING	1	400-B-1-14	400-B-1-15	400-B-1-16	400-B-1-17	400-B-1-18	400-B-1-19
7	BONNET	1	0-101-1	0-008-1	0-008-1	0-010-1	0-011-1	0-112-1
8	BONNET O-RING	1	BU-006	BU-006	BU-010	BU-010	BU-011	BU-112
9	PACKING	2	13-A-7-6	1-A-7-6	4-A-7-6	7-A-7-6	10-A-7-6	25-A-7-6
10	PACKING NUT (SET SCREW)	1	707-B-1-1	707-B-1-1	707-B-1-1	708-B-2-1	708-B-2-1	709-B-2-3
11	HANDLE	1	13-A-82-10	1-A-238-10	4-A-179-10	7-A-110-10	10-A-164-10	25-A-138-10
12	HANDLE NUT	1	13-B-5-2	1-B-5-2	4-B-5-2	7-B-5-2	10-B-5-2	25-B-5-2

STEEL VALVE - PARTS LIST

ITEM NO.	DESCRIPTION	QTY PER ASSY	F-200-S-10	F-400-S-10	F-600-S-10	F-800-S-10	F-1200-S-10	F-1600-S-10	F-2000-S-10	F-2400-S-10	F-3200-S-10
1	SPRING	1	13-B-154-3	1-B-491-3	4-B-375-3	7-A-301-3	10-B-324-3	25-B-300-3	32-B-300-3	32-B-300-3	32-B-300-3
2	STEM	1	13-A-154-5	1-A-316-5	4-A-394-5	7-A-310-5	10-A-311-5	25-A-314-5	32-A-314-5	32-A-314-5	32-A-314-5
3	SEAT	1	13-B-210-3	1-B-492-3	4-B-314-3	7-B-313-3	10-B-312-3	25-B-313-3	32-B-313-3	32-B-313-3	32-B-313-3
4	BALL	1	13-B-2-3	1-B-2-3	4-B-2-3	7-B-2-3	10-B-2-3	25-B-3-3	32-B-3-3	32-B-3-3	32-B-3-3
5	BODY (STEEL)	1	13-B-153-2	1-B-483-2	4-B-371-2	7-B-222-2	10-B-331-2	25-B-298-2	32-B-298-2	32-B-298-2	32-B-298-2
6	BALL RETAINING RING	1	400-B-1-14	400-B-1-15	400-B-1-16	400-B-1-17	400-B-1-18	400-B-1-19	400-B-1-20	400-B-1-21	400-B-1-22
7	BONNET	1	0-101-1	0-008-1	0-008-1	0-010-1	0-011-1	0-112-1	0-112-1	0-112-1	0-112-1
8	BONNET O-RING	1	———	BU-006	BU-006	BU-010	BU-011	BU-112	BU-112	BU-112	BU-112
9	PACKING	2	13-A-7-6	1-A-7-6	4-A-7-6	7-A-7-6	10-A-7-6	25-A-7-6	32-A-7-6	32-A-7-6	32-A-7-6
10	PACKING NUT (SET SCREW)	1	707-B-1-1	707-B-1-1	707-B-1-1	708-B-2-1	708-B-2-1	709-B-2-3	709-B-2-3	709-B-2-3	709-B-2-3
11	HANDLE	1	13-A-82-10	1-A-238-10	4-A-179-10	7-A-110-10	10-A-164-10	25-A-138-10	32-A-138-10	32-A-138-10	32-A-138-10
12	HANDLE NUT	1	13-B-5-2	1-B-5-2	4-B-5-2	7-B-5-2	10-B-5-2	25-B-5-2	32-B-5-2	32-B-5-2	32-B-5-2

316 SS VALVE - PARTS LIST

ITEM NO.	DESCRIPTION	QTY PER ASSY	F-200-S-10	F-400-S-10	F-600-S-10	F-800-S-10	F-1200-S-10
1	SPRING	1	13-B-154-3	1-B-491-3	4-B-375-3	7-A-301-3	10-B-324-3
2	STEM	1	13-A-154-5	1-A-316-5	4-A-394-5	7-A-310-5	10-A-311-5
3	SEAT	1	13-B-210-3	1-B-492-3	4-B-371-3	7-B-222-3	10-B-312-3
4	BALL	1	13-B-2-3	1-B-2-3	4-B-2-3	7-B-2-3	10-B-2-3
5	BODY	1	13-B-153-3	1-B-483-3	4-B-371-3	7-B-298-3	10-B-331-3
6	BALL RETAINING RING	1	400-B-1-14	400-B-1-15	400-B-1-16	400-B-1-17	400-B-1-18
7	BONNET	1	0-101-3	0-008-3	0-008-3	0-010-3	0-011-3
8	BONNET O-RING	1	———	BU-006	BU-006	BU-010	BU-011
9	PACKING	2	13-A-7-6	1-A-7-6	4-A-7-6	7-A-7-6	10-A-7-6
10	PACKING NUT (SET SCREW)	1	707-B-1-1	707-B-1-1	707-B-1-1	708-B-2-1	708-B-2-1
11	HANDLE	1	13-A-82-10	1-A-238-10	4-A-179-10	7-A-110-10	10-A-164-10
12	HANDLE NUT	1	13-B-5-2	1-B-5-2	4-B-5-2	7-B-5-2	10-B-5-2



DIMENSION TABLE

MODEL NO.	A PORT SIZE	B	C	D	E ±.02	F	G	H	J
F-200-B-10	1/8-27 NPTF	1.54	1.59	.31	.62	1.26	2.00	.75	.31
F-400-B-10	1/4-18 NPTF	1.79	1.59	.49	.81	1.97	2.62	.81	.43
F-600-B-10	3/8-18 NPTF	2.16	1.93	.50	1.00	1.75	2.75	1.00	.68
F-800-B-10	1/2-14 NPTF	2.70	2.42	.62	1.25	2.24	3.43	1.18	.96
F-1200-B-10	3/4-14 NPTF	3.38	2.81	.75	1.50	2.53	3.81	1.31	1.34
F-1600-B-10	1-11½-27 NPTF	4.87	4.21	.87	1.75	3.27	5.00	1.87	1.78
F-2000-B-10	1¼-11½-27 NPTF	5.12	4.46	1.12	2.25	3.67	5.65	1.87	2.08
F-2400-B-10	1½-11½-27 NPTF	5.37	4.71	1.37	2.75	4.45	5.62	1.87	2.08
F-3200-B-10	2-11½-27 NPTF	5.75	5.08	1.75	3.50	5.31	6.50	1.87	2.64

NOTES:

1. MATERIAL:

	BODY	NEEDLE	O-RING	BACK-UP	SPRING	RETAINER	POPPET
BRASS VALVES	BRASS	416 SS	BUNA N	TEFLON	316 SS	416 SS	1/8-1/2 IN. 416 SS W/BUNA N SEAL 3/4-1 1/2 IN. 416 SS SOLID POPPET
STEEL VALVES	STEEL	416 SS	BUNA N	TEFLON	316 SS	416 SS	416 SS SOLID POPPET-ALL SIZES
316 SS VALVES	316 SS	316 SS	VITON	TEFLON	316 SS	316 SS	316 SS SOLID POPPET-ALL SIZES

2. PRESSURE RATINGS:
   MAX. NON-SHOCK WORKING PRESSURE:
   BRASS VALVES 2000 PSI
   STEEL VALVES 5000 PSI
   316 SS VALVES 5000 PSI

ORIFICE & FLOW CHART

MODEL NO.	NPTF THD.	FREE FLOW INCHES-MAX	CONTROL FLOW INCHES-MAX	RECOMMENDED FLOW MAX. GPM
F-200-B-10	1/8	.18 DIA.	.12 DIA.	4
F-200-B-10	1/4	.30 "	.16 "	6
F-600-B-10	3/8	.39 "	.23 "	8
F-800-B-10	1/2	.48 "	.30 "	12
F-1200-B-10	3/4	.65 "	.37 "	27
F-1600-B-10	1	.84 "	.62 "	40
F-2000-B-10	1-1/4	1.09 "	.62 "	75
F-2400-B-10	1-1/2	1.12 "	.62 "	100
F-3200-B-10	2	1.62 "	.62 "	160

H	9-3-10	ECR NO 2288

MANATROL DIVISION
PARKER HANNIFIN

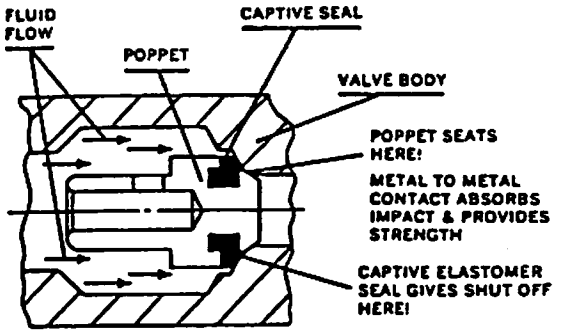
5-27-88		SH

ASSY: FLOW CONTROL VALVE - NPTF THD
PORT SIZES: 1/8 THRU 2 INCHES

MODEL "F" SERIES - 100 DESIGN — 203-B-712

NON COMPENSATED FLOW CONTROLS

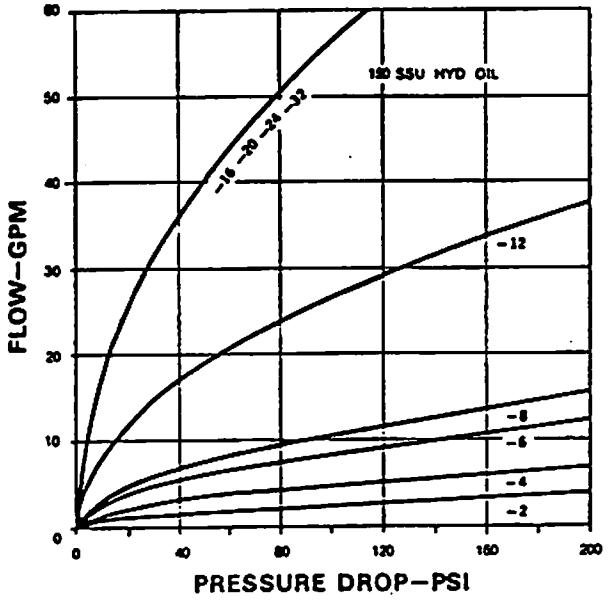
F SERIES
CATALOG 2502



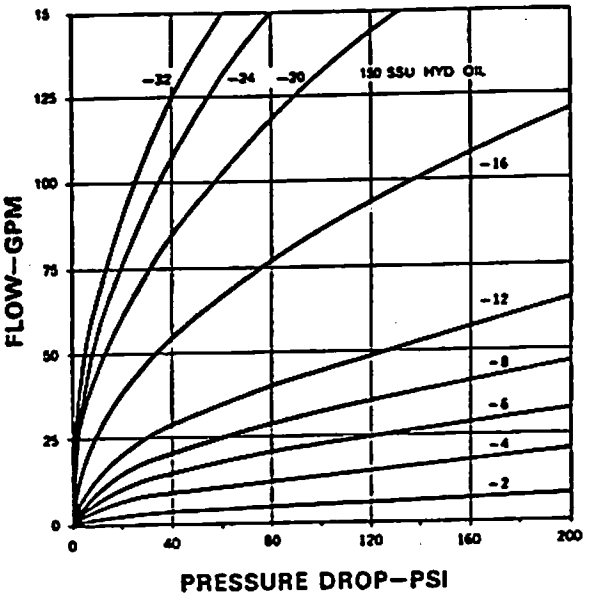
EXCLUSIVE CAPTIVE SOFT SEAL POPPET

SIZE INFORMATION					
SIZE	MAXIMUM RECOMMENDED FLOW RATE GPM	ORIFICE AREA FREE FLOW (SQ. IN.)	Cv (FREE FLOW)	EFFECTIVE ORIFICE AREA CONTROL FLOW (SQ. IN.)	EFFECTIVE Cv (CONTROL FLOW)
— 2	4	.021	0.47	.0102	.230
— 4	6	.057	1.30	.0194	.443
— 6	8	.096	2.12	.0344	.787
— 8	12	.132	3.04	.0427	.976
—12	27	.183	4.18	.1080	2.470
—16	40	.345	7.88	.2300	5.250
—20	75	.535	12.20	.2300	5.250
—24	100	.682	15.60	.2300	5.250
—32	160	.792	18.10	.2300	5.250

CONTROL FLOW
NEEDLE FULL OPEN



FREE FLOW
5 PSI CRACKING



ORDERING INFORMATION

0F — 400 — B — 10

OPTIONAL THREAD
No Symbol—Standard
8 — British Standard Taper pipe thread (BSTP)
9 — British Standard Parallel pipe thread (BSPP)

MOUNTING
F — line mtd.
FS — subplate mtd.
FSB — subplate mtd. w/subplate

NOTE:
See pg 292, Dwg 203-C-1356 for subplate details

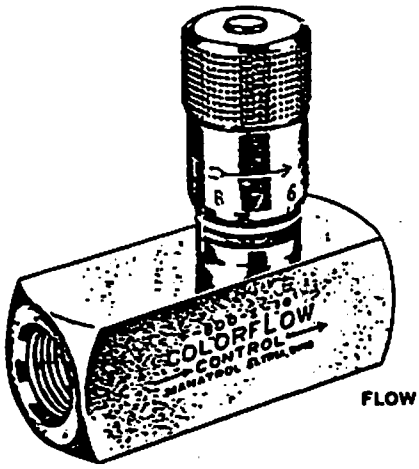
SIZE
2 — ⅛"
4 — ¼"
6 — ⅜"
8 — ½"
12 — ¾"
16 — 1" *
20 — 1¼" *
24 — 1½" *
32 — 2" *

MATERIAL
B — Brass
S — Steel
SS6 — 316 Stainless

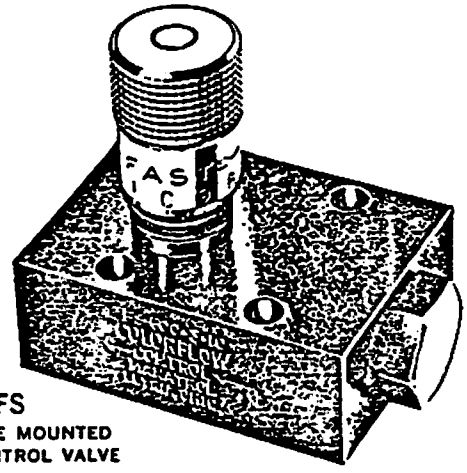
*NOTE:
16, 20, 24, 32 sizes not available in 316 S.S.
20, 24, 32 sizes not available in Brass.

NON COMPENSATED FLOW CONTROLS

F SERIES
CATALOG 2502



F
FLOW CONTROL VALVE



FS
SUBPLATE MOUNTED FLOW CONTROL VALVE

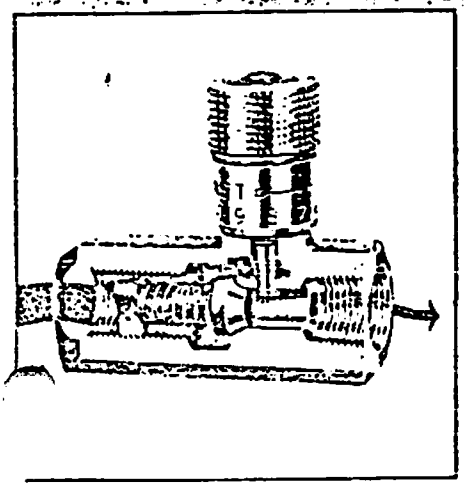
- **INLINE AND SUBPLATE MTD. NON-COMPENSATED FLOW CONTROLS.**
- **PATENTED COLORFLOW CALIBRATION SCALE**
- **SIZES—⅛", ¼", ⅜", ½", ¾", 1", 1¼" 1½" 2"**
- **INLINE FULL FLOW CHECK VALVE.**
- **TWO STEP NEEDLE PROVIDES MICRO-FINE AND STANDARD METERING.**
- **SOFT SEAL POPPET PROVIDES DEAD TIGHT SHUT OFF, ULTIMATE IN FLOW METERING.**
- **0 TO 160 GPM FLOW RATES.**
- **SET SCREW LOCKS FLOW SETTING.**
- **ATTRACTIVE KNURLED KNOB FOR EASE OF ADJUSTMENT.**
- **2000 PSI — BRASS VALVES, 5000 PSI — STEEL VALVES.**
- **BARSTOCK — STEEL, BRASS, 316 STAINLESS.**

COLORFLOW barstock control valves give precise controlled flow and shutoff in one direction with free flow in the reverse direction.

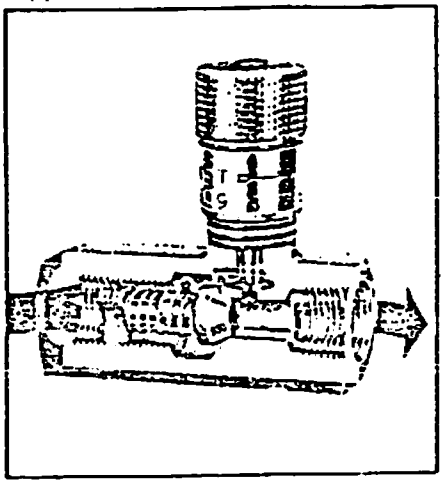
COLORFLOW soft seal poppets are standard on all brass valves — ⅛ thru ½" sizes. On brass valves ¾" and 1" a rugged steel poppet is standard. Steel and Stainless Steel valves have, as standard, a hardened steel poppet in all sizes.

Strong, one piece, triangular retainer doubles as a poppet guide and securely captivates the spring. Flow does not pass thru the poppet spring.

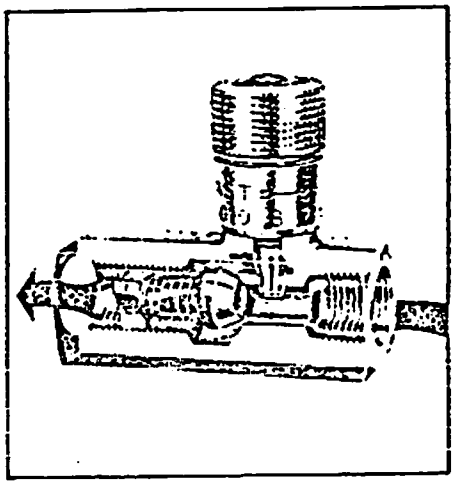
COLORFLOW valves are available in steel, brass, and 316 stainless steel (subplate mounted valves available in steel only), subplate or inline mounting, and in sizes from ⅛" thru 2". Brass valves have a 2000 psi maximum operating pressure, steel and 316 SS valves have a 5000 psi maximum operating pressure. A Buna N O-ring and a teflon back up ring is the standard seal.



First three turns of two-step needle from fully closed position provides fine adjustment for low flows.



Last three turns of two-step needle provide conventional throttling control to fully open position.



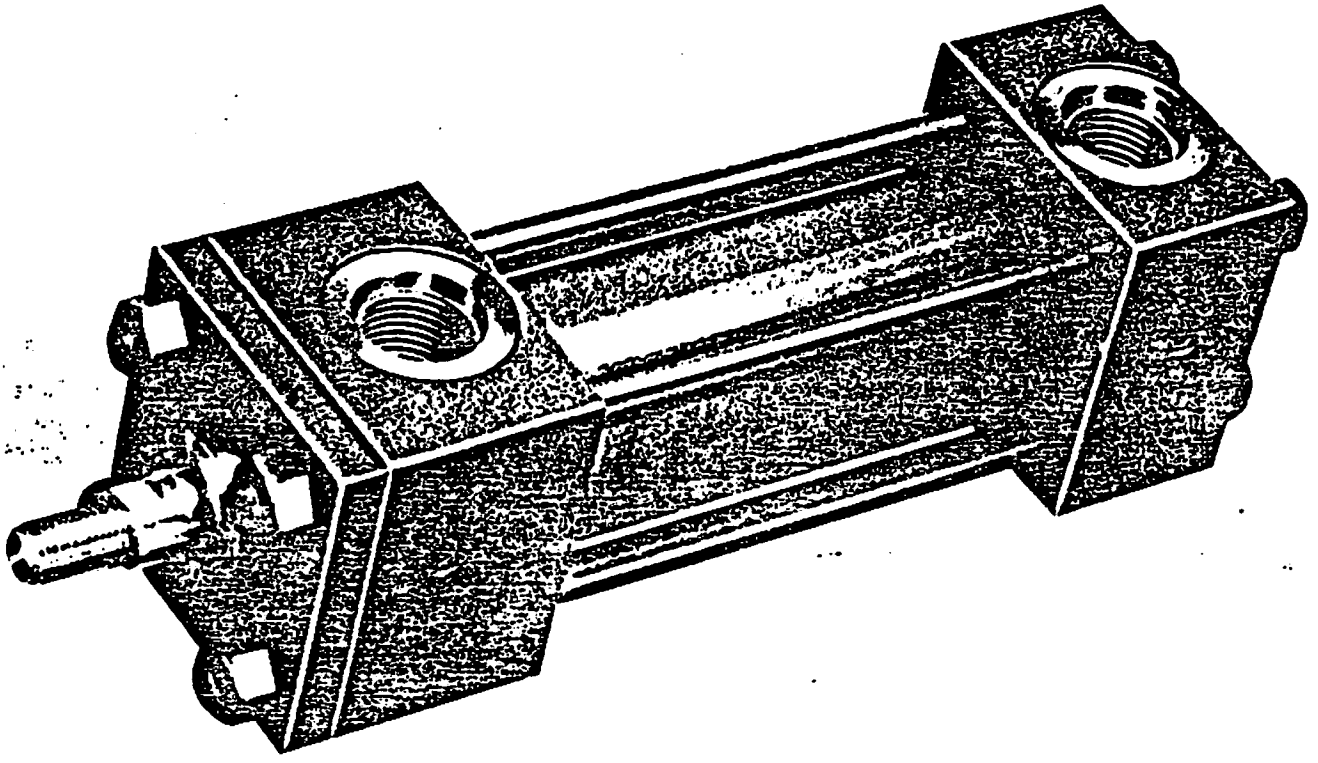
In reverse direction, new heavy duty poppet/retainer combination provides maximum full flow capacity.

Parker Heavy Duty Hydraulic Cylinders

Series 2H

Exclusive
with the New Parker Stepped Cushion
for increased performance and productivity.

- **Faster cycle time**
- **Reduced hydraulic shock**
- **Reduced machine noise**
- **Lower machine maintenance**

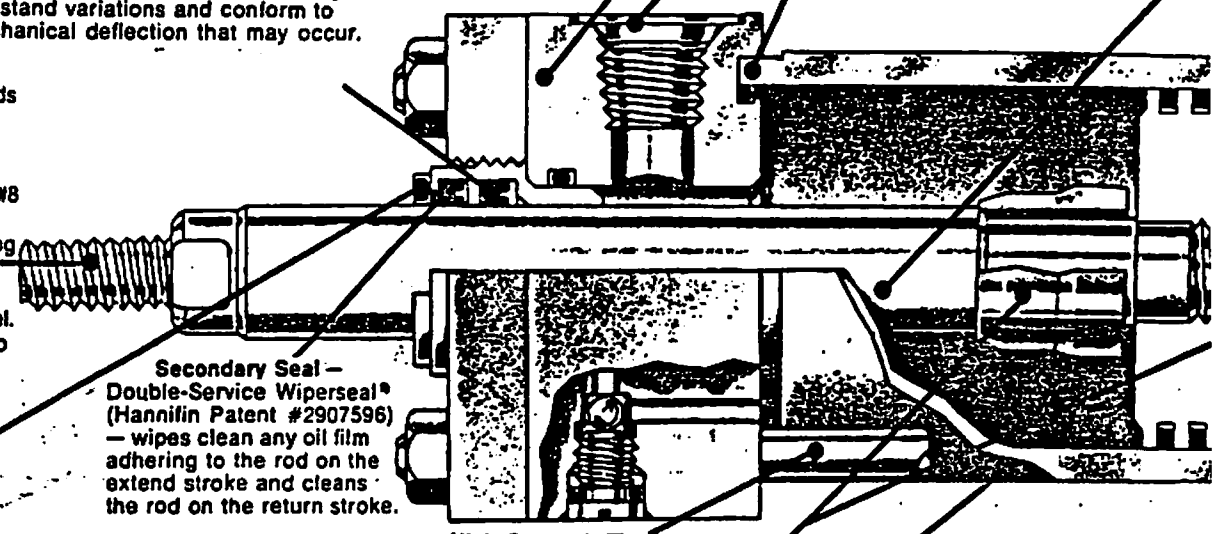


Heavy Duty Service-Industrial Tie-Rod Construction

Nominal Pressure—3000 P.S.I.
Standard Bore Sizes—1½" Through 8"
Pision Rod Diameters—⅝" Through 5½"
Eighteen Standard Mounting Styles

Parker Cylinder Division
[illegible] GA
[illegible], NC
[illegible]

The inside story on why series 2H is your best choice in heavy duty hydraulic cylinders



Steel Head — bored and grooved to provide concentricity for mating parts.

Ports — S.A.E. "O" ring 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, (Hannifin Patent #2997318) — 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 1⅜" 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.

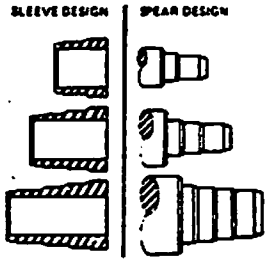
Secondary Seal — Double-Service Wiperseal® (Hannifin Patent #2907596) — wipes clean any oil film adhering to the rod on the extend stroke and cleans the rod on the return stroke.

"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.

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

The Cylinder Body — Heavy-wall steel tubing, honed to a micro finish bore.

STEPPED CUSHIONS



Adjustable Floating Stepped Cushions — For maximum performance - economical and flexible for even the most demanding applications - provides superior performance in reducing shock. Cushions are optional and can be supplied at head end, cap end, or both ends without change in envelope or mounting dimensions.

PARKER'S NEW, EXCLUSIVE

Stepped floating cushions combine the best features of known cushion technology.

Deceleration devices or built-in "cushions" are optional and can be supplied at head end, cap end, or both ends without change in envelope or mounting dimensions. Parker cylinder cushions are a stepped design and combine the best features of known cushion technology.

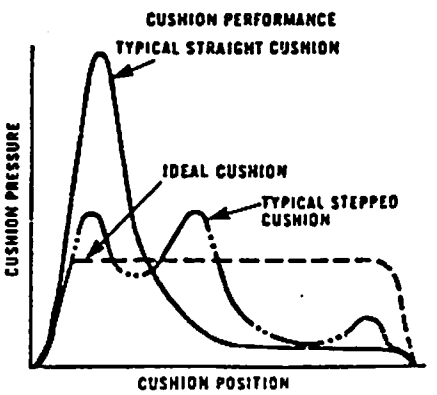
Standard straight or tapered cushions have been used in industrial cylinders over a very broad range of applications, Parker research has found that both designs have their limitations.

As a result, Parker has taken a new approach in cushioning of industrial hydraulic cylinders and for specific load and velocity conditions have been able to obtain deceleration curves that come very close to the ideal. The success lies in a stepped sleeve or spear concept where the steps are calculated to approximate theoretical orifice areas curves.

The cushion performance chart, pressure traces show the results typical orifice flow conditions. Tests of a three-step sleeve or spear show three pressure pulses coinciding with the steps. The deceleration cushion plunger curves shape comes very close to being theoretical, with the exception of the last ½ inch of travel. This is a constant shape in order to have some flexibility in application.

The stepped cushion design shows reduced pressure peaks for most load and speed conditions, with comparable reduction of objectionable stopping forces being transmitted to the load and the support structure.

All Parker Hannifin cushions are adjustable.



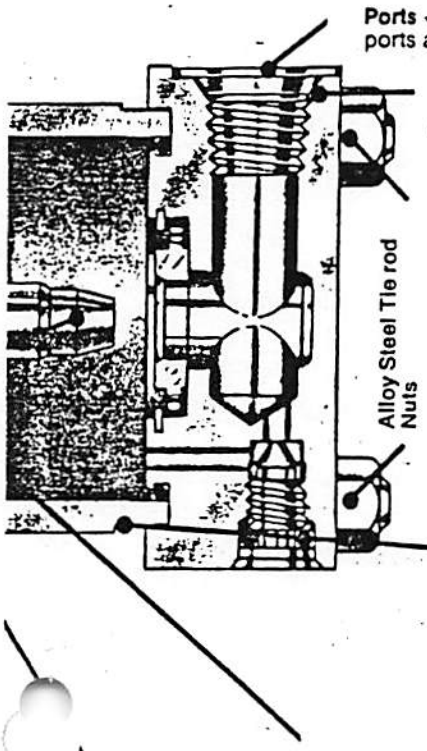
The Series 2H cylinder design incorporates the longest cushion

Parker Cylinder Division
500 So. Wolf Road
Des Plaines, IL 60018

Atlanta, GA
404 349-0360

Enfield, CT
203 749-2215

Piston Rod — Medium carbon steel, induction case-hardened to 54 R_c, hard chrome-plated and polished to 10 RMS finish. Piston rods are made from 90,000 to 100,000 psi minimum yield material in ⅝" 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 — S.A.E. "O" ring ports are standard.

Steel Cap — bored and grooved to provide concentricity for mating parts.

OPTIONAL PORTS

Ports — N.P.T.F. ports are optional at no extra charge. Oversize N.P.T.F. and S.A.E. ports are available at no extra charge.

Seals — Buna-N (Nitrile) seals are standard.

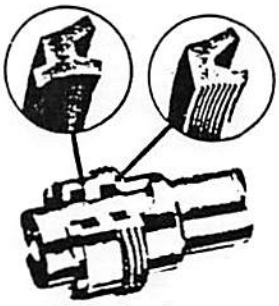
Viton Seals — Optional at extra charge.

Align-A-Groove — (Patent #3043639) — A ¾" wide surface machined at each end of the cylinder body. Makes precise mounting quick and easy.

Step Cut Iron Piston Rings are standard.

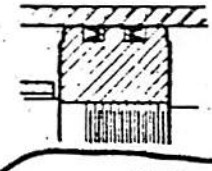
One-Piece Fine-Grained Cast Iron Piston — The wide piston surface contacting cylinder bore reduces bearing loads, and a long thread engagement with rod provides greater shock absorption. Anaerobic adhesive is used to permanently lock and seal the piston to the rod.

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

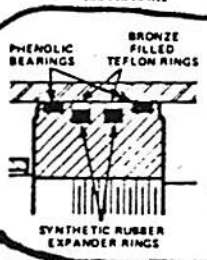


An extra-long inboard bearing surface insures lubrication from within the cylinder. Outboard of the bearing surface are two leakproof seals — The Lipseal® and Wiperseal.
The serrated Lipseal® (primary seal) is completely self compensating and self relieving. It adjusts to mechanical deflections or any 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.

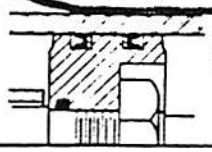
OPTIONAL PISTONS



Lipseal® Piston — Optional at no extra charge. 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.



Hi Load Piston — Optional at extra charge. Includes phenolic wear rings and bronze-filled teflon seals. Two wear rings serve as bearings which deform radially under side-loading, enabling the load to be spread over a larger area and reduce unit loading. Bronze-filled teflon seals are designed for extrusion-free, leak-proof service and longer cylinder life than the lipseal type piston.



Nut Retained Piston — optional at extra charge.

---

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 stepped sleeve is furnished on the piston rod assembly.
   b. A needle valve is provided that is flush with the side of the head even 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, JJ, HH 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 on the face opposite the needle valve except on mounting styles D, DB, DD, JJ, HH and E, where it is mounted on side number 3, next to 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 stepped spear is provided on the piston rod.
   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, JJ, HH and E. In these styles it is located on side number 3.

Cushion Length

CYL. BORE IN.	ROD DIA. IN.	ROD NO.	CUSHION LENGTH — IN. HEAD*	CAP
1½	⅝	1	1⅛	1⅛
	1	2	1⅛	1⅛
2	1	1	1⅛	1⅛
	1⅜	2	1⅛	1⅛
2½	1	1	1⅛	1⅛
	1⅜	2	1⅛	1⅛
3¼	1⅜	1	1⅜	1⅜
	2	2	1⅜	1⅜
4	1⅜	1	1⅜	1⅜
	2½	2	1⅜	1⅜
5	2	1	1⅜	1⅜
	3½	2	1⅜	1⅜

CYL. BORE IN.	ROD DIA. IN.	ROD NO.	CUSHION LENGTH — IN. HEAD*	CAP
6	2½	1	1⅜	1½
	4	2	1⅜	1½
7	3	1	1⅜	1⅜
	5	2	1⅜	1⅜
8	3½	1	2⅛	2
	5½	2	1⅜	2

*Head end cushions for rod diameters not listed have cushion lengths within the limits shown.

Parker Cylinder Division
500 So. Wolf Road
Des Plaines, IL 60018

■ Atlanta, GA
404 347-0693

■ Hillsborough, NC
919 732-3071

■ Enfield, CT
203 749-2175

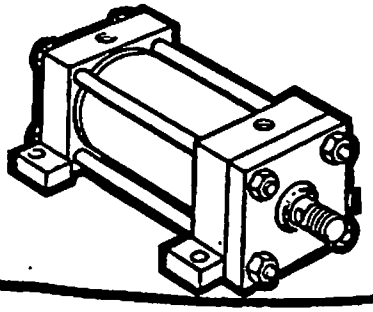
Side Lugs, Centerline Lugs and Side Tapped Mountings

1½" to 8" bore sizes

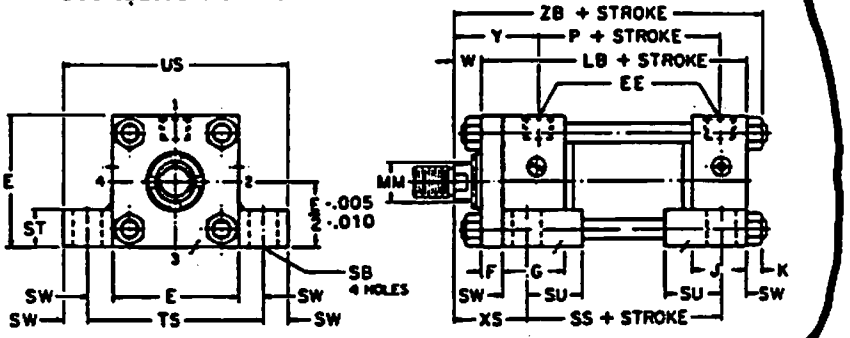
Parker Series 2H Heavy Duty Hydraulic Cylinders

CATALOG 1110 — OCTOBER, 1975

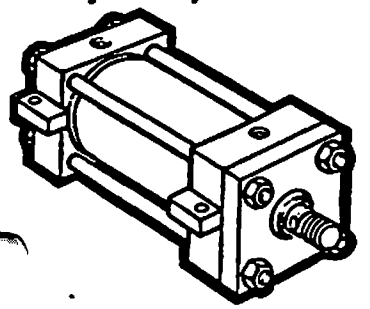
Lug Mountings
ker Style C
(NFPA Style MS2)



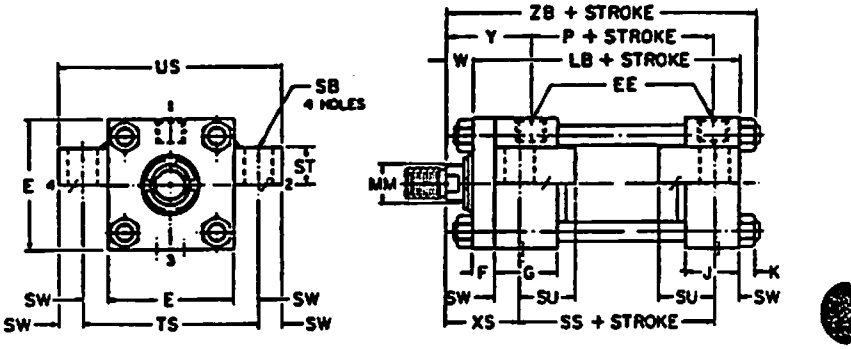
Envelope and mounting dimensions— see tables 1 and 3



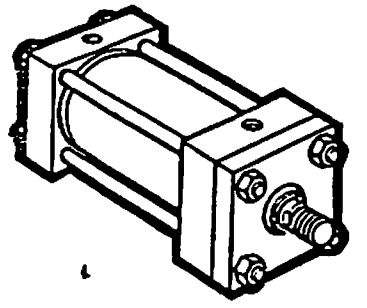
Centerline Lugs Mounting
Parker Style E
(NFPA Style MS3)



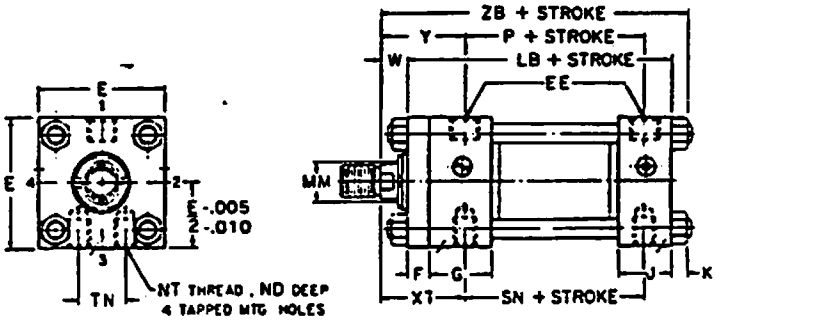
Envelope and mounting dimensions— see tables 1 and 3



Side Tapped Mounting
Parker Style F
(NFPA Style MS4)

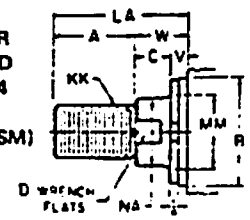


Envelope and mounting dimensions— see tables 1 and 3

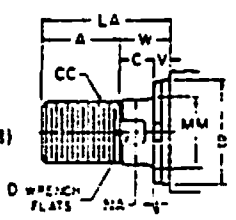


Rod end dimensions—see table 2

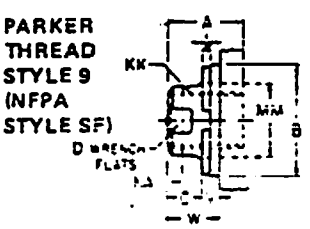
PARKER THREAD STYLE 4 (NFPA STYLE SM)



PARKER THREAD STYLE 8 (NFPA STYLE 1M)



PARKER THREAD STYLE 9 (NFPA STYLE SF)



...od end high strength stud is supplied on thread styles 4 and 8 through 2½" diameter piston 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 2½" 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.

Table 1—Envelope and mounting dimensions

BORE	E	EE NPTF ★	EE SAE ⊖	F	G	J	K	NT	SB •	ST	SU	SW	TN	TS	US	ADD STROKE LB	P	SN	SS
1½§	2½	½	10	⅜	1¾	1½	⅜	⅜-16	⅞	½	1⅜	⅜	¾	3¼	4	5	2⅞	2⅞	3⅜
2§	3	½	10	⅜	1¾	1½	⅞	½-13	⅞	¾	1¼	½	1⅜	4	5	5¼	2⅞	2⅞	3⅜
2½§	3½	½	10	⅜	1¾	1½	⅞	⅝-11	1⅜	1	1⅝	1⅛	1⅜	4⅞	6¼	5⅜	3	3	3⅜
3¼	4½	¾	16	¾	2	1¾	⅞	¾-10	1⅜	1	1⅝	1⅛	1½	5⅞	7¼	6¼	3½	3½	4⅛
4	5	¾	16	⅞	2	1¾	⅞	1-8	1¼	1¼	2	⅞	2¼	6¾	8½	6⅜	3¾	3¾	4
5	6½	¾	16	⅞	2	1¾	1⅜	1-8	1¼	1¼	2	⅞	2⅜	8¼	10	7⅛	4¼	4¼	4½
6	7½	1	16	1	2¼	2¼	⅞	1¼-7	1⅜	1½	2½	1⅛	3⅜	9¾	12	8⅜	4⅞	5⅛	5⅛
7	8½	1¼	20	1	2¾	2¾	1	1½-6	1⅝	1¾	2⅞	1⅜	3¾	11¼	14	9½	5⅜	5⅜	5¾
8	9½	1½	24	1	3	3	1¼	1½-6	1⅝	1¾	2⅞	1⅜	4¼	12¼	15	10½	6⅛	6⅜	6¾

★ NPTF ports will be furnished as standard unless SAE straight thread ports are specified.
⊖ SAE straight thread ports are indicated by port number. For dimensional information, see page 26.
§ Head end cushions are non-adjustable in 1½", 2" and 2½" bore cylinders with No. 2 rods.
• Upper surface spotfaced for socket head screws.

Table 2—Rod dimensions

BORE	ROD NO.	ROD DIA. MM	THREAD CC Style 6	THREAD KK Style 4 & 5	ROD EXTENSIONS AND PILOT DIMENSIONS A	+ .000 B − .002	C	D	LA	NA	V	W
1½	1 (Std.)	⅝	½-20	⅞-20	¾	1.124	⅜	½	1⅜	⅝	¼	⅜
	2	1	⅞-14	¾-16	1⅛	1.499	½	⅞	2⅛	1⅜	½	1
2	1 (Std.)	1	⅞-14	¾-16	1⅛	1.499	½	⅞	1⅞	1⅜	¼	¾
	2	1⅜	1¼-12	1-14	1⅜	1.999	⅝	1⅛	2⅝	1¾	⅜	1
2½	1 (Std.)	1	⅞-14	¾-16	1⅛	1.499	½	⅞	1⅞	1⅜	¼	¾
	2	1¾	1½-12	1¼-12	2	2.374	¾	1½	3¼	1 11/16	½	1¼
	3	1⅜	1¼-12	1-14	1⅜	1.999	⅝	1⅛	2⅝	1¾	⅜	1
3¼	1 (Std.)	1⅜	1¼-12	1-14	1⅜	1.999	⅝	1⅛	2½	1⅜	¼	⅞
	2	2	1¾-12	1½-12	2¼	2.624	⅞	1 11/16	3½	1 13/16	⅜	1¼
	3	1¾	1½-12	1¼-12	2	2.374	¾	1½	3⅛	1 11/16	⅜	1⅛
4	1 (Std.)	1¾	1½-12	1¼-12	2	2.374	¾	1½	3	1 11/16	¼	1
	2	2½	2¼-12	1⅞-12	3	3.124	1	2¼	4⅜	2⅜	⅜	1⅜
	3	2	1¾-12	1½-12	2¼	2.624	⅞	1 11/16	3⅜	1 13/16	¼	1⅛
5	1 (Std.)	2	1¾-12	1½-12	2¼	2.624	⅞	1 11/16	3⅜	1 13/16	¼	1⅛
	2	3½	3¼-12	2½-12	3½	4.249	1	3	4⅞	3⅜	⅜	1⅜
	3	2½	2¼-12	1⅞-12	3	3.124	1	2¼	4⅜	2⅜	⅜	1⅜
	4	3	2¾-12	2¼-12	3½	3.749	1	2⅝	4⅞	2⅞	⅜	1⅜
6	1 (Std.)	2½	2¼-12	1⅞-12	3	3.124	1	2¼	4¼	2⅜	¼	1¼
	2	4	3¾-12	3-12	4	4.749	1	3⅝	5¼	3⅞	¼	1¼
	3	3	2¾-12	2¼-12	3½	3.749	1	2⅝	4¾	2⅞	¼	1¼
	4	3½	3¼-12	2½-12	3½	4.249	1	3	4¾	3⅜	¼	1¼
7	1 (Std.)	3	2¾-12	2¼-12	3½	3.749	1	2⅝	4¾	2⅞	¼	1¼
	2	5	4¾-12	3½-12	5	5.749	1	4¼	6¼	4⅜	¼	1¼
	3	3½	3¼-12	2½-12	3½	4.249	1	3	4¾	3⅜	¼	1¼
	4	4	3¾-12	3-12	4	4.749	1	3⅝	5¼	3⅞	¼	1¼
	5	4½	4¼-12	3¼-12	4½	5.249	1	3⅞	5¾	4⅜	¼	1¼
8	1 (Std.)	3½	3¼-12	2½-12	3½	4.249	1	3	4¾	3⅜	¼	1¼
	2	5½	5¼-12	4-12	5½	6.249	1	4⅜	6¾	5⅜	¼	1¼
	3	4	3¾-12	3-12	4	4.749	1	3⅝	5¼	3⅞	¼	1¼
	4	4½	4¼-12	3¼-12	4½	5.249	1	3⅞	5¾	4⅜	¼	1¼
	5	5	4¾-12	3½-12	5	5.749	1	4¼	6¼	4⅞	¼	1¼

Table 3—Envelope and mounting dimensions

BORE	ROD NO.	ND	XS	XT	Y	ADD STROKE ZB
1½	1 (Std.)	⅜	1⅜	2	2	6
	2	⅜	1¾	2⅜	2⅜	6⅜
2	1 (Std.)	⅜	1⅜	2⅜	2⅜	6⅜
	2	7/16	2⅛	2⅝	2⅝	6 11/16
2½	1 (Std.)	9/16	2⅛	2⅜	2⅜	6⅝
	2	½	2⅝	2⅞	2⅞	7⅛
	3	9/16	2⅝	2⅝	2⅝	6 13/16
3¼	1 (Std.)	⅞	2⅝	2¾	2¾	7 11/16
	2	1 1/16	2 11/16	3⅛	3⅛	8⅛
	3	⅞	2⅝	3	3	7 13/16
4	1 (Std.)	1	2¾	3	3	8¾
	2	1 1/16	3⅛	3⅜	3⅜	8⅝
	3	1	2⅞	3⅛	3⅛	8¾
5	1 (Std.)	1⅛	2⅞	3⅛	3⅛	9¼
	2	1	3⅛	3⅜	3⅜	9⅝
	3	1⅛	3⅛	3⅜	3⅜	8 15/16
	4	1⅛	3⅛	3⅜	3⅜	8 15/16
6	1 (Std.)	1¾	3⅜	3½	3½	10½
	2	1¼	3⅜	3½	3½	10½
	3	1¾	3⅜	3½	3½	10½
	4	1½	3⅜	3½	3½	10½
7	1 (Std.)	2⅛	3⅜	3 13/16	3 13/16	11¾
	2	1⅛	3⅜	3 13/16	3 13/16	11¾
	3	2⅛	3⅜	3 13/16	3 13/16	11¾
	4	1¾	3⅜	3 13/16	3 13/16	11¾
	5	1⅜	3⅜	3 13/16	3 13/16	11¾
8	1 (Std.)	2¼	3⅜	3 13/16	3 13/16	12 13/16
	2	1½	3⅜	3 13/16	3 13/16	12 13/16
	3	2¼	3⅜	3 13/16	3 13/16	12 13/16
	4	2	3⅜	3 13/16	3 13/16	12 13/16
	5	1¾	3⅜	3 13/16	3 13/16	12 13/16

Parker Series 2H
Heavy Duty Hydraulic Cylinders

CATALOG 1110 SEPTEMBER, 1976

HEAD ASSEMBLIES

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

ASS'Y NO.	DESCRIPTION
SA1	Basic head (symbol 1)
SA2	Side lug mounting head (symbol 2)
SA3	Centerline mounting head (symbol 3)
SA4	Side tapped mounting head (symbol 4)
SA5	Trunnion mounting head (symbol 5)
SA6	End lug mounting head (symbol 6)

SERVICE ASSEMBLY KITS

HOW TO ORDER

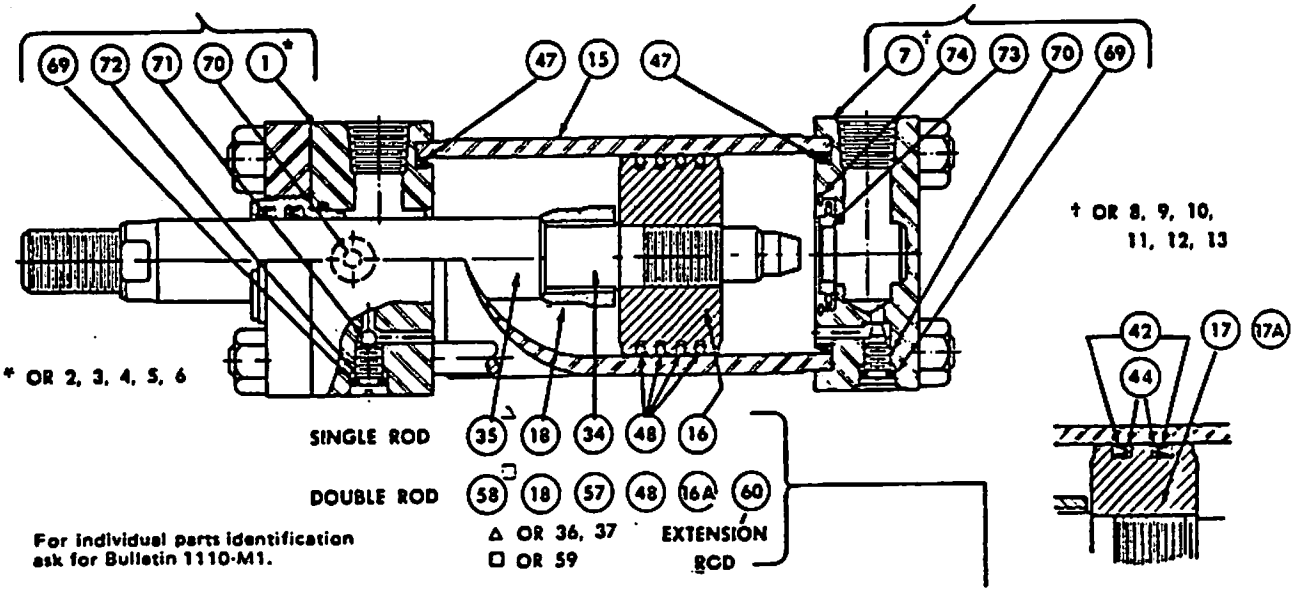
Service assemblies for servicing "2H" cylinders reduce your maintenance time and purchasing time. By specifying service assemblies for your power cylinder, you will receive subassemblies ready for installation. Instructions for installation will be included. Your paper work will be reduced by avoiding the necessity of the identification of each part.

When ordering Service Assemblies, specify Serial Number, Bore, Stroke and Model Number shown on the cylinder's name plate.

CAP ASSEMBLIES

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

ASS'Y NO.	DESCRIPTION
SA7	Basic cap (symbol 7)
SA8	Side lug mounting cap (symbol 8)
SA9	Centerline lug mounting cap (symbol 9)
SA10	Side tapped mounting cap (symbol 10)
SA11	Trunnion mounting cap (symbol 11)
SA12	Fixed clevis mounting cap (symbol 12)
SA13	End lug mounting cap (symbol 13)



For individual parts identification ask for Bulletin 1110-M1.

PARTS LIST — 1½" THROUGH 8" BORE SIZES

(For parts information on 10" and 12" bore cylinders, consult factory.)

Symbol	PART NAME
1	HEAD, Basic, Styles BB, DB, DD, H, HB, J, JB, T, TB, TC & TD
2	HEAD, Side Lug Mounting, Style C
3	HEAD, Centerline Lug Mounting, Style E
4	HEAD, Side Flush Mounting, Style F
5	HEAD, Trunnion Mounting, Style D
6	HEAD, Style G
7	CAP, Basic, Styles D, DD, H, HB, J, JB, T, TB, TC & TD
8	CAP, Side Lug Mounting, Style C
9	CAP, Centerline Lug Mounting, Style E
10	CAP, Side Flush Mounting, Style F
11	CAP, Trunnion Mounting, Style DB
12	CAP, Fixed Clevis Mounting, Style BB
13	CAP, End Lug Mounting, Style G
15	CYLINDER BODY, Standard—Plain
16	PISTON BODY, Ring Type, Single Rod
16A	PISTON BODY, Ring Type, Double Rod
17	PISTON BODY, Lipseal Type, Single Rod
17A	PISTON BODY, Lipseal Type, Double Rod
18	CUSHION SLEEVE, Rod Head Cushion
34	PISTON ROD, Single Rod Type—Non-cushioned

Symbol	PART NAME
35	PISTON ROD, Single Rod Type—Cushioned Head End
36	PISTON ROD, Single Rod Type—Cushioned Cap End
37	PISTON ROD, Single Rod Type—Cushioned Both Ends
42	LIPSEAL, Piston
44	BACK-UP WASHER, Piston
47	O-RING, Cylinder Body to Head & Cap Seal
48	PISTON RING, Iron
57	PISTON ROD, Double Rod Type—Non-cushioned
58	PISTON ROD, Double Rod Type—Cushioned One End
59	PISTON ROD, Double Rod Type—Cushioned Both Ends
60	EXTENSION ROD, Double Rod Type—Non-cushioned
61	EXTENSION ROD, Double Rod Type—Cushioned Both Ends
69	O-RING, Cushion Adjustment and Check Valve Plug Screw
70	NEEDLE, Cushion Adjustment Valve
71	BALL, Cushion Check Valve
72	PLUG SCREW, Cushion Check Valve
73	BUSHING, Float Check, Cushion on Cap End
74	RETAINING RING, Float Check Cushion Bushing

PISTON AND ROD ASSEMBLIES

Factory assembled piston and rod assemblies consisting of parts listed below, are recommended for cylinders 6" bore size or smaller in stroke lengths to 25". Factory assembled Assembly Nos. SA 34 and SA 36 are identical, as are Assembly Nos. SA 35 and SA 37. For larger bore sizes or longer stroke lengths, pistons and rods should be ordered separately as required.

SINGLE ROD TYPES

ASS'Y NO.	DESCRIPTION
SA34	Non-cushioned models, includes symbols 34, 16, 48
SA35	Cushioned head end models, includes symbols 35, 16, 18, 48
SA36	Cushioned cap end models, includes symbols 36, 16, 48
SA37	Cushioned both ends models, includes symbols 37, 16, 18, 48

DOUBLE ROD TYPES

ASS'Y NO.	DESCRIPTION
SA57	Non cushioned models, includes symbols 57, 16A, 42, 48
SA58	Cushioned one end models, includes symbols 58, 16A, 18, 42, 48
SA59	Cushioned both ends models, includes symbols 59, 16A, 18, 42, 48

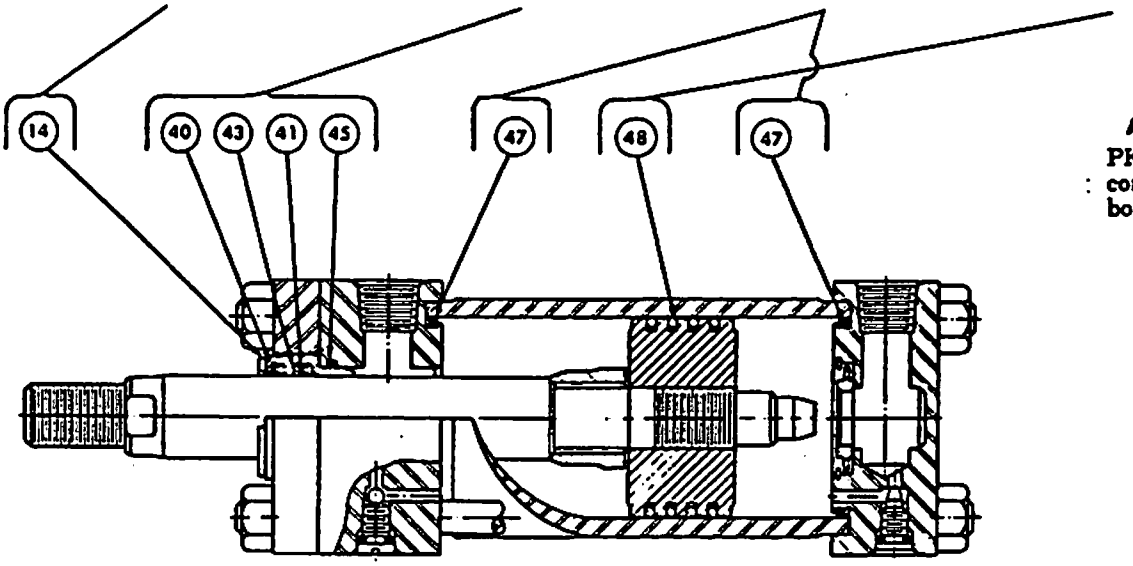
SEAL KITS

RG KITS CONTAIN "JEWEL" GLAND AND SEALS
(Includes symbols 14, 40, 41, 43, 45.)

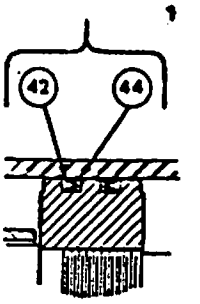
RK KITS CONTAIN ALL SEALS FOR GLAND CARTRIDGE
(Includes symbols 40, 41, 43 and 45.)

CB KITS CONTAIN CYLINDER BODY END SEALS
CB kits for Series "2H" cylinders contain two each of symbol 47.

PR KITS CONTAIN PISTON RINGS
PR kits for Series "2H" cylinders contain four each of symbol 48.



PK KITS CONTAIN PISTON LIPSEALS® AND BODY END SEALS
PK kits for Series "2H" contain two each of symbols 42, 44 and 47.



Service kits of expendable parts for Series "2H" 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 office.

For complete part identification and service instructions, ask for Maintenance Bulletin 1110-M1.

Standard Seals—Class 1 Service Kits are standard, and contain seals of Nitrile (Buna-N) elastomers for standard fluid service. These seals are suitable for use when air, hydraulic (mineral-type) oil, water-glycol fluid or water-in-oil emulsions are 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.

Special Seals—Class 5 Service Kits contain seals of fluorocarbon elastomers (Viton▲) for special fluid service. These seals are especially suitable for most straight synthetic phosphate ester and phosphate ester base (fire-resistant) fluids. They can also be used when air, hydraulic oil, water glycol or water-in-oil emulsions are the operating medium.

The recommended operating temperature range for Class 5 seals is -10° F. to +350° F. These seals will function at temperatures up to +400° F. with reduced life.

To order Class 1 or 5, specify operating medium and use kit numbers listed in the table below.

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

ST'D. ROD DIA.	RG GLAND CARTRIDGE KIT NOS.* INCLUDES RK KIT	RK ROD SEAL KIT NOS.* CONTAINS ROD SEALS	GLAND CARTRIDGE WRENCH PART NO.	SPANNER WRENCH PART NO.
1/2"	RG2AHL 0051	RK2AHL 0051	069590 0000	011676 0000
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

BORE SIZE	CB BODY SEALS KIT NOS.	PR PISTON RINGS KIT NOS.	PK PISTON SEAL KIT NOS.	TIE ROD NUT TORQUE SPECIFICATIONS FOOT POUNDS
1½"	CB152A HL01	PR152H 0000	PK152H LL01	18
2"	CB202A HL01	PR202H 0000	PK202H LL01	45
2½"	CB252A HL01	PR252H 0000	PK252H LL01	45
3¼"	CB322A HLU1	PR322H 0000	PK322H LLU1	120
4"	CB402A HLU1	PR402H 0000	PK402H LLU1	130
5"	CB502A HLU1	PR502H 0000	PK502H LLU1	310
6"	CB602A HLU1	PR602H 0000	PK602H LLU1	575
7"	CB702A HLU1	PR702H 0000	PK702H LLU1	790
8"	CB802A HLU1	PR802H 0000	PK802H LLU1	1160

*Kit numbers listed above identify Class 1 seals only. To order kits with Class 5 seals, substitute "5" for "1" as last digit of kit number.

NOTE: Expendable parts for 10" and 12" bore sizes are also available.
See bulletin 0995-B4.

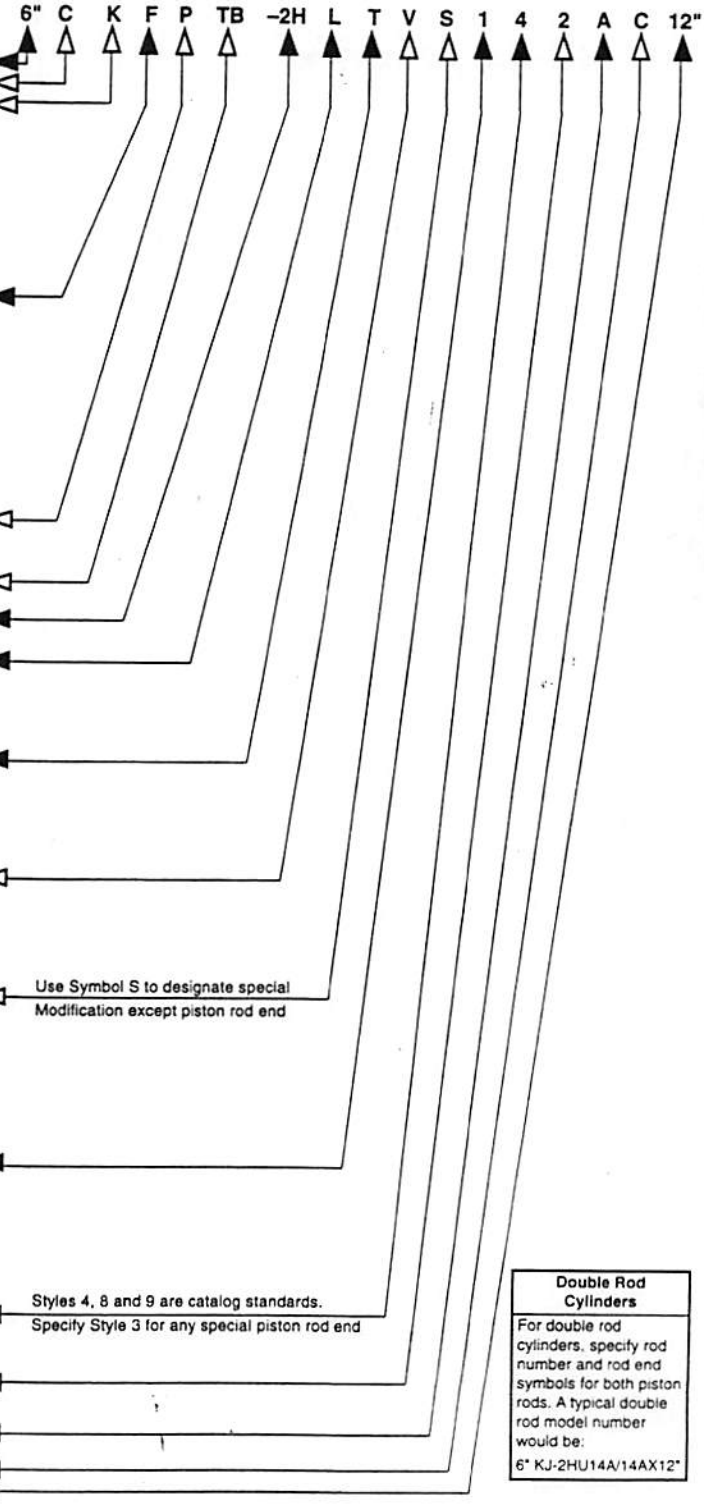
HOW TO ORDER SEAL KITS | When ordering seal kits, call out kit number listed above, and if your fluid or temperature conditions differ from standard service, call out the name of the fluid and the temperature.

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

Parker Series 2H cylinders can be completely and accurately described by a model number consisting of coded symbols. For single rod cylinders a maximum of 17 places for digits and letters are used in a prescribed sequence to produce a model number. Only nine places are needed to completely describe a standard noncushioned Series 2H cylinder. 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	C94,42 & 43	C
Double-Rod	Used only if double-rod cylinder is required	58	K
Mounting* Style	Head Tie Rods Extended	44	TB
	Cap Tie Rods Extended	44	TC
	Both End Tie Rods Extended	44	TD
	Head Rectangular Flange	46	J
	Head Square Flange	46	JB
	Head Rectangular	46	JJ
	Cap Rectangular Flange	48	H
	Cap Square Flange	48	HB
	Cap Rectangular	48	HH
	Side Lugs	50	C†
	Centerline Lugs	50	E
	Side Tapped	50	F†
	Side End Angles	52	CB
	Side End Lugs	52	G†
	Cap Fixed Clevis	52	BB
	Head Trunnion	54	D
	Cap Trunnion	54	DB
	Intermediate Fixed Trunnion	54	DD
	Spherical Bearing	56	SB
Mounting Modifications	Used only for Thrust Key (Styles C,F,G, & CB)	C93	P
	Used only for Manifold Port O-Ring Seal (Style C)	C91	M
Combination Mounting Style	Any Practical Mounting Style Listed Above	–	As listed above
Series*	Used in all 2H Model Numbers	–	–2H
Piston	Ring packed piston standard	–	C
	Used only for Lipseal® Piston	43	L
	Used only for Hi-Load Piston	43	K
Ports*	SAE Straight Thread O-Ring Port (Standard)	C89	T
	Used only for NPTF (Dry Seal Pipe Thread)	C89	U
	Used only for BSP (Parallel Thread ISO 228)	C89	R
	Used only for SAE Flange Ports (3000 psi)	C89	P
	Used only for BSPT (Taper Thread)	C89	B
	Used only for Metric Thread	C89	G
	Used only for Metric Thread per ISO 6149	C89	Y
Common Modifications	High Water Content Fluid	C83	J
	Nut Retained Piston	43	F
	Viton Seals	C83	V
	Water Service	C83	W
	EPR Seals	C83	X
Special Modifications	Used only if special Modifications are required: Oversize Ports	C91	S
	Port Position Change	C89	
	Special Seals	C83	
	Stop Tube	C95	
	Stroke Adjuster	C93	
	Tie Rod Supports	C93	
Piston Rod* Number	For Single Rod Cylinders, select one only. Refer to Rod number listing, Table 2, Pages 44 through 55 See chart in Section C 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 8 Intermediate Male	C92	8
	Style 9 Short Female	C92	9
	Style 3 Special (Specify)	C92	3
Piston Rod Alternate Thds.	Used only for stud two times longer than standard	C92	2
Piston Rod* Threads	UNF Standard	C92	A
	BSF (British Fine)	C92	W
	Metric	C92	M
Cushion-Cap	Used only if cushion required	C94, 42 & 43	C
Stroke*	Specify in inches	C93	–



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-2HU14A/14AX12"

*Required for Basic Cylinder Model Number

Dark Arrows Indicate Basic Minimum Model Number †Cylinders with these mounting styles should have a minimum stroke length equal to or greater than their bore size.

B

For Cylinder Division Plant Locations – See Page IV.

Parker Motion & Control

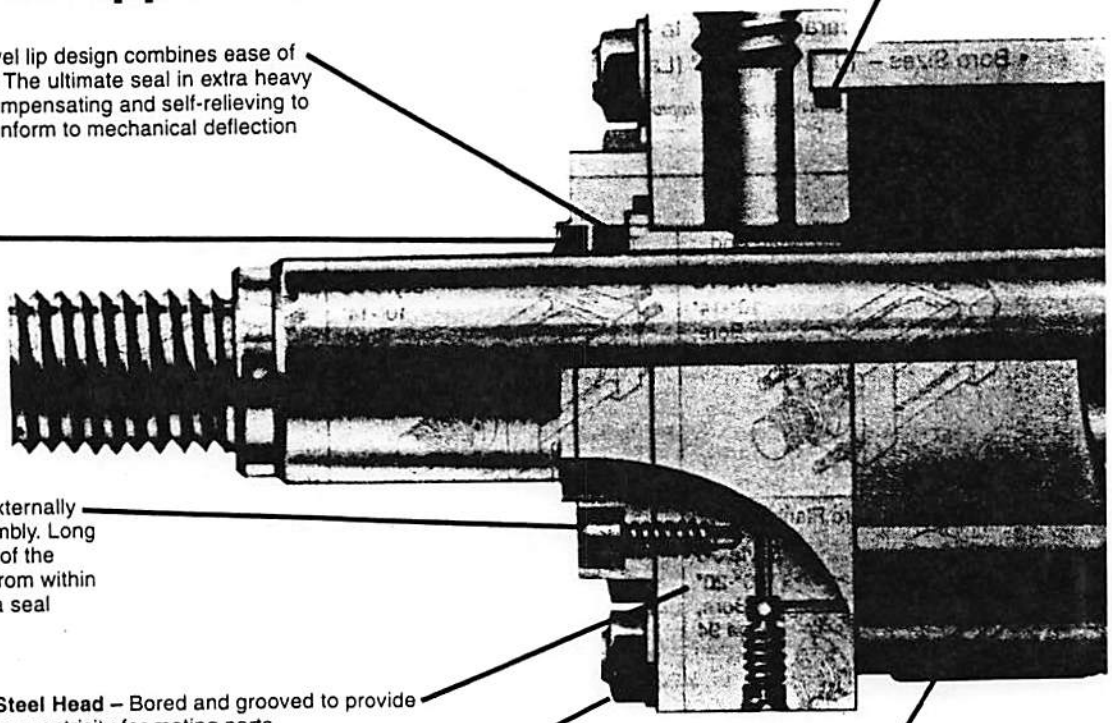
These innovative design features make Parker Series 3H your best choice...

for all your large bore high pressure hydraulic cylinder applications...

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

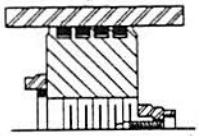
Primary Seal – Polypak® double-bevel lip design combines ease of installation with rugged construction. The ultimate seal in extra heavy duty applications. Completely self-compensating and self-relieving to withstand pressure variations and conform to mechanical deflection that may occur.

Secondary Seal – Double-Service Wiperseal® (Patent #2907596) – wipes clean any oil film adhering to the rod on the extend stroke and cleans the rod on the return stroke.



Bolt-On Rod Gland Assembly – Externally removable without cylinder disassembly. Long cast-iron 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.

Optional Piston



Cast iron ring piston is available as a special modification.

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

Alloy Steel Tie Rod Nuts – With hardened washer.

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

Parker's Exclusive

Stepped floating cushions combine the best features of known cushion technology.

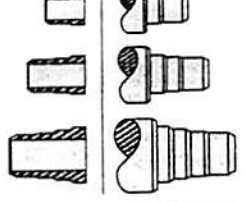
Deceleration devices or built-in "cushions" are optional and can be supplied at head end, cap end, or both ends without change in envelope or mounting dimensions.

Standard straight or tapered cushions have been used in industrial cylinders over a very broad range of applications. Parker research has found that both designs have limitations. As a result, Parker has taken a new approach in cushioning of industrial hydraulic cylinders and for specific load and velocity conditions have been able to obtain deceleration curves that come very close to the ideal. The success lies in a stepped sleeve or spear concept where the steps are calculated to approximate theoretical orifice areas curves. In the cushion performance chart, pressure traces show the results of typical orifice flow conditions. Tests of a three-step sleeve or spear show three pressure pulses coinciding with the steps. The deceleration cushion plunger curves shape comes very close to being theoretical, with the exception of the last $^1/_2$" of travel. This is a constant shape in order to have some flexibility in application. The stepped cushion design shows reduced pressure peaks for most load and speed conditions, with comparable reduction of objectionable stopping forces being transmitted to the load and the support structure.

The Series 3H 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.

Stepped Cushions

Sleeve Design | Spear Design



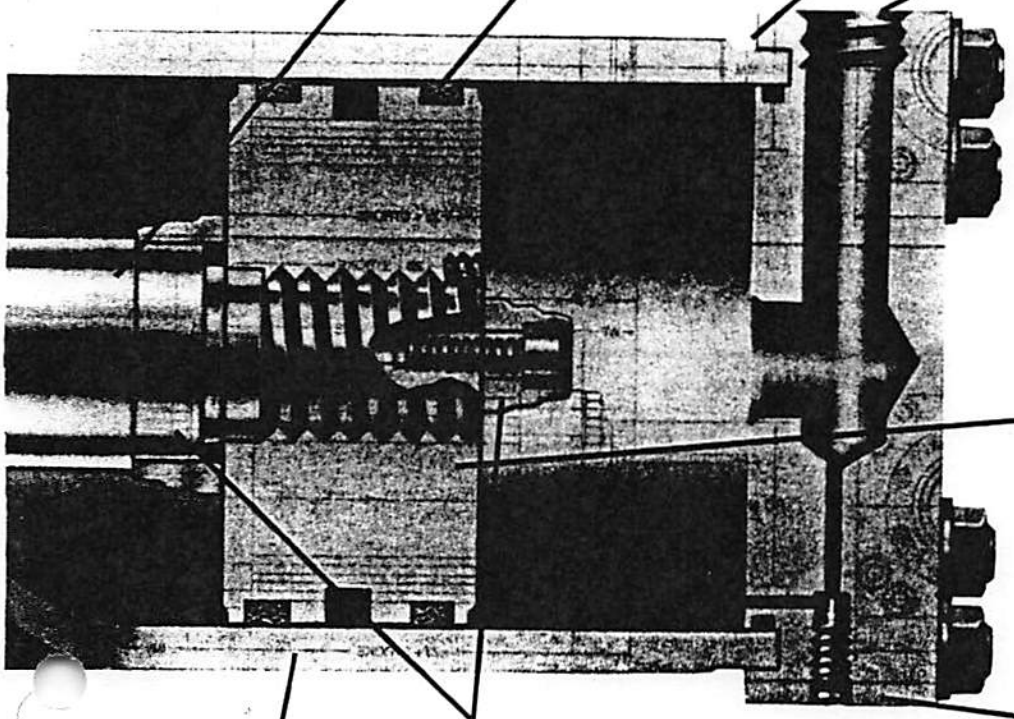
For additional information – call your local Parker Fluidpower Motion & Control Distributor.

Piston Rod – Hard chrome-plated and polished for maximum seal and rod bearing life. Two standard thread styles. Rod end is supplied with spanner wrench holes.

Hi-Load Piston Seals – Are standard.

Align-A-Groove® – (Patent #3043639) – A 3/16" wide surface machined at each end of the cylinder body. Makes precise mounting quick and easy.

Ports – SAE O-ring straight thread ports are standard.



Optional Ports

Ports – SAE straight thread ports or NPTF (Dry Seal Pipe Ports) are available for an extra charge. (See pages C-99, B-101.)

Seals – Buna-N (Nitrile) seals are standard.

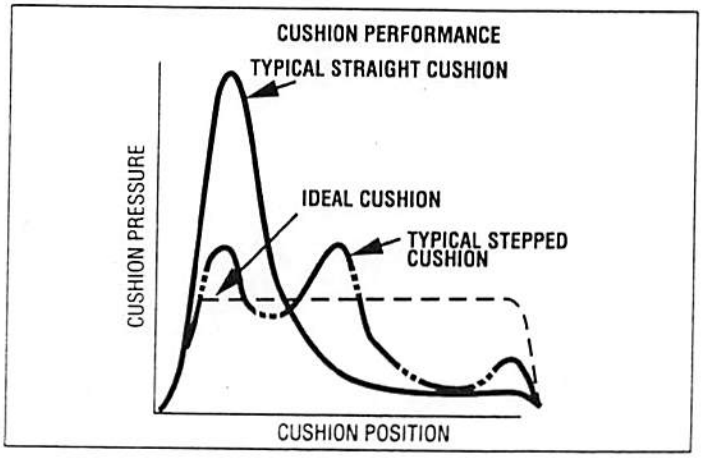
Viton Seals – Optional at extra charge.

One-Piece Cast Iron Piston – For maximum strength and minimum size. Long thread engagement and largest practical thread sized provides maximum shock resistance. One piece design is piloted to piston rod assuring concentricity. Piston is locked with set screw. Anaerobic adhesive and peening of set screw locks and seals piston to rod.

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

The Cylinder Body – Heavy-wall steel tubing is honed to a 15 RMS micro finish bore providing a wear surface for long lasting piston bearing and seal life.

Adjustable Floating Stepped Cushions – For maximum performance. Economical and flexible for even the most demanding applications. Provides superior performance in reducing shock. Cushions are optional and can be supplied at head end, cap end, or both ends without change in envelope or mounting dimensions.



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

a. A stepped sleeve is furnished on the piston rod assembly.

b. A needle valve is provided that is flush with the side of the head even when wide open. It may be identified by the fact that it is socket-keyed. It is located on side number 3, in all mounting styles except C. In this style it is located on side number 2.

c. A springless check valve is provided that is also flush with the side of the head and is mounted on the same side as the needle valve except on mounting style C, where it is mounted on side number 2, next to 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-stepped spear is provided on the piston rod.

b. 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 3 in all mounting styles except C. In this style it is located on side number 2.

c. A springless check valve is provided that is also flush with the side of the cap and is mounted on the same side as the needle valve except on mounting style C, where it is mounted on side number 2, next to the needle valve.

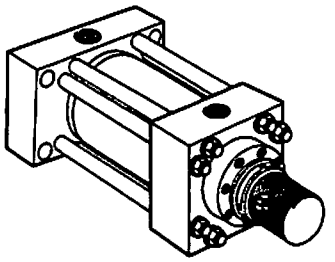
d. The check and needle valves are interchangeable in the cap.

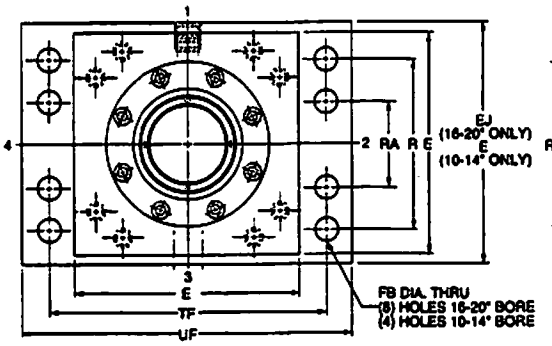
For Cylinder Division Plant Locations – See Page IV.

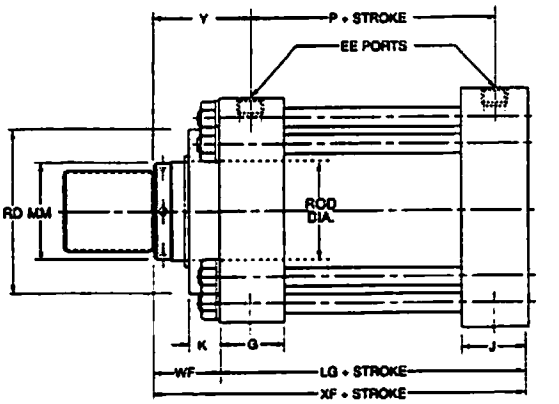
Parker Motion & Control

Cap Rectangular Mountings
Style HH
(NFPA Style ME6)

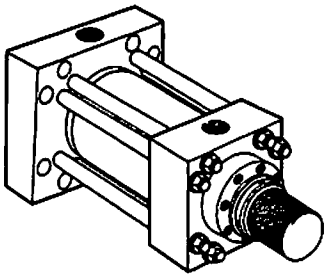
Note: 10"-14" Bores have (4) mounting holes, 16"-20" Bores have (8) mounting holes.

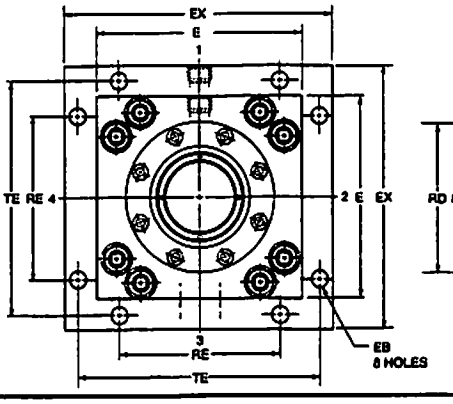


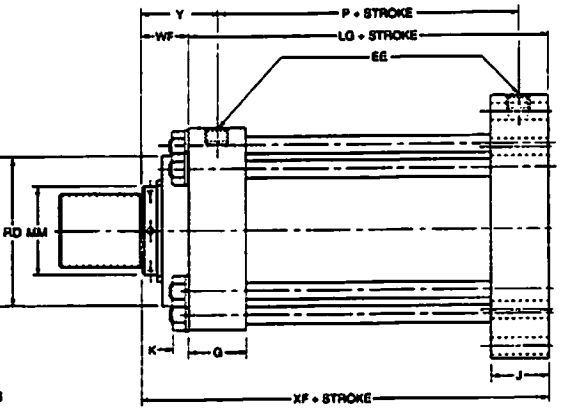




Cap Square Flange Mounting
Style HB
(NFPA Style MF6)

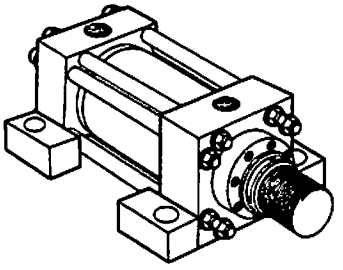


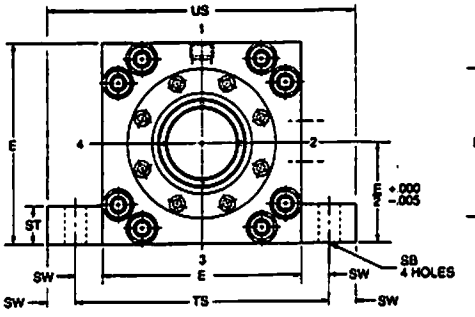


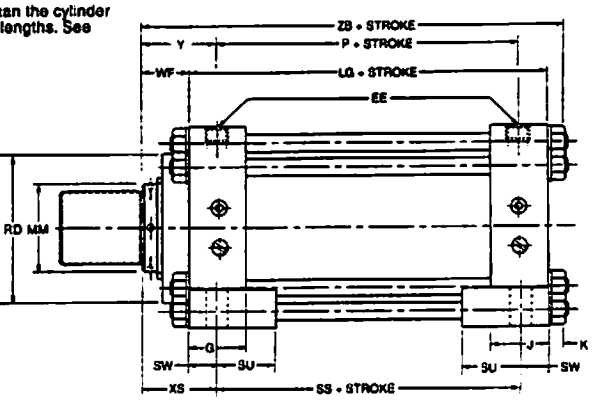


Side Lugs Mounting
Style C
10"-14" Bore only
(NFPA Style MS2)

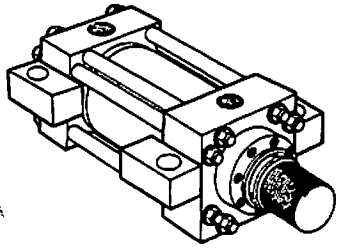
Note: Stroke lengths on lug mounted cylinders should not be shorter than the cylinder bore diameter. Consult factory for recommendations on shorter stroke lengths. See page 100 for further recommendations on side lug mountings.

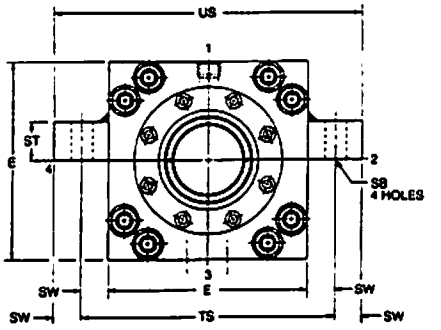


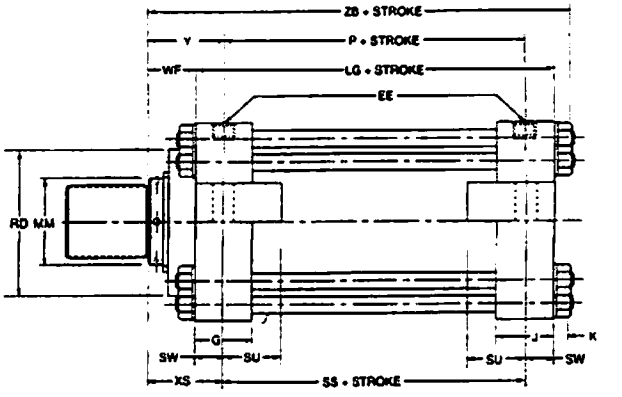




Centerline Lugs Mounting
Style E
10"-14" Bore only
(NFPA Style MS3)





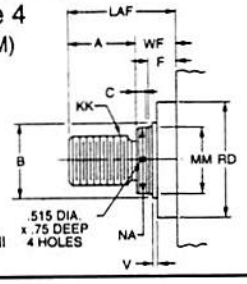


For additional information – call your local Parker Fluidpower Motion & Control Distributor.

Series 3H Large Bore High Pressure Hydraulic Cylinders

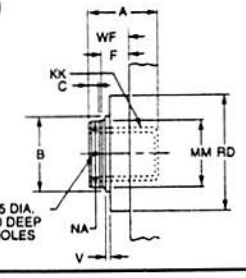
Rod End Dimensions — see table 2

Thread Style 4
(NFPA Style SM)
Small Male



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

Thread Style 9
(NFPA Style SF)
Small Female



Use Style 9 for applications where female rod ends are required.

Special Thread Style 3

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

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

Table 1—Envelope and Mounting Dimensions

Bore	E	EB	EE* NPTF	EE▲ S.A.E. FLANGE PORT	EE** S.A.E. STRAIGHT THREAD	EX	FB	G	J	K	R	RE	SB	ST	SU	SW	TE	TF	TS	UF	US	Add Stroke LG	Add Stroke P	Add Stroke SS
10	12 5/8	1 5/16	2	2	24	16 5/8	1 13/16	3 11/16	3 11/16	1 9/32	9.62	9.89	1 9/16	2 1/4	3 1/2	1 5/8	14.13	15 7/8	15 7/8	19	19 1/8	12 1/8	8 1/2	8 7/8
12	14 7/8	1 9/16	2 1/2	2 1/2	24	19 3/4	2 1/16	4 7/16	4 7/16	1 13/32	11.45	11.75	1 9/16	3	4 1/4	2	16.79	18 1/2	18 7/8	22	22 7/8	14 1/2	10 1/8	10 1/2
14	17 1/8	1 13/16	2 1/2	2 1/2	24	21 3/4	2 5/16	4 7/8	4 7/8	1 13/32	13.26	12.90	2 5/16	4	4 3/4	2 1/4	18.43	21	21 5/8	25	26 1/8	15 5/8	10 7/8	11 1/8

Table 1A—Envelope and Mounting Dimensions

Bore	E	EB	EE (SAE)	EE (FLANGE)	EJ	EX	FB	G	J	K	R	RA	RE	TE	TF	UF	Add Stroke LG	Add Stroke P
16	19	1 13/16	24	3	20	24 1/2	1 13/16	5 7/8	5 7/8	1 29/32	15 1/2	8	15.28	21.03	21	24 1/2	18 1/8	12 1/8
18	22	2 1/16	24	3	23	26 1/2	2 1/16	6 7/8	6 7/8	1 29/32	18	7 1/4	16.45	22.65	24 1/4	28 1/4	21 1/8	15 1/8
20	24	2 1/16	24	3	25	29	2 1/16	7 7/8	7 7/8	1 29/32	20	8	18.07	24.87	26 1/2	30 1/2	23 5/8	17 5/8

* NPTF ports are available at an extra charge.

▲ Optional SAE flange ports may be specified – flange to be supplied by customer. See Table 4 for flange port pattern dimensions.

** SAE straight thread ports are standard and are indicated by port number.

Table 2—Rod Dimensions

Bore	Rod No.	Rod Dia. MM	Thread KK	Rod Extensions and Pilot Dimensions A	+.000 -.005 B	C	F	LAF	NA	RD	V	WF
10	1(Std.)	4 1/2	3 1/4-12	4 1/2	5.249	1	1 15/16	7 7/16	4 3/8	8 1/4	1/4	2 15/16
	2	7	5-12	7	7.999	1	1 15/16	10 1/2	6 7/8	10 1/2	3/8	3 1/2
	3	5	3 1/2-12	5	5.749	1	1 15/16	8 3/16	4 7/8	8 7/8	1/4	3 3/16
	4	5 1/2	4-12	5 1/2	6.249	1	1 15/16	8 11/16	5 3/8	9 3/8	1/4	3 3/16
12	1(Std.)	5 1/2	4-12	5 1/2	6.249	1	1 15/16	8 11/16	5 3/8	9 3/8	1/4	3 3/16
	2	8	5 3/4-12	8	8.999	1	1 15/16	12	7 7/8	12 1/2	3/8	4
	3	7	5-12	7	7.999	1	1 15/16	10 1/2	6 7/8	10 1/2	3/8	3 1/2
14	1	7	5-12	7	7.999	1	1 15/16	10 1/2	6 7/8	10 1/2	3/8	3 1/2
	2	10	7 1/4-12	10	10.999	1	1 15/16	14 1/2	9 7/8	14 1/2	3/8	4 1/2
	3	8	5 3/4-12	8	8.999	1	1 15/16	12	7 7/8	12 1/2	3/8	4
16	1	8	5 3/4-12	8	8.999	1	1 15/16	12	7 7/8	12 1/2	3/8	4
	3	9	6 1/2-12	9	9.999	1	1 15/16	13 1/4	8 7/8	13 1/2	3/8	4 1/4
	4	10	7 1/4-12	10	10.999	1	1 15/16	14 1/2	9 7/8	14 1/2	3/8	4 1/2
18	1	9	6 1/2-12	9	9.999	1	1 15/16	13 1/4	8 7/8	13 1/2	3/8	4 1/4
	3	10	7 1/4-12	10	10.999	1	1 15/16	14 1/2	9 7/8	14 1/2	3/8	4 1/2
20	1	10	7 1/4-12	10	10.999	1	1 15/16	14 1/2	9 7/8	14 1/2	3/8	4 1/2

Table 3 —Envelope and Mounting Dimensions

Bore	Y	XS	Add Stroke XF	Add Stroke ZB
10	4 3/4	4 9/16	15 1/16	16 11/32
	5 5/16	5 1/8	15 5/8	16 29/32
	5	4 13/16	15 5/16	16 19/32
	5	4 13/16	15 5/16	16 19/32
	5 3/8	5 3/16	17 11/16	19 3/32
12	6 3/16	6	18 1/2	19 29/32
	5 11/16	5 1/2	18	19 13/32
14	5 7/8	5 3/4	19 1/8	20 17/32
	6 7/8	6 3/4	20 1/8	21 17/32
	6 3/8	6 1/4	19 5/8	21 1/32
	7	*	22 1/8	*
16	7 1/4	*	22 3/8	*
	7 1/2	*	22 5/8	*
	7 1/4	*	25 3/8	*
18	7 1/2	*	25 5/8	*
	7 1/2	*	28 1/8	*
20	7 1/2	*	28 1/8	*

*Consult Factory

Table 4—Optional SAE Flange Port Pattern

Nom. Flange Size	A	Q	GG	W	X	Z-THD UNC-2B	AA Min.
1 1/2	1.50	2.750	1.406	1.38	0.70	1/2-13	1.06
2	2.00	3.062	1.688	1.53	0.84	1/2-13	1.06
2 1/2	2.50	3.500	2.000	1.75	1.00	1/2-13	1.19
3	3.00	4.188	2.438	2.09	1.22	5/8-11	1.19

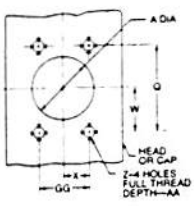
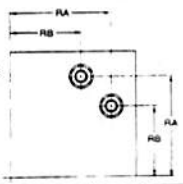
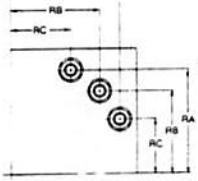


Table 5—Tie Rod Information

10", 12" Bores



14" Bore



Bore	10	12	14	16	18	20
Tie Rod Thread	1 1/8-12	1 1/4-12	1 1/4-12	*	*	*
RA	5.291	6.270	7.485	*	*	*
RB	3.775	4.555	6.143	*	*	*
RC	—	—	4.409	*	*	*

*Consult factory for dimensions

For Cylinder Division Plant Locations – See Page IV.

Parker Motion & Control

Series 3H Large Bore High Pressure Hydraulic Cylinders

Series 3H Model Numbers – How to Develop Them – How to "Decode" Them

Parker Series 3H cylinders can be completely and accurately described by a model number consisting of coded symbols. For single rod cylinders a maximum of 13 places for digits and letters are used in a prescribed sequence to produce a model number. Only nine places are needed to completely describe a standard non-cushioned Series 3H cylinder. To develop a model number, select only those symbols that represent the cylinder required, and place them in the sequence indicated below. The example makes use of all 13 places, although many model numbers will not require all 13, as in the case where cushioning, double rod, or special modifications are not required. **Note: Page numbers with a letter prefix, i.e.: 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	C94, 90	C
Double-Rod	Used **only** if double-rod cylinder is required	100	K
Mounting* Style	Tie Rods Extended Cap End (10"-14" Bore)	92	TB
	Tie Rods Extended Head End (10"-14" Bore)	92	TC
	Tie Rods Extended Both Ends (10"-14" Bore)	92	TD
	Head Square Flange	94	JB
	Head Rectangular	94	JJ
	Cap Square Flange	96	HB
	Cap Rectangular	96	HH
	Side Lugs (10"-14" Bore)	96	C†
	Centerline Lugs (10"-14" Bore)	96	E
	Cap Fixed Clevis	98	BB
	Head Trunnion (10"-14" Bore)	98	D
	Cap Trunnion (10"-14" Bore)	98	DB
	Intermediate Fixed Trunnion	98	DD
Combination Mounting Style	Any Practical Mounting Style Listed Above	– –	As listed above
Series*	Used in **all** 3H Model Numbers	–	3H
Piston	Hi-Load Piston standard	B89, C4	K
	Used **only** for Ring Packed Piston	B88	C
Ports*	SAE Straight Thread O-Ring Port (Standard)	C89	T
	Used **only** for NPTF (Dry Seal Pipe Thread) (10-14" Bore Only)	C89	U
	Used **only** for BSP (Parallel Thread ISO 228)	C89	R
	Used **only** for SAE Flange Ports (3000 psi)	C89	P
	Used **only** for BSPT (Taper Thread)	C89	B
	Used **only** for Metric Thread	C89	G
	Used **only** for Metric Thread per ISO 6149	C89	Y
Common Modifications	Viton Seals	C83	V
	Water Service	C83	W
Special Modifications	Used **only** if special Modifications are required:		
	Port Position Change	C119	S
	Special Seals	C83	
	Stop Tube	C95, C122	
Piston Rod* Number	For Single Rod Cylinders, select one only. Refer to Rod number listing, Table 2, Pages 90 through 97	– – –	1 2 3
Piston* Rod End	Select:		
	Style 4 Small Male	C92	4
	Style 9 Short Female		9
	Style 3 Special (Specify)		3
Piston Rod* Threads	UNF Standard	C92	A
	BSF (British Fine)		W
	Metric		M
Cushion-Cap	Used **only** if cushion required	C94, 90	C
Stroke*	Specify in inches	C122	–

10" C K C JB 3H K T V S 1 4 A C 12"

Use Symbol S to designate special

Modification except piston rod end

Styles 4, 8, and 9 are catalog standards
Specify Style 3 for any special piston rod end

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:

10" KJJ-3HK14/14X12"

†Cylinders with this mounting style should have a minimum stroke length of equal to or greater than its bore diameter.

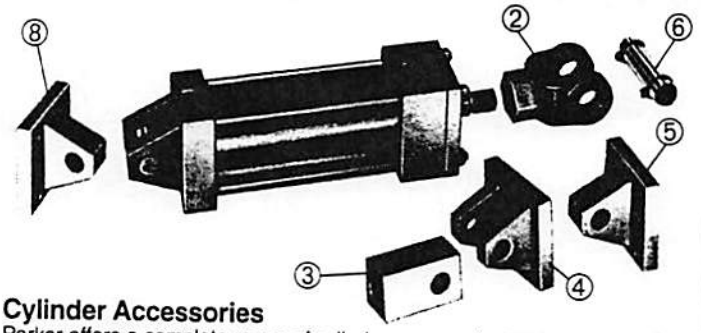
*Required for Basic Cylinder Model Number

**See chart in Section C for minimum piston rod diameter.

For Cylinder Division Plant Locations – See Page IV.

Parker Motion & Control

Series 2H
Heavy Duty 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, 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	144500-0105
7/16-20	50940	69195	68368	69089	69205	68368	144500-0107
1/2-20	50941	69195	68368	69090	69205	68368	144500-0108
3/4-16	50942	69196	68369	69091	69206	68369	144500-0112
3/4-16	133284	69196	68369	69091	69206	68369	144500-0112
7/8-14	50943	*85361	68370	69092	69207	68370	144500-0114
1-14	50944	*85361	68370	69093	69207	68370	144500-0116
1-14	133285	*85361	68370	69093	69207	68370	144500-0116
1 1/4-12	50945	69198	68371	69094	69208	68371	144500-0120
1 1/4-12	133286	69198	68371	69094	69208	68371	144500-0120
1 1/2-12	50946	*85362	68372	69095	69209	68372	Consult Factory
1 3/4-12	50947	*85363	68373	69096	69210	69215	
1 7/8-12	50948	*85363	68373	69097	69210	69215	
2 1/4-12	50949	*85364	68374	69098	69211	68374	
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	

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.

Accessory Load Capacity

The various accessories on this and the following pages have been load rated for your convenience. The load capacity in lbs., shown on the following 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.

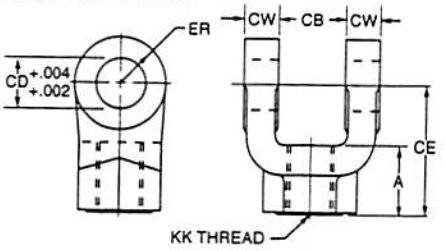
Chart B

Mtg. Plate Part No.	Series 2H Bore Size
69195	1 1/2"
69196	2", 2 1/2"
*85361	3 1/4"
69198	4"
*85362	5"
*85363	6"

Mounting Plates

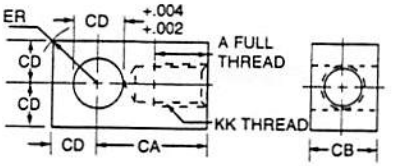
Mounting Plates for Style BB (clevis mounted) cylinders are offered. To select proper part number for your application, refer to Chart B, above right.

② Female Rod Clevis



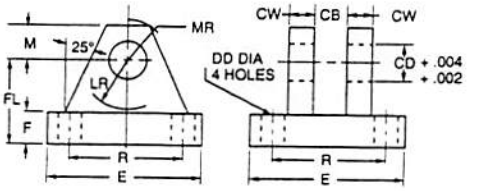
Order to fit thread size.

③ Knuckle (Female Rod Eye)



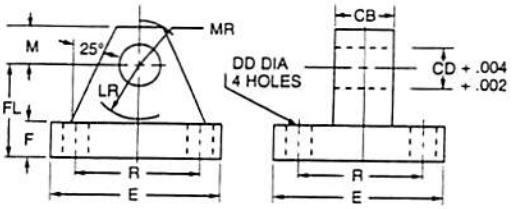
Order to fit thread size.

④ Clevis Bracket for Knuckle



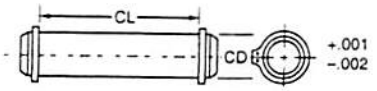
Order to fit Knuckle.

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.

Series 2H
Heavy Duty Hydraulic Cylinders

	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	2	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	15/16-24	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. Θ	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‡	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. Θ	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. Θ	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. Θ	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.Θ	6600	8600	18300	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.

Θ 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.