Tim Falke

Power Dynamics, Inc.
Harvey, LA

Electrohydraulic Control System Retrofit
G.E. Steam Turbine No. 1

For

Dow Chemical , Plaquemine, LA

Reference Manual

Hydraulic Power Unit & Electrohydraulic Actuators

September 1994

List of Drawings

Drawing Title	Drawing No.	Vendor
Cylinder Specification Control Drawing (7" Bore Stop Valve Actuator)	1145291	Parker
Hydraulic Control System Operational Schematic	CM93-36-1	Power Dynamics
Hydraulic Control System Power Unit Arrangement	CM93036-2	Power Dynamics
Power Dynamics/Dow Chemical 2.50" Bore x 8.00" Stroke (For Extraction Valve)	1100185	Parker
Power Dynamics/Dow Chemical 3.25" Bore x 13 00" Stroke (For Throttle Valve)	1100186	Parker
Power Dynamics/Dow Chemical (Stop Valve Actuator Control Manifold)	T-30406	Parker

Introduction

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

Some of the Information in this manual may not apply to your power unit. Information on custom units may require 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. They should be aware of the limitations of the system and its 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, "L" shaped, or vertical reservoir all of which incorporate sump drain, oil level gage, filler/breather assembly and spare return connections.

The pump will be coupled to the motor using either an integral close coupled configuration or flexible shaft coupling

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 the skid until it has been carefully checked for damage that may have occurred in transit. Report all damage immediately 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.

St rag

If the Power Unit is not going to be installed immediately, it should be stored indoors, covered with waterproof 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

Vertical Power Units should be removed from the skid by wrapping a heavy duty nylon strap around the base of the motor mounting feet. This strap should be firmly secured to the lift truck forks when unit is lifted.

Small horizontal style Power Units should be moved with a fork–lift truck, with 2 x 4 boards under the reservoir belly, to distribute and steady the load. Larger horizontal 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 heat 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. (See fig. 1)

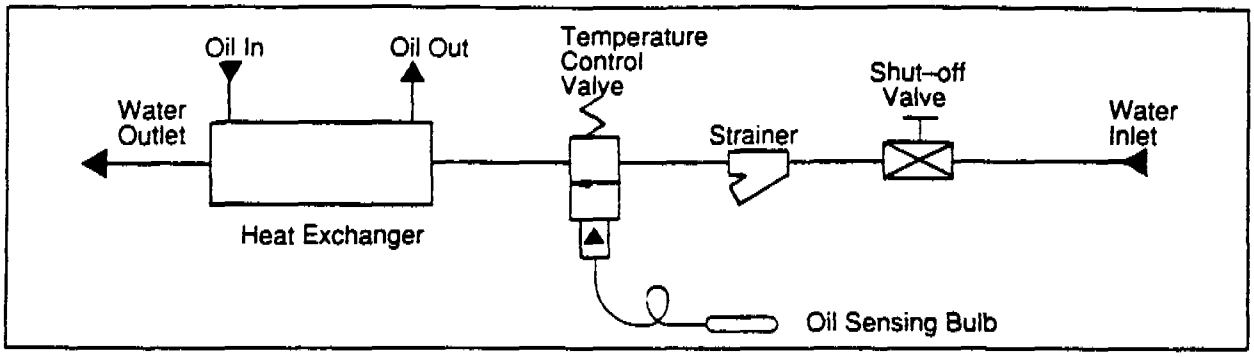


Figure 1

Service Connections (Cont.)

Electrical Connect the pump motor to the 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 name tag 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 most dirt infiltrates a hydraulic system during installation, we recommend the following:

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 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

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 (V–Pak), 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.

Maintenance Suggestions (Cont.)

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 temperature is normal going into a component but hot coming out, that could be one of the potential problem areas.

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

Check Oil Samples Periodically

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 Normally it will contain more contaminants, because hot oil leads to accelerated wear of component parts

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 or insufficient protection of air breather.)

4) Tank not properly sealed.

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 identification 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) Tank line not returned below fluid level.

2) Broken pipe

3) Line left out between a bulkhead coupling and the bottom of the tank after cleaning

4) Inadequate baffles in reservoir.

5) Fluid contaminated with incompatible foreign matter

6) Suction leak to pump aerating oil.

7) 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 sealed 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) Relief valve set too close to compensator pressure setting.

2) Water shut off or heat exchanger clogged.

Troubleshooting (Cont.)

3) Continuous operation at relief setting.

a. Stalling under load, etc.

b. Fluid viscosity too high or too low.

4) Excessive slippage or internal leakage.

a. Check stall leakage past pump, motors and cylinders.

b. Fluid viscosity too low.

5) Reservoir sized too small.

6) Case drain line from pressure compensated pump returning oil too close to suction line.

a. Re–pipe 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 premature wear and subsequent high noise level in operation.

4) Check manufacturer's 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 manufacturer's 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 filler breather.

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

17) Air leak in suction line or fittings may cause irregular movement of hydraulic system.

18) Loose or worn pump parts.

19) Pump being driven in excess of rated speed.

20) Air leak at pump shaft seal.

21) Oil level too low and drawing air in through inlet.

22) Air bubbles in intake oil.

23) Suction filter too small or too dirty.

24) Suction line too small or too long.

26) Pump housing bolts loose or not properly torqued.

Tr ubleshooting Pumps (Cont.)

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 sea 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 is not sufficient to complete the stroke of the solenoid, it will burn out the coil.

2) Voltage too high. Excessive voltage can also burn out coils.

3) 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.)

4) Mechanical damage to leads. (Short circuit, open connections, etc.)

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

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

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. (DC)

9) Long lead 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.)

Troubleshooting Solenoid Valves (Cont.)

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 tank port and check for operation with the combined flow draining into an open container...block line to main tank from 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 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.

Ordering Code Cartridges

2-Way Slip-In Cartridges Series CE and C

CE							10
Cartridge	Nominal Size	Variation	Poppet	Spring	Orifice	Seals	Design Series

Code	Description
016	NG 16
025	NG 25
032	NG 32
040	NG 40
050	NG 50
063	NG 63
080	NG 80
100	NG 100

Code	Pressure
A	without spring
L	0.1 bar
N *	0.5 bar
S *	1.6 bar
U *	4.0 bar

* not for code "F" normally open

Code	Material
N	Buna N
V	Viton
E	Ethylene-Propylene

Description	Code
normally closed	
standard, no poppet seal	C
with poppet seal	S *
normally open	
standard, no poppet seal	F

* for spring S or U only
Not for NG 16
Not with poppet C* up to NG 63

Code	Area Ratio
01	$A_1 = A$
04	$A_1 = 1.4\ A$ $A_2 = 0.4\ A$
07 *	$A_1 = 1.7\ A$ $A_2 = 0.7\ A$
08	$A_1 = 1.8\ A$ $A_2 = 0.8\ A$

* not for NG 16
80 and 100

Code	Description
00	plug without orifice
08*	plug with orifice code denotes orifice diameter in tenths of millimeter Examples: orifice dia. 0.8 mm
20*	orifice dia. 2.0 mm
99	open, no orifice, no plug

* for other orifice sizes see page 49

Covers

C									10
Cover	Nominal Size	Variation	Stroke Adjustment	Orifices				Seals	Design Series

Code	Description
016	NG 16
025	NG 25
032	NG 32
040	NG 40
050	NG 50
063	NG 63
080	NG 80
100	NG 100

Description	Code
without stroke adjustment	A
adjustment screw and locknut	N
knob with lock	O *
knob with ratchet	S * *
knob with ratchet and lock	Y *

* not for sizes 63 to 100
** not for sizes 32 to 100

Material	Code
Buna N	N
Viton	V
Ethylene-Propylene	E

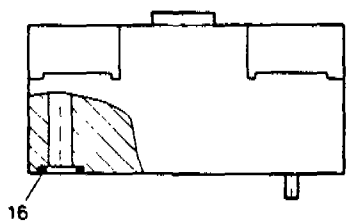
Code	Description
A	with port "X" for external piloting
B	as "A", with stroke adjustment
C	for fitting of pilot function

Description	Code
plug without orifice	00
plug with orifice, code denotes orifice diameter in tenths of millimeter Examples: orifice dia. 0.8 mm orifice dia. 2.0 mm	08* 20*
open, no orifice, no plug	99

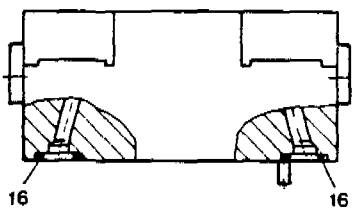
*for other orifice sizes see page 49

for positioning and sizing of orifices see page 48 to 50

C016AA to C100AA

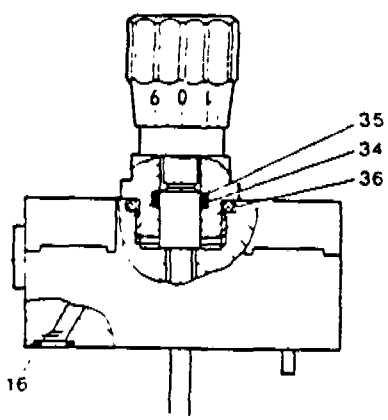


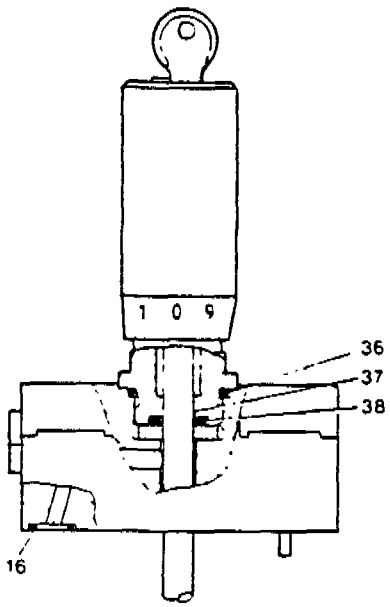
C016AA to C100AA



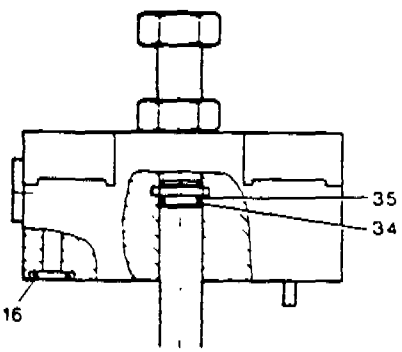
C032BY

C016BS to C025BS





C032BN to C100BN



Spare Parts

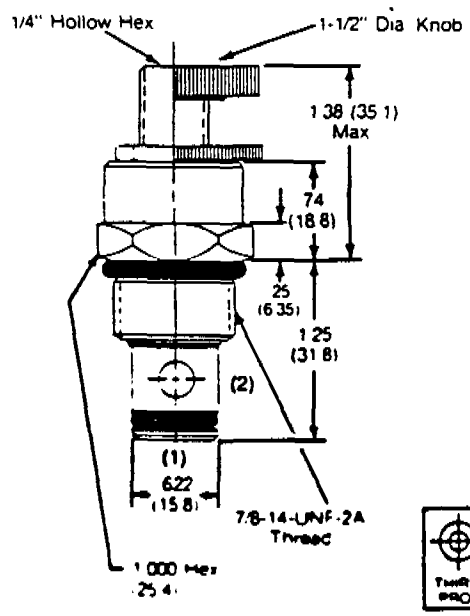
Position Nr	Description	Part Number C016	C025	C032	C040	C050	C063	C080	C100
16	O-Ring Buna N 552-90 Viton V 747-90	5000902 5001012 2-010	5000904 5001014 2-012	5000905 5001015 2-013	5000931 5001035 2-112	5000931 5001035 2-112	5000935 5001039 2-116	5000973 5001068 2-215	5000973 5001068 2-215
34	O-Ring Viton	5001036 2-113	5001036 2-113	5001033 2-110	5001037 2-114	5001037 2-114	5001041 2-118	5001048 2-125	5001090 2-129
35	backup ring N 300-90	5001135 B-113	5001135 B-113	-	-	-	-	-	5001143 B-129
36	O-Ring Buna N 552-90 Viton V 747-90	5000943 5001047 2-124	5000943 5001047 2-124	5000943 5001047 2-124	-	-	-	-	-
37	Glyd Ring	-	-	5001262*	-	-	-	-	-
38	O-Ring Buna N 552-90 Viton V 747-90	-	-	5000932 5001036 2-113	-	-	-	-	-

*S 55043-0100-10

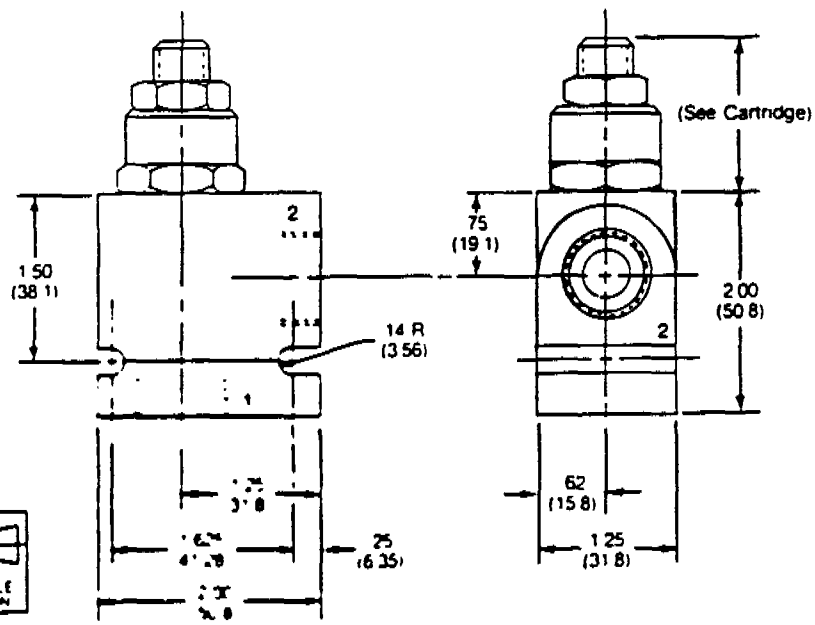
Dimensions (Millimeters)

Inches

Cartridge Only



Cartridge in Body



Ordering Information

NV	10	1			—	
NEEDLE VALVE	SIZE	STYLE	ADJUSTMENT STYLE	SEALS		BODY OPTION

SIZE

7/8–14

STYLE

Code	Style
1	Direct Acting

ADJUSTMENT STYLE

Code	Style
K	Knob Adjust
S	Screw Adjust

SEALS

Code	Type
Omit	Nitrile
V	Viton

BODY OPTION

Code	Porting
Omit	Cartridge Only
4P	1/4" NPTF (B10–2–4P)
6P	3/8" NPTF (B10–2–6P)
8P	1/2" NPTF (B10–2–8P)
6T	SAE–6 (B10–2–6T)
8T	SAE–8 (B10–2–8T)

Shipping Weight
Cartridge Only 0.4 lbs. (.18 kg)
Cartridge in Body 1.4 lbs. (.63 kg)

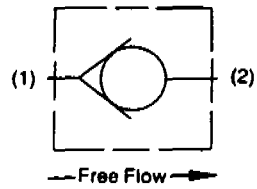
SERVICE PARTS

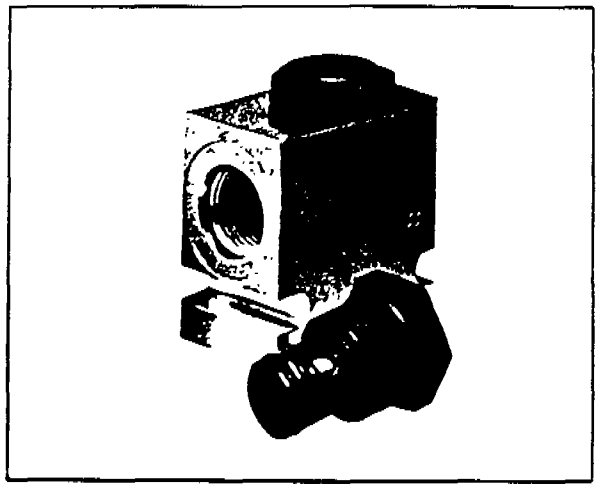
Knob Kit – 840208K (To convert screw adjust to knob adjust)
Nitrile Seal Kit – SK10–2
Viton Seal Kit – SK10–2V
Panel Mount Kit – PMK101

DO A 134800
CONFIDENTIAL

Parker
Motion & Control

Poppet–Type Check Valve





Application

The CV101 Series Check Valves allow free flow in one direction while preventing flow in the reverse direction. They can be used to isolate portions of a hydraulic circuit or to provide a free flow path around a restrictive valve.

Operation

Pressure on the inlet of the check creates a force against the poppet, pushing it off its seat and permitting free flow. Reverse flow through the check is blocked by the poppet.

Features

- Hardened operating parts for long life
- Fully guided poppet for smooth operation
- Cartridge design

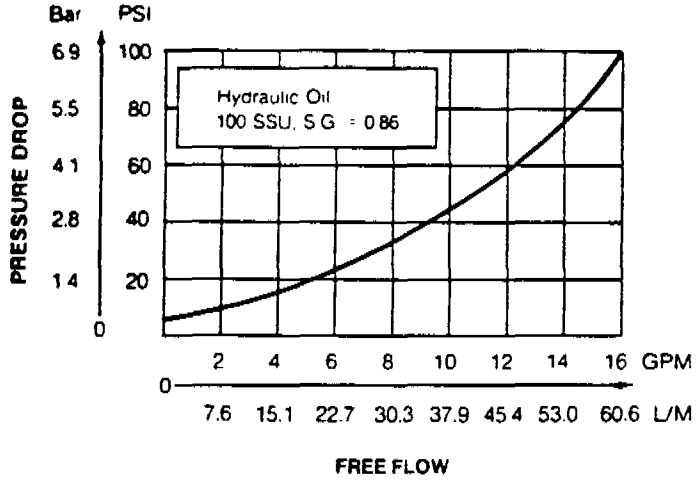
Installation Data

See the Installation Information section of this catalog for specific recommendations pertaining to system cleanliness, fluids, seals and other important factors relative to the proper installation and use of these products

Performance Curve

Free Flow vs. Pressure Drop

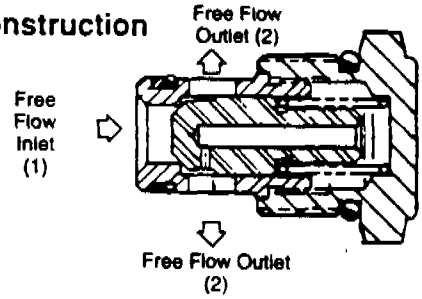
(Through cartridge only For performance of bodies, see section MV)



Cartridge Valve Specifications

Rated Flow	15 GPM (56.25 L/M)
Max Operating Pressure	3500 PSI (245 Bar)
Max Leakage at Rated Pressure	5 drops/min (1.3 cc/min.)
Operating Temp Range (Ambient)	–40°F to + 200°F (Nitrile) –25°F to + 250°F (Viton)
Cartridge Material	All parts steel. All operating parts hardened steel
Body Material	Steel
Filtration	ISO Code 16/13, SAE Class 4 or better
Mounting	No Restrictions
Cavity	Common Cavity No. C10–2 (See Cavity Details section)

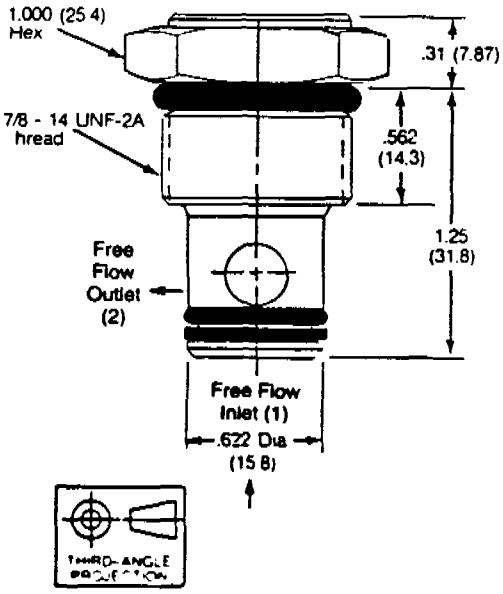
Construction



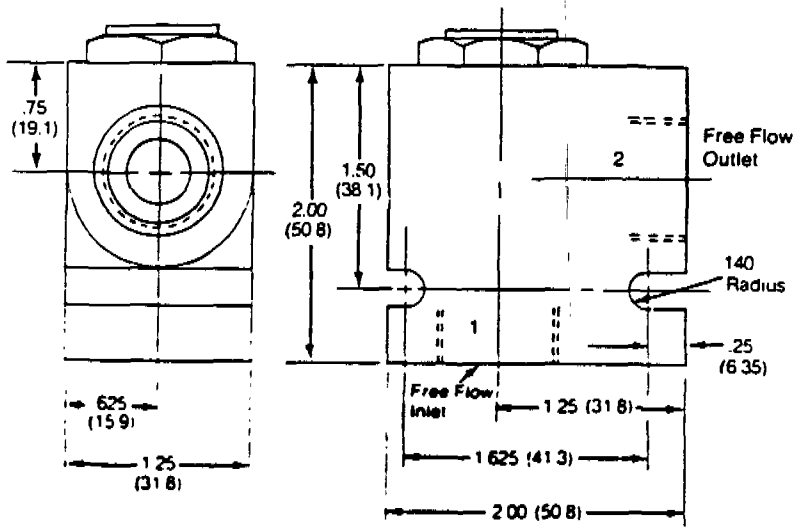
For additional information – call your local Park r Fluidpower Motion & Control Distributor.

Dimensions (Inches / Millimeters)

Cartridge Only



Cartridge in Body



Ordering Information

CV	10	1P				—	
CHECK VALVE	SIZE	STYLE	CRACKING PRESSURE	SEALS			BODY OPTION

Size
7/8–14

Style
Guided Poppet

Code	Type
Omit	Nitrile
V	Viton

Code	Pressure
Omit	5 PSI
15	15 PSI
20	20 PSI
40	40 PSI
50	50 PSI
65	65 PSI
80	80 PSI

Code	Port Size
Omit	Cartridge Only
4P	1/4" NPTF (B10–2–4P)
6P	3/8" NPTF (B10–2–6P)
8P	1/2" NPTF (B10–2–8P)
6T	SAE–6 (B10–2–6T)
8T	SAE–8 (B10–2–8T)

Shipping Weight
Cartridge Only 0.2 lbs. (.09 kg)
Cartridge in Body 1.2 lbs. (.54 kg)

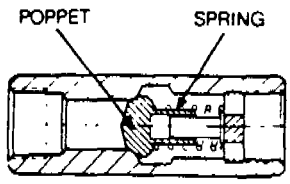
SERVICE PARTS
Nitrile Seal Kit – SK10–2
Viton Seal Kit – SK10–2V

*Cracking pressure is defined as the pressure at which the poppet begins to unseat. It occurs when leakage exceeds 5 drops (1/3cc)/minute

Colorflow® Service Parts

T-30406 #9

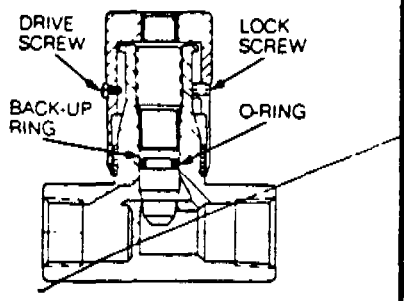
SERIES C



Check Valves

BODY SIZE	POPPET (SOFT SEAL)			SPRINGS	
	METAL	BUNA	VITON	5 PSI	65 PSI
C 200	013155-3	013320-N7	013320-V7	013151	013215
C 400 C 620	001490-3	001839-N7	001839-V7	001516	001585
C 600 C 820	004374-3	004917-N7	004917-V7	004394	004496
C 800 C 1020	007300-3	007596-N7	007596-V7	007310	007379
C 1200 C 1220	010353-3	N/A	N/A	010371	010453
C 1420	0103533	N/A	N/A	010371	010453
C 1600	025299-3	N/A	N/A	025314	N/A
C 1620	025299-3	N/A	N/A	025314	N/A
C 2000	022195-3	N/A	N/A	022192	N/A
C 2020	022195-3	N/A	N/A	022192	N/A
C 2400	026143-3	N/A	N/A	026139	N/A
C 2420	026143-3	N/A	N/A	026139	N/A
C 3200	030166-3	N/A	N/A	030158	N/A
C 3220	030166-3	N/A	N/A	030158	N/A

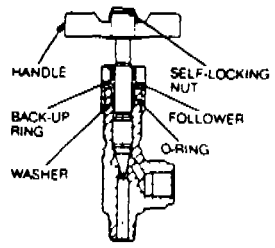
SERIES N



Needle Valves

BODY SIZE	O-RING		BACK-UP RING	DRIVE SCREW	LOCK SCREW
	BUNA	VITON			
N 200	5101N-7	5101V-7	NONE	013300	001832
N 400 N 620	2006N-7	2006V-7	107X6	001830	001832
N 600 N 820	2008N-7	2008V-7	107X8	004677	004691
N 800 N 1020	2010N-7	2010V-7	107X10	007523	007524
N 1200 N 1220	2011N-7	2011V-7	107X11	010673	010678
N 1420	2012N-7	2012V-7	107X12	010673	010678
N 1600 N 1620	2112N-7	2112V-7	107X112	025543	025544
N 2000	2112N-7	2112V-7	107X112	025543	025544
N 2020	2113N-7	2113V-7	107X113	025543	025544

SERIES MV



Metering Valves

BODY SIZE	O-RING		BACK-UP RING	FOLLOWER	WASHER	HANDLE	SELF-LOCKING NUT
	BUNA	VITON					
2**	2010N-7	2010V-7	400004-1	014012-2	014013-2	014083-6	454001
4** 620	2011N-7	2011V-7	400004-2	002028-2	002023-2	002118-6	454001
6** 820	2012N-7	2012V-7	400004-3	005017-2	005012-2	005065-6	457001
8** 1020	2111N-7	2111V-7	400004-4	008013-2	008014-2	008079-6	459001
12** 1220	2112N-7	2112V-7	400004-5	011013-2	011014-2	011066-6	459001

Parker Fluidpower

DO A 134803
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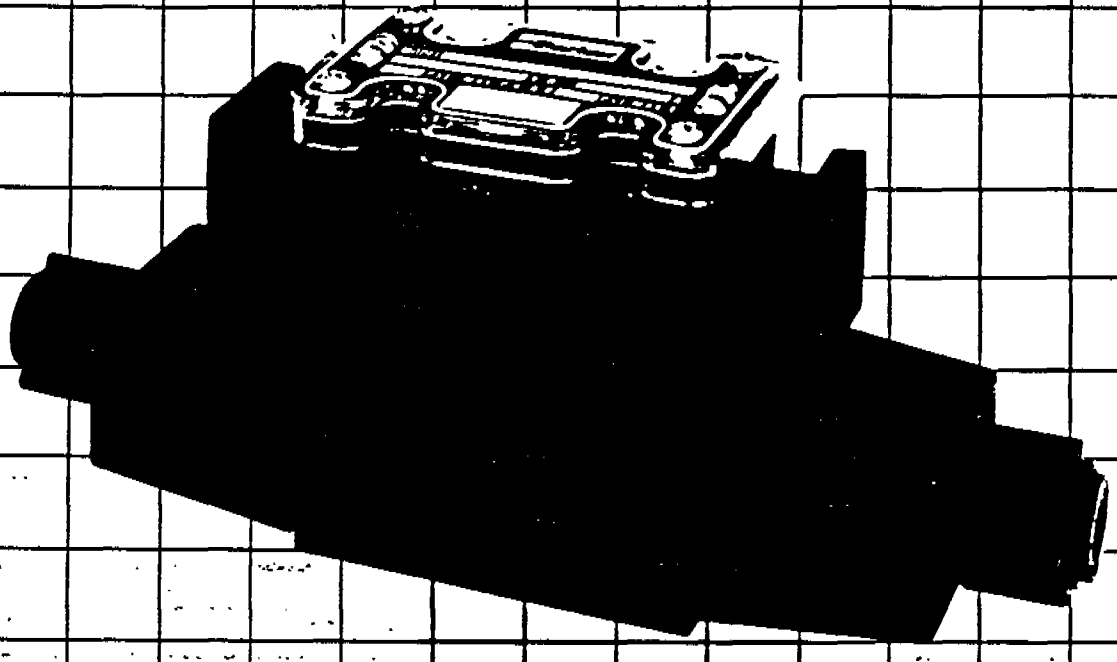
T-30406 #10

Bulletin No. DC-D1VW-2-70 Design

D1VW Series Solenoid Operated Directional Valves Service Bulletin



Parker
Fluidpower

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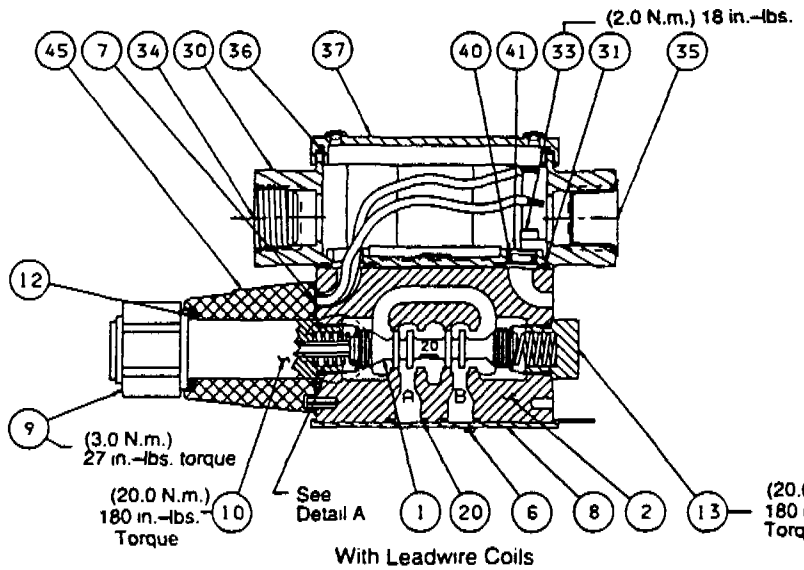


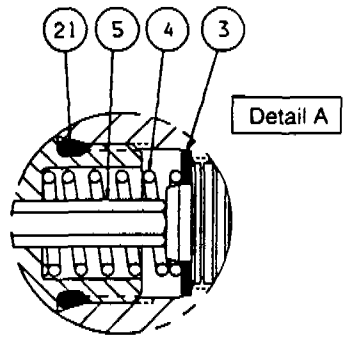
With Leadwire Coils

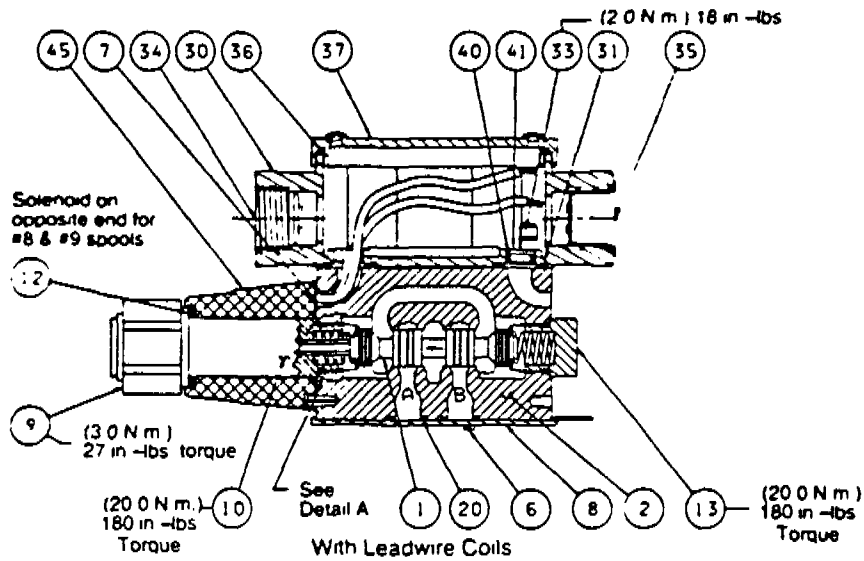
D1VW * B

As Shown

Reverse Solenoid and Associated Parts For

D1VW * H





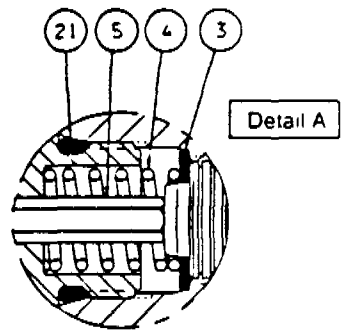
With Leadwire Coils

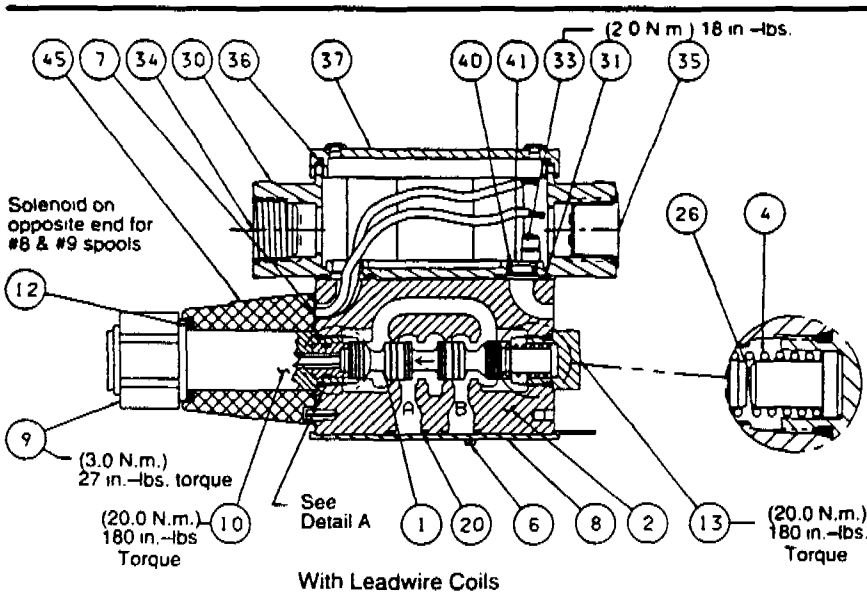
D1VW * E

As Shown

Reverse Solenoid and Associated Parts For

D1VW * K





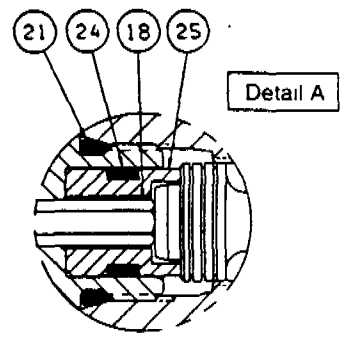
With Leadwire Coils

D1VW * F

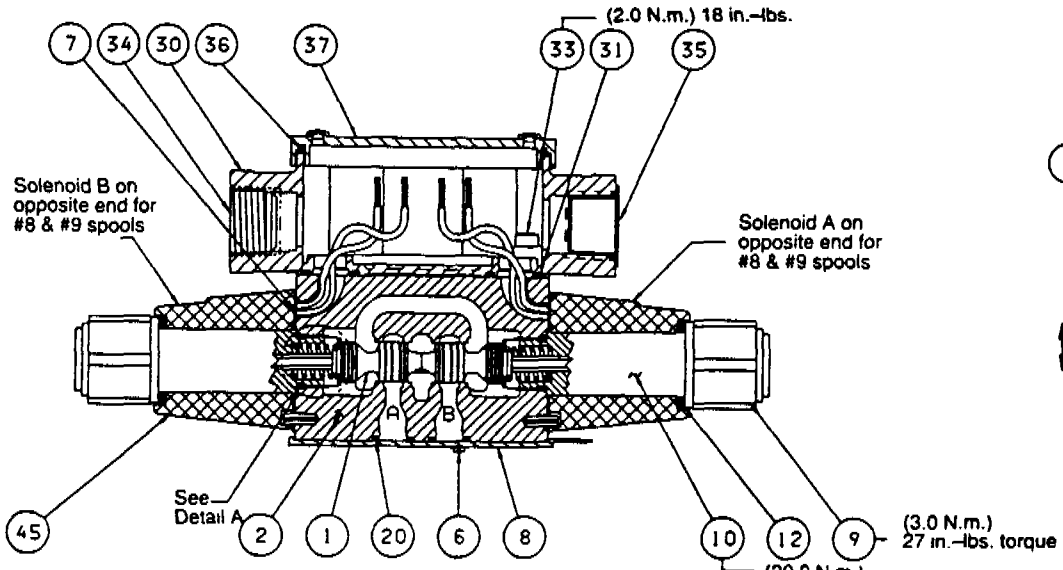
As Shown

Reverse Solenoid and Associated Parts For

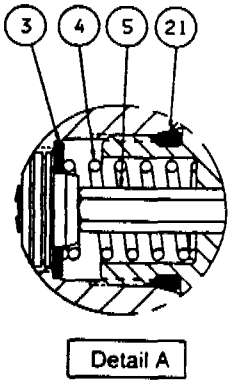
D1VW * M



D1VW * C
As Shown

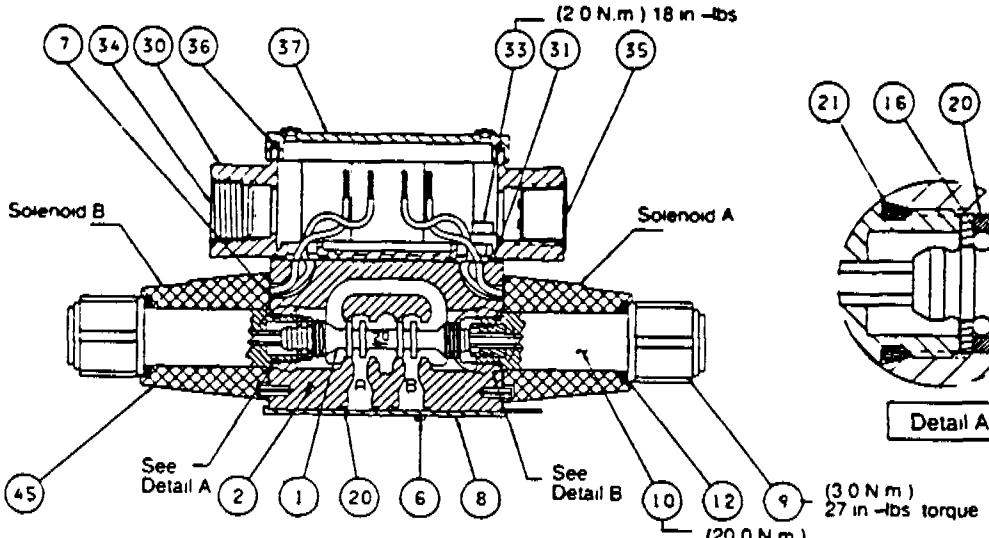


With Leadwire Coils



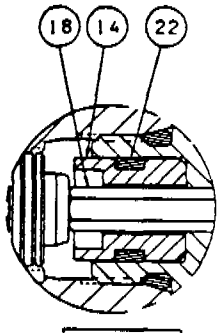
Detail A

D1VW * D
As Shown

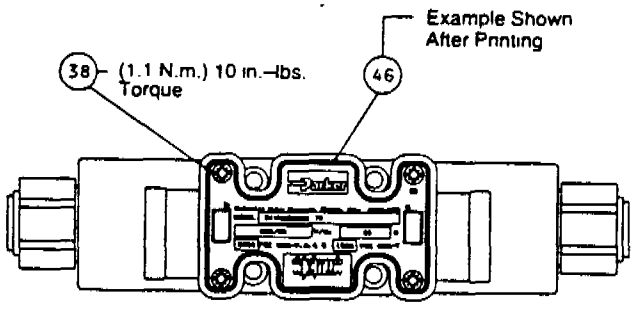


With Leadwire Coils

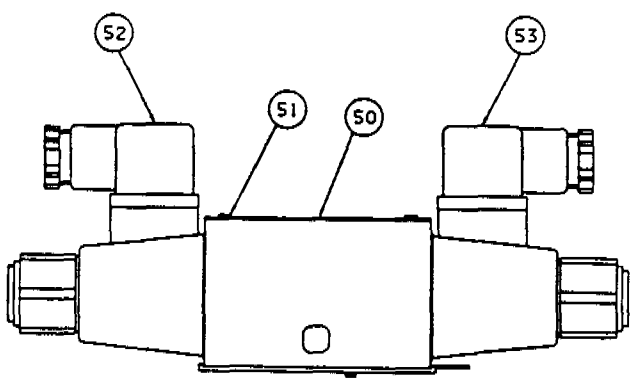
Detail A



Detail B



With Conduit Box Coils



With Hirschmann–Style Coils (Double Voltage Letter)

DO A 134806
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D1VW Seri s Mod l Number System

D1VW

*

*

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*

*

70

Design Code

SPOOLS			
	ITM	PART NO.	DESCRIPTION
1	1	697601	#1 Spool
2	1	697602	#2 Spool
3	1	697603	#3 Spool
4	1	697604	#4 Spool
5	1	697605	#5 Spool
6	1	697606	#6 Spool
7	1	697607	#7 Spool
8	1	697608	#8 Spool
9	1	697609	#9 Spool
10	1	697610	#10 Spool
11	1	697611	#11 Spool
14	1	697607	#7 Spool *
15	1	697603	#3 Spool *
16	1	697605	#5 Spool *
20	1	697620 697662 +	#20 Spool
21	1	697621	#21 Spool
22	1	697621	#22 Spool
30	1	697630 697663 +	#30 Spool

*Assembled in Reverse + Detent Version

SEAL COMPOUND	
N	Use Nitrile Seals (N)
V	Use Viton Seals (V)

⬡ Insert N for Nitrile, V for Viton

VARIATIONS		
	KEY / PART NO.	DESCRIPTION
5	EL1270	120 VAC Solenoid Style
	EL12070	120 VDC Solenoid Style
	EL12K70	12 VDC Solenoid Style
	EL12J70	24 VDC Solenoid Style
	EL12L70	6 VDC Solenoid Style
	EL12R70	24 VAC Solenoid Style
	EL12T70	240 VAC Solenoid Style
	EL12Z70	250 VDC Solenoid Style
	ELH1DP	120 VDC Hirschmann
	ELH1JP	24 VDC Hirschmann
	ELH1KP	12 VDC Hirschmann
	ELH1TP	220/240 VAC Hirschmann
	ELH1YP	120 VAC Hirschmann
6	EP1370	3 Pin Plug
	EP1570	5 Pin Plug
H	697714	AC High Pressure Tube
	697717	DC High Pressure Tube

	INTERNAL PARTS		
	ITM	PART NO.	DESCRIPTION
B	2	Not Available	Body
	3	988-8x14x1	Centering Washer
	4	697625	Centering Spring
		697626	Springs 2,7,8,9,14 spools
C	5	697627	Push Rod
	6	99x37	Roll Pin
	7	697648	Gasket
D	8	697628	Shipping Plate
	9	697981	Coil Retainer
	10	697632	AC Tube Y,T,Q,E
		697633	DC Tube L,K,J,D,Z
E	12	697647	Seal Coil
	13	697649	End Cap
	14	697675	Spool Stop
	15	702809	Ball Clamp
F	16	98x5	Ball
	17	697661	Spool Stop
	18	697660	Push Rod
H	20	2-012 ○ -9	O-Ring
	21	3-907 ○ -9	O-Ring
	22	2-011 ○ -7	O-Ring
K	30	1300634	Conduit Box
	31	697646	Seal Bottom
	33	1301070	Screw Ground
	34	678800	Plug Conduit
M	35	120x21	Shipping Plug
	36	1300828	Seal Top
	37	1300635	Cover Conduit Box
	38	1301067	Screw Conduit Box
	40	697624	Plug
	41	2-010 ○ -7	O-Ring
	46	1300637	Name Plate
	50	1300638	Name Plate
	51	1301066	Stick Screws
	52	EPHB	Plug Black 'B'
	53	EPHA	Plug Grey 'A'

COILS		
ITEM	CODE	PART NO.
45	YC	697212
45	YF	697250
45	YP	697228
45	TC	697213
45	TP	697229
45	RC	1300344
45	LF	692622
45	KC	697216
45	KCF	692623
45	KPF	693714
45	KSF	694791
45	JC	697217
45	JCF	692624
45	JPF	693713
45	JSF	694793
45	DC	697218
45	DCF	692625
45	DPF	694073
45	ZC	697219
45	ZCF	693759

Note: See Page 4 for Solenoid Assemblies

Parts Included in Solenoid Ass mbly

AC Part No.	Description	Quantity	DC Part No.	Description	Quantity
See COIL chart on pg.3	Coil	1 ea.	See COIL chart on pg.3	Coil	1 ea.
697632	Tube Assembly	1 ea.	697633	Tube Assembly	1 ea.
697981	Retainer	1 ea.	697981	Retainer	1 ea.
697648	Gasket	1 ea.	697648	Gasket	1 ea.
697627	Push Rod	1 ea.	697627	Push Rod	1 ea.
697647	Seal Coil	1 ea.	697647	Seal Coil	1 ea.

Miscellaneous Parts

Nametag for Conduit Box	1300637
Nametag Hirschman / Mech.	1300638
Hirschmann Plugs (Female)	
Black – "B" Solenoid	EPHB
Grey – "A" Solenoid	EPHA
Hirschmann Plugs with Lights	
12 Volts DC (KP)	ELHIKP
24 Volts DC (JP)	ELHIJP
110/120 VAC (YP)	ELHIYP
120 VDC (DP)	ELHIDP
220/240 Volts AC (TP)	ELHITP
Conduit Box	1300634
Seal Kit	SKD1VW70

Solenoid Assemblies

Code	Part No.	Description
YC	697931	110–120 50/60 Sol Assy
YCF	697935	120/60; 110/50 Low Amp Assy
YP	697947	120/60, 110/50 Hirschmann Assy
TC	697932	240/60, 220/50 Sol Assy
TP	697948	240/60; 220/50 Hirschmann Assy
EC	697934	24/60 Sol. Assy
ECF	697936	Low Amp Sol. Assy.
LC	697937	6 VDC Low Amp Assy
LCF	697942	6 VDC Low Amp Assy
KC	697938	12 VDC Sol. Assy
KCF	697943	12 VDC Low Amp Assy
KPF	697957	12 VDC Hirschmann Low Amp
KSF	697965	12 VDC Spade Low Amp
JC	697939	24 VDC Sol. Assy.
JCF	697944	24 VDC Low Amp Assy.
JPF	697958	24 VDC Hirschmann Low Amp
JSF	697966	24 VDC Spade Low Amp
DC	697940	120 VDC Sol. Assy.
DCF	697945	120 VDC Low Amp Assy.
DPF	697959	120 VDC Hirschmann
ZC	697941	250 VDC Sol. Assy.
ZCF	697946	250 VDC Low Amp Assy.
RC	1300346	24/60; 24/50 Sol. Assy.

Solenoid Ratings

Insulation Class F

Wet Armature Type

Allowable Deviation from rated voltage −10% +15%

Solenoid Electrical Characteristics *

Solenoid Code	Nominal Volts/Hz	In Rush Amps	Holding Amps	Watts
Y	120/60	2.00	0.49	25
	110/50	2.10	0.58	27
YF**	120/60	0.90	0.18	10
	110/50	0.94	0.20	9.5
T	240/60	1.00	0.26	25
	220/50	1.05	0.31	27
R	24/60	10.50	2.70	27
L	6 VDC	—	5.00	30
LF*	6 VDC	—	4.00	24
K	12 VDC	—	2.50	30
KF*	12 VDC	—	2.00	24
J	24 VDC	—	1.25	30
JF*	24 VDC	—	1.00	24
D	120 VDC	—	0.25	30
DF*	120 VDC	—	0 20	24
Z	250 VDC	—	0 12	30
ZF*	250 VDC	—	0 10	24

*Based on nominal voltage @ 72°F.
**3000 PSI 40% rated flow (low watt A.C.)
* 3000 PSI. 85% rated flow
Coil Leadwire. 18 awg

C.S A. file LR60407

Explosion Proof Solenoid Ratings

U.L. (EU)	Class I, Div. 1 & 2, Groups C & D. Class II, Div. 1 & 2, Groups E, F & G. As defined by the N.E.C.
M.S.H.A. (EM)	Complies with 30 CFR, Part 18.

Solenoid Electrical Characteristics * EU and EM

Solenoid Code	Nominal Volts/Hz	In Rush Amps	Holding Amps	Watts
Q	100/60	2.60	0.70	27
Y	120/60	2.20	0.58	27
T	240/60	1.10	0.29	27
R	24/60	11.10	2.90	27
L	6 VDC	—	5.50	33
K	12 VDC	—	2.75	33
J	24 VDC	—	1.38	33
D	120 VDC	—	0.28	33
Z	250 VDC	—	0.13	33

Note: Consult factory for Explosion Proof Coil Assembly Part Numbers

Acc ssories

Manaplugs — El ctri al Plug–In

E	P	1		70
ELECTRICAL	PLUG–IN	VALVE MODEL	BASIC CONFIGURATIONS	DESIGN SERIES (Required when ordenng)

D1V (1/8")

Code	Description
3	3 pin plug
5	5 pin plug

Hirschmann — Female Connector

E	P	H	
ELECTRICAL	PLUG	HIRSCHMANN STYLE	CONNECTOR COLOR

Code	Description
A	Gray (Solenoid A)
B	Black (Solenoid B)

Electrical Cords

E	C		
ELECTRICAL	CORD	NO. OF CONDUCTORS	ELECTRICAL REQUIREMENTS

Code	Description
[illegible]	3 Conductors (std
5	5 Conductors

Code	Description
[illegible]	6 feet (std.)
3	3 feet
[illegible]	12 feet

Indicator Lights

Conduit Box Style

EL12		70
ELECTRICAL LIGHTS	VOLTAGE	DESIGN SERIES

* Conduit Box Style	
Code	Description
Y	120V AC Solenoid style
T	240V AC Solenoid Style
R	24V AC Solenoid style
D	120V DC Solenoid style
L	6V DC Solenoid style
J	24V DC Solenoid style
K	12V DC Solenoid style
Z	250V DC Solenoid style

* Conduit box style has 2 ea. lights per kit

Hirschmann Style

ELH1	
ELECTRICAL LIGHTS	VOLTAGE

** Hirschmann Style	
Code	Description
KP	12V DC Hirschmann
JP	24V DC Hirschmann
YP	110/120V AC Hirschmann
DP	120V DC Hirschmann
TP	220/240V AC Hirschmann

** Hirschmann style has 1 ea. light per connector.

Standard Bolt Kit

Model Number BK209
1.25" long x 10–24 UNC–2A, SAE Grade 8, Torque to 50 in. lbs. (5.6 N.m.)

Note – Valves used in conjunction with Manapaks require longer bolts.

2/93, EG, 5M

DO A 134809
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Special Installations

Consult your Parker representative for any application requiring the following:

- Pressure above maximums (see Specifications).
- Fluids other than those specified.
- Oil temperature above 71.1°C (160°F).

Fluid Recommendations

Premium quality hydraulic oil with a viscosity range between 150–250 SSU (32–54 cst) at 38°C (100°F) is recommended. The absolute operation viscosity range is from 80–1000 SSU (16–220 cst). Oil should have maximum anti–wear properties and rust and oxidation treatments

Fluids And Seals

Valves using synthetic, fire–resistant fluids require special seals When phosphate ester or its blends are used, VITON seals are required Water–glycol water–in–oil emulsions and petroleum oil may be used with NITRILE seals

Filtration

For maximum valve and system component life, the system should be protected at a contamination level not to exceed 125 particles greater than 10 microns per milliliter of fluid (SAE Class 4 or better, ISO Code 16/13)

Tank Line Surges

If several valves are piped with a common tank line flow surges in the line may cause unexpected spool shift Detent style valves are most susceptible to this Separate tank lines should be used when line surges are expected in an application.

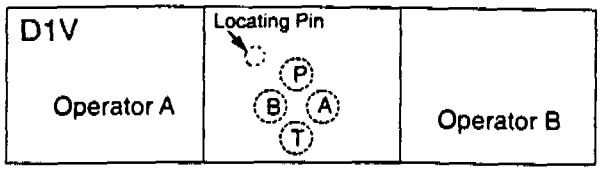
Silting

Silting can cause any sliding spool valve to stick and not spring return, if held shifted under pressure for long periods of time. The valve should be cycled periodically to prevent sticking.

Single Pass Operation

Valve flow ratings are for double pass operation (with equal flow in both paths). When using these components in single pass applications, flow capabilities may be reduced. Consult your local Parker representative for details.

Flow Path Data



*Note: On valves with 8 or 9 spool, A and/or B operators reverse sides. Flow paths remain the same as viewed from top of valve.

Double Solenoid – With solenoid "A" energized, flow path is P→A and B→T. When solenoid "B" is energized, flow path is P→B and A→T. The center condition on a spring–centered valve exists when both coils are de–energized, or during a complete shift, as the spool passes through center.

Detent and Spring Offset – The center condition exists on detent and spring offset valves only during spool crossover To shift and hold a detented spool, only a momentary energizing of the solenoid is necessary The minimum duration of the signal is approximately 0 1 seconds for both AC and DC voltages This position will be held provided the spool center line is in a horizontal plane, and no shock or vibration is present to displace the spool

Single Solenoid - Spring offset valves can be ordered in six styles B E F. H. K. and M Flow path data for the various styles are described in the order chart

Lever Operated (on B end)

Pull lever away from valve P→A B→T
Push lever toward valve P→B A→T
Note Reverse with a #8 or #9 spool

Electrical Failure

Should electric power fail, spring offset and spring centered valves will shift to the spring held position Detented valves will stay in the last position held before power failure If main flow does not fail or stop simultaneously, machine actuators may continue to function in an undesirable manner or sequence.

Loss of Pilot Pressure (D1VA & D1VP)

Should a loss of pilot pressure occur, spring offset and spring centered valves will shift to the spring held position. Detented valves will remain in the last position held. If main hydraulic flow does not simultaneously stop, machine actuators may continue to function in an undesirable manner or sequence.

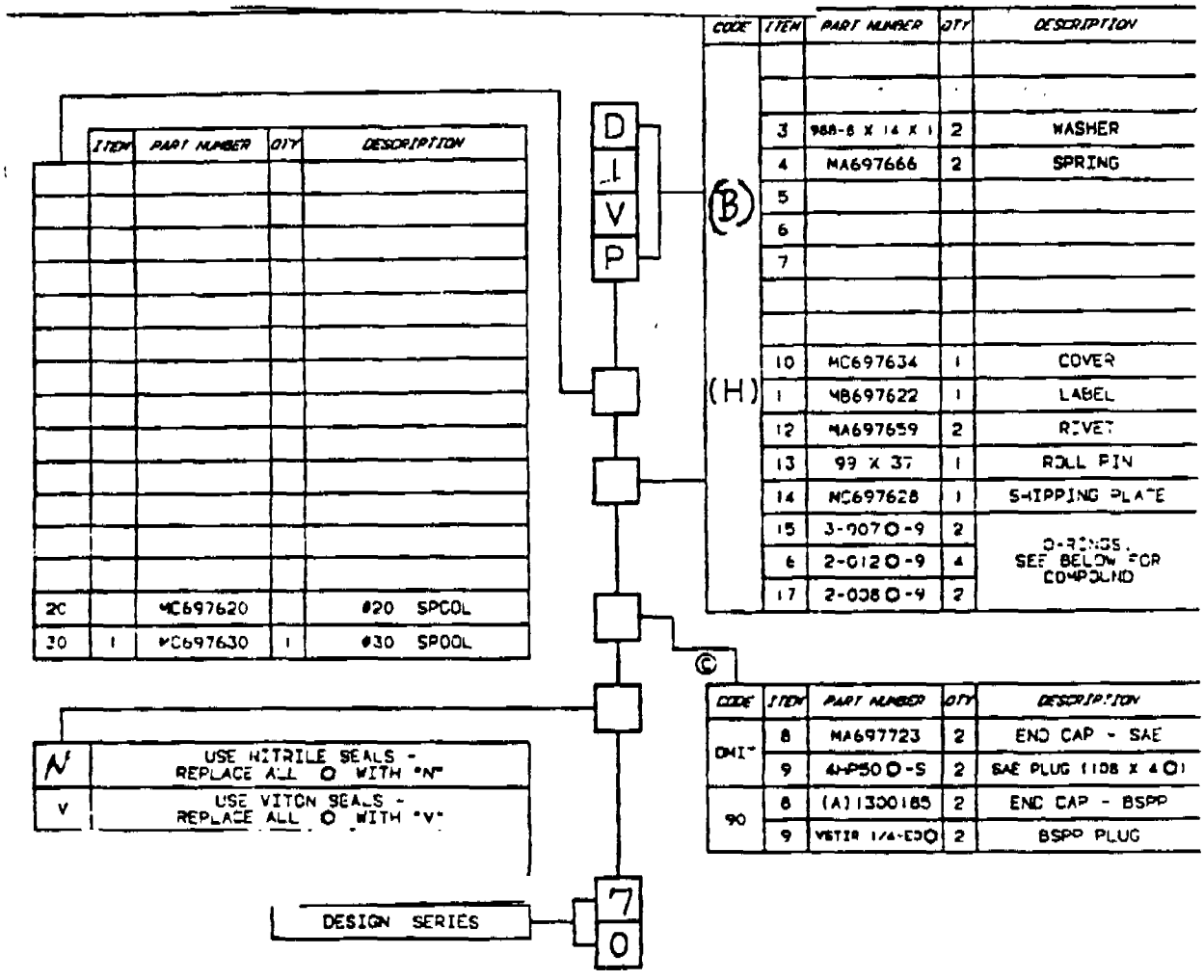
Torque Specifications

Torque values recommended for the bolts which mount the valve to the manifold or subplate are as follows: #10–24 thread (M5–0.8) torque 5.6 N.m. (50 in–lbs.).

T-30406 #14

Post-it™ Fax Note 7671 | Date 5/27/94 | # of pages ▶ 2

To Chuck	From Shirley
Co./Dept Ford MC.	Co. Parker
Phone #	Phone # 216-366-5225
Fax # 504-533-5919	Fax # 216-366-5293



ITEM	PART NUMBER	QTY	DESCRIPTION
20	MC697620		#20 SPOOL
30	MC697630	1	#30 SPOOL

N	USE NITRILE SEALS - REPLACE ALL O WITH "N"
V	USE VITON SEALS - REPLACE ALL O WITH "V"

CODE	ITEM	PART NUMBER	QTY	DESCRIPTION
	3	968-6 X 14 X 1	2	WASHER
	4	MA697666	2	SPRING
(B)	5			
	6			
	7			
	10	MC697634	1	COVER
(H)	1	MB697622	1	LABEL
	12	MA697659	2	RIVET
	13	99 X 37	1	ROLL PIN
	14	MC697628	1	SHIPPING PLATE
	15	3-907O-9	2	O-RINGS. SEE BELOW FOR COMPOUND
	6	2-012O-9	4	
	17	2-038O-9	2	

CODE	ITEM	PART NUMBER	QTY	DESCRIPTION
DMI*	8	MA697723	2	END CAP - SAE
	9	4HP50O-S	2	SAE PLUG 1108 X 4O1
90	8	(A)1300185	2	END CAP - BSPP
	9	VSTIR 1/4-EDO	2	BSPP PLUG

DO A 134811
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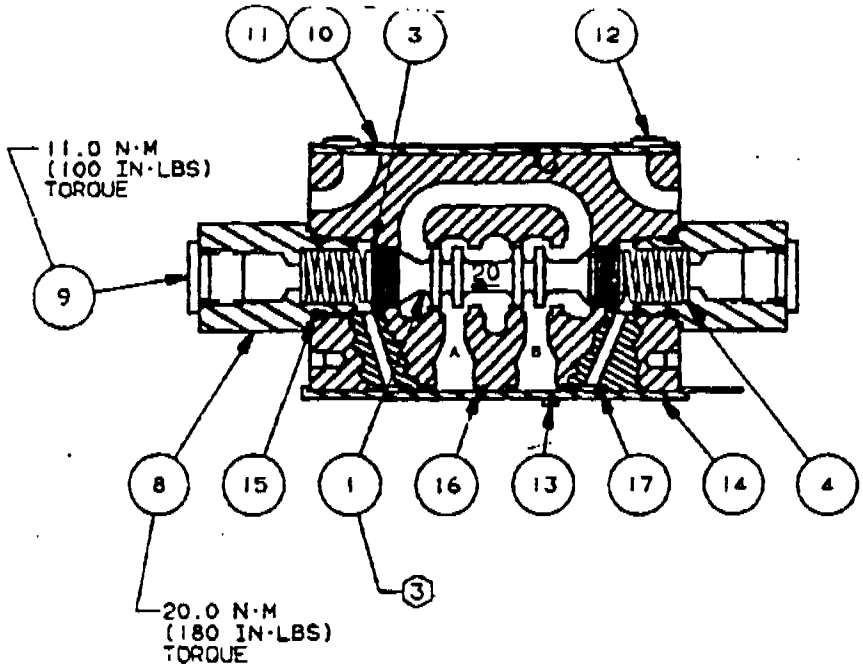
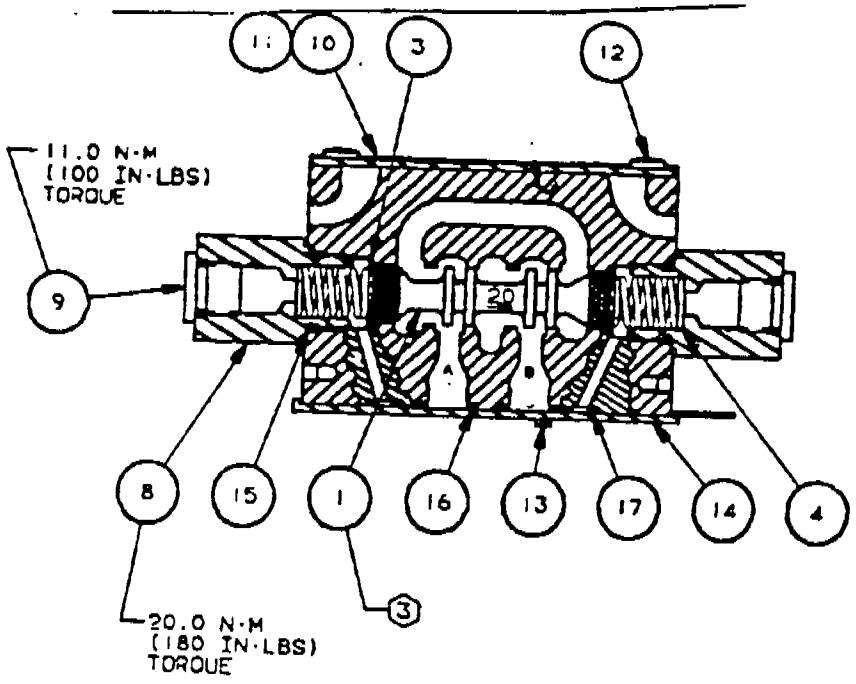


DIVP2 B
AS SHOWN



DIVP20H
AS SHOWN

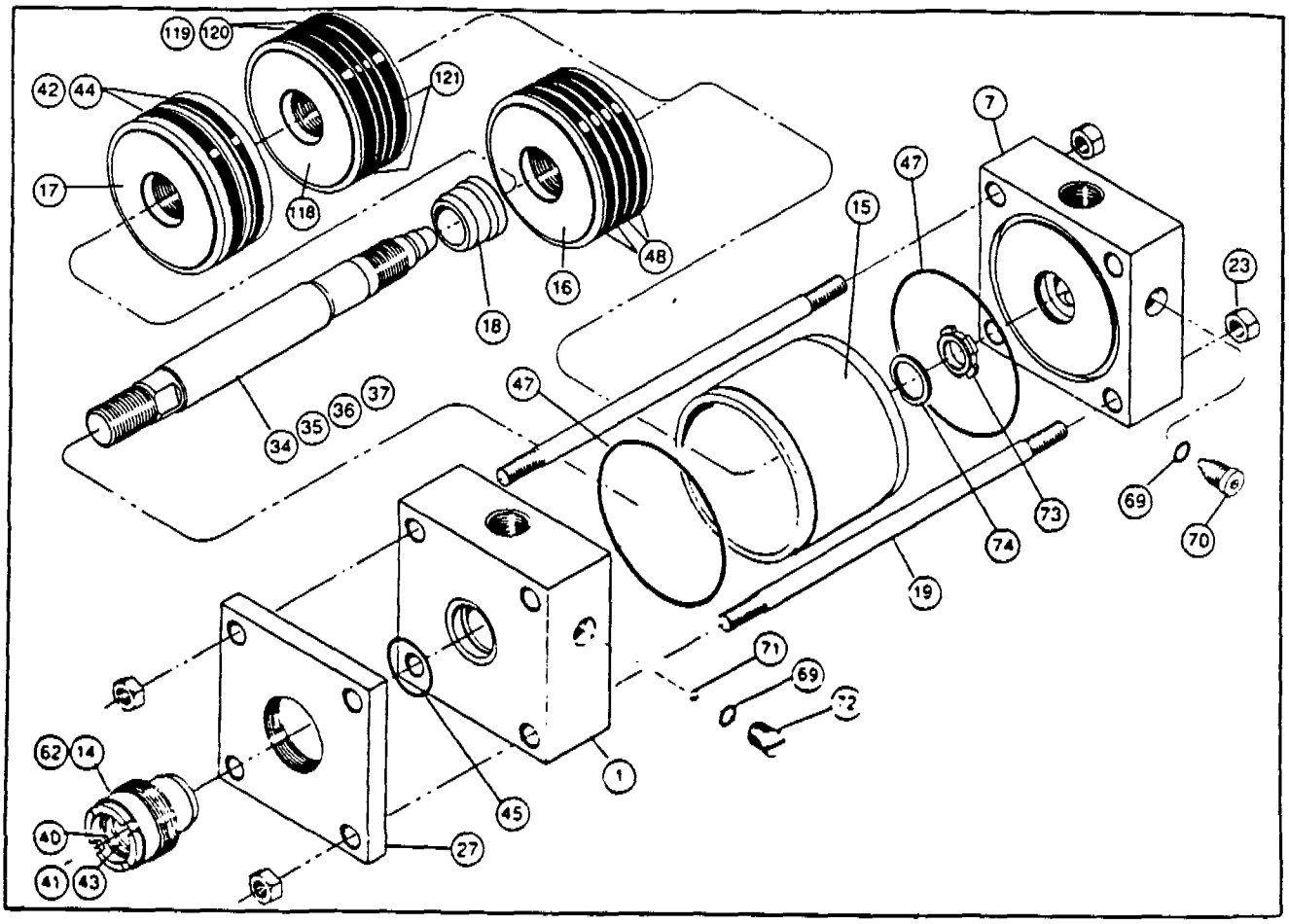
NOTES:

2.) OPERATOR, MODEL NUMBER, ELECTRICAL INFORMATION, MAXIMUM PRESSURES, DATE CODE, & VALVE SCHEMATIC TO BE PRINTED ON LABEL (ITEM 11) AS SHOWN, WITH COLUMBIA GREAT LAKES RIBBON #79. (SEE MD697271 FOR SCHEMATIC SYMBOLS.)

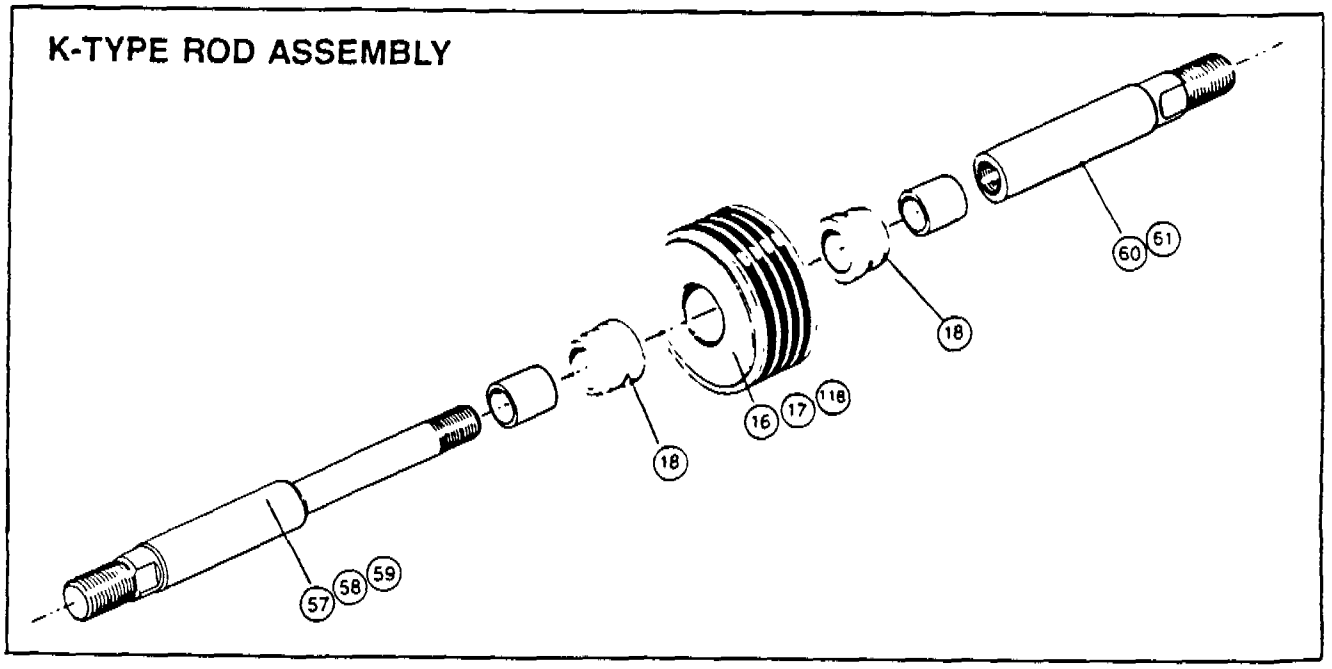
(A) (3)) ARROW POINT TO A-PORT END FOR ALL SPOOLS.

1100185 #1

Parker Series
2A, 2H, 3L, VH Cylinders



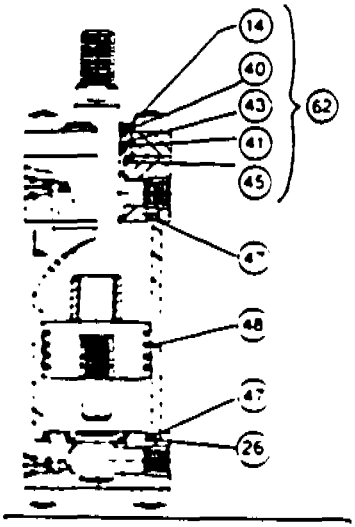
K-TYPE ROD ASSEMBLY



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

Parker Ser.
2A, 2H, 3L, VH Cylind rs

SYMBOL	DESCRIPTION
14	Gland cartridge
40	Gland wiperseal
41	Gland lipseal
42	Piston lipseal
43	Gland back-up washer
44	Piston back-up washer
45	Gland to head o-ring
47	End seal o-ring
48	Piston ring
62	Gland cartridge kit
119	Outer ring
120	Inner ring
121	Wear ring

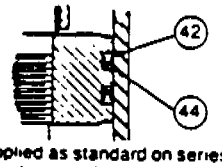


PISTON SEAL OPTIONS

RING TYPE PISTON

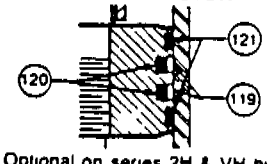
as shown above) Supplied as standard on series 2H 3L & VH hydraulic cylinders

LIPSEAL TYPE PISTON



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

HI-LOAD TYPE PISTON



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

SEAL KITS FOR CLASS 5 SERVICE

Material: Fluorocarbon (Viton®)
For operating temperature and fluid compatibility see Section C, page 71.

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

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

ROD DIA.	SERIES 2A, 2H, 3L & VH CYLINDERS			
	RG GLAND (SYM. 62) CARTRIDGE KITS CONTAINS SYMBOLS 14, 40, 41, 43 & 45	RK ROD SEAL KITS CONTAINS SYMBOLS 40, 41, 43 & 45	GLAND WRENCH	SPANNER WRENCH
½	RG2AHL 0055	RK2AHL 0055	069590 0000	011676 0000
⅝	RG2AHL 0065	RK2AHL 0065	069590 0000	011676 0000
1	RG2AHL 0105	RK2AHL 0105	069591 0000	011676 0000
1⅜	RG2AHL 0135	RK2AHL 0135	069592 0000	011703 0000
1¾	RG2AHL 0175	RK2AHL 0175	069593 0000	011677 0000
2	RG2AHL 0205	RK2AHL 0205	069594 0000	011677 0000
2½	RG2AHL 0255	RK2AHL 0255	069595 0000	011677 0000
3	RG2AHL 0305	RK2AHL 0305	069596 0000	011677 0000
3½	RG2AHL 0355	RK2AHL 0355	069597 0000	011677 0000
4	RG2AHL 0405	RK2AHL 0405	069598 0000	011677 0000
4½	RG2AHL 0455	RK2AHL 0455	083877 0000	011678 0000
*5	RG2AHL 0505	RK2AHL 0505	069599 0000	011678 0000
*5½	RG2AHL 0555	RK2AHL 0555	069600 0000	011676 0000

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

BORE SIZE	PK PISTON SEAL KITS SERIES 2A ONLY CONTAINS 2 EA SYMBOLS 42 & 47	PK PISTON SEAL KITS SERIES 2H, 3L & VH CONTAINS 2 EA SYMBOLS 42, 44 & 47	PR PISTON RING KITS SERIES 2H, 3L & VH CONTAINS 2 SYM 47 & 4 SYM 48	HI-LOAD PISTON SEAL KITS SERIES 2H & VH CONTAINS 2 EA SYMBOLS 119, 120 & 121
1	PK102A005	PK102HL005	PR102H0005	—
1½	PK152A005	PK152HL005	PR152H0005	PK152HK005
2	PK202A005	PK202HL005	PR202H0005	PK202HK005
2½	PK252A005	PK252HL005	PR252H0005	PK252HK005
3¼	PK322A005	PK322HL005	PR322H0005	PK322HK005
4	PK402A005	PK402HL005	PR402H0005	PK402HK005
5	PK502A005	PK502HL005	PR502H0005	PK502HK005
6	PK602A005	PK602HL005	PR602H0005	PK602HK005
7	PK702A005	PK702HL005	PR702H0005	PK702HK005
8	PK802A005	PK802HL005	PR802H0005	PK802HK005
10	PK902A005	PK902HL005	PR902H0005	PK902HK005
12	PK922A005	PK922HL005	PR922H0005	PK922HK005
14	PK942A005	—	—	—

BORE SIZE	CB CYLINDER BODY SEAL KITS SERIES 2A CONTAINS 2 EA SYMBOL 47	CB CYLINDER BODY SEAL KITS SERIES 2H, 3L & VH CONTAINS 2 EA. SYMBOL 47	TIE ROD TORQUE SPECIFICATIONS (FT. LBS.) SERIES 2A STEEL CYL. BODY	SERIES 2A BRASS CYL. BODY	SERIES 2H & VH	SERIES 3L
1	CB102AL005	CB102HL005	2	1	—	2
1½	CB152AL005	CB152HL005	5	3	18	5
2	CB202AL005	CB202HL005	11	6	45	11
2½	CB252AL005	CB252HL005	11	6	45	11
3¼	USE (PK) PISTON SEAL KITS FOR THESE SIZES	CB322HL005	25	18	120	25
4		CB402HL005	25	18	130	25
5		CB502HL005	60	45	310	60
6		CB602HL005	60	45	525	60
7		CB702HL005	90	—	790	—
8		CB802HL005	110	80	1160	110
10		CB902HL005	150	115	2500	—
12		CB922HL005	172	150	528	—
14		—	275	230	—	—

For use with High Water Content Fluids.

Class 6 Service kit numbers listed above identify Class 5 seals only. To order with Class 6 seals (HWCF) substitute "6" for "5" as last digit of part number.

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

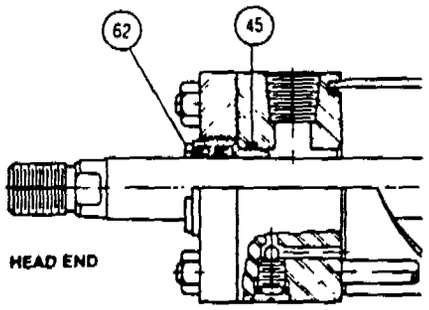
Cylinder Division
500 So. Wolf Road
Des Plaines, IL 60016
708/298-2400

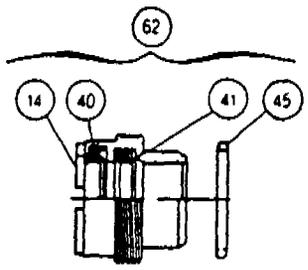
Regional Plants
- Santa Fe Springs, CA 310/698-0985
- Enfield, CT 203/749-2215
- Atlanta, GA 404/349-0563
- Goodland, IN 219/297-3182
- Plymouth, MI 313/455-1700
- Hillsborough, NC (Accum) 919/732-6183
- Hillsborough, NC 919/732-9371
- Akron, OH 216/253-4500
- Portland, OR 503/285-0884
- Owen Sound, Ont. Can. 519/371-2662
- Toronto, Ont. Can 416/255-4567
- Lachine, Quebec, Can. 514/631-3995

Parker Motion & Control

Gland Seal Kits For Hydraulic Cylinders

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

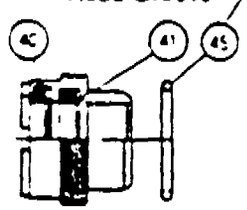




GLAND CARTRIDGE KIT

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

Installs in Rod End Head Groove



ROD SEAL KIT

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

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

Standard Seals — Class 1 Service Kits are standard, and contain polyurethane and Buna-N seals for standard hydraulic service. These seals are suitable for use when hydraulic (mineral-type) oil is the operating medium. The recommended operating temperature range for Class 1 seals is -10°F (-23°C) to +165°F (+74°C).

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

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

Class 1 Hydraulic Oil Service Only

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

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

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

How To R plac Cylinder Gland Packing

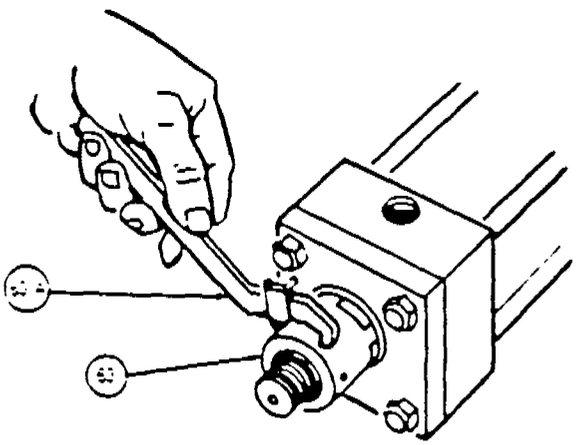
Fluid leakage around piston rod at the gland area will normally indicate a need to replace gland seals. First, remove cylinder from machine to which it is mounted or, if this is not feasible, disconnect the piston rod from rod clevis, knuckle or machine member to which it is fastened.

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

To remove the gland:

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

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



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

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

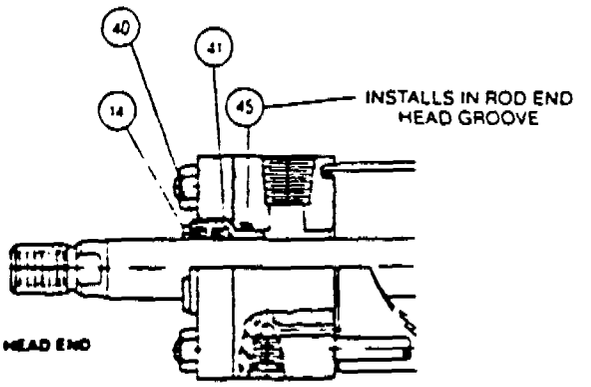
e) An O-ring, Sym. #45, is supplied with each gland cartridge kit. It serves as a seal between the gland and the head. This O-ring is a static seal and does not normally require replacement. The original O-ring may be left in place, unless it is known to be leaking (fluid flow around gland thread).

Installation

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

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

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



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

Tie Rod Nut Torque (Ft. Lbs.)		
Cylinder Bore Size	Cylinder Series	
	L - 2L - 3L	H - 2H - VH - 3H
1"	2	—
1½"	5	18
2"	11	45
2½"	11	45
3¼"	25	120
4"	25	130
5"	60	310
6"	L - 2L = 244 3L = 60	525
7"	—	790
8"	L - 2L = 513 3L = 110	1160

Retainer Bolt Torque

For Cylinders with Round or Small Square Gland Retainer

Bolt Dia.	Torque
3/16"	15 In. Lbs.
1/4"	60 In. Lbs.
5/16"	10 Ft. Lbs.
3/8"	20 Ft. Lbs.
7/16"	35 Ft. Lbs.

Gland Cartridge Wrenches

Rod Dia.	Gland Wrench (Symbol 63)	Spanner Wrench (Symbol 63-A)	Rod Dia.	Gland Wrench (Symbol 63)	Spanner Wrench (Symbol 63-A)
½" ⅝" 1"	069590 0000 069590 0000 069591 0000	011676 0000	2½" 3" 3½"	069595 0000 069596 0000 069597 0000	011677 0000
1⅜"	069592 0000	011703 0000	4"	069598 0000	011678 0000
1¾" 2"	069593 0000 069594 0000	011677 0000 011677 0000	5" 5½"	069599 0000 069600 0000	

Cylinder Division
500 So. Wolf Road
Des Plaines, IL 60016
708/298-2400

Regional Plants
- Santa Fe Springs, CA 310/698-0985
- Enfield, CT 203/749-2215
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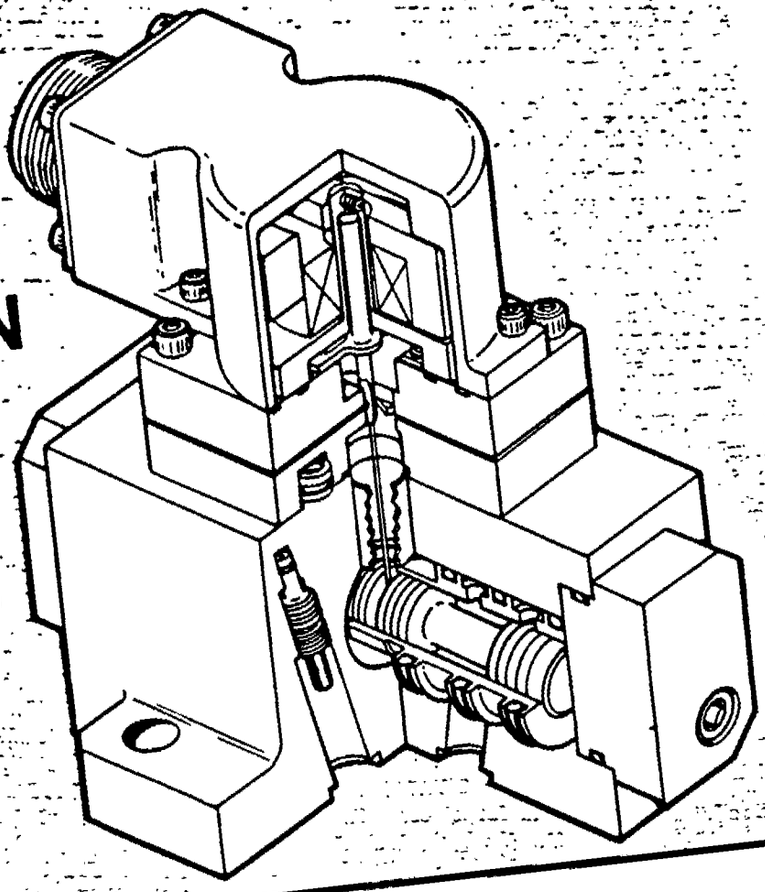
- Goodland, IN 219/297-3182
- Plymouth, MI 313/455-1700
- Hillsborough, NC (Accum) 919/732-6183
- Hillsborough, NC 919/732-9371
- Akron, OH 216/253-4500
- Portland, OR 503/285-0684
- Owen Sound, Ont. Can. 519/371-2682
- Toronto, Ont. Can. 416/255-4567
- Lachine, Quebec, Can. 514/631-3995

Parker Motion & Control

1100185 #3

BD15
BD30

Flow Control Servovalves



INSTALLATION AND SERVICE MANUAL

Parker Fluidpower

CATALOG NO. 1450 ISM.

DO A 134817
CONFIDENTIAL

BD 15
BD 30

INSTALLATION AND SERVICE MANUAL CONTAMINATION RESISTANT ELECTRO-HYDRAULIC SERVOVALVES

The Parker BD series servovalves are ruggedly designed specifically for use in the industrial market place. From its inception, over twelve years ago, the first stage amplifier (pilot valve) has established a solid history of trouble-free operation in very harsh environments. Minimum orifice diameters up to 20 times larger than other servovalves models substantially increase reliability by reducing problems due to contamination. The second stage is a closed center, four-way spool and sleeve which features rectangular slots in the sleeve. The spool metering edges exactly match the flow slot edges in the sleeve to provide linear flow with respect to electrical input. The valves have rated flows up to 30 GPM.

OPERATION

The BD series servovalves operate on a force feedback principle between the second stage spool metering valve and the first stage pilot valve torque motor. The pilot valve is a single jet pressure recovery unit that directs a continuing stream of control fluid into a receiver. The receiver has two outlets that are ported to the ends of the valve main spool, PC_1 and PC_2. The pressure in these ports is equal when the fluid jet is centered in the receiver opening.

The feedback spring attached to the armature measures spool position as a force. This force and the force of the torque motor armature provide the error displacement of the armature and it's diverter blade window. The window edges divert the jet stream to the proper receiver outlet to position the spool to the electrically commanded position.

An electrical signal applied to the pilot valve coil generates a magnetic force on the armature/diverter blade assembly, pivoting the assembly and allowing fluid to flow into PC_1. See Figure 1. This positions the main power spool to the left until the force from the feedback spring matches the magnetic force. At this time the diverter blade is recentered over the receiving orifices, and the spool motion stops at this position. Flow, proportional to the input electrical current, is then metered out the C_2 port. Removal of the electrical signal to the coil unbalances the forces, which reverses the armature deflection and drives the spool to the zero current or null position, as shown in Figure 2. Changing the polarity of the current to the coil causes a magnetic force in the opposite direction that results in flow from the C_1 port.

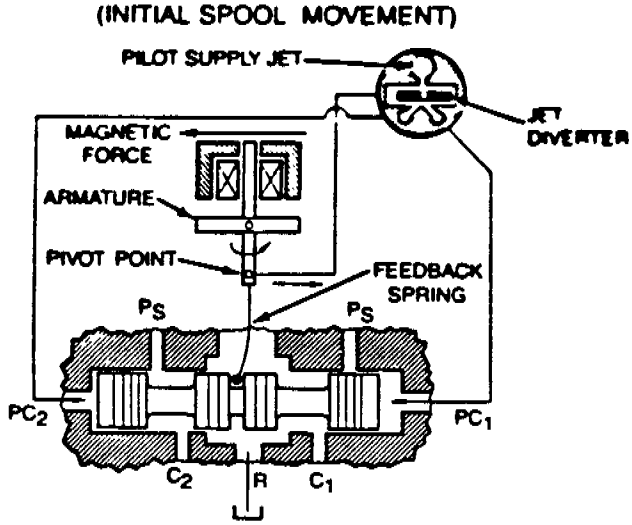


FIGURE 1. SERVOVALVE OPERATION - COMMAND FOR FLOW FROM CONTROL PORT C_2

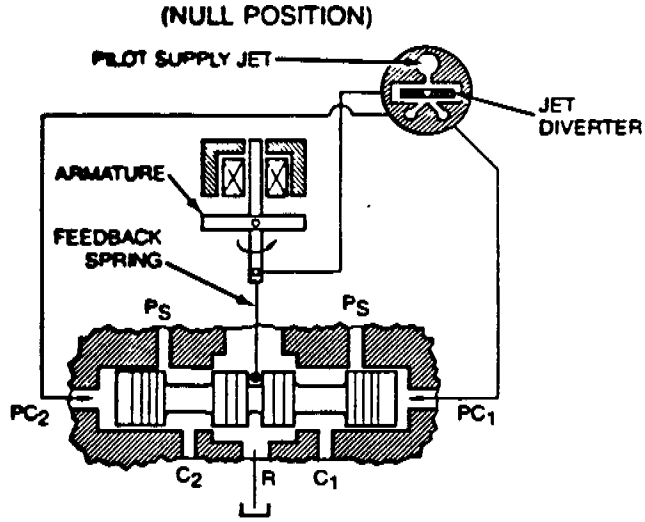
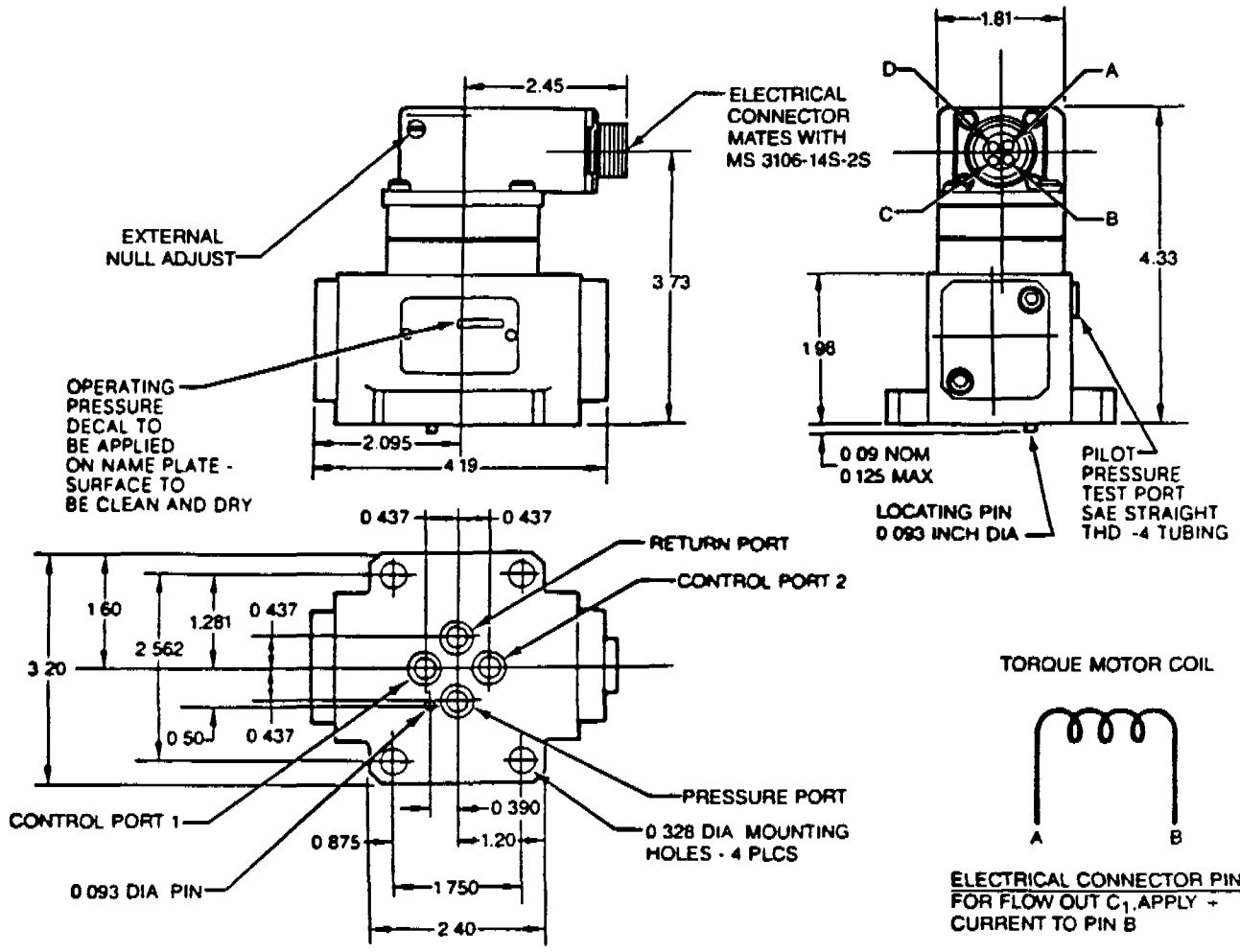


FIGURE 2. SERVOVALVE OPERATION - NULL POSITION, VALVE IN BALANCE

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio 44035

Parker Fluidpower

BD 15 INSTALLATION INFORMATION



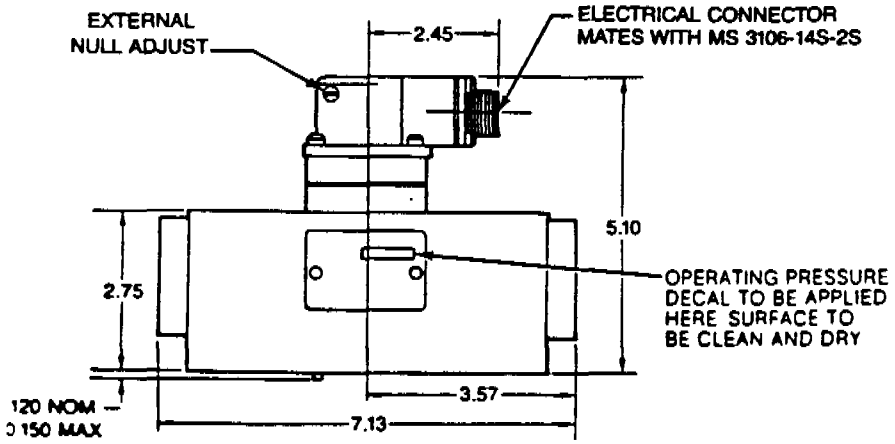
BD15 INSTALLATION DATA

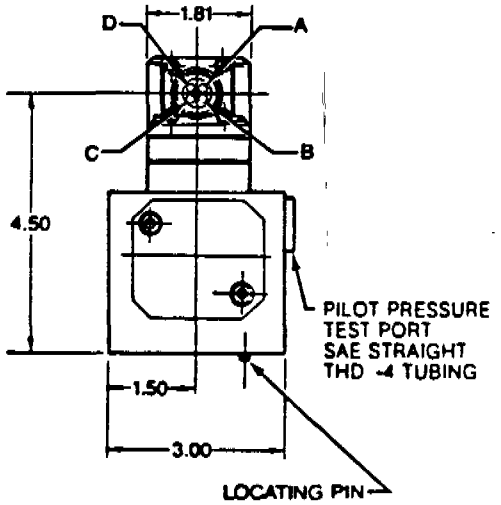
WEIGHT	2.6 LBS.	O-RING SIZE	2-013
PORT DIAMETER	0.375 IN.	ELECT. CONNECTOR MATES WITH -	MS3106-14S-2S
MOUNTING SCREWS, SOC.HD.CAP,	5/16-18 TH x 1.00 LONG	MAXIMUM OPERATING PRESSURE:	3000 PSI
TORQUE	110 to 150 IN. LB.	ELECTRICAL INPUT (STD. VALVE)	± 60 MA (FULL FLOW)
O-RING GROOVES	0.560 DIA. x 0.052 DEEP	COIL RESISTANCE (STD. VALVE)	60 ± 6 OHMS

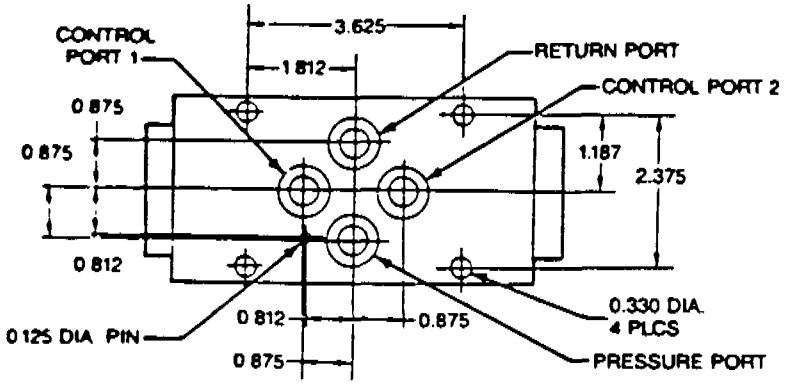
NOTES:

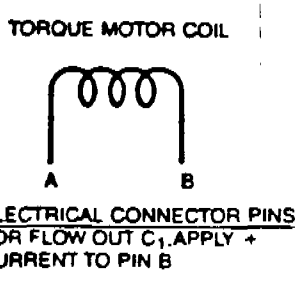
1. SERVOVALVE MATING SURFACE TO BE FLAT WITHIN 0.002 INCH TIR, AND SMOOTH TO WITHIN 63 RMS.
2. SERVOVALVE MOUNTING SCREWS ARE TO BE TORQUED TO 110-150 IN.-LBS. ABOVE RUN DOWN TORQUE.
3. FOR PROPER ORIFICE SELECTION AND DECAL PART NUMBER, REFER TO TABLE 2.

BD30 INSTALLATION INFORMATION









BD30 INSTALLATION DATA

WEIGHT	6.3 LBS.	O-RING SIZE	2-018
PORT DIAMETER	0.500 IN.	ELECT. CONNECTOR MATES WITH -	MS3106-14S-2S
MOUNTING SCREWS, SOC.HD.CAP.	5/16-18x3.25 LONG	MAXIMUM OPERATING PRESSURE:	3000 PSI
TORQUE	110 to 150 IN. LB.	ELECTRICAL INPUT (STD. VALVE)	± 60 MA (FULL FLOW)
O-RING GROOVES	0.866 DIA. x 0.052 DEEP	COIL RESISTANCE (STD. VALVE)	60 ± 6 OHMS

NOTES:

1. SERVOVALVE MATING SURFACE TO BE FLAT WITHIN 0.002 INCH TIR, AND SMOOTH TO WITHIN 63 RMS.
2. SERVOVALVE MOUNTING SCREWS ARE TO BE TORQUED TO 110-150 IN.-LBS. ABOVE RUN DOWN TORQUE.
3. FOR PROPER ORIFICE SELECTION AND DECAL PART NUMBER, REFER TO TABLE 2.

BD 15 BD 30 SERVOVALVE INSTALLATION

For maximum valve and system component life, the hydraulic system should be flushed and filtered to an absolute filtration of 25 µ m before installing the servovalve. A flushing block should be used in place of the valve while cleaning the system. These blocks are available from Hydraulic Valve Division, as follows:

BD15 – PN 810099
BD30 – PN 820099

To keep contaminants from entering the servovalve and/ or hydraulic system, keep the valve shipping cover in place until immediately prior to installation. Never leave the port surfaces uncovered and exposed to contamination. A permanent non-bypass filter should be installed in the system to assure that the valve receives a clean supply of oil.

The valve should be mounted as close as possible to the actuator or motor. It can be mounted in any plane, but it is best to have the spool as nearly horizontal as possible.

The servovalve should be set up for the system operating pressure according to the instructions in the OPERATING PRESSURE portion of the SERVOVALVE MAINTENANCE section.

After installing the servovalve, it must be determined if the valve and its electronics are phased properly. This can be accomplished by noting servovalve response to a change in input command. If there is no servovalve response, the two electrical leads to the valve must be interchanged to correct an out-of-phase condition.

NULL ADJUSTMENT

If it is desired to have the actuator go to a preferred position with electrical power off (electrical failure), a null offset adjustment can be made to make sure the actuator moves to the desired position. To adjust the valve null, the following procedure should be used:

1. Remove the screw from the null adjust access hole in the valve cover. (see installation drawing for its location).

2. Make sure the actuator or motor is unobstructed in case it were to move its load fully in either direction.

3. Disconnect the electrical connector on the valve.

4. Apply the rated supply pressure to the valve.

5. Insert a nonmagnetic 1/16 inch hex wrench into the access hole and engage the adjusting screw. (A magnetic wrench can be used but must be moved out of the hole after each adjustment to determine if the desired position has been achieved). The screw can be rotated in either direction until the desired result is obtained. (Actuator motion stops, retracts, etc.). The adjustment available is ± 10 to 15% of full valve stroke through approximately ±4 turns of the screw. The screw is trapped on either end so it cannot come out; however, it should not be overtightened at the ends of its travel. The adjusting screw locking device offers resistance to turning or moving on its own.

6. After adjustment, replace the access hole sealing screw.

DITHER

If the system resolution is not as precise as desired, it can sometimes be improved through the use of "dither". A small amplitude signal at a relatively high (60-150 Hz) frequency is superimposed on the valve command signal. This signal will cycle the valve spool at this higher frequency sufficiently to prevent valve "silting" and "stiction". It should be noted however, that if the amplitude is high enough, or the frequency low enough, the acutator could respond to the signal in such a way that would wear the seals rapidly. Therefore, care should be exercized in setting the frequency and amplitude of the dither. If dither does not solve the problem, the feedback device may be the limiting factor, or the servovalve may be sized too large for the accuracy desired

BD 15 BD 30 SERVOVALVE MAINTENANCE

GENERAL

This section provides maintenance instructions for the BD Series servovalves.

Except for orifice changing and filter removal, cleaning and reinstallation, field disassembly of the servovalves should never be attempted.

FILTER MAINTENANCE

If the valve performance appears sluggish or exhibits slow overshooting, the valve filter would be the first thing to check. It can be serviced as follows:

1. Wipe the surface around valve mounting flange as clean as possible, then loosen the four bolts securing valve to mounting pad.

2. Remove the valve, taking care not to set uncovered port flange of servovalve on a contaminated surface.

3. Inspect the port flange carefully, and if necessary, remove contamination using a clean wiper. Make certain that contamination is prevented from entering open fluid ports.

4. Using the special wrench 820000TF3-1 remove filter cartridge. See Figure 3.

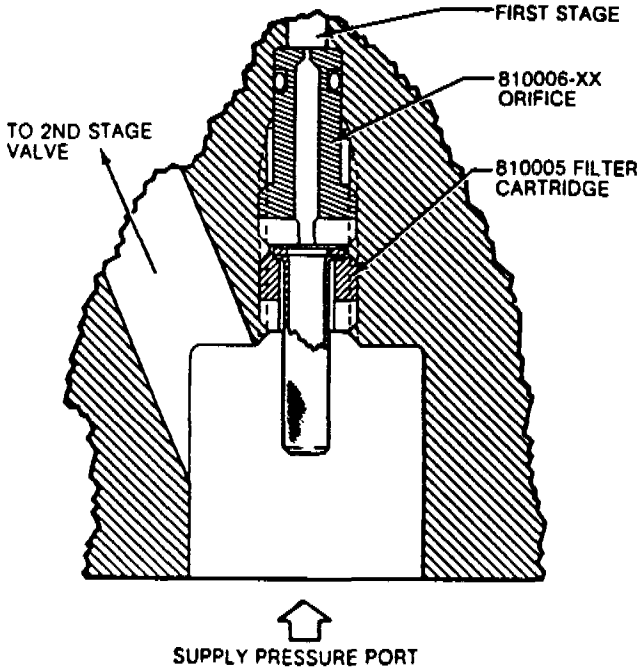


FIGURE 3 FILTER CARTRIDGE REMOVAL

5 Clean filter by soaking in tricloroethylene or other suitable solvent for 5 minutes, and blow dry from the inside out using filtered dry compressed air.

6 Be sure cartridge is dry and free from solvent before reinstalling

7. Inspect filter for cleanliness and damage to screen.

8 Position filter in servovalve cavity using the 820000TF3-1, wrench.

9 Tighten filter to 15 - 30 in. lbs above run down torque.

10. Install servovalve on mounting pad. Refer to pages 3 or 4 as required for installation.

PILOT OPERATING PRESSURE

The servovalve pilot stage operates on a relatively constant supply pressure.

The pilot supply pressure should be approximately 450 psi. This pressure is established by placing an orifice between the servovalve supply pressure and the pilot valve. The orifice, part number 8100006, is located under the filter shown in Figure 3. Table 2 shows the color coding, the dash number and the servovalve supply pressure range recommended for each particular orifice. It is important that the proper orifice be selected for the system pressure being applied to the servo. Improper orifice selection may over pressurize the pilot or result in very sluggish performance. To check or change the orifice, remove the filter as described in maintenance section. The top of the orifice should be visible when the filter is removed. It can be removed with a small blade screwdriver.

The valve is set up to operate within a pressure range that can be verified by the dash number on the orifice. Should it be decided to change this pressure range, a suitable new orifice must be selected and then install d as follows:

1. Lightly lubricate the new O-ring, with hydraulic fluid.

2. Install orifice in pressure port, and snug down with a straight-slot screwdriver. Care should be taken to select a screwdriver whose blade is not so wide that it will damage the threads in the housing.

3. Install filter as described in the FILTER MAINTENANCE section.

USE OF TEST PORT

The -4 Test port is provided should a verification of pilot valve supply pressure be desired. To use this port, the -4 plug must be removed, and replaced with a -4 tube fitting and suitable pressure gage. When system supply pressure is applied to the servovalve, the pressure indicated on the pressure gage is pilot valve supply pressure. This pressure should be 350 to 600 psi with the valve at null.

The test port may be also be used as an alternate pilot supply port by installing a blank supply orifice, -00 (red) in the valve body. The pilot supply pressure should be set between 450 psi and 500 psi. Special care must be taken to assure that this source is provided with a 25μ filter in it.

It should be noted that the tank line from the pilot is joined inside the valve with the 2nd stage tank line.

ELECTRICAL CHECKOUT

These instructions are for a standard valve. Valves with other coils should be checked to $\pm$10% of the rated resistance of the valve.

1 Using a standard ohmmeter, check the servovalve lead resistance.

2. Check the coil resistance as follows:

a. Attach ohmmeter leads to pin A and pin B. Coil resistance should read between 54 ohms and 66 ohms.

b. There shall be no continuity between either pin and servovalve case.

c. If coil resistance is greater than 66 ohms or less than 54 ohms, return the servovalve to the factory.

BACK PRESSURE

During normal hydraulic system operation, back pressure in the return system (tank line) is approximately 25 psi. Excessive back pressures due to clogged filters, system contamination, system out of trim etc., impose undesired forces on system components, and add significantly to the work required to move a load. Energy is being wasted and system components are being overworked. Back pressures in excess of 200 psi should be investigated immediately and the discrepancies corrected.

FIELD SERVICE SUGGESTIONS

Initial Check ut Procedure

1. Remove the electrical cable from the valve and connect pins A & B to a hand held power source (a 1 1/2 to 9 volt battery with a potentiometer to vary the input will do.).
2. Operate the valve with the hand held power source. If the indicated problem cannot be duplicated, the malfunction is more than likely in the wiring, controller or hydraulic system.
3. If the valve does exhibit the problem, refer to Table 1 for service suggestions.

TABLE 1. SERVICE SUGGESTIONS

Symptoms	Possible Causes	To Verify or Correct
Servovalve does not follow input command. (Actuator or motor is stopped.)	1) Open coil wire or open coil lead to connector pin 2) Totally plugged supply orifice or filter 3) Spool stuck	1) Check lead and coil resistance. If there is an "open", remove the connector and check it's solder joints. Resolder if required 2) Remove and inspect filter and orifice per Maintenance Section. 3) Return to factory
Sluggish valve (Servovalve output lags electrical command signal or it fails to meet its rated output.)	1) Partially plugged a Filter element b Orifice c Pilot valve 2) Leaky sleeve "O" rings 3) Low pilot supply pressure 4) Cylinder piston ring failure 5) Shorted coil 6) Low supply pressure	1) a Remove and inspect filter per Maintanance Section b Remove and inspect orifice per Maintenance Section c Return to factory 2) Investigate excessive internal leakage to tank (bypassing flow sound) 3) Check pilot supply pressure per Maintenance Section 4) Check cylinder (listen for bypassing sound.) 5) Check coil resistance in accordance with Maintenance Section, Electrical Checkout. 6) Verify that the supply pressure to the valve falls within the range noted on the valve nameplate
High null bias (high input current required to maintain actuator or motor stationary.)	1) Incorrect null adjust 2) Partially plugged receiver	1) Adjust null per Servovalve Maintenance Section. 2) Return valve to factory.
Output flow obtained from one port (Actuator hard over no response to servo command.)	1) Valve improperly phased 2) Plugged pilot valve receiver port 3) Spool stuck	1) Swap the two leads to the valve coil to change the polarity of the current to the coil. 2) Return valve to factory. 3) Return valve to factory.
Very high flow to cyl. port with little or no current input.	1) Pilot valve malfunction.	1) Return to factory.
Oscillation or hunting motion of acutator in the closed loop system.	1) Valve drive electronics gain set too high or some other misadjustment. 2) Partially plugged orifice or filter 3) Sticky spool.	1) Reset electronics. See electronics installation manual 1460 IM. 2) Check pilot pressure at test port and/or remove, inspect, and clean orifice/filter per Servovalve Maintenance Section. 3) Return valve to factory.

TABLE 2. ORIFICE SELECTION AND RDERING INFORMATION

KIT NUMBER*	PRESSURE RANGE (PSI)	COLOR CODE
810014-00**	EXT. PILOT 0 TO 3000	RED
810014-16	2600 — 3000	GREEN
810014-18	2000 — 2550	BLUE
810014-20	1400 — 1950	YELLOW
810014-22	1000 — 1350	ORANGE
810014-33	700 — 950	BLACK
810014-50	200 — 650	WHITE

*Kits include the orifice, an O-ring (PN 5-103) and the proper decal to be applied to the valve name plate.

Viton O-ring kits are also available, order Parter Number 810013-XX

**This Part Number is a blank with no hole. It is used when an external pilot fluid source is supplied to the test port.

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OHIO
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TEXAS
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(214) 238-5020

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TORONTO, ONT.
(416) 255-7371

YGS 6/91 2.5M

Parker Hannifin Corporation
Hydraulic Valve Division
520 Ternes Avenue
Elyria, Ohio 44035
Phone: (216) 366-5200

DO A 134824
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Parker Fluidpower

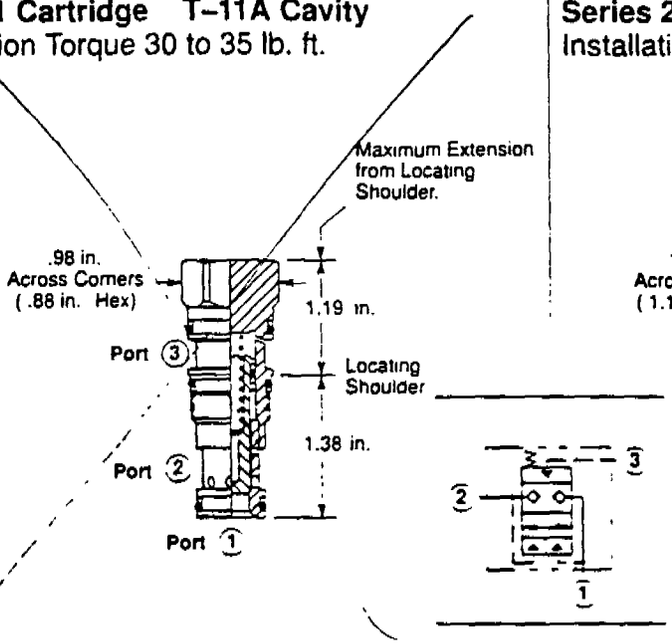
PILOT-TO-CLOSE SWITCHING ELEMENT WITH DIFFERENTIAL AREA POPPET

1100185 #10

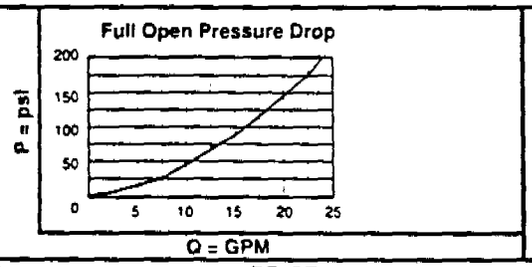
Refer to page 9.02 for furth r technical information.

- Bi-directional operation with sealed pilot for zero leakage.
- 5000 psi maximum operating pressure.

0 to 25 GPM Nominal
Series 1 Cartridge T–11A Cavity
Installation Torque 30 to 35 lb. ft.

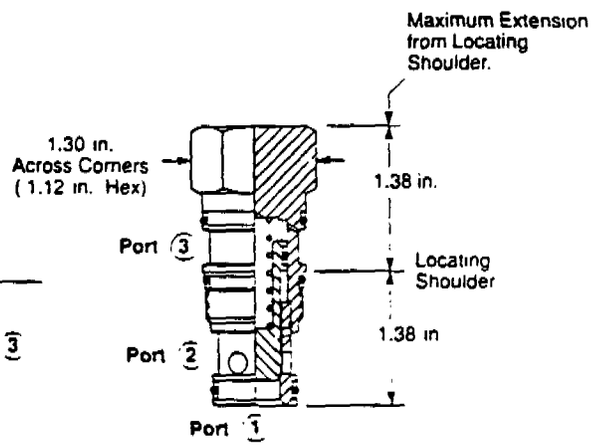


Port 3 pilot displacement = .04 in³
Area at Port 3 is 1.8 times the area at Port 1.
Leakage rate less than 5 drops/min.

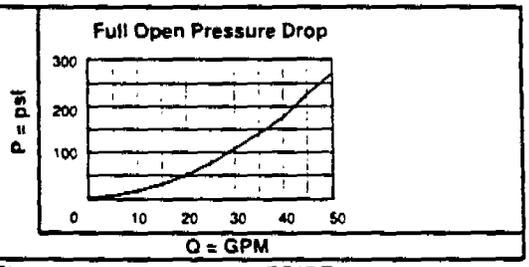


MODEL **LODC–XDN** PRICE **$ 27.40**

0 to 50 GPM Nominal
Series 2 Cartridge T–2A Cavity
Installation Torque 45 to 50 lb. ft.



Port 3 pilot displacement = .07 in³
Area at Port 3 is 1.8 times the area at Port 1.
Leakage rate less than 5 drops/min



MODEL **LOFC–XDN** PRICE **$ 37.50**

9

OPTIONS

LO* C – X D* – * * * / *
Basic cartridge from above

CONTROLS

X Non–adjustable + $ .00

CRACKING PRESSURE

D Opening pressure at Port 1 = 50 psi + $ .00

SEALS

N Buna–N + $ .00

V Viton + $1.50

BODY

Omit for Cartridge Only
or
See Body Locator Page 9.06

DO A 134825
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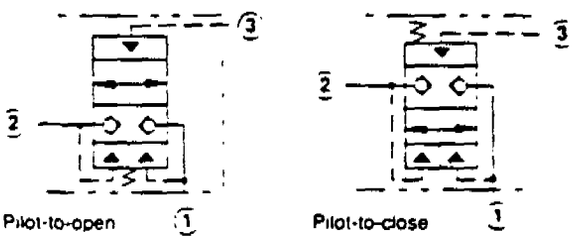
an orifice, regardless of variations in upstream or downstream pressure. The orifice may be fixed or variable, including the variable orifice created by proportional type directional valves.

Modulating cartridges can serve as main stage pressure controls to handle high flows with a low flow pilot circuit to control the performance of the cartridge. This allows a great deal of flexibility in creating a variety of operating conditions during a machine cycle. Functions such as multiple control pressures and venting or deventing can be incorporated at appropriate points in the cycle, using small solenoid operated valves.

Switching Cartridges

SUN offers two basic logic switching cartridges: pilot-to-open (LK*C) and pilot-to-close (LO*C).



Switching cartridges are unbalanced poppet, two-way valves with a third (pilot) port to control poppet operation The unbalanced poppet can be operated:

A) directly by pressure at either work port
B) by pilot pressure from an external source

NOTE: Because of their unbalanced poppet design, the operation of SUN's switching cartridges is pressure dependent The opening and closing movements of the poppet are functions of the force balances on three areas – port 1, port 2, and port 3

NOTE: Because logic switching cartridges are pressure responsive at all three ports, it is essential to consider all aspects of the system operation through a complete cycle when designing logic circuits. If pressure changes on any port are of sufficient magnitude, they may cause a valve element to switch from a closed to open condition, or vice versa. All possible pressure changes in the complete circuit cycle must be considered to assure a safe functional system design.

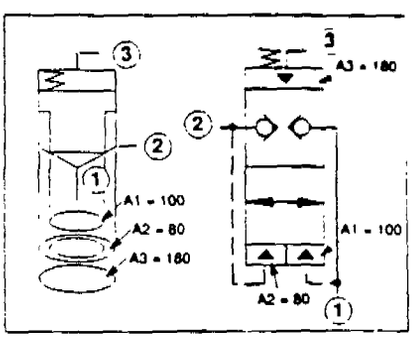
Operation of LO*C

Area Ratios
Port 1 Area (A1) = 100%
Port 2 Area (A2) = 80%
Port 3 Area (A3) = 180%

Area Ratios

$\frac{A3}{A1}$ = 1.8:1

$\frac{A3}{A2}$ = 2.25:1



Pilot-to-Close
Switching Cartridge LO*C

Pressure at port 1 or port 2, acting on areas A1 or A2, tends to open the valve. The bias spring force, together with pilot pressure at port 3, acting on area A3, tends to close the valve. Depending on the direction of flow, pilot-to-close switching valves open when the forces affecting the surface areas at port 1 or port 2 are greater than the force affecting the surface area at port 3. When port 3 is vented, the valve will open to either direction of flow when pressure at port 1 or port 2 is high enough to overcome the bias spring force. For example:

Pressure required to open at port 1 = 50 psi
Pressure required to open at port 2 = 65 psi

When pilot pressure is applied at port 3, this pressure, acting on A3 (plus the bias spring force), tends to hold the valve closed The valve may then be opened by venting the pilot port (3) to tank, or by introducing a proportionately higher pressure at port 1 or port 2 From the area ratios listed above it can be seen that.

$\frac{A3}{A1}$ = 1 8 1 or 1000 psi at port 3 will hold the valve closed against pressures up to 1800 psi at port 1 with port 2 referenced to tank.

$\frac{A3}{A2}$ = 2 25 1 or 1000 psi at port 3 will hold the valve closed against pressures up to 2250 psi at port 2 with port 1 referenced to tank.

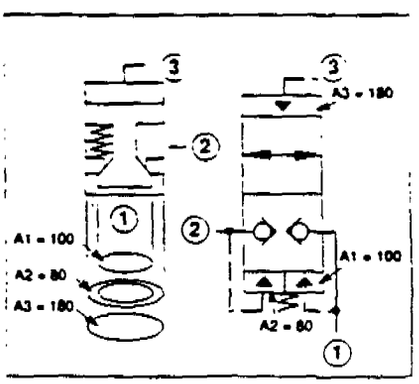
Operation of LK*C

Area Ratios
Port 1 Area (A1) = 100%
Port 2 Area (A2) = 80%
Port 3 Area (A3) = 180%

Area Ratios

$\frac{A3}{A1}$ = 1.8 1

$\frac{A3}{A2}$ = 2.25 1



Pilot-to-Open
Switching Cartridge LK*C

Pressure at port 1 or port 2, acting on areas A1 or A2, plus the bias spring force, tends to close the valve or add to the closing force. Pilot pressure at port 3, acting on area A3, tends to open the valve. Pilot-to-open switching cartridges close when the forces affecting the surface areas at port 1 or port 2 are greater than the forces affecting the surface area at port 3. When port 3 is vented, the valve will close and remain closed regardless of the pressure at port 1 or port 2.

When pilot pressure is applied at port 3, this pressure, acting on A3 (minus the bias spring force), tends to open the valve. The valve may be closed by venting port 3 (pilot) to tank, or by introducing a proportionately higher pressure at port 1 or port 2. From the area ratios listed above, it can be seen that:

$\frac{A3}{A1}$ = 1.8:1 or 1000 psi at port 3 will open the valve against pressures up to 1800 psi at port 1 with port 2 referenced to tank.

$\frac{A3}{A2}$ = 2.25:1 or 1000 psi at port 3 will open the valve against pressures up to 2250 psi at port 2 with port 1 referenced to tank.

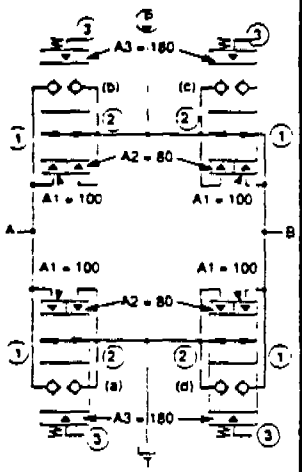
Switching Elements as Directional Controls

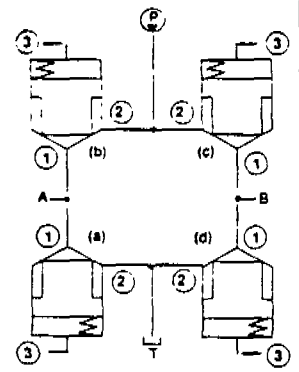
Four logic switching cartridges are required to duplicate the functions of a spool type four-way directional valve; one cartridge for each port – P, T, A, and B. By controlling the opening and closing of each element, twelve different flow paths can be obtained. Using logic switching cartridges, it is possible to shift from one flow condition to any other without going through any intermediate (or "center") valve condition or function. Because the opening of the cartridges can be precisely controlled, the logic circuit can anticipate the requirements of the system, allowing flow to shift direction smoothly. By contrast, most spool type directional valves have only three operating positions and must always pass through a center condition when changing from one flow path to another. The opening order and shifting conditions are rigidly fixed by the spool configuration and overlap.

Typical logic element four-way directional valve circuits, illustrating pilot-to-close and pilot-to-open cartridges are described below.

NOTE Both normally open and normally closed switching cartridges are seated poppet type valve designs, so leakage between port 1 and port 2 is essentially zero. All SUN switching cartridges are manufactured with seats on the pilot piston, eliminating any leakage between the pilot and work ports. Therefore, either work port can be selected as a source for self-piloting without fear of loss of pressure from the pilot section of the work port. Port 3 must be free of air and full of oil before starting up new systems.

PILOT TO CLOSE SWITCHING ELEMENTS
Typical Circuit

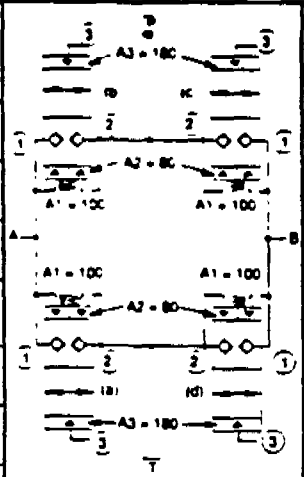


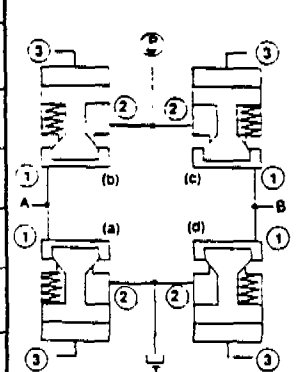


Equivalent Spool Valve Symbol (A, B, P, T)	Logic Element a	b	c	d
	O	O	O	O
	X	X	X	X
	X	O	X	O
	O	X	O	X
	X	O	X	X
	X	X	O	X
	O	X	X	X
	X	X	X	O
	X	O	O	X
	O	X	X	O
	O	O	X	X
	X	X	O	O

o – vented x – piloted

PILOT TO OPEN SWITCHING ELEMENTS
Typical Circuit



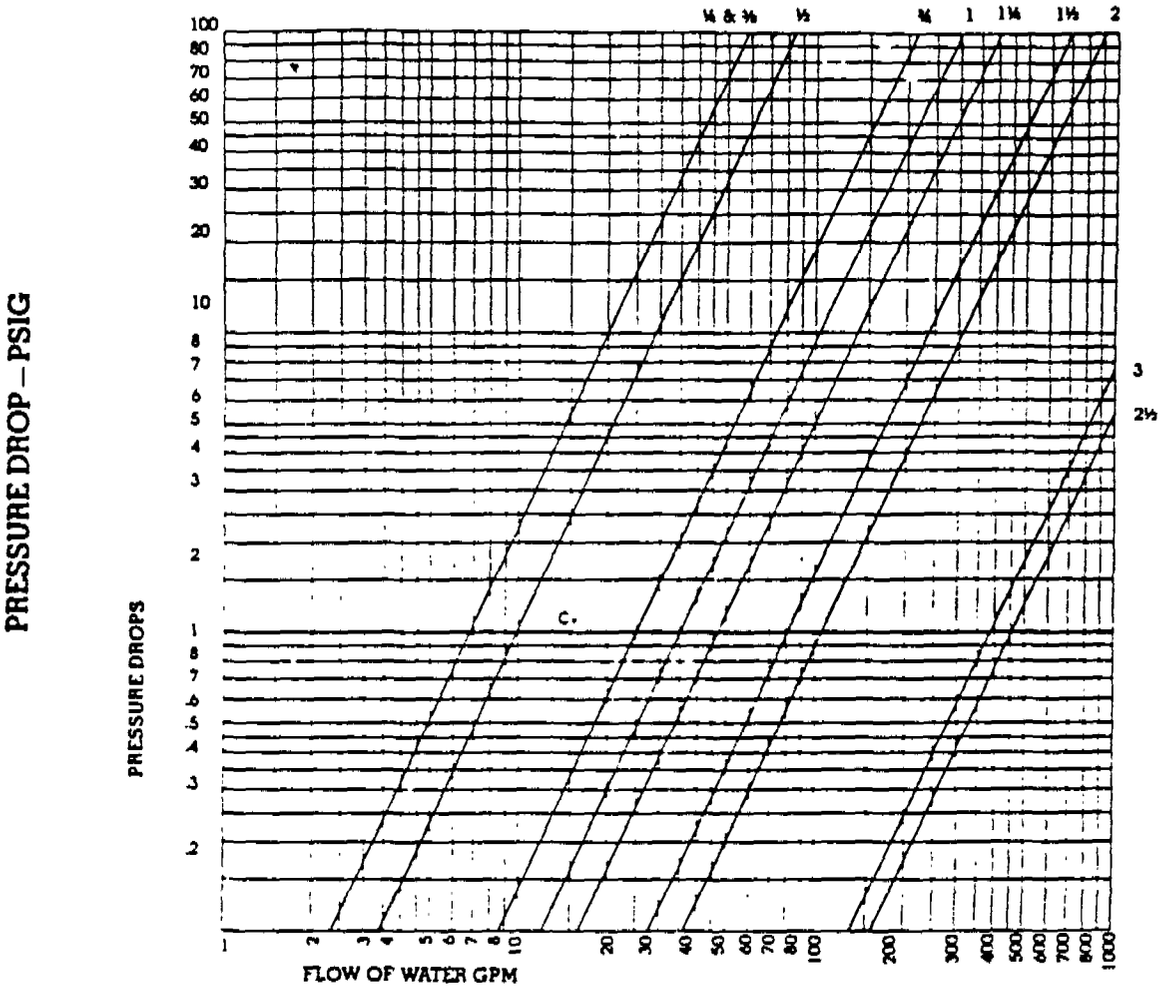


Equivalent Spool Valve Symbol (A, B, P, T)	Logic Element a	b	c	d
	X	X	X	X
	O	O	O	O
	O	X	O	X
	X	O	X	O
	O	X	O	O
	O	O	X	O
	X	O	O	O
	O	O	O	X
	O	X	X	O
	X	O	O	X
	X	X	O	O
	O	O	X	X

o – vented x – piloted

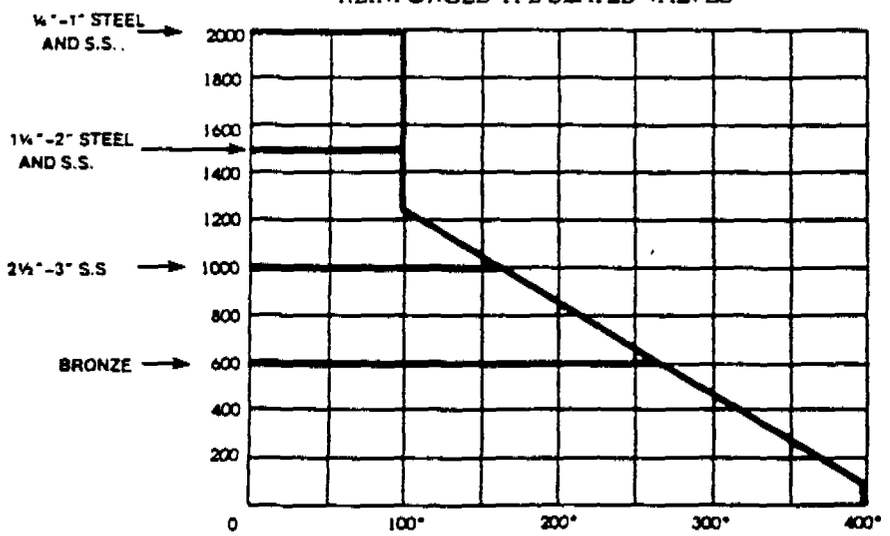
Apollo® Data

PRESSURE DROP



PRESSURE/TEMP RATINGS*

REINFORCED TFE SEATED VALVES



STANDARD VALVE RATINGS

- Bronze Valves
  -600 P.S.I. WOG, Cold, Non-Shock
- 316 Stainless Steel and Carbon Steel Valves
  -2000 P.S.I. WOG, ¼" through 1"
  -1500 P.S.I. WOG, 1¼" through 2"
  -1000 P.S.I. WOG, 2½" & 3" Cold Non-Shock

- All standard valves rated for 150 P.S.I. saturated steam on-off service
- Vacuum service to 29 inches mercury
- All valves tested to MSS-SP-72, 100 P.S.I. air under water, in the opened and closed positions

***NOTE:** Additional Pressure/Temperature Charts For Specialized Valves Are Shown On Pages 8, 10, 12, 13, 14, 16, 26, 32, 39, 40, 43. 55 and 58

THE 'Apollo' NUMBERING SYSTEM

PLEASE USE ALL SEVEN DIGITS WHEN ORDERING

(Catalog number plus design number) AVAILABILITY ON REQUEST

00-0 0 0-00

MATERIAL OR STYLE

70. BRONZE
71. BRONZE WITH PADS
72. CARBON STEEL, HI-PRESSURE
73. CARBON STEEL
74. NICKEL
75. PAD-LOCKING BRONZE
76. 316 STAINLESS STEEL
77. BRONZE FULL PORT
78. SPECIAL VALVES
79. REFRIGERANT VALVES
7A. CHLORINE, CARBON STEEL
7B. BRONZE FULL PORT HYDRO
7C. C.S., REG. PORT, 3000 PSI
7E. C.S., FULL PORT, 3000 PSI
7F. S.S., REG. PORT, 3000 PSI
7G. S.S., FULL PORT, 3000 PSI
80 BRONZE, UL LISTED
81. BRONZE, UL LISTED, PLAIN BALL
82 BRONZE 3 PIECE FULL PORT
83 CARBON STEEL 3 PIECE FULL PORT
85 316 S.S 3 PIECE STD PORT
86 316 S.S 3 PIECE FULL PORT
87 316 S.S FLANGED
88 CARBON STEEL FLANGED
89 CAST CARBON STEEL W/PADS
9A BRONZE HVY. PATT., UNIBODY
90 BRONZE, UL LISTED
91. BRONZE, UNIBODY
92. CAST STEEL, UNIBODY
93 STEEL, UNIBODY
95 BRONZE STOP & DRAIN
96 316 S.S. UNIBODY

TYPE

1. NPT FEMALE/150 FLANGE
2. SOLDER & SOC. WELD/150 FLANGE-FULL PORT
3. UNION END-NPT/STD. PORT 3 PIECE NPT
4. UNION END, SOLDER/STD. PORT SOC. WELD
5. "DEADMAN"/HIGH PRESSURE, FULL PORT NPT
6. 3-WAY, NPT/HIGH PRESSURE, SOC. WELD FULL PORT
7. BUTT WELD/300 FLANGE
8. MALE X FEMALE NPT/600 FLANGE
9. 3-WAY, SOLDER/O-RING BOSS

VARIATIONS

1. ONE SIZE LARGER MALE RETAINER
2. ADJUSTABLE STOP LEVER
3. MONEL BALL & STEM
4. S.S. BALL & STEM
5. ORIGINAL BALANCING STOP—ATTACH TO LEVER OR T-HANDLE
6. N.A.C.E. TRIM, 73 STYLE
7. ONE SIZE SMALLER FEMALE RETAINER
8. NOT ASSIGNED
9. PINNED RETAINERS

SIZE*

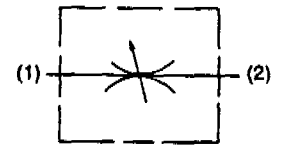
1. ¼"
2. ⅜"
3. ½"
4. ¾"
5. 1"
6. 1¼"
7. 1½"
8. 2"
9. 2½"
0. 3"
A. 4"
C. 6"
E. 8"
G. 10"
H. 12"

*BODY SIZE WHEN ENDS ARE MIXED

NOTE NOT ALL VARIATIONS AND FEATURES AVAILABLE ON SAME VALVE CONSULT CONBRACO REPRESENTATIVE

DESIGN			
01	STANDARD	26	DRY CHLORINE TRIM (7A-130 SERIES)
02	GROUNDED	27	LATCH LOCK LEVER
03	1¼" EXT. STEM	28	MOUNTING PADS NOT THREADED (76-100 SERIES)
04	2¼" EXT. STEM	29	1500 LB. 3-PC FIRESAFE DESIGN
05	PLAIN BALL	30	CAM-LOCK HANDLE
06	SPECIAL 2000 LB. (73 SERIES 1¼, 2")	31	SIDE OUTLET NOT TAPPED (7B SERIES)
07	TEE HANDLE	32	S.S. TEE HANDLE AND NUT
08	90° REVERSED STEM	33	76-300/400 THD'D. FOR ACTUATOR MTG.
10	S.S. LEVER & NUT	35	VIRGIN TFE TRIM
12	STAMP 157 SWP & BAGGED	37	ACTUATED
13	STAMP 157 SWP	41	AUTO DRAIN, BRONZE VALVES
14	VENTED BALL	45	LESS LEVER & NUT
15	ROUND HANDLE	49	ASSEMBLED DRY
16	VERT. CHAIN LEVER (EXCEPT 73 & 93)	57	OXYGEN CLEANED—BRONZE & S.S. ONLY
17	ROUGH CHROME	59	S.S. EXTERNAL TRIM (82 & 83 SERIES)
19	WITH LOCK PLATE (73,93 & 76)	60	GROUNDED BALL & STEM
21	UHMWPE SEATS, 3-PEICE/R.P. FLANGE	62	3 PIECE CENTER SECTION
23	TANK VALVE, 3 PIECE ONLY	63	NPT X SOLDER/SOCKET WELD
24	GRAPHITE STEM PACKING	64	250 LB. STEAM

Needle Valve



Metered Flow—Either Direction

Application

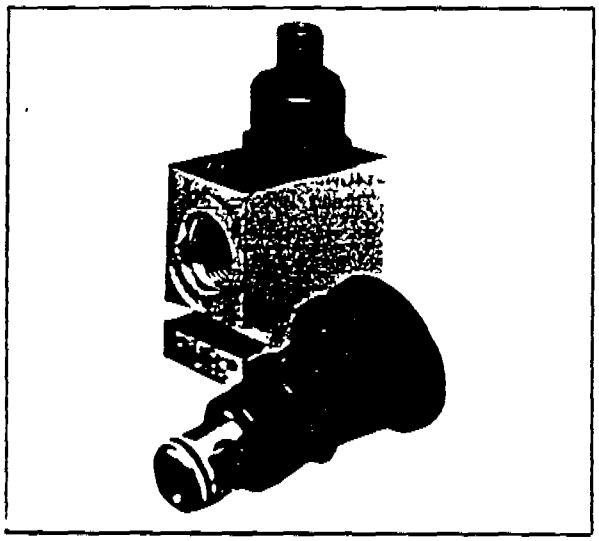
The NV101 Series Needle Valves provide speed control and shutoff where a reverse flow check is not required.

Operation

The valve acts as a fixed orifice in a hydraulic circuit. The effective size of the orifice increases as the tapered needle is opened. Shutoff is provided when fully closed. Flow can be metered with this cartridge in either direction.

Features

- Hardened operating parts for long life
- Compact cartridge design
- Fine thread on needles for precise adjustment



Installation Data

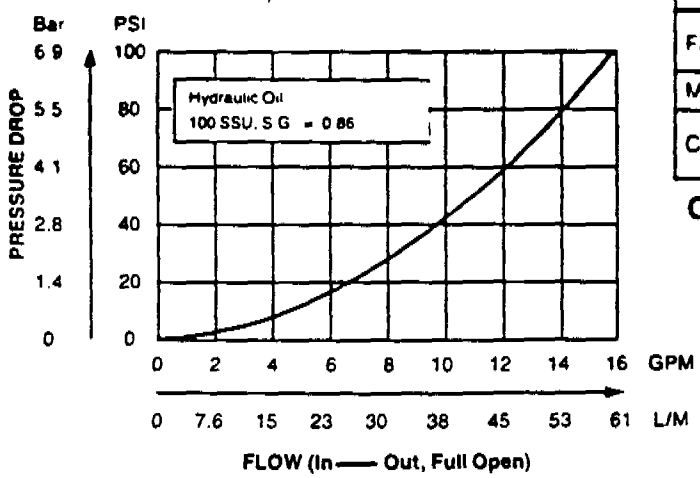
See the Installation Information section of this catalog for specific recommendations pertaining to system cleanliness, fluids, seals and other important factors relative to the proper installation and use of these products.

Performance Curve

Controlled Flow vs. Pressure Drop

(Needle Full Open)

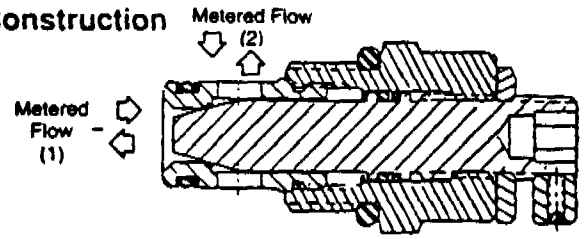
(Through cartridge only. For performance of bodies see section MV).



Cartridge Valve Specifications

Nominal Flow Rating	16 GPM (60 L/M)
Max. Operating Pressure	3500 PSI (245 Bar)
Max. Shutoff Leakage at Rated Pressure & Flow	5 drops/min. (1/3 cc/min.)
Max. Effective Orifice Area	.062 in²
Operating Temp. Range (Ambient)	–40°F to + 200°F (Nitrile) –25°F to + 250°F (Viton)
Cartridge Material	All parts steel. All operating parts hardened steel
Body Material	Steel
Filtration	ISO Code 16/13, SAE Class 4 or better
Mounting	No Restrictions
Cavity	Common Cavity No. C10–2 (See Cavity Details section)

Construction

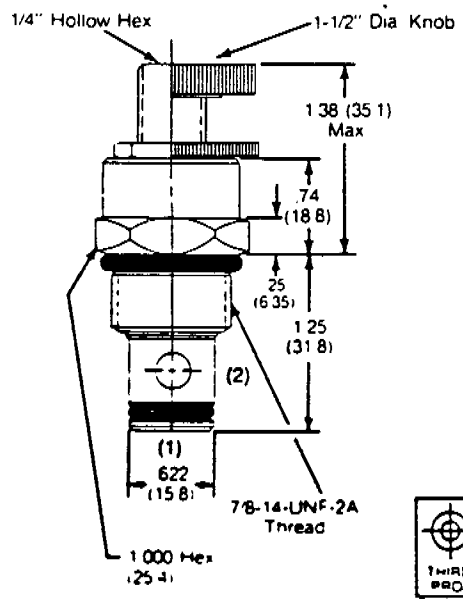


For additional information – call your local Parker Fluidpower Motion & Control Distributor.

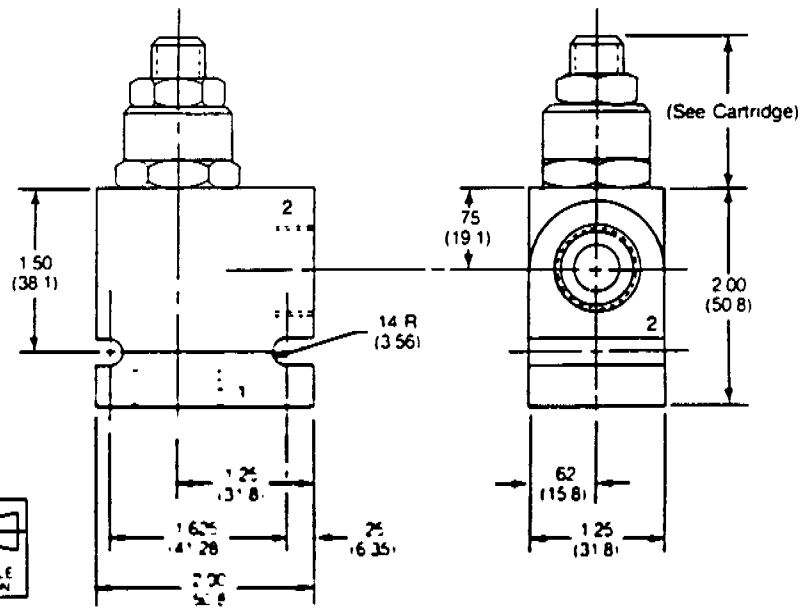
Dimensions (Millimeters)

Inches

Cartridge Only



Cartridge in Body



Ordering Information

NV	10	1				—	
NEEDLE VALVE	SIZE	STYLE	ADJUSTMENT STYLE		SEALS		BODY OPTION

SIZE

7/8–14

STYLE

Code	Style
1	Direct Acting

SEALS

Code	Type
Omit	Nitrile
V	Viton

ADJUSTMENT STYLE

Code	Style
K	Knob Adjust
S	Screw Adjust

BODY OPTION

Code	Porting
Omit	Cartridge Only
4P	1/4" NPTF (B10–2–4P)
6P	3/8" NPTF (B10–2–6P)
8P	1/2" NPTF (B10–2–8P)
6T	SAE–6 (B10–2–6T)
8T	SAE–8 (B10–2–8T)

Shipping Weight
Cartridge Only 0.4 lbs (.18 kg)
Cartridge in Body 1.4 lbs. (.63 kg)

SERVICE PARTS

Knob Kit – 840208K (To convert screw adjust to knob adjust)
Nitrile Seal Kit – SK10–2
Viton Seal Kit – SK10–2V
Panel Mount Kit – PMK101

F

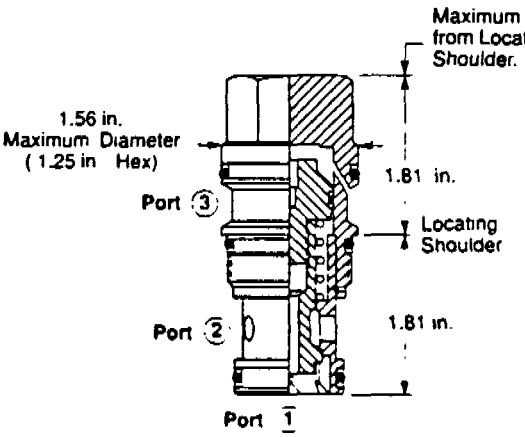
PILOT-TO-OPEN SWITCHING ELEMENT WITH DIFFERENTIAL AREA POPPET

1100185 #11

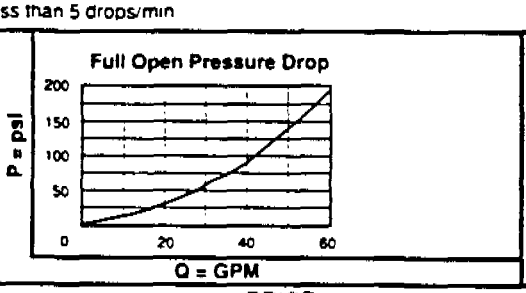
Refer to page 9.02 for further technical information.

- Bi–directional operation with sealed pilot for zero leakage.
- With no pilot signals, flow is blocked in both directions.

0 to 60 GPM Nominal
Series 3 Cartridge T–17A Cavity
Installation Torque 150 to 160 lb. ft.

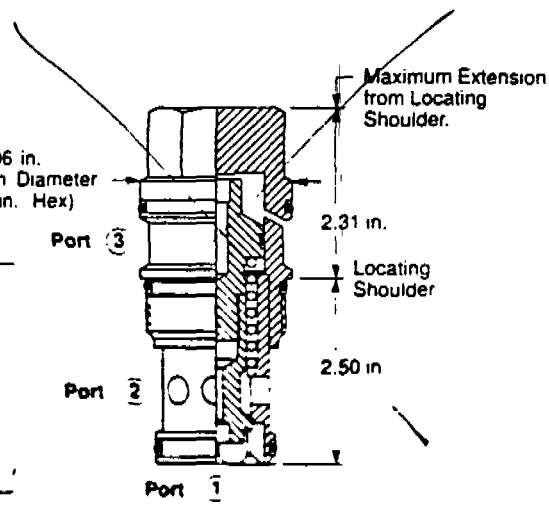


Port 3 pilot displacement = .15 in ^{3}
5000 psi maximum operating pressure
Area at Port 3 is 1.8 times the area at Port 1.
Leakage rate less than 5 drops/min

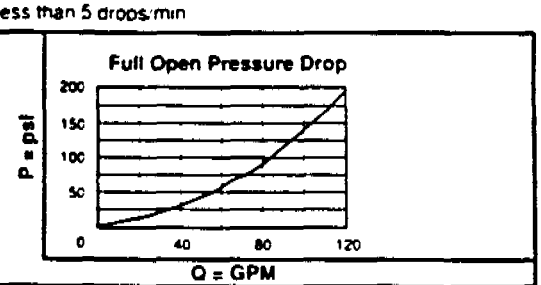


MODEL **LKHC–XDN** PRICE **$ 69.00**

0 to 120 GPM Nominal
Series 4 Cartridge T–19A Cavity
Installation Torque 350 to 375 lb. ft.



Port 3 pilot displacement = .30 in ^{3}
5000 psi maximum operating pressure
Area at Port 3 is 1.8 times the area at Port 1
Leakage rate less than 5 drops/min



MODEL **LKJC–XDN** PRICE **$119.50**

OPTIONS

LK★C – XD★ – ★★★/★
Basic cartridge from above

CONTROLS
- **X** Non–adjustable + $ .00

CRACKING PRESSURE
- **D** Bias spring is equivalent to 30 psi on Port 3 + $ .00

SEALS
- **N** Buna–N + $ .00
- **V** Viton + $2.00

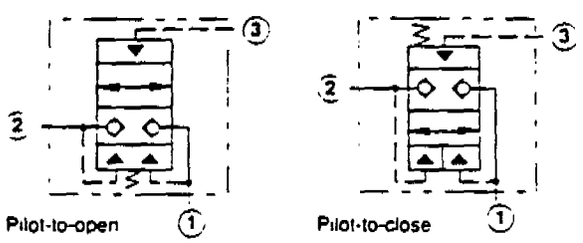
BODY
Omit for Cartridge Only
or
See Body Locator Page 9.06

an orifice, regardless of variations in upstream or downstream pressure. The orifice may be fixed or variable, including the variable orifice created by proportional type directional valves.

Modulating cartridges can serve as main stage pressure controls to handle high flows with a low flow pilot circuit to control the performance of the cartridge. This allows a great deal of flexibility in creating a variety of operating conditions during a machine cycle. Functions such as multiple control pressures and venting or deventing can be incorporated at appropriate points in the cycle, using small solenoid operated valves.

Switching Cartridges

SUN offers two basic logic switching cartridges: pilot–to–open (LK*C) and pilot–to–close (LO*C).



Switching cartridges are unbalanced poppet, two–way valves with a third (pilot) port to control poppet operation. The unbalanced poppet can be operated:

A) directly by pressure at either work port
B) by pilot pressure from an external source

NOTE: Because of their unbalanced poppet design, the operation of SUN's switching cartridges is pressure dependent. The opening and closing movements of the poppet are functions of the force balances on three areas – port 1, port 2, and port 3.

NOTE: Because logic switching cartridges are pressure responsive at all three ports, it is essential to consider all aspects of the system operation through a complete cycle when designing logic circuits. If pressure changes on any port are of sufficient magnitude, they may cause a valve element to switch from a closed to open condition, or vice versa. All possible pressure changes in the complete circuit cycle must be considered to assure a safe functional system design.

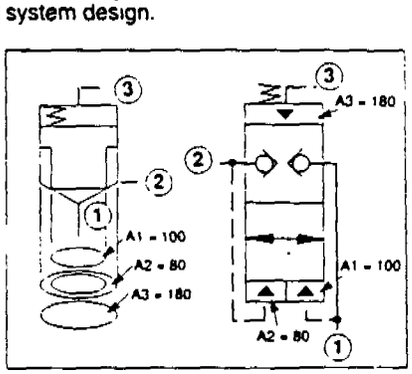
Operation of LO*C

Area Ratios
Port 1 Area (A1) = 100%
Port 2 Area (A2) = 80%
Port 3 Area (A3) = 180%

Area Ratios

$\frac{A3}{A1}$ = 1.8:1

$\frac{A3}{A2}$ = 2.25:1



Pilot–to–Close
Switching Cartridge LO*C

Pressure at port 1 or port 2, acting on areas A1 or A2, tends to open the valve. The bias spring force, together with pilot pressure at port 3, acting on area A3, tends to close the valve. Depending on the direction of flow, pilot–to–close switching valves open when the forces affecting the surface areas at port 1 or port 2 are greater than the force affecting the surface area at port 3. When port 3 is vented, the valve will open to either direction of flow when pressure at port 1 or port 2 is high enough to overcome the bias spring force. For example:

Pressure required to open at port 1 = 50 psi
Pressure required to open at port 2 = 65 psi

When pilot pressure is applied at port 3, this pressure, acting on A3 (plus the bias spring force), tends to hold the valve closed. The valve may then be opened by venting the pilot port (3) to tank, or by introducing a proportionately higher pressure at port 1 or port 2. From the area ratios listed above, it can be seen that:

$\frac{A3}{A1}$ = 1.8:1 or 1000 psi at port 3 will hold the valve closed against pressures up to 1800 psi at port 1 with port 2 referenced to tank.

$\frac{A3}{A2}$ = 2.25:1 or 1000 psi at port 3 will hold the valve closed against pressures up to 2250 psi at port 2 with port 1 referenced to tank.

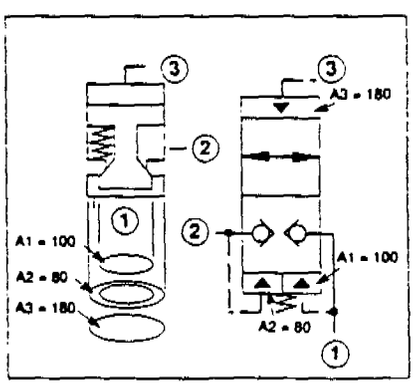
Operation of LK*C

Area Ratios
Port 1 Area (A1) = 100%
Port 2 Area (A2) = 80%
Port 3 Area (A3) = 180%

Area Ratios

$\frac{A3}{A1}$ = 1.8:1

$\frac{A3}{A2}$ = 2.25:1



Pilot–to–Open
Switching Cartridge LK*C

Pressure at port 1 or port 2, acting on areas A1 or A2, plus the bias spring force, tends to close the valve or add to the closing force. Pilot pressure at port 3, acting on area A3, tends to open the valve. Pilot–to–open switching cartridges close when the forces affecting the surface areas at port 1 or port 2 are greater than the forces affecting the surface area at port 3. When port 3 is vented, the valve will close and remain closed regardless of the pressure at port 1 or port 2.

When pilot pressure is applied at port 3, this pressure, acting on A3 (minus the bias spring force), tends to open the valve. The valve may be closed by venting port 3 (pilot) to tank, or by introducing a proportionately higher pressure at port 1 or port 2. From the area ratios listed above, it can be seen that:

$\frac{A3}{A1}$ = 1.8:1 or 1000 psi at port 3 will open the valve against pressures up to 1800 psi at port 1 with port 2 referenced to tank.

$\frac{A3}{A2}$ = 2.25:1 or 1000 psi at port 3 will open the valve against pressures up to 2250 psi at port 2 with port 1 referenced to tank.

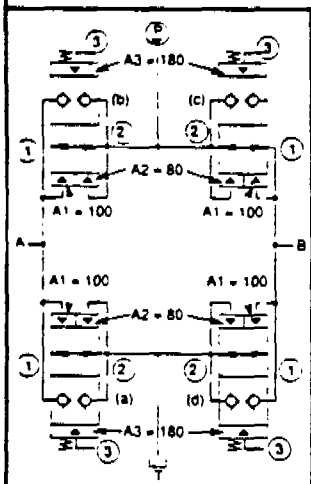
Switching Elements as Directional Controls

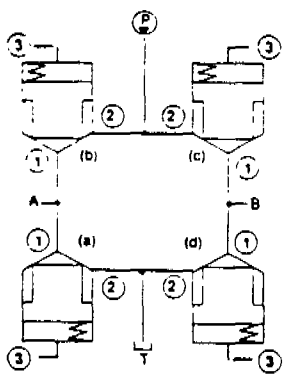
Four logic switching cartridges are required to duplicate the functions of a spool type four-way directional valve: one cartridge for each port – P, T, A, and B. By controlling the opening and closing of each element, twelve different flow paths can be obtained. Using logic switching cartridges it is possible to shift from one flow condition to any other without going through any intermediate (or "center") valve condition or function. Because the opening of the cartridges can be precisely controlled, the logic circuit can anticipate the requirements of the system, allowing flow to shift direction smoothly. By contrast, most spool type directional valves have only three operating positions and must always pass through a center condition when changing from one flow path to another. The opening order and shifting conditions are rigidly fixed by the spool configuration and overlap.

Typical logic element four-way directional valve circuits, illustrating pilot-to-close and pilot-to-open cartridges are described below.

NOTE Both normally open and normally closed switching cartridges are seated poppet type valve designs, so leakage between port 1 and port 2 is essentially zero. All SUN switching cartridges are manufactured with seats on the pilot piston, eliminating any leakage between the pilot and work ports. Therefore either work port can be selected as a source for self-piloting without fear of loss of pressure from the pilot section of the work port. Port 3 must be free of air and full of oil before starting up new systems.

PILOT TO CLOSE SWITCHING ELEMENTS
Typical Circuit

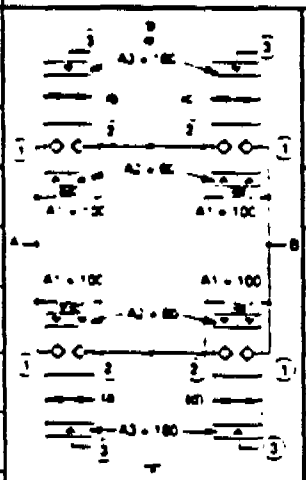


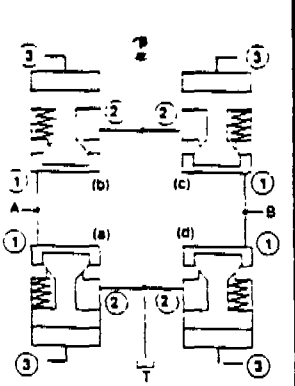


Equivalent Spool Valve Symbol A___B P___T	*Logic Element* a	b	c	d
	O	O	O	O
	X	X	X	X
	X	O	X	O
	O	X	O	X
	X	O	X	X
	X	X	O	X
	O	X	X	X
	X	X	X	O
	X	O	O	X
	O	X	X	O
	O	O	X	X
	X	X	O	O

o – vented x – piloted

PILOT TO OPEN SWITCHING ELEMENTS
Typical Circuit





Equivalent Spool Valve Symbol A___B P___T	*Logic Element* a	b	c	d
	X	X	X	X
	O	O	O	O
	O	X	O	X
	X	O	X	O
	O	X	O	O
	O	O	X	O
	X	O	O	O
	O	O	O	X
	O	X	X	O
	X	O	O	X
	X	X	O	O
	O	O	X	X

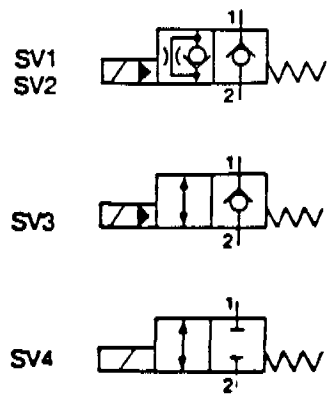
o – vented x – piloted

1100185 #11

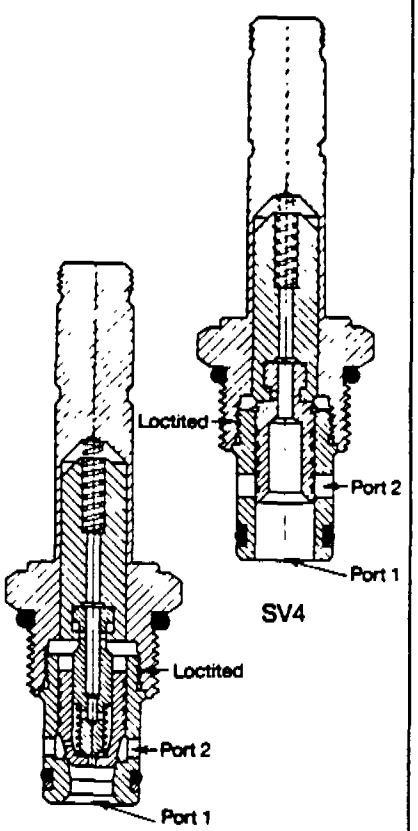
Solenoid directional valves, two-way two-position (2/2), normally-closed series

SV1/2/3/4-10(V)-C

Functional symbols



Typical sections
Solenoids omitted



SV1
Similar construction for SV2 and SV3

Model and ordering code

SV * -10(V)-C- * -**** *
[1] [2] [3] [4] [5]

[1] Type
See also "Functional symbols" section
1 = Poppet type, two-stage, high flow
2 = Poppet type, two-stage, fast acting
3 = Poppet type, two-stage, free reverse flow
4 = Spool type, direct acting

[2] Fluid compatibility
Blank = Antiwear hydraulic oil
V = As above or with phosphate-ester (not alkyl type)

[3] Form
0 = Cartridge only

In light-duty housing;
207 bar (3000 psi) max.
6T = With SAE 6 size ports

In NFPA fatigue-rated housing;
207 bar (3000 psi) max.
6H = With SAE 6 size ports
Continued in next column
8H = With SAE 8 size ports
2G = With G¼" (BSPF) size ports
3G = With G⅜" (BSPF) size ports

[4] Voltage rating

		Amps	Lead color
00	= No coil	—	—
12D	= 12VDC	1,50	Red
24D	= 24VDC	0,75	Black
36D	= 36VDC	0,50	Blue
24A	= 24VAC 60/50 Hz	0,75	Orange
115A	= 115VAC 60 Hz/ 110VAC 50 Hz	0,16	Yellow
230A	= 230VAC 60/50 Hz	0,08	Red/ White

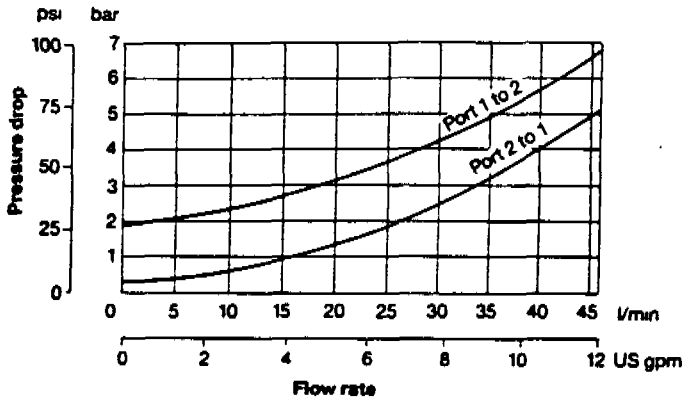
[5] Connector types
Blank = No coil
G = ISO 4400 (DIN 43650) connector. Order requisite connector plug separately; see "Spare parts", two pages on.
P = ½" NPT conduit port, with leadwire
Q = Spade terminal (option for DC voltages only)
W = Leadwire (option for DC and 24VAC only)

Operating data
Performance data is typical with fluid at 28 cSt (132 SUS) and 38°C (100°F)

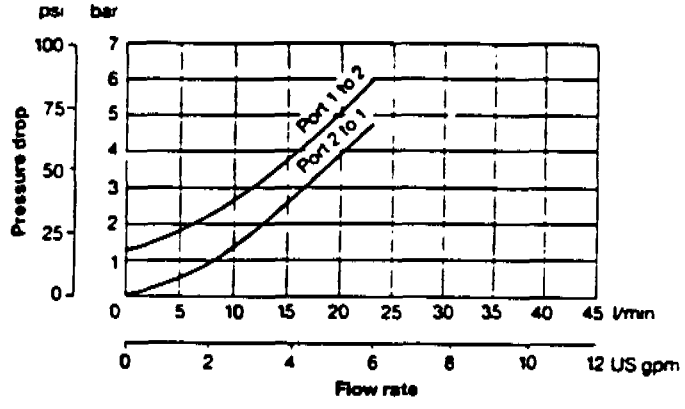
Max. pressure, both ports	207 bar (3000 psi)
Rated flow: SV1 & SV3 models SV2 & SV4 models	45 l/min (12 US gpm) 23 l/min (6 US gpm)
Pressure drop characteristics	See graphs on next page
Electrical characteristics and options	See [4] and [5] in "Model code" above, and also page 49
Hydraulic fluids, temperature ranges and filtration recommendations	See [2] in "Model code" and also page 266
Installation dimensions, cartridge only	See two pages on
Cavity size	C-10-2 See page 247 for dimensions
Mass, cartridge including solenoid	0,4 kg (0.87 lb) approx.
Housing options: Standard light duty type Standard fatigue-rated type Customized types	 See page 255 See page 251 Consult your local sales engineer
Spare parts	See two pages on

Pressure drop characteristics
Cartridges only

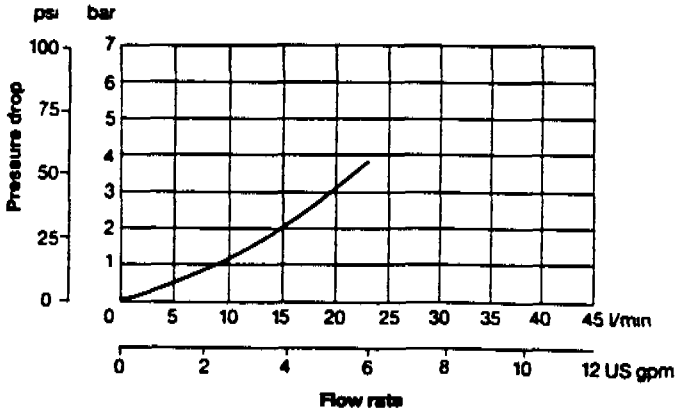
SV1 & SV3



SV2

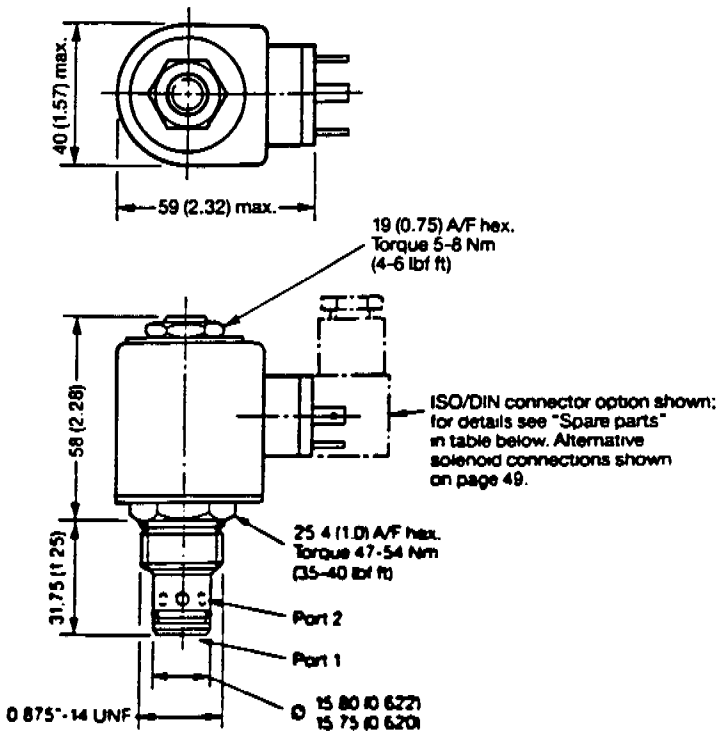


SV4



Installation dimensions in mm (inch s)

3rd angle projection



Spare parts

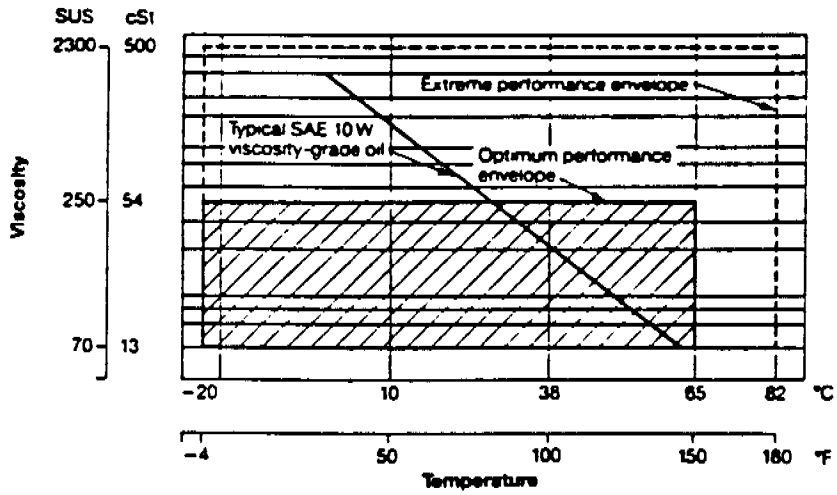
The only parts available are:	Kit no.
a. Seal kits comprising external seals and back-up rings for:	
SV*-10-C	SK-10-2
SV*-10V-C	SK-10V-2
b. Solenoid coil and ancillary parts	See page 49
c. ISO/DIN connector plug options:	Part no.
Black, marked B	710775
Gray, marked A	710776
	For dimensions see page 50

Supporting information

Hydraulic fluids, temperature ranges, filtration recommendations and contaminant control
Spare parts
Repair and warranty

Hydraulic fluids	
Usable with	Options
All valves with "V" immediately after the nominal size e.g. RV1-10V-* relief valve FR2-16V-* flow control	Antiwear hydraulic oils or phosphate esters (not alkyl types)
All valves with the "V" omitted e.g. RV1-10-* relief valve FR2-16-* flow control	Antiwear hydraulic oils

Temperature ranges
Viscosity/operating temperature envelopes



For general information about the fluids see, for:

Antiwear hydraulic oils

a) Data sheet about hydraulic fluids in industrial applications. Available on request and also in the main Vickers product catalog.
b) Fluid suppliers' publications.

Phosphate esters

a) Fluid suppliers' publications.
b) "Guidelines for the use of fire-resistant fluids in hydraulic systems" CETOP publication, available in English, German and French from CETOP members e.g.
British Fluid Power Association, London, UK
VDMA, Frankfurt/Main-Niederrad, W. Germany
SCTHP, 16 Avenue Hoche, Paris, France.
c) "Standard practice for use of fire-resistant fluids in fluid power systems" ANSI, New York, USA.

Filtration recommendations

For consistent, efficient performance, filtration must maintain fluid cleanliness to ISO 4406: 1986 class 16/13 or cleaner. This task is made easier by good system design, installation and maintenance practices as described below.

Contaminant control

Contaminant in hydraulic systems is now recognized as the most likely cause of any malfunction or failure of hydraulic equipment. Dependent on the nature, size and/or amount of contaminant it can cause:

☐ Machine malfunction, particularly when operating toward maximum capacity.
☐ Risk of frequent breakdowns under the same conditions.
☐ Production rates below schedule.
☐ High product scrap rates and quality faults.

Nature of contaminant
Contaminant can be either particle contaminant or the product(s) of fluid degradation.

Particle contaminant can be of metal, rubber, plastic, dirt, dust, fiber, sand, paint, etc.; several types may be present at any time. It can enter the fluid at any time after the fresh clean fluid has been shipped by the fluid manufacturer. There is usually little likelihood that fresh fluid became contaminated during the refining and blending processes.

Continued on next page

Fluid degradati n shows in one or more of the following ways:

☐ Oxidation and/or the formation of gummy deposits and sludge from the combined effects of high temperatures, air, water and particle contaminant. These can increase viscosity, cause gummy deposits to coat moving parts, clog orifices and small passages, thus impairing smooth mechanical movements, and form sludge.

☐ Unstable emulsions of poor lubricity formed when water accidently emulsifies with oil. These impair smooth movements and promote wear.

☐ Air bubbles in the fluid, particularly at low pressures. In excess, they cause noise in pumps and valves leading to erratic or spongy machine movements, premature wear and failure.

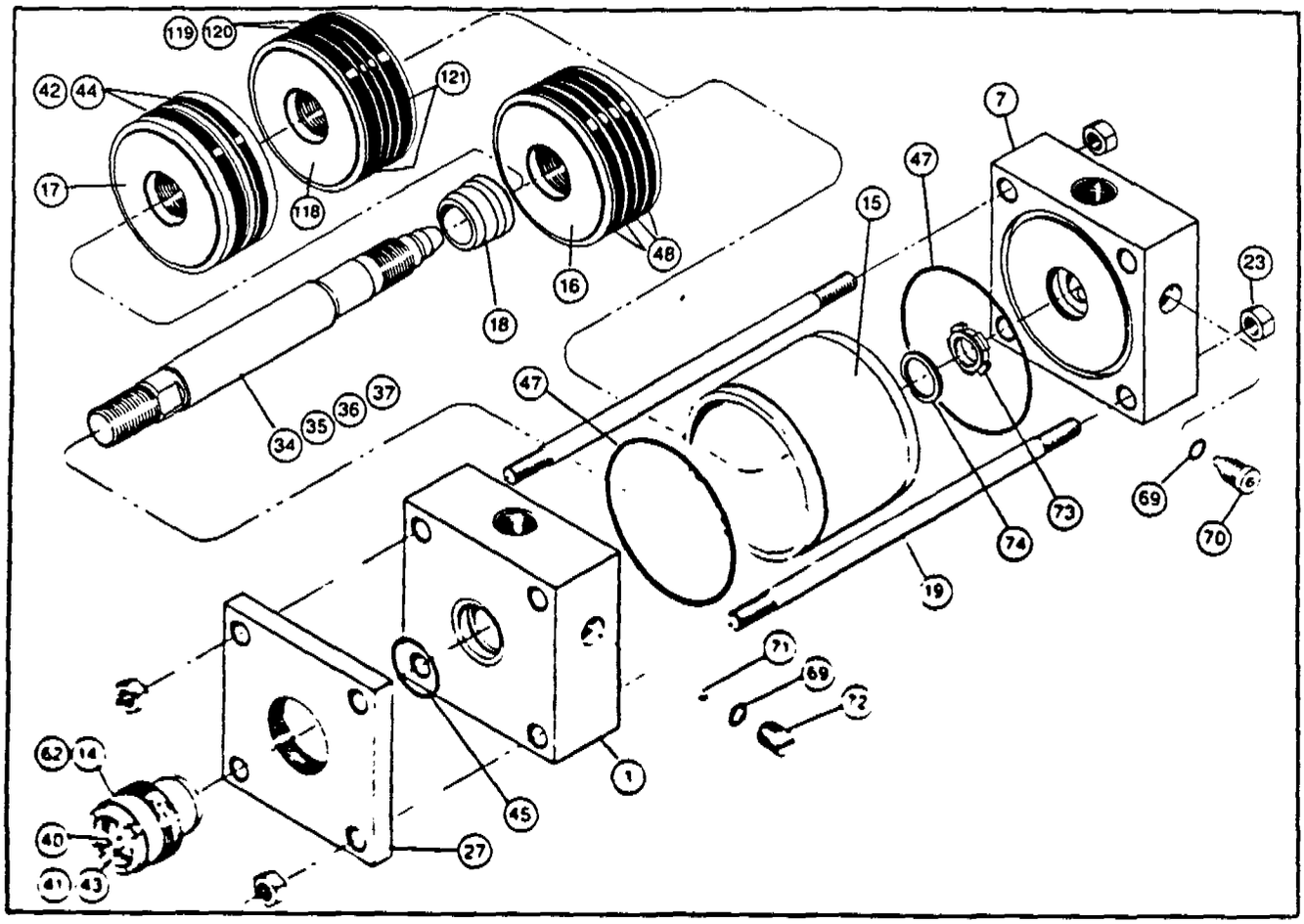
Control of contaminant

The table below prescribes preventive measures relative to the different common types and causes of contamination. For a more comprehensive treatise of the subject ask for the Vickers publication "Effective contamination control in fluid power systems".

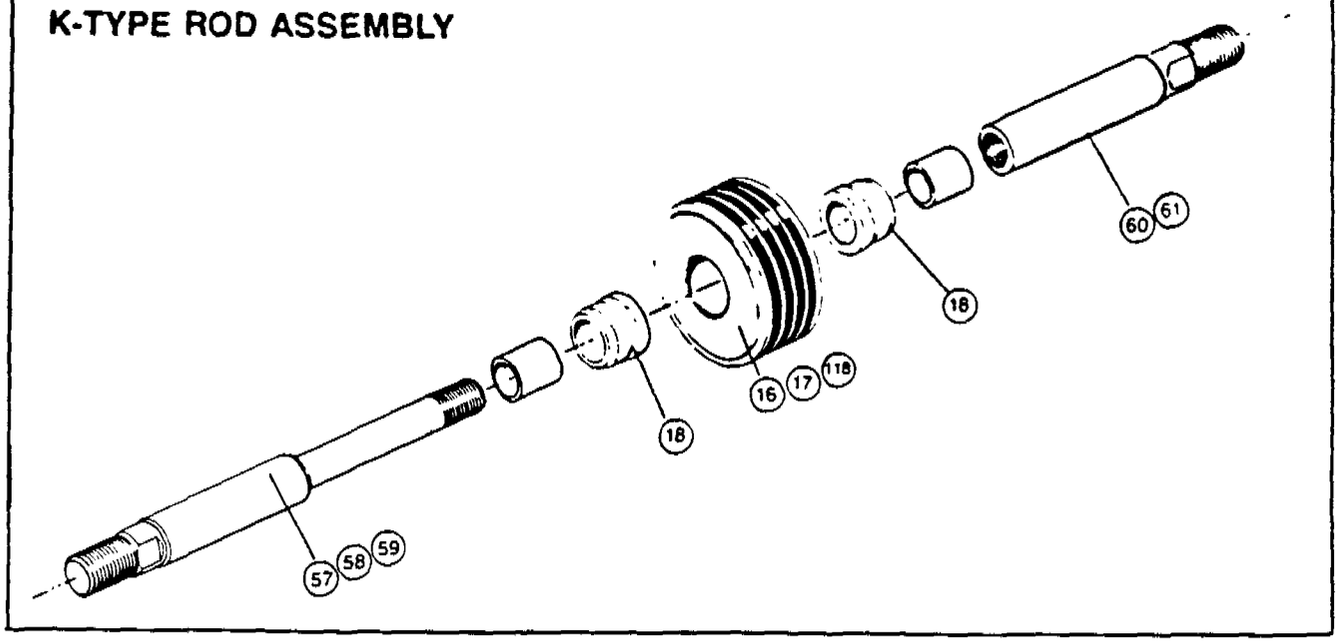
Preventive measures	Solid contam.	Fluid degradation by – High temp.	Water	Air
For storage barrels				
☐ Store in cool, dry location.		●		
☐ Ensure that bungs or plugs fully seal-in the fluid.	●			
☐ Wipe away any dirt and moisture from around the bung or plug before loosening and emptying.	●			
☐ Use a portable filtration unit for emptying and re-filling	●			
For storage tanks				
☐ Install in cool, dry location.		●		
☐ Ensure that all covers and stop valves effectively seal in the fluid	●			
☐ Keep filling lines clean, cap ends when not in use	●			
☐ Use a portable filtration unit for filling and emptying	●			
For hydraulic systems				
☐ Provide fluid filter(s) in location(s) that ensure the required protection	●			
☐ The ideal steady-state flow conditions through an off-line filter makes this a "must" for most applications	●			
☐ Whenever possible, use filters having element condition indicators	●			
☐ Vented systems must be fitted with an air breather appropriate to the environment(s) in which the machine is to be operated and the requirements of the system.	●			●
☐ Fit strainers to pump inlet lines if there is risk of gross contaminant (e.g. string, rag, screws, etc.) entering the lines	●			
☐ Prevent air entering the system, particularly through pump inlet lines. Ensure air-tight joints in any sub-atmospheric zone of pump inlet lines. Also ensure that those lines and all return and drain lines terminate below the minimum fluid level in the reservoir, pump inlet lines should be sufficiently below to prevent air entering through a vortex at low fluid levels				
☐ Design for, and maintain, fluid temperatures at optimum levels for the application. Fit coolers if necessary		●		
☐ Locate or screen hydraulic systems away from high temperature sources e.g. furnaces.	●	●		
☐ Assemble system in clean conditions and by using clean practices.	●			
☐ Pre-clean pipes and reservoir immediately before installation. Cap any ends that cannot immediately be connected to mating components e.g. between shifts.	●			
☐ Remove protective caps only just before connecting mating components.	●			
☐ Use a portable filtration unit to fill the reservoir system.	●			
☐ Flush new systems, and those that have undergone major repairs, before commissioning. Temporarily remove cylinders and semi-rotary motors and replace by bridging pipes. Servo valves and similar high precision units should also be replaced by bridging units for flushing operations. Ensure that cylinders and semi-rotary motors are clean internally before connecting to the system.	●			
☐ Ensure that air breathers and reservoir covers are at all times properly installed and secured tightly.	●			
☐ Stop any leakage of water into the system from coolers or other sources. Make a leak-tight repair.			●	
☐ By planned maintenance, ensure that fresh filter elements are fitted (or metallic elements cleaned when appropriate) when indicators or visual inspection shows this to be necessary.	●	●		
☐ Take fluid samples periodically and examine to determine whether effects of particle contaminant, heat, water and air indicate need for more control of those factors or the replacement of the fluid fill.	●	●		
☐ Whenever the reservoir is emptied, clean it out thoroughly and remove all residual contaminant. If necessary, restore protective paint or other finishes. On completion, cap all openings unless the system is to be refilled immediately in which case ensure that air breathers, covers etc., are replaced.				

1100186 #1

Parker Series
2A, 2H, 3L, VH Cylind rs



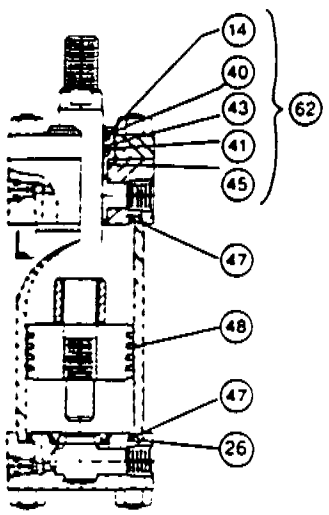
K-TYPE ROD ASSEMBLY



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

Parker S r.
2A, 2H, 3L, VH Cylinders

SYMBOL	DESCRIPTION
14	Gland cartridge
40	Gland wiperseal
41	Gland lipseal
42	Piston lipseal
43	Gland back-up washer
44	Piston back-up washer
45	Gland to head o-ring
47	End seal o-ring
48	Piston ring
62	Gland cartridge kit
119	Outer ring
120	Inner ring
121	Wear ring

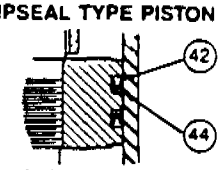


PISTON SEAL OPTIONS

RING TYPE PISTON

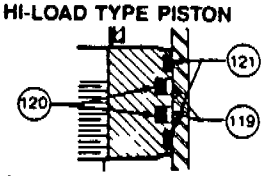
(as shown above) Supplied as standard on series 2H, 3L & VH hydraulic cylinders

LIPSEAL TYPE PISTON



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

HI-LOAD TYPE PISTON



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

SEAL KITS FOR CLASS 5 SERVICE

Material: Fluorocarbon (Viton®)
For operating temperature and fluid compatibility see Section C, page 71.

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

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

ROD DIA.	SERIES 2A, 2H, 3L & VH CYLINDERS			
	RG	RK		
	GLAND (SYM. 62) CARTRIDGE KITS	ROD SEAL KITS	GLAND WRENCH	SPANNER WRENCH
	CONTAINS SYMBOLS 14, 40, 41, 43 & 45	CONTAINS SYMBOLS 40, 41, 43 & 45		
½	RG2AHL 0055	RK2AHL 0055	069590 0000	011676 0000
⅝	RG2AHL 0065	RK2AHL 0065	069590 0000	011676 0000
1	RG2AHL 0105	RK2AHL 0105	069591 0000	011676 0000
1⅜	RG2AHL 0135	RK2AHL 0135	069592 0000	011703 0000
1¾	RG2AHL 0175	RK2AHL 0175	069593 0000	011877 0000
2	RG2AHL 0205	RK2AHL 0205	069594 0000	011677 0000
2½	RG2AHL 0255	RK2AHL 0255	069595 0000	011677 0000
3	RG2AHL 0305	RK2AHL 0305	069596 0000	011677 0000
3½	RG2AHL 0355	RK2AHL 0355	069597 0000	011677 0000
4	RG2AHL 0405	RK2AHL 0405	069598 0000	011677 0000
4½	RG2AHL 0455	RK2AHL 0455	083877 0000	011678 0000
*5	RG2AHL 0505	RK2AHL 0505	069599 0000	011678 0000
*5½	RG2AHL 0555	RK2AHL 0555	069600 0000	011678 0000

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

BORE SIZE	PK-PISTON SEAL KITS		PR PISTON RING KITS	HI-LOAD PISTON SEAL KITS
	SERIES 2A ONLY	SERIES 2HL, 3LL & VHL	SERIES 2H, 3L & VH	SERIES 2H & VH
	CONTAINS 2 EA. SYMBOLS 42 & 47	CONTAINS 2 EA. SYMBOLS: 42, 44 & 47	CONTAINS 2 SYM. 47 & 4 SYM 48	CONTAINS 2 EA. SYMBOLS 119, 120 & 121
1	PK1002A005	PK102HLL05	PR102H0005	—
1½	PK1502A005	PK152HLL05	PR152H0005	PK152HK005
2	PK2002A005	PK202HLL05	PR202H0005	PK202HK005
2½	PK2502A005	PK252HLL05	PR252H0005	PK252HK005
3¼	PK3202A005	PK322HLL05	PR322H0005	PK322HK005
4	PK4002A005	PK402HLL05	PR402H0005	PK402HK005
5	PK5002A005	PK502HLL05	PR502H0005	PK502HK005
6	PK6002A005	PK602HLL05	PR602H0005	PK602HK005
7	PK7002A005	PK702HLL05	PR702H0005	PK702HK005
8	PK8002A005	PK802HLL05	PR802H0005	PK802HK005
10	PK9002A005	PK902HLL05	PR902H0005	PK902HK005
12	PK9202A005	PK922HLL05	PR922H0005	PK922HK005
14	PK9402A005	—	—	—

BORE SIZE	CB-CYLINDER BODY SEAL KITS		TIE ROD TORQUE SPECIFICATIONS (FT. LBS.)			
	SERIES 2A	SERIES 2H, 3L & VH	SERIES 2A		SERIES 2H & VH	SERIES 3L
	CONTAINS 2 EA. SYMBOL 47	CONTAINS 2 EA. SYMBOL 47	STEEL CYL. BODY	BRASS CYL. BODY		
1	CB102HL005	CB102HL005	2	1	—	2
1½	CB152HL005	CB152HL005	5	3	18	5
2	CB202HL005	CB202HL005	11	6	45	11
2½	CB252HL005	CB252HL005	11	6	45	11
3¼	USE (PK) PISTON SEAL KITS FOR THESE SIZES	CB322HL005	25	18	120	25
4		CB402HL005	25	18	130	25
5		CB502HL005	60	45	310	60
6		CB602HL005	60	45	525	60
7		CB702HL005	90	—	790	—
8		CB802HL005	110	80	1160	110
10		CB902HL005	150	115	2500	—
12		CB922HL005	172	150	528	—
14		—	275	230	—	—

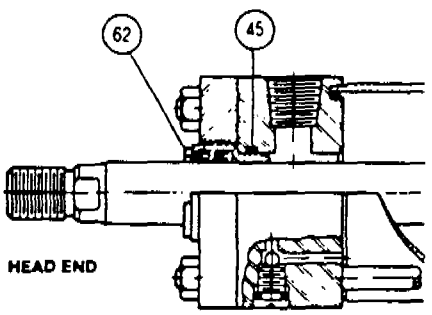
For use with High Water Content Fluids.

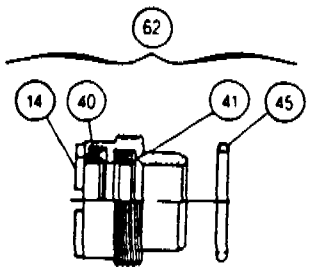
Class 6 Service: kit numbers listed above identify Class 5 seals only. To order with Class 6 seals (HWCF) substitute "6" for "5" as last digit of part number.

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

Gland Seal Kits For Hydraulic Cylinders

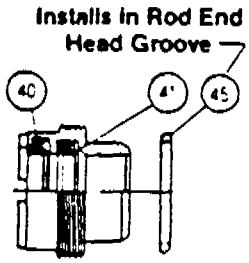
(Gland Cartridges & Rod Seals, Including TS-2000 Rod Seals) For Series H, 2H, 7" & 8" Bore 3H, VH, L, 2L & 3L Hydraulic Cylinders





GLAND CARTRIDGE KIT

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



ROD SEAL KIT

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

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

Standard Seals — Class 1 Service Kits are standard, and contain polyurethane and Buna-N seals for standard hydraulic service. These seals are suitable for use when hydraulic (mineral-type) oil is the operating medium. The recommended operating temperature range for Class 1 seals is -10°F (-23°C) to +165°F (+74°C).

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

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

Class 1 Hydraulic Oil Service Only

	Gland Cartridge Kits (Sym. #62)	Rod Seal Kits
	Class 1 (Std.)	Class 1 (Std.)
Rod Dia.	Buna-N (Nitrile) & Polyurethane	Buna-N (Nitrile) & Polyurethane
½"	RG2HLTS051	RK2HLTS051
⅝"	RG2HLTS061	RK2HLTS061
1"	RG2HLTS101	RK2HLTS101
1⅜"	RG2HLTS131	RK2HLTS131
1¾"	RG2HLTS171	RK2HLTS171
2"	RG2HLTS201	RK2HLTS201
2½"	RG2HLTS251	RK2HLTS251
3"	RG2HLTS301	RK2HLTS301
3½"	RG2HLTS351	RK2HLTS351
4"	RG2HLTS401	RK2HLTS401
4½"	RG2HLTS451	RK2HLTS451
5"	RG2HLTS501	RK2HLTS501
5½"	RG2HLTS551	RK2HLTS551

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

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

How To Replac Cylinder Gland Packing

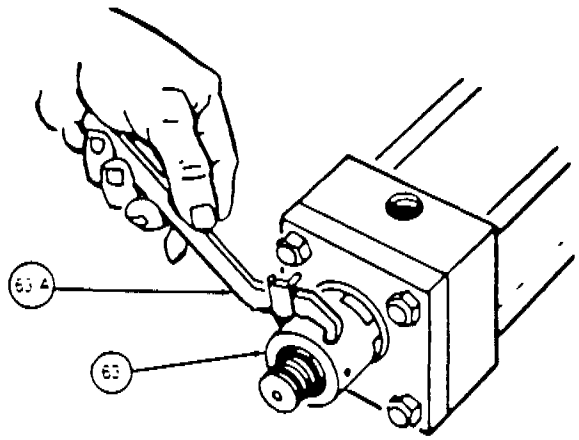
Fluid leakage around piston rod at the gland area will normally indicate a need to replace gland seals. First, remove cylinder from machine to which it is mounted or, if this is not feasible, disconnect the piston rod from rod clevis, knuckle or machine member to which it is fastened.

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

To remove the gland:

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

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



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

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

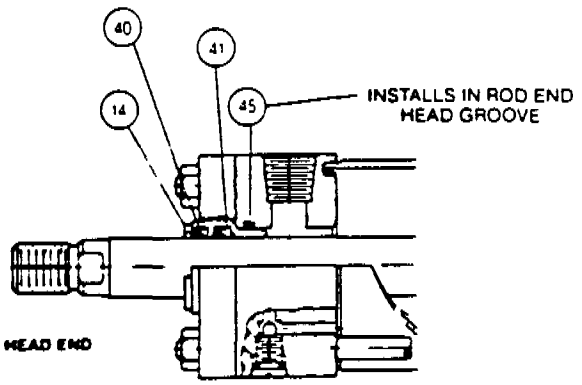
e) An O-ring, Sym. #45, is supplied with each gland cartridge kit. It serves as a seal between the gland and the head. This O-ring is a static seal and does not normally require replacement. The original O-ring may be left in place, unless it is known to be leaking (fluid flow around gland thread).

Installation

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

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

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



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

Tie Rod Nut Torque (Ft. Lbs.)		
Cylinder Bore Size	Cylinder Series	
	L - 2L - 3L	H - 2H - VH - 3H
1"	2	—
1 1/2"	5	18
2"	11	45
2 1/2"	11	45
3 1/4"	25	120
4"	25	130
5"	60	310
6"	L - 2L = 244 3L = 60	525
7"	—	790
8"	L - 2L = 513 3L = 110	1160

Retainer Bolt Torque

For Cylinders with Round or Small Square Gland Retainer

Bolt Dia.	Torque
3/16"	15 In. Lbs.
1/4"	60 In. Lbs
5/16"	10 Ft. Lbs.
3/8"	20 Ft. Lbs
7/16"	35 Ft. Lbs

Gland Cartridge Wrenches

Rod Dia.	Gland Wrench (Symbol 63)	Spanner Wrench (Symbol 63-A)	Rod Dia.	Gland Wrench (Symbol 63)	Spanner Wrench (Symbol 63-A)
1/2" 5/8" 1"	069590 0000 069590 0000 069591 0000	011676 0000	2 1/2" 3" 3 1/2"	069595 0000 069596 0000 069597 0000	011677 0000
1 3/8"	069592 0000	011703 0000	4"	069598 0000	
1 3/4" 2"	069593 0000 069594 0000	011677 0000 011677 0000	5" 5 1/2"	069599 0000 069600 0000	011678 0000

Cylinder Division
500 So. Wolf Road
Des Plaines, IL 60016
708/298-2400

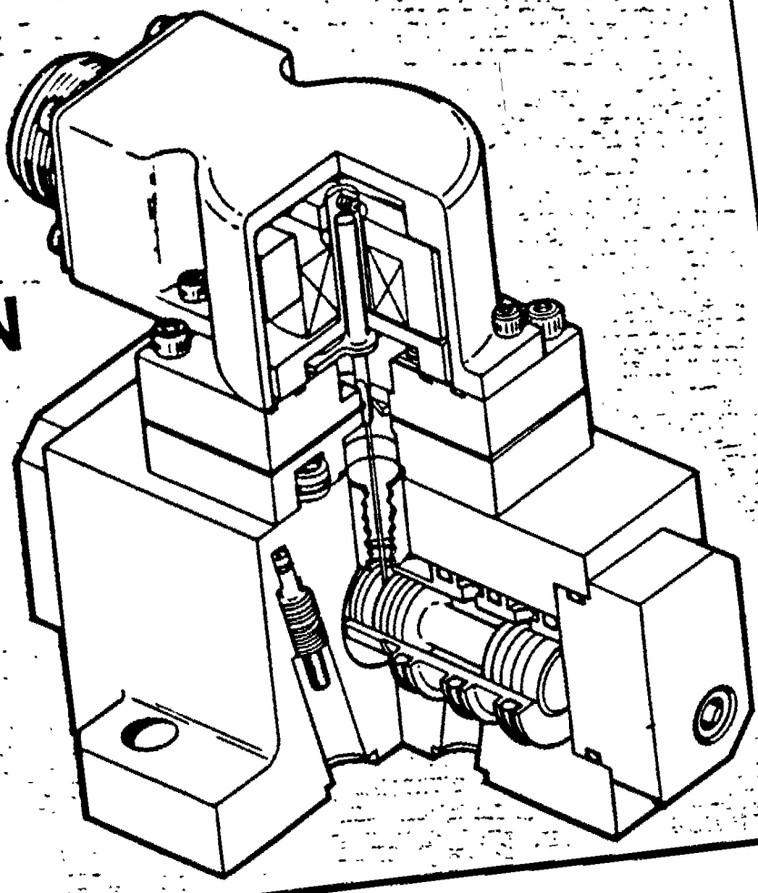
Regional Plants
- Santa Fe Springs, CA 310/698-0985
- Enfield, CT 203/749-2215
- Atlanta, GA 404/349-0567
- Goodland, IN 219/297-3182
- Plymouth, MI 313/455-1700
- Hillsborough, NC (Accum) 919/732-6183
- Hillsborough, NC 919/732-9371
- Akron, OH 216/253-4500
- Portland, OR 503/285-0884
- Owen Sound, Ont. Can. 519/371-2662
- Toronto, Ont. Can 416/255-4567
- Lachine, Quebec, Can 514/631-2065

Parker Motion & Control

1100186 #3

BD15
BD30

Flow Control Servovalves



INSTALLATION AND SERVICE MANUAL

Parker Fluidpower

CATALOG NO. 1450 ISM.

DO A 134844
CONFIDENTIAL

BD 15
BD 30

INSTALLATION AND SERVICE MANUAL CONTAMINATION RESISTANT ELECTRO-HYDRAULIC SERVOVALVES

The Parker BD series servovalves are ruggedly designed specifically for use in the industrial market place. From its inception, over twelve years ago, the first stage amplifier (pilot valve) has established a solid history of trouble-free operation in very harsh environments. Minimum orifice diameters up to 20 times larger than other servovalves models substantially increase reliability by reducing problems due to contamination. The second stage is a closed center, four-way spool and sleeve which features rectangular slots in the sleeve. The spool metering edges exactly match the flow slot edges in the sleeve to provide linear flow with respect to electrical input. The valves have rated flows up to 30 GPM.

OPERATION

The BD series servovalves operate on a force feedback principle between the second stage spool metering valve and the first stage pilot valve torque motor. The pilot valve is a single jet pressure recovery unit that directs a continuing stream of control fluid into a receiver. The receiver has two outlets that are ported to the ends of the valve main spool, PC_1 and PC_2. The pressure in these ports is equal when the fluid jet is centered in the receiver opening.

The feedback spring attached to the armature measures spool position as a force. This force and the force of the torque motor armature provide the error displacement of the armature and it's diverter blade window. The window edges divert the jet stream to the proper receiver outlet to position the spool to the electrically commanded position.

An electrical signal applied to the pilot valve coil generates a magnetic force on the armature/diverter blade assembly, pivoting the assembly and allowing fluid to flow into PC_1. See Figure 1. This positions the main power spool to the left until the force from the feedback spring matches the magnetic force. At this time the diverter blade is recentered over the receiving orifices, and the spool motion stops at this position. Flow, proportional to the input electrical current, is then metered out the C_2 port. Removal of the electrical signal to the coil unbalances the forces, which reverses the armature deflection and drives the spool to the zero current or null position, as shown in Figure 2. Changing the polarity of the current to the coil causes a magnetic force in the opposite direction that results in flow from the C_1 port.

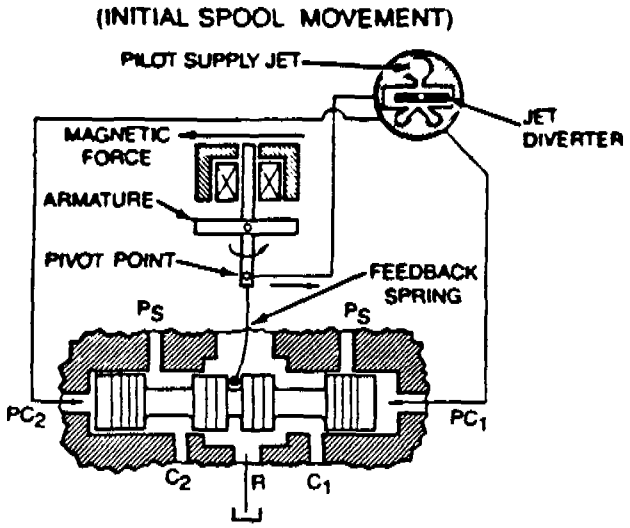


FIGURE 1. SERVOVALVE OPERATION - COMMAND FOR FLOW FROM CONTROL PORT C_2

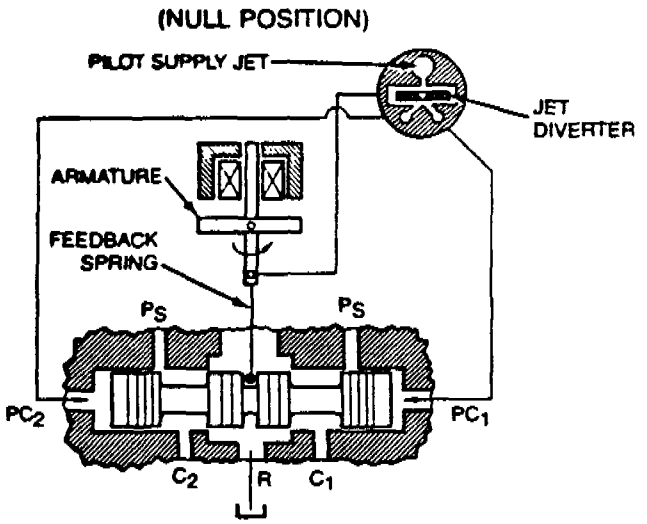
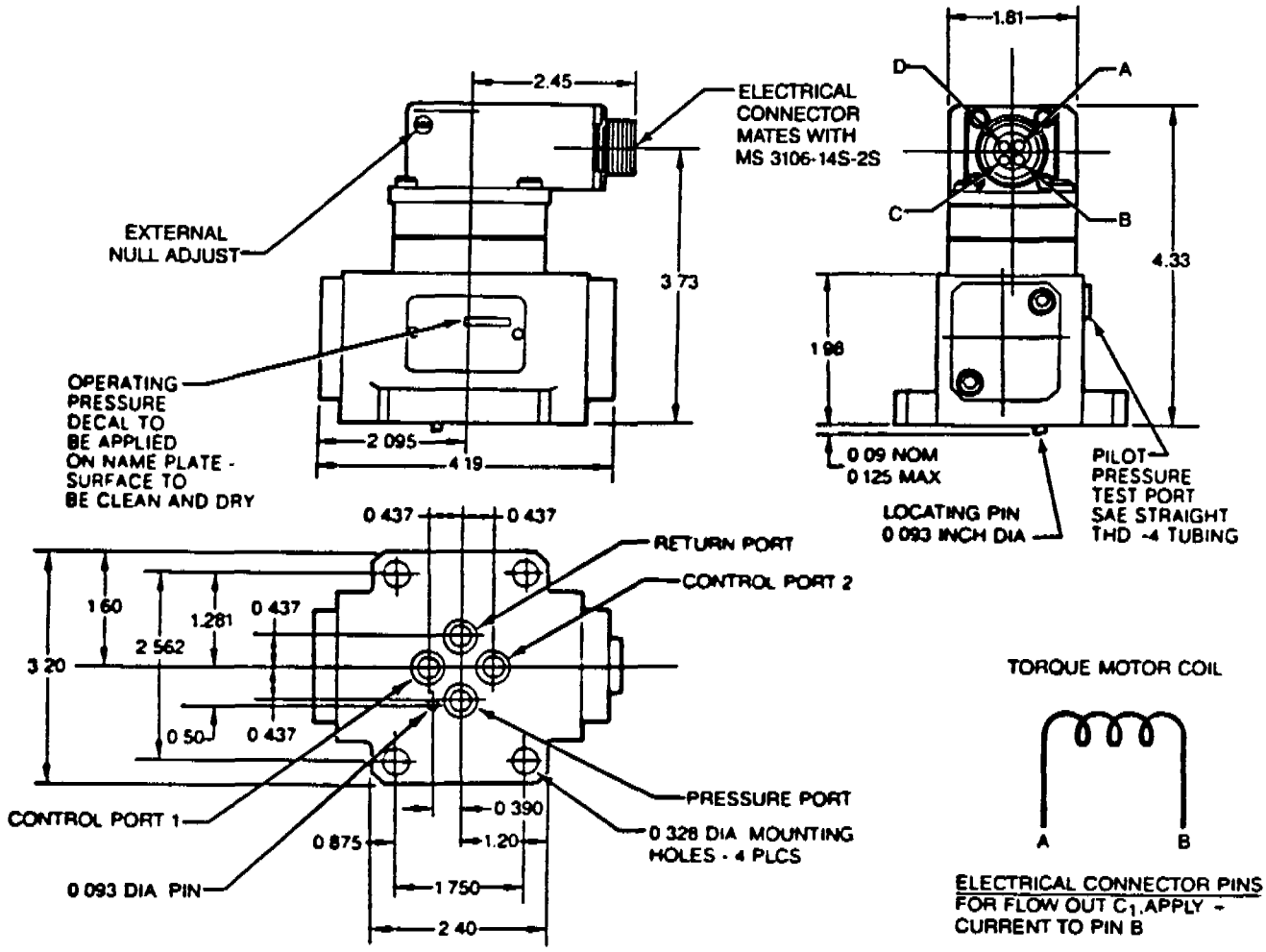


FIGURE 2. SERVOVALVE OPERATION - NULL POSITION, VALVE IN BALANCE

Parker Hannifin Corporation
Hydraulic Valv Division
Elyria, Ohio 44035

Parker Fluidpower

BD 15 INSTALLATION INFORMATION



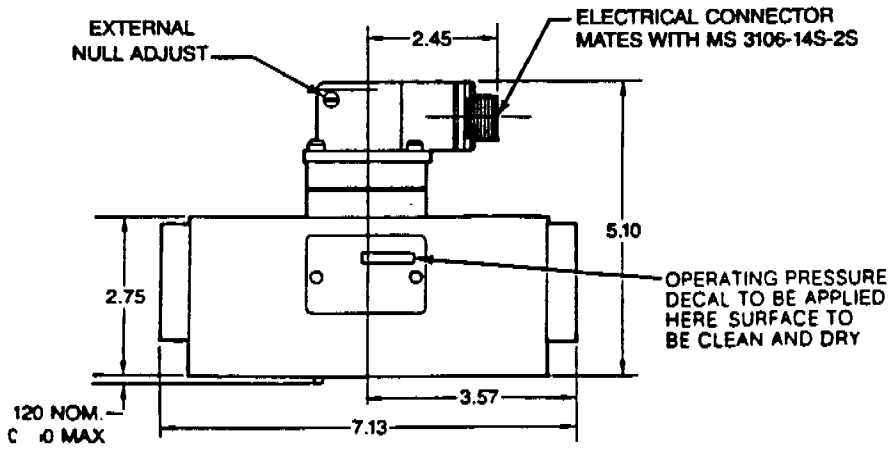
BD15 INSTALLATION DATA

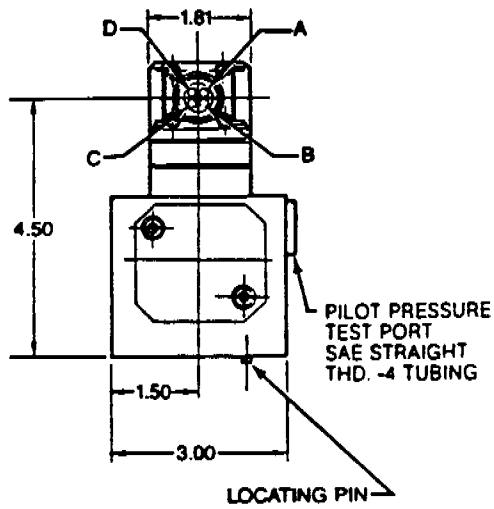
WEIGHT	2.6 LBS.	O-RING SIZE	2-013
PORT DIAMETER	0.375 IN.	ELECT. CONNECTOR MATES WITH -	MS3106-14S-2S
MOUNTING SCREWS, SOC.HD.CAP,	5/16-18 TH x 1.00 LONG	MAXIMUM OPERATING PRESSURE:	3000 PSI
TORQUE	110 to 150 IN. LB.	ELECTRICAL INPUT (STD. VALVE)	± 60 MA (FULL FLOW)
O-RING GROOVES	0.560 DIA. x 0.052 DEEP	COIL RESISTANCE (STD. VALVE)	60 ± 6 OHMS

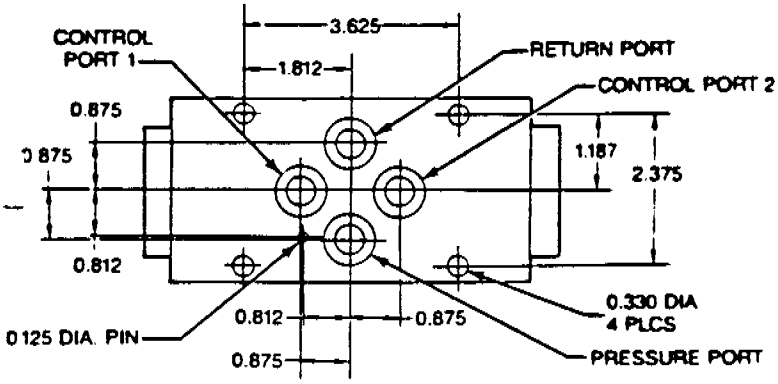
NOTES:

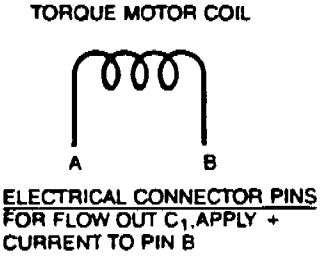
1. SERVOVALVE MATING SURFACE TO BE FLAT WITHIN 0.002 INCH TIR, AND SMOOTH TO WITHIN 63 RMS.
2. SERVOVALVE MOUNTING SCREWS ARE TO BE TORQUED TO 110-150 IN.-LBS. ABOVE RUN DOWN TORQUE.
3. FOR PROPER ORIFICE SELECTION AND DECAL PART NUMBER, REFER TO TABLE 2.

BD30 INSTALLATION INFORMATION









BD30 INSTALLATION DATA

WEIGHT	6.3 LBS.	O-RING SIZE	2-018
PORT DIAMETER	0.500 IN.	ELECT. CONNECTOR MATES WITH -	MS3106-14S-2S
MOUNTING SCREWS, SOC.HD.CAP.	5/16-18x3.25 LONG	MAXIMUM OPERATING PRESSURE:	3000 PSI
TORQUE	110 to 150 IN. LB.	ELECTRICAL INPUT (STD. VALVE)	± 60 MA (FULL FLOW)
O-RING GROOVES	0.866 DIA. x 0.052 DEEP	COIL RESISTANCE (STD. VALVE)	60 ± 6 OHMS

NOTES:

1. SERVOVALVE MATING SURFACE TO BE FLAT WITHIN 0.002 INCH TIR, AND SMOOTH TO WITHIN 63 RMS.
2. SERVOVALVE MOUNTING SCREWS ARE TO BE TORQUED TO 110-150 IN.-LBS. ABOVE RUN DOWN TORQUE.
3. FOR PROPER ORIFICE SELECTION AND DECAL PART NUMBER, REFER TO TABLE 2.

BD15 BD30 SERVOVALVE INSTALLATION

For maximum valve and system component life, the hydraulic system should be flushed and filtered to an absolute filtration of 25 μ m before installing the servovalve. A flushing block should be used in place of the valve while cleaning the system. These blocks are available from Hydraulic Valve Division, as follows:

BD15 – PN 810099
BD30 – PN 820099

To keep contaminants from entering the servovalve and/or hydraulic system, keep the valve shipping cover in place until immediately prior to installation. Never leave the port surfaces uncovered and exposed to contamination. A permanent non-bypass filter should be installed in the system to assure that the valve receives a clean supply of oil.

The valve should be mounted as close as possible to the actuator or motor. It can be mounted in any plane, but it is best to have the spool as nearly horizontal as possible

The servovalve should be set up for the system operating pressure according to the instructions in the OPERATING PRESSURE portion of the SERVOVALVE MAINTENANCE section

After installing the servovalve it must be determined if the valve and its electronics are phased properly This can be accomplished by noting servovalve response to a change in input command If there is no servovalve response, the two electrical leads to the valve must be interchanged to correct an out-of-phase condition

NULL ADJUSTMENT

If it is desired to have the actuator go to a preferred position with electrical power off (electrical failure) a null offset adjustment can be made to make sure the actuator moves to the desired position To adjust the valve null, the following procedure should be used.

1. Remove the screw from the null adjust access hole in the valve cover. (see installation drawing for its location).

2. Make sure the actuator or motor is unobstructed in case it were to move its load fully in either direction

3. Disconnect the electrical connector on the valve

4. Apply the rated supply pressure to the valve

5. Insert a nonmagnetic 1/16 inch hex wrench into the access hole and engage the adjusting screw. (A magnetic wrench can be used but must be moved out of the hole after each adjustment to determine if the desired position has been achieved). The screw can be rotated in either direction until the desired result is obtained. (Actuator motion stops, retracts, etc.). The adjustment available is ± 10 to 15% of full valve stroke through approximately ±4 turns of the screw. The screw is trapped on either end so it cannot come out; however, it should not be overtightened at the ends of its travel. The adjusting screw locking device offers resistance to turning or moving on its own.

6. After adjustment, replace the access hole sealing screw.

DITHER

If the system resolution is not as precise as desired, it can sometimes be improved through the use of "dither". A small amplitude signal at a relatively high (60-150 Hz) frequency is superimposed on the valve command signal This signal will cycle the valve spool at this higher frequency sufficiently to prevent valve "silting" and "stiction" It should be noted however, that if the amplitude is high enough, or the frequency low enough, the acutator could respond to the signal in such a way that would wear the seals rapidly Therefore, care should be exercized in setting the frequency and amplitude of the dither If dither does not solve the problem, the feedback device may be the limiting factor, or the servovalve may be sized too large for the accuracy desired

BD15 BD30 SERVOVALVE MAINTENANCE

GENERAL

This section provides maintenance instructions for the BD Series servovalves.

Except for orifice changing and filter removal, cleaning and reinstallation, field disassembly of the servovalves should never be attempted.

FILTER MAINTENANCE

If the valve performance appears sluggish or exhibits slow overshooting, the valve filter would be the first thing to check. It can be serviced as follows:

1. Wipe the surface around valve mounting flange as clean as possible, then loosen the four bolts securing valve to mounting pad.

2. Remove the valve, taking care not to set uncovered port flange of servovalve on a contaminated surface.

3. Inspect the port flange carefully, and if necessary, remove contamination using a clean wiper. Make certain that contamination is prevented from entering open fluid ports.

4. Using the special wrench 820000TF3-1 remove filter cartridge. See Figure 3.

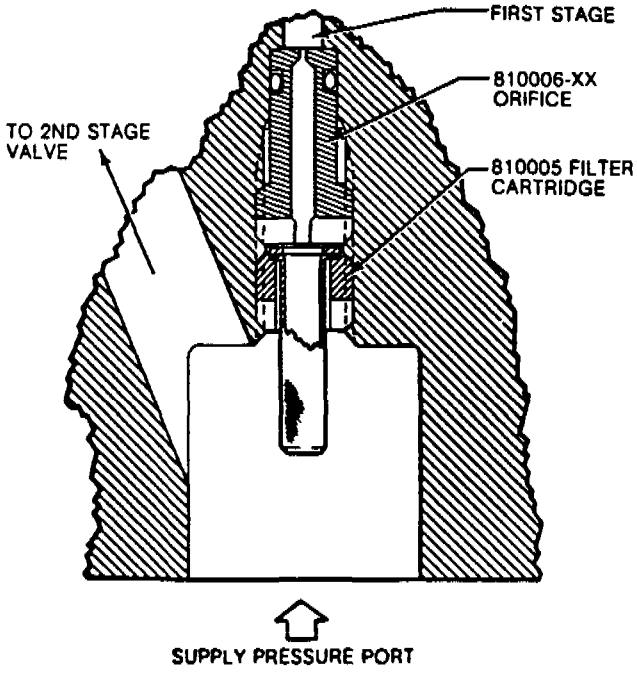


FIGURE 3. FILTER CARTRIDGE REMOVAL

5 Clean filter by soaking in tricloroethylene or other suitable solvent for 5 minutes, and blow dry from the inside out using filtered dry compressed air.

6 Be sure cartridge is dry and free from solvent before reinstalling

7 Inspect filter for cleanliness and damage to screen.

8 Position filter in servovalve cavity using the 820000TF3-1, wrench.

9 Tighten filter to 15 - 30 in. lbs above run down torque

10 Install servovalve on mounting pad. Refer to pages 3 or 4 as required for installation.

PILOT OPERATING PRESSURE

The servovalve pilot stage operates on a relatively constant supply pressure.

The pilot supply pressure should be approximately 450 psi. This pressure is established by placing an orifice between the servovalve supply pressure and the pilot valve. The orifice, part number 8100006, is located under the filter shown in Figure 3. Table 2 shows the color coding, the dash number and the servovalve supply pressure range recommended for each particular orifice. It is important that the proper orifice be selected for the system pressure being applied to the servo. Improper orifice selection may over pressurize the pilot or result in very sluggish performance. To check or change the orifice, remove the filter as described in maintenance section. The top of the orifice should be visible when the filter is removed. It can be removed with a small blade screwdriver.

The valve is set up to operate within a pressure range that can be verified by the dash number on the orifice. Should it be decided to change this pressure range, a suitable new orifice must be selected and then installed as follows:

1. Lightly lubricate the new O-ring, with hydraulic fluid.

2. Install orifice in pressure port, and snug down with a straight-slot screwdriver. Care should be taken to select a screwdriver whose blade is not so wide that it will damage the threads in the housing.

3. Install filter as described in the FILTER MAINTENANCE section.

USE OF TEST PORT

The -4 Test port is provided should a verification of pilot valve supply pressure be desired. To use this port, the -4 plug must be removed, and replaced with a -4 tube fitting and suitable pressure gage. When system supply pressure is applied to the servovalve, the pressure indicated on the pressure gage is pilot valve supply pressure. This pressure should be 350 to 600 psi with the valve at null.

The test port may be also be used as an alternate pilot supply port by installing a blank supply orifice, -00 (red) in the valve body The pilot supply pressure should be set between 450 psi and 500 psi. Special care must be taken to assure that this source is provided with a 25μ filter in it

It should be noted that the tank line from the pilot is joined inside the valve with the 2nd stage tank line.

ELECTRICAL CHECKOUT

These instructions are for a standard valve. Valves with other coils should be checked to ±10% of the rated resistance of the valve

1 Using a standard ohmmeter, check the servovalve lead resistance.

2. Check the coil resistance as follows:

a. Attach ohmmeter leads to pin A and pin B. Coil resistance should read between 54 ohms and 66 ohms.

b. There shall be no continuity between either pin and servovalve case.

c. If coil resistance is greater than 66 ohms or less than 54 ohms, return the servovalve to the factory.

BACK PRESSURE

During normal hydraulic system operation, back pressure in the return system (tank line) is approximately 25 psi. Excessive back pressures due to clogged filters, system contamination, system out of trim etc., impose undesired forces on system components, and add significantly to the work required to move a load. Energy is being wasted and system components are being overworked. Back pressures in excess of 200 psi should be investigated immediately and the discrepancies corrected.

FIELD SERVICE SUGGESTIONS

Initial Check ut Procedure

1. Remove the electrical cable from the valve and connect pins A & B to a hand held power source (a 1 1/2 to 9 volt battery with a potentiometer to vary the input will do.).
2. Operate the valve with the hand held power source. If the indicated problem cannot be duplicated, the malfunction is more than likely in the wiring, controller or hydraulic system.
3. If the valve does exhibit the problem, refer to Table 1 for service suggestions.

TABLE 1. SERVICE SUGGESTIONS

Symptoms	Possible Causes	To Verify or Correct
Servovalve does not follow input command. (Actuator or motor is stopped.)	1) Open coil wire or open coil lead to connector pin. 2) Totally plugged supply orifice or filter 3) Spool stuck	1) Check lead and coil resistance. If there is an "open", remove the connector and check it's solder joints Resolder if required. 2) Remove and inspect filter and orifice per Maintenance Section. 3) Return to factory
Sluggish valve. (Servovalve output lags electrical command signal or it fails to meet its rated output.)	1) Partially plugged a Filter element b Orifice c Pilot Valve 2) Leaky sleeve "O"rings 3) Low pilot supply pressure 4) Cylinder piston ring failure 5) Shorted coil 6) Low supply pressure	1) a Remove and inspect filter per Maintanance Section b Remove and inspect orifice per Maintenance Section c Return to factory 2) Investigate excessive internal leakage to tank (bypassing flow sound) 3) Check pilot supply pressure per Maintenance Section 4) Check cylinder (listen for bypassing sound) 5) Check coil resistance in accordance with Maintenance Section, Electrical Checkout 6) Verify that the supply pressure to the valve falls within the range noted on the valve nameplate
High null bias (high input current required to maintain actuator or motor stationary.)	1) Incorrect null adjust 2) Partially plugged receiver	1) Adjust null per Servovalve Maintenance Section. 2) Return valve to factory
Output flow obtained from one port (Actuator hard over no response to servo command.)	1) Valve improperly phased 2) Plugged pilot valve receiver port 3) Spool stuck.	1) Swap the two leads to the valve coil to change the polarity of the current to the coil. 2) Return valve to factory. 3) Return valve to factory.
Very high flow to cyl. port with little or no current input.	1) Pilot valve malfunction.	1) Return to factory.
Oscillation or hunting motion of acutator in the closed loop system.	1) Valve drive electronics gain set too high or some other misadjustment. 2) Partially plugged orifice or filter. 3) Sticky spool.	1) Reset electronics. See electronics installation manual 1460 IM. 2) Check pilot pressure at test port and/or remove, inspect, and clean orifice/filter per Servovalve Maintenance Section. 3) Return valve to factory.

TABLE 2. ORIFICE SELECTION AND ORDERING INFORMATION

KIT NUMBER*	PRESSURE RANGE (PSI)	COLOR CODE
810014-00**	EXT. PILOT 0 TO 3000	RED
810014-16	2600 — 3000	GREEN
810014-18	2000 — 2550	BLUE
810014-20	1400 — 1950	YELLOW
810014-22	1000 — 1350	ORANGE
810014-33	700 — 950	BLACK
810014-50	200 — 650	WHITE

*Kits include the orifice, an O-ring (PN: 5-103) and the proper decal to be applied to the valve name plate

Viton O-ring kits are also available; order Parter Number 810013-XX.

**This Part Number is a blank with no hole. It is used when an external pilot fluid source is supplied to the test port.

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MICHIGAN
TROY, MI
(313) 589-2400

NEW ENGLAND
SMITHTOWN, NY
(516) 231-3737

OHIO
CLEVELAND, OH
(216) 531-3000

OHIO
CINCINNATI, OH
(513) 793-2011

TEXAS
RICHARDSON, TX
(214) 238-5020

CANADA
TORONTO, ONT.
(416) 255-7371

HGS 6/91 2.5M

Parker Hannifin Corporation
Hydraulic Valve Division
520 Ternes Avenue
Elyria, Ohio 44035
Phone: (216) 366-5200

DO A 134851
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Parker Fluidpower

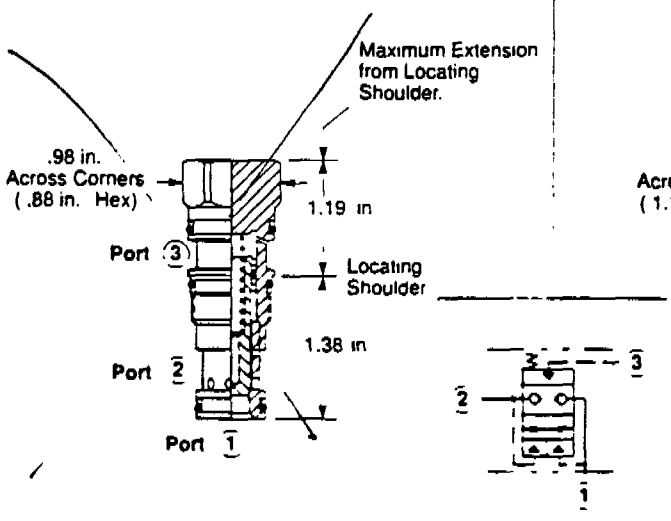
PILOT-TO-CLOSE SWITCHING ELEMENT WITH DIFFERENTIAL AREA POPPET

1100186 #1

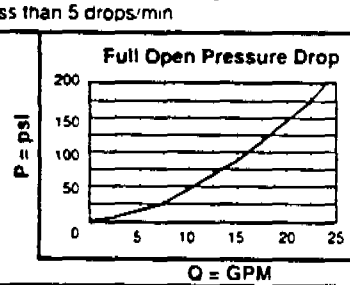
Refer to page 9.02 for further technical information.

- Bi-directional operation with sealed pilot for zero leakage.
- 5000 psi maximum operating pressure.

0 to 25 GPM Nominal
Series 1 Cartridge T–11A Cavity
Installation Torque 30 to 35 lb. ft.

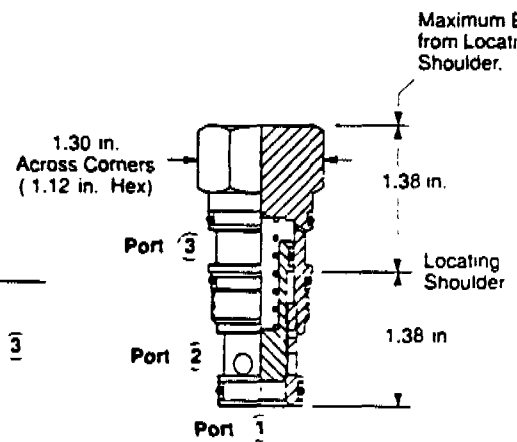


Port 3 pilot displacement = .04 in³
Area at Port 3 is 1.8 times the area at Port 1.
Leakage rate less than 5 drops/min

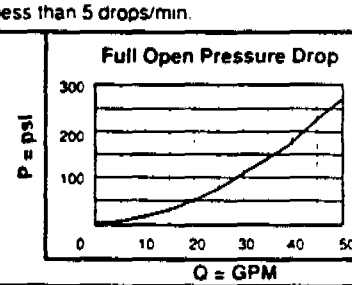


MODEL **LODC–XDN** PRICE **$ 27.40**

0 to 50 GPM Nominal
Series 2 Cartridge T–2A Cavity
Installation Torque 45 to 50 lb. ft.



Port 3 pilot displacement = .07 in³
Area at Port 3 is 1.8 times the area at Port 1.
Leakage rate less than 5 drops/min.



MODEL **LOFC–XDN** PRICE **$ 37.50**

OPTIONS

LO* C – X D* – * * * / *
Basic cartridge from above

CONTROLS

X Non–adjustable + $ .00

CRACKING PRESSURE

D Opening pressure at Port 1 = 50 psi + $ .00

SEALS

N Buna–N + $ .00

V Viton + $1.50

BODY

Omit for Cartridge Only
or
See Body Locator Page 9.06

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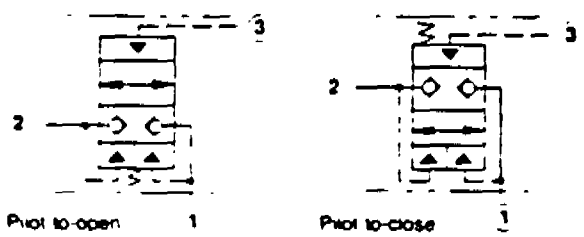
an orifice, regardless of variations in upstream or downstream pressure. The orifice may be fixed or variable, including the variable orifice created by proportional type directional valves.

Modulating cartridges can serve as main stage pressure controls to handle high flows with a low flow pilot circuit to control the performance of the cartridge. This allows a great deal of flexibility in creating a variety of operating conditions during a machine cycle. Functions such as multiple control pressures and venting or deventing can be incorporated at appropriate points in the cycle, using small solenoid operated valves.

Switching Cartridges

SUN offers two basic logic switching cartridges: pilot-to-open (LK*C) and pilot-to-close (LO*C).



Switching cartridges are unbalanced poppet, two-way valves with a third (pilot) port to control poppet operation. The unbalanced poppet can be operated:

A) directly by pressure at either work port

B) by pilot pressure from an external source

NOTE: Because of their unbalanced poppet design the operation of SUN s switching cartridges is pressure dependent. The opening and closing movements of the poppet are functions of the force balances on three areas – port 1, port 2, and port 3.

NOTE: Because logic switching cartridges are pressure responsive at all three ports, it is essential to consider all aspects of the system operation through a complete cycle when designing logic circuits. If pressure changes on any port are of sufficient magnitude, they may cause a valve element to switch from a closed to open condition, or vice versa. All possible pressure changes in the complete circuit cycle must be considered to assure a safe functional system design.

Operation of LO*C

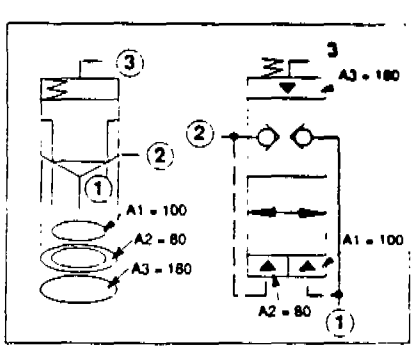
Area Ratios

Port 1 Area (A1) = 100%
Port 2 Area (A2) = 80%
Port 3 Area (A3) = 180%

Area Ratios

$\frac{A3}{A1}$ = 1.8:1

$\frac{A3}{A2}$ = 2.25:1



Pilot-to-Close
Switching Cartridge LO*C

Pressure at port 1 or port 2, acting on areas A1 or A2, tends to open the valve. The bias spring force, together with pilot pressure at port 3, acting on area A3, tends to close the valve. Depending on the direction of flow, pilot-to-close switching valves open when the forces affecting the surface areas at port 1 or port 2 are greater than the force affecting the surface area at port 3. When port 3 is vented, the valve will open to either direction of flow when pressure at port 1 or port 2 is high enough to overcome the bias spring force. For example:

Pressure required to open at port 1 = 50 psi
Pressure required to open at port 2 = 65 psi

When pilot pressure is applied at port 3, this pressure, acting on A3 (plus the bias spring force), tends to hold the valve closed. The valve may then be opened by venting the pilot port (3) to tank, or by introducing a proportionately higher pressure at port 1 or port 2. From the area ratios listed above it can be seen that:

$\frac{A3}{A1}$ = 1.8:1 or 1000 psi at port 3 will hold the valve closed against pressures up to 1800 psi at port 1 with port 2 referenced to tank.

$\frac{A3}{A2}$ = 2.25:1 or 1000 psi at port 3 will hold the valve closed against pressures up to 2250 psi at port 2 with port 1 referenced to tank.

Operation of LK*C

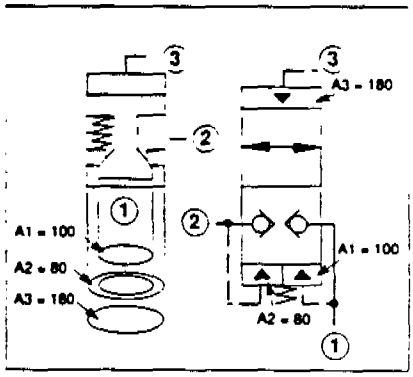
Area Ratios

Port 1 Area (A1) = 100%
Port 2 Area (A2) = 80%
Port 3 Area (A3) = 180%

Area Ratios

$\frac{A3}{A1}$ = 1.8:1

$\frac{A3}{A2}$ = 2.25:1



Pilot-to-Open
Switching Cartridge LK*C

Pressure at port 1 or port 2, acting on areas A1 or A2, plus the bias spring force, tends to close the valve or add to the closing force. Pilot pressure at port 3, acting on area A3, tends to open the valve. Pilot-to-open switching cartridges close when the forces affecting the surface areas at port 1 or port 2 are greater than the forces affecting the surface area at port 3. When port 3 is vented, the valve will close and remain closed regardless of the pressure at port 1 or port 2.

When pilot pressure is applied at port 3, this pressure, acting on A3 (minus the bias spring force), tends to open the valve. The valve may be closed by venting port 3 (pilot) to tank, or by introducing a proportionately higher pressure at port 1 or port 2. From the area ratios listed above, it can be seen that:

$\frac{A3}{A1}$ = 1.8:1 or 1000 psi at port 3 will open the valve against pressures up to 1800 psi at port 1 with port 2 referenced to tank.

$\frac{A3}{A2}$ = 2.25:1 or 1000 psi at port 3 will open the valve against pressures up to 2250 psi at port 2 with port 1 referenced to tank.

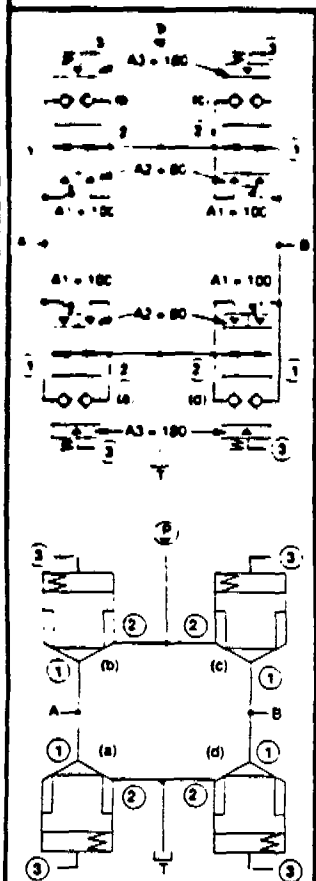
Switching Elements as Directional Controls

Four logic switching cartridges are required to duplicate the functions of a spool type four-way directional valve one cartridge for each port – P, T, A, and B. By controlling the opening and closing of each element, twelve different flow paths can be obtained. Using logic switching cartridges it is possible to shift from one flow condition to any other without going through any intermediate (or "center") valve condition or function. Because the opening of the cartridges can be precisely controlled, the logic circuit can anticipate the requirements of the system, allowing flow to shift direction smoothly. By contrast, most spool type directional valves have only three operating positions and must always pass through a center condition when changing from one flow path to another. The opening order and shifting conditions are rigidly fixed by the spool configuration and overlap.

Typical logic element four-way directional valve circuits, illustrating pilot-to-close and pilot-to-open cartridges are described below.

NOTE Both normally open and normally closed switching cartridges are seated poppet type valve designs, so leakage between port 1 and port 2 is essentially zero. All SUN switching cartridges are manufactured with seats on the pilot piston, eliminating any leakage between the pilot and work ports. Therefore either work port can be selected as a source for self piloting without fear of loss of pressure from the pilot section of the work port. Port 3 must be free of air and full of oil before starting up new systems.

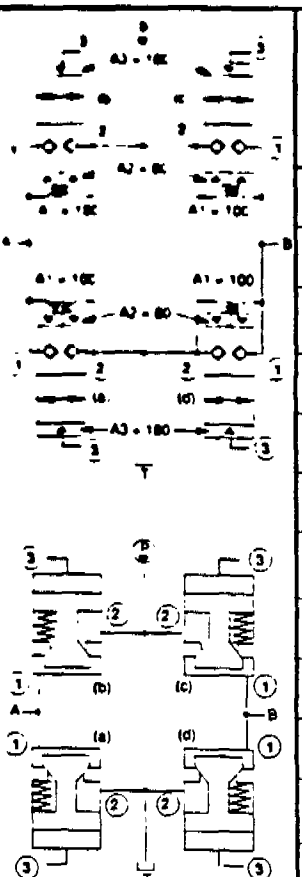
PILOT TO CLOSE SWITCHING ELEMENTS
Typical Circuit



Equivalent Spool Valve Symbol A B / P T	Logic Element a	b	c	d
	O	O	O	O
	X	X	X	X
	X	O	X	O
	O	X	O	X
	X	O	X	X
	X	X	O	X
	O	X	X	X
	X	X	X	O
	X	O	O	X
	O	X	X	O
	O	O	X	X
	X	X	O	O

o – vented x – piloted

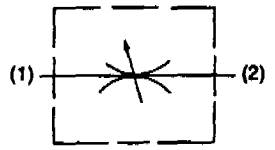
PILOT TO OPEN SWITCHING ELEMENTS
Typical Circuit



Equivalent Spool Valve Symbol A B / P T	Logic Element a	b	c	d
	X	X	X	X
	O	O	O	O
	O	X	O	X
	X	O	X	O
	O	X	O	O
	O	O	X	O
	X	O	O	O
	O	O	O	X
	O	X	X	O
	X	O	O	X
	X	X	O	O
	O	O	X	X

o – vented x – piloted

Needle Valve



Metered Flow—Either Direction

Application

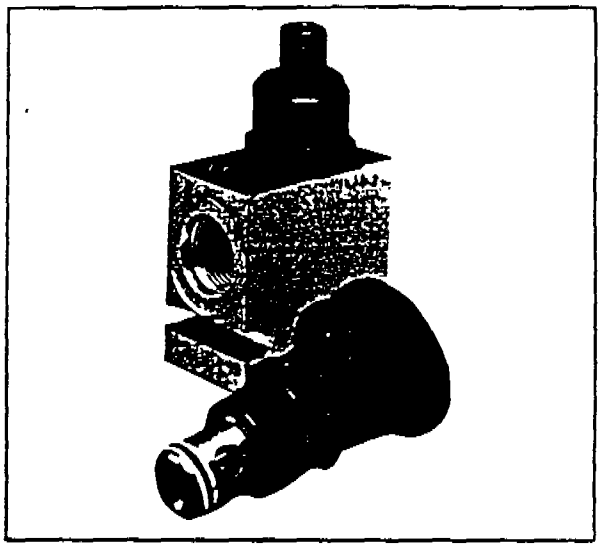
The NV101 Series Needle Valves provide speed control and shutoff where a reverse flow check is not required.

Operation

The valve acts as a fixed orifice in a hydraulic circuit. The effective size of the orifice increases as the tapered needle is opened. Shutoff is provided when fully closed. Flow can be metered with this cartridge in either direction.

Features

- Hardened operating parts for long life
- Compact cartridge design
- Fine thread on needles for precise adjustment



Installation Data

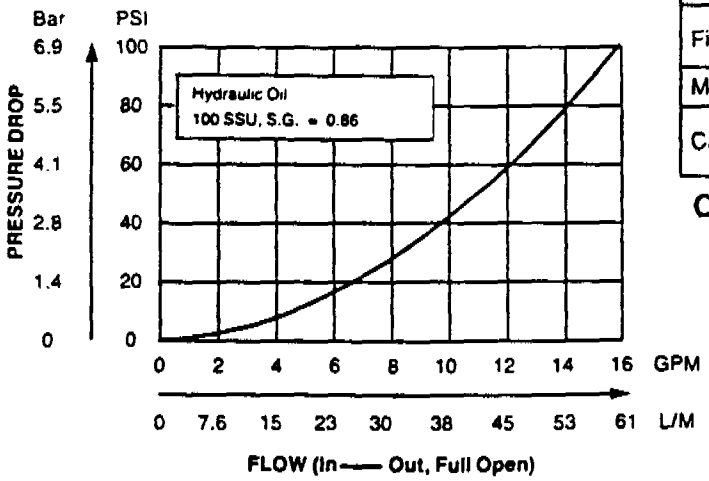
See the Installation Information section of this catalog for specific recommendations pertaining to system cleanliness, fluids, seals and other important factors relative to the proper installation and use of these products.

Performance Curve

Controlled Flow vs. Pressure Drop

(Needle Full Open)

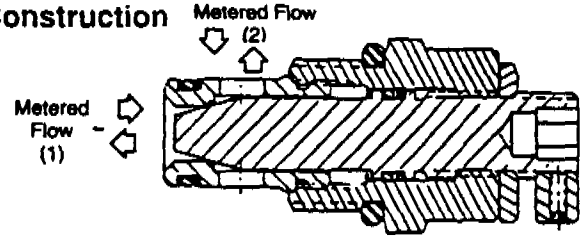
(Through cartridge only. For performance of bodies, see section MV).



Cartridge Valve Specifications

Nominal Flow Rating	16 GPM (60 L/M)
Max. Operating Pressure	3500 PSI (245 Bar)
Max. Shutoff Leakage at Rated Pressure & Flow	5 drops/min. (1/3 cc/min.)
Max. Effective Orifice Area	.062 in^2
Operating Temp. Range (Ambient)	–40°F to + 200°F (Nitrile) –25°F to + 250°F (Viton)
Cartridge Material	All parts steel. All operating parts hardened steel
Body Material	Steel
Filtration	ISO Code 16/13, SAE Class 4 or better
Mounting	No Restrictions
Cavity	Common Cavity No. C10–2 (See Cavity Details section)

Construction

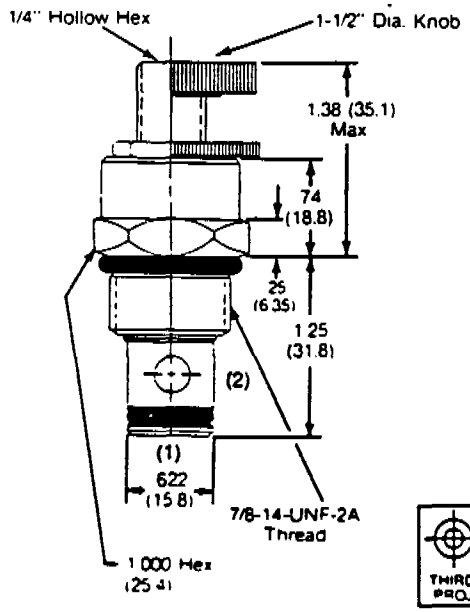


For additional information – call your local Parker Fluidpower Motion & Control Distributor.

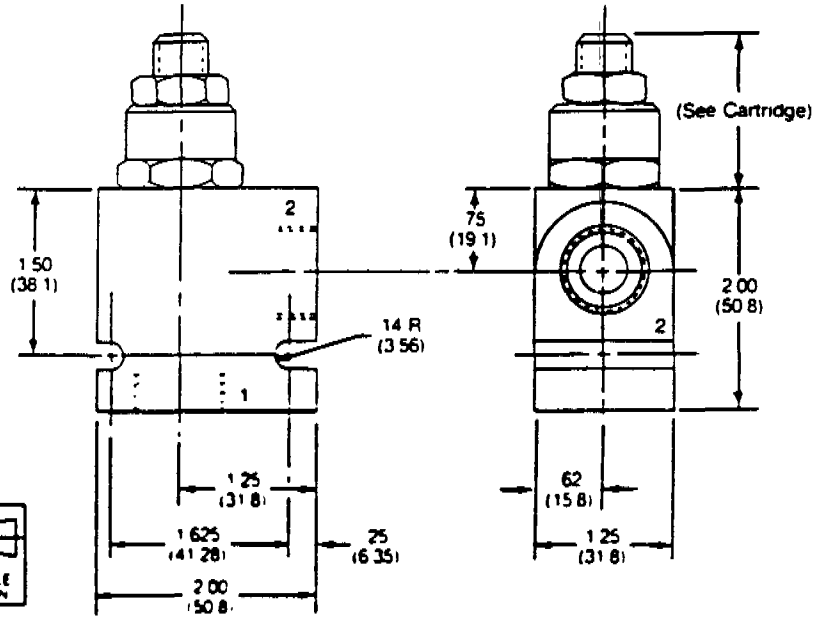
Dimensions (Millimeters)

Inches

Cartridge Only



Cartridge in Body



Ordering Information

NV	10	1				—	
NEEDLE VALVE	SIZE	STYLE	ADJUSTMENT STYLE	SEALS			BODY OPTION

SIZE

7/8–14

STYLE

Code	Style
1	Direct Acting

ADJUSTMENT STYLE

Code	Style
K	Knob Adjust
S	Screw Adjust

SEALS

Code	Type
Omit	Nitrile
V	Viton

BODY OPTION

Code	Porting
Omit	Cartridge Only
4P	1/4" NPTF (B10–2–4P)
6P	3/8" NPTF (B10–2–6P)
8P	1/2" NPTF (B10–2–8P)
6T	SAE–6 (B10–2–6T)
8T	SAE–8 (B10–2–8T)

Shipping Weight
Cartridge Only 0.4 lbs. (.18 kg)
Cartridge in Body 1.4 lbs. (.63 kg)

SERVICE PARTS

Knob Kit – 840208K (To convert screw adjust to knob adjust)
Nitrile Seal Kit – SK10–2
Viton Seal Kit – SK10–2V
Panel Mount Kit – PMK101

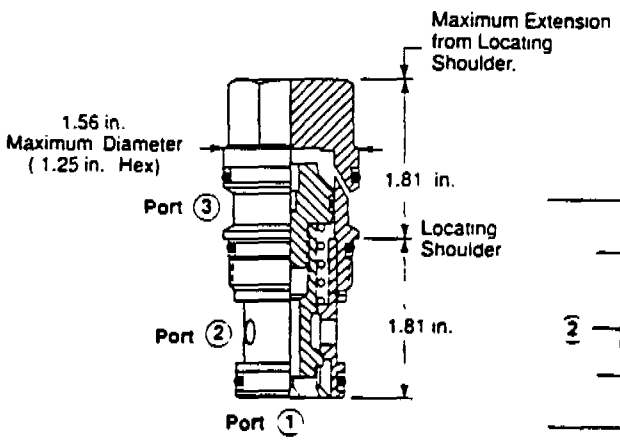
PILOT-TO-OPEN SWITCHING ELEMENT WITH DIFFERENTIAL AREA POPPET

1100186 #11

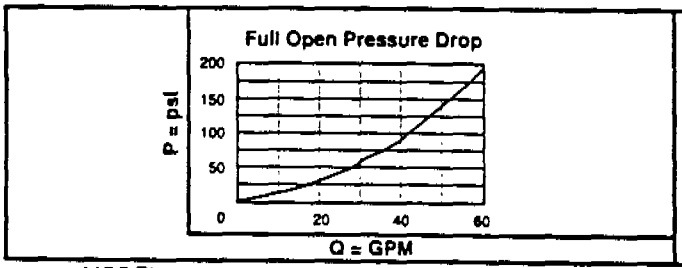
Refer to page 9.02 for further technical information.

- Bi–directional operation with sealed pilot for zero leakage.
- With no pilot signals, flow is blocked in both directions.

0 to 60 GPM Nominal
Series 3 Cartridge T–17A Cavity
Installation Torque 150 to 160 lb. ft.

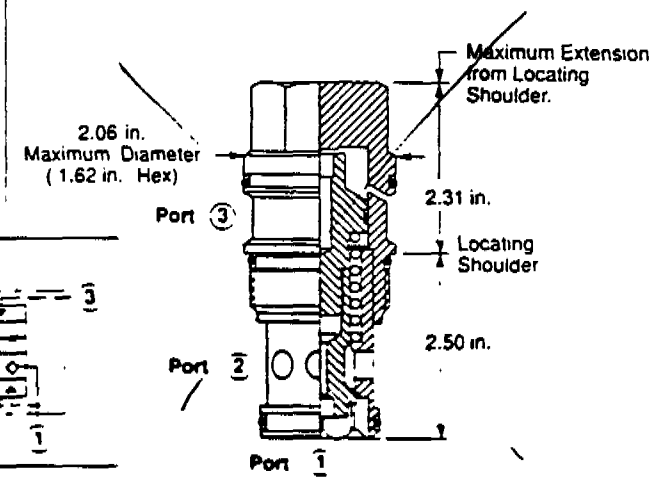


Port 3 pilot displacement = .15 in.^{3}
5000 psi maximum operating pressure.
Area at Port 3 is 1.8 times the area at Port 1.
Leakage rate less than 5 drops/min.

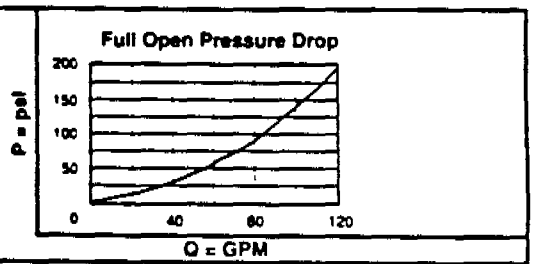


MODEL **LKHC–XDN** PRICE **$ 69.00**

0 to 120 GPM Nominal
Series 4 Cartridge T–19A Cavity
Installation Torque 350 to 375 lb. ft.



Port 3 pilot displacement = .30 in.^{3}
5000 psi maximum operating pressure
Area at Port 3 is 1.8 times the area at Port 1.
Leakage rate less than 5 drops/min.



MODEL **LKJC–XDN** PRICE **$119.50**

OPTIONS

LK* C – X D* – * / ***
Basic cartridge from above

CONTROLS
X Non–adjustable + $ .00

CRACKING PRESSURE
D Bias spring is equivalent to 30 psi on Port 3 + $ .00

SEALS
N Buna–N + $ .00
V Viton + $2.00

BODY
Omit for Cartridge Only
or
See Body Locator Page 9.06

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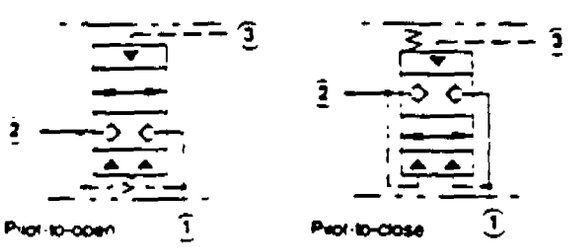
an orifice, regardless of variations in upstream or downstream pressure. The orifice may be fixed or variable, including the variable orifice created by proportional type directional valves.

Modulating cartridges can serve as main stage pressure controls to handle high flows with a low flow pilot circuit to control the performance of the cartridge. This allows a great deal of flexibility in creating a variety of operating conditions during a machine cycle. Functions such as multiple control pressures and venting or deventing can be incorporated at appropriate points in the cycle, using small solenoid operated valves.

Switching Cartridges

SUN offers two basic logic switching cartridges: pilot-to-open (LK*C) and pilot-to-close (LO*C).



Switching cartridges are unbalanced poppet, two-way valves with a third (pilot) port to control poppet operation. The unbalanced poppet can be operated:

A) directly by pressure at either work port
B) by pilot pressure from an external source

NOTE: Because of their unbalanced poppet design, the operation of SUN's switching cartridges is pressure dependent. The opening and closing movements of the poppet are functions of the force balances on three areas – port 1, port 2, and port 3.

NOTE: Because logic switching cartridges are pressure responsive at all three ports, it is essential to consider all aspects of the system operation through a complete cycle when designing logic circuits. If pressure changes on any port are of sufficient magnitude, they may cause a valve element to switch from a closed to open condition, or vice versa. All possible pressure changes in the complete circuit cycle must be considered to assure a safe functional system design.

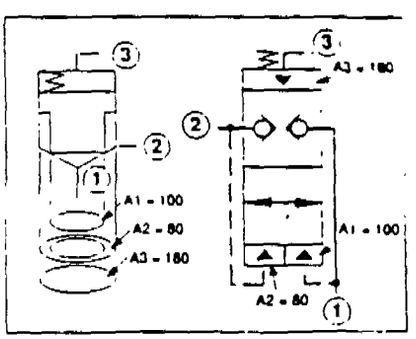
Operation of LO*C

Area Ratios
Port 1 Area (A1) = 100%
Port 2 Area (A2) = 80%
Port 3 Area (A3) = 180%

Area Ratios

$\frac{A3}{A1}$ = 1.8:1

$\frac{A3}{A2}$ = 2.25:1



Pilot-to-Close
Switching Cartridge LO*C

Pressure at port 1 or port 2, acting on areas A1 or A2, tends to open the valve. The bias spring force, together with pilot pressure at port 3, acting on area A3, tends to close the valve. Depending on the direction of flow, pilot-to-close switching valves open when the forces affecting the surface areas at port 1 or port 2 are greater than the force affecting the surface area at port 3. When port 3 is vented, the valve will open to either direction of flow when pressure at port 1 or port 2 is high enough to overcome the bias spring force. For example:

Pressure required to open at port 1 = 50 psi
Pressure required to open at port 2 = 65 psi

When pilot pressure is applied at port 3, this pressure, acting on A3 (plus the bias spring force), tends to hold the valve closed. The valve may then be opened by venting the pilot port (3) to tank, or by introducing a proportionately higher pressure at port 1 or port 2. From the area ratios listed above it can be seen that:

$\frac{A3}{A1}$ = 1.8:1 or 1000 psi at port 3 will hold the valve closed against pressures up to 1800 psi at port 1 with port 2 referenced to tank.

$\frac{A3}{A2}$ = 2.25:1 or 1000 psi at port 3 will hold the valve closed against pressures up to 2250 psi at port 2 with port 1 referenced to tank.

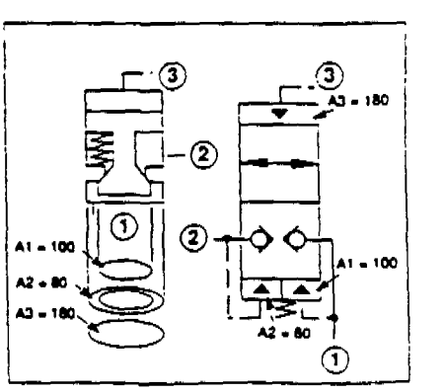
Operation of LK*C

Area Ratios
Port 1 Area (A1) = 100%
Port 2 Area (A2) = 80%
Port 3 Area (A3) = 180%

Area Ratios

$\frac{A3}{A1}$ = 1.8:1

$\frac{A3}{A2}$ = 2.25:1



Pilot-to-Open
Switching Cartridge LK*C

Pressure at port 1 or port 2, acting on areas A1 or A2, plus the bias spring force, tends to close the valve or add to the closing force. Pilot pressure at port 3, acting on area A3, tends to open the valve. Pilot-to-open switching cartridges close when the forces affecting the surface areas at port 1 or port 2 are greater than the forces affecting the surface area at port 3. When port 3 is vented, the valve will close and remain closed regardless of the pressure at port 1 or port 2.

When pilot pressure is applied at port 3, this pressure, acting on A3 (minus the bias spring force), tends to open the valve. The valve may be closed by venting port 3 (pilot) to tank, or by introducing a proportionately higher pressure at port 1 or port 2. From the area ratios listed above, it can be seen that:

$\frac{A3}{A1}$ = 1.8:1 or 1000 psi at port 3 will open the valve against pressures up to 1800 psi at port 1 with port 2 referenced to tank.

$\frac{A3}{A2}$ = 2.25:1 or 1000 psi at port 3 will open the valve against pressures up to 2250 psi at port 2 with port 1 referenced to tank.

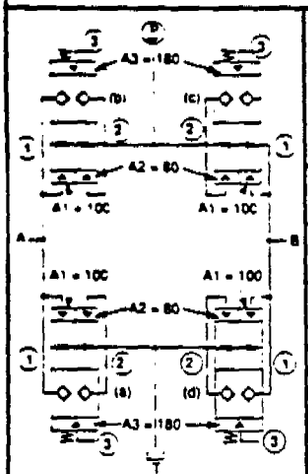
Switching Elements as Directional Controls

Four logic switching cartridges are required to duplicate the functions of a spool type four-way directional valve: one cartridge for each port - P, T, A, and B. By controlling the opening and closing of each element, twelve different flow paths can be obtained. Using logic switching cartridges, it is possible to shift from one flow condition to any other without going through any intermediate (or "center") valve condition or function. Because the opening of the cartridges can be precisely controlled, the logic circuit can anticipate the requirements of the system, allowing flow to shift direction smoothly. By contrast, most spool type directional valves have only three operating positions and must always pass through a center condition when changing from one flow path to another. The opening order and shifting conditions are rigidly fixed by the spool configuration and overlap.

Typical logic element four-way directional valve circuits, illustrating pilot-to-close and pilot-to-open cartridges are described below.

NOTE Both normally open and normally closed switching cartridges are seated poppet type valve designs, so leakage between port 1 and port 2 is essentially zero. All SUN switching cartridges are manufactured with seats on the pilot piston, eliminating any leakage between the pilot and work ports. Therefore, either work port can be selected as a source for self-piloting without fear of loss of pressure from the pilot section of the work port. Port 3 must be free of air and full of oil before starting up new systems.

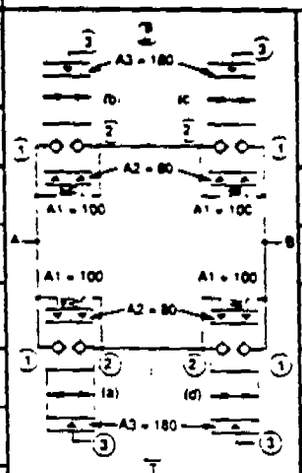
PILOT TO CLOSE SWITCHING ELEMENTS
Typical Circuit



Equivalent Spool Valve Symbol A B / P T	*Logic Element* a	b	c	d
	O	O	O	O
	X	X	X	X
	X	O	X	O
	O	X	O	X
	X	O	X	X
	X	X	O	X
	O	X	X	X
	X	X	X	O
	X	O	O	X
	O	X	X	O
	O	O	X	X
	X	X	O	O

o – vented x – piloted

PILOT TO OPEN SWITCHING ELEMENTS
Typical Circuit



Equivalent Spool Valve Symbol A B / P T	*Logic Element* a	b	c	d
	X	X	X	X
	O	O	O	O
	O	X	O	X
	X	O	X	O
	O	X	O	O
	O	O	X	O
	X	O	O	O
	O	O	O	X
	O	X	X	O
	X	O	O	X
	X	X	O	O
	O	O	X	X

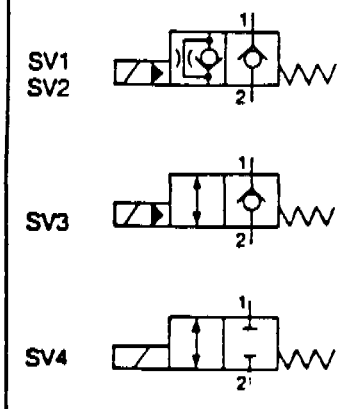
o – vented x – piloted

1100186 #11

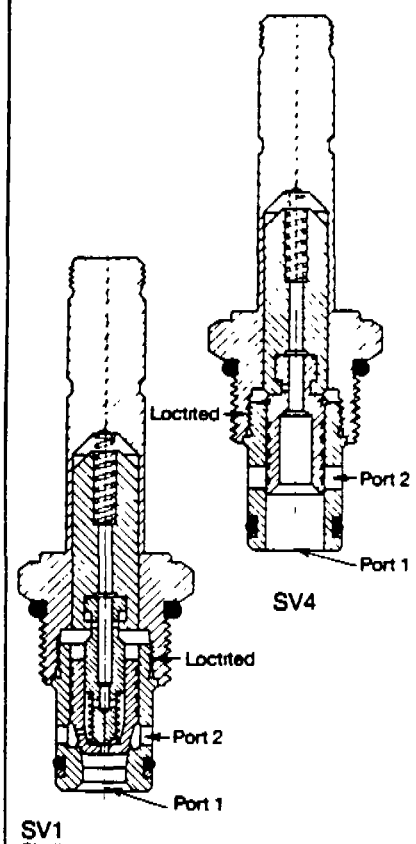
Solenoid directional valves, two-way two-position (2/2), normally-closed series

SV1/2/3/4-10(V)-C

Functional symbols



Typical sections
Solenoids omitted



Similar construction for SV2 and SV3

Model and ordering code

SV * -10(V)-C- * -**** *
[1] [2] [3] [4] [5]

[1] Type
See also "Functional symbols" section
1 = Poppet type, two-stage, high flow
2 = Poppet type, two-stage, fast acting
3 = Poppet type, two-stage, free reverse flow
4 = Spool type, direct acting

[2] Fluid compatibility
Blank = Antiwear hydraulic oil
V = As above or with phosphate-ester (not alkyl type)

[3] Form
0 = Cartridge only

In light-duty housing;
207 bar (3000 psi) max.
6T = With SAE 6 size ports

In NFPA fatigue-rated housing;
207 bar (3000 psi) max.
6H = With SAE 6 size ports

Continued in next column

8H = With SAE 8 size ports
2G = With G¼" (BSPF) size ports
3G = With G⅜" (BSPF) size ports

[4] Voltage rating		Amps	Lead color
00	= No coil	—	—
12D	= 12VDC	1,50	Red
24D	= 24VDC	0,75	Black
36D	= 36VDC	0,50	Blue
24A	= 24VAC 60/50 Hz	0,75	Orange
115A	= 115VAC 60 Hz/ 110VAC 50 Hz	0,16	Yellow
230A	= 230VAC 60/50 Hz	0,08	Red/ White

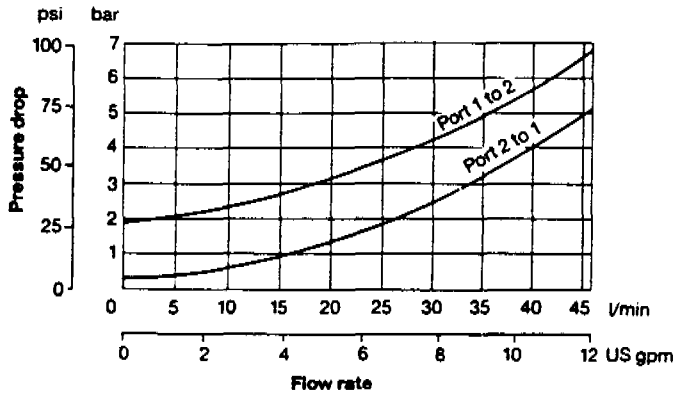
[5] Connector types
Blank = No coil
G = ISO 4400 (DIN 43650) connector. Order requisite connector plug separately; see "Spare parts", two pages on.
P = ½" NPT conduit port, with leadwire
Q = Spade terminal (option for DC voltages only)
W = Leadwire (option for DC and 24VAC only)

Operating data
Performance data is typical with fluid at 28 cSt (132 SUS) and 38°C (100°F)

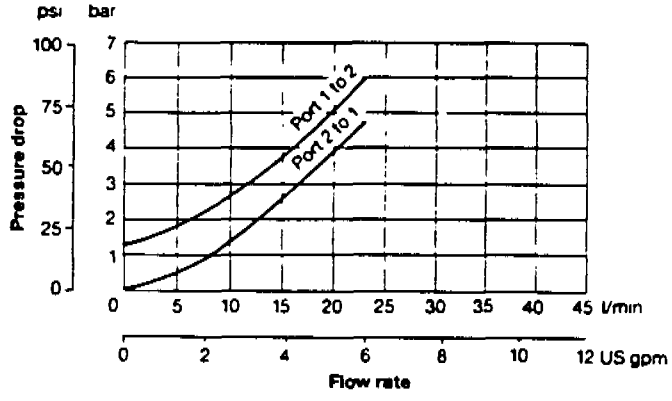
Max. pressure, both ports	207 bar (3000 psi)
Rated flow: SV1 & SV3 models SV2 & SV4 models	45 l/min (12 US gpm) 23 l/min (6 US gpm)
Pressure drop characteristics	See graphs on next page
Electrical characteristics and options	See [4] and [5] in "Model code" above, and also page 49
Hydraulic fluids, temperature ranges and filtration recommendations	See [2] in "Model code" and also page 266
Installation dimensions, cartridge only	See two pages on
Cavity size	C-10-2 See page 247 for dimensions
Mass, cartridge including solenoid	0,4 kg (0.87 lb) approx.
Housing options: Standard light duty type Standard fatigue-rated type Customized types	 See page 255 See page 251 Consult your local sales engineer
Spare parts	See two pages on

Pressure drop characteristics
Cartridges only

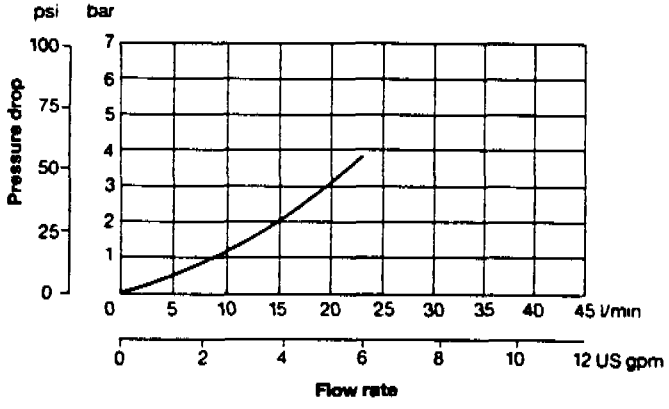
SV1 & SV3



SV2

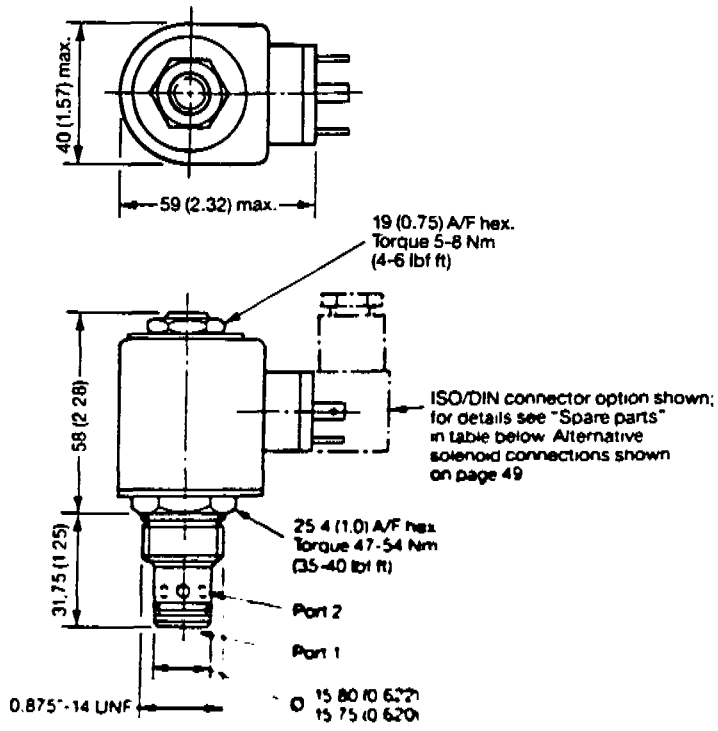


SV4



Installati n dimensions in mm (inches)

3rd angle projection



Spare parts

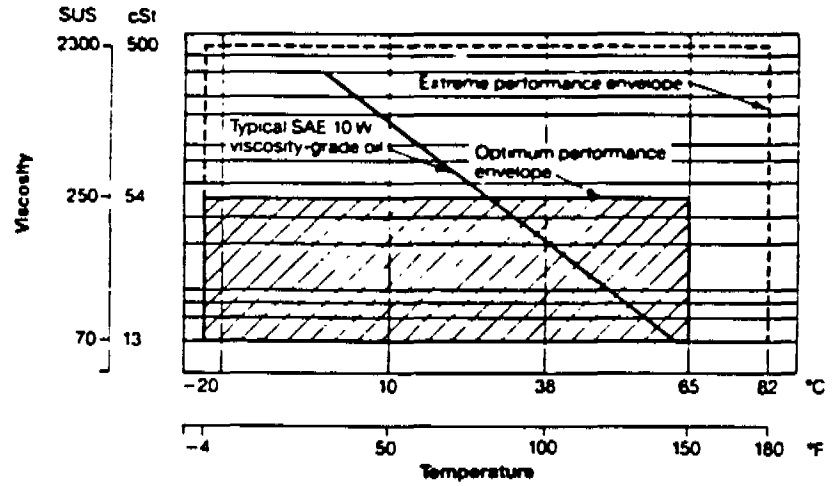
The only parts available are:	Kit no
a. Seal kits comprising external seals and back-up rings for	
SV*-10-C	SK-10-2
SV*-10V-C	SK-10V-2
b. Solenoid coil and ancillary parts	See page 49
c. ISO/DIN connector plug options:	Part no
Black, marked B	710775
Gray, marked A	710776
	For dimensions see page 50

Supporting information

Hydraulic fluids, temperature ranges, filtration recommendations and contaminant control
Spare parts
Repair and warranty

Hydraulic fluids	
Usable with	Options
All valves with "V" immediately after the nominal size e.g. RV1-10V-* relief valve FR2-16V-* flow control	Antiwear hydraulic oils or phosphate esters (not alkyl types)
All valves with the "V" omitted e.g. RV1-10-* relief valve FR2-16-* flow control	Antiwear hydraulic oils

Temperature ranges
Viscosity/operating temperature envelopes



For general information about the fluids see, for:

Antiwear hydraulic oils

a) Data sheet about hydraulic fluids in industrial applications. Available on request and also in the main Vickers product catalog.
b) Fluid suppliers' publications.

Phosphate esters

a) Fluid suppliers' publications.
b) "Guidelines for the use of fire-resistant fluids in hydraulic systems" CETOP publication, available in English, German and French from CETOP members e.g.
British Fluid Power Association, London, UK
VDMA, Frankfurt/Main-Niederrad, W. Germany
SCTHP, 16 Avenue Hoche, Paris, France.
c) "Standard practice for use of fire-resistant fluids in fluid power systems" ANSI, New York, USA.

Filtration recommendations

For consistent, efficient performance, filtration must maintain fluid cleanliness to ISO 4406: 1986 class 16/13 or cleaner. This task is made easier by good system design, installation and maintenance practices as described below.

Contaminant control

Contaminant in hydraulic systems is now recognized as the most likely cause of any malfunction or failure of hydraulic equipment. Dependent on the nature, size and/or amount of contaminant it can cause:

☐ Machine malfunction, particularly when operating toward maximum capacity.
☐ Risk of frequent breakdowns under the same conditions.
☐ Production rates below schedule.
☐ High product scrap rates and quality faults.

Nature of contaminant
Contaminant can be either particle contaminant or the product(s) of fluid degradation.

Particle contaminant can be of metal, rubber, plastic, dirt, dust, fiber, sand, paint, etc.; several types may be present at any time. It can enter the fluid at any time after the fresh clean fluid has been shipped by the fluid manufacturer. There is usually little likelihood that fresh fluid became contaminated during the refining and blending processes.

Continued on next page

Fluid d gradation shows in one or more of the following ways:
☐ Oxidation and/or th formation of gummy deposits and sludge from the combined effects of high temperatures, air, water and particle contaminant. These can increase viscosity, cause gummy deposits to coat moving parts, clog orifices and small passages, thus impairing smooth mechanical movements, and form sludge.
☐ Unstable emulsions of poor lubricity formed when water accidently emulsifies with oil. These impair smooth movements and promote wear.
☐ Air bubbles in the fluid, particularly at low pressures. In excess, they cause noise in pumps and valves leading to erratic or spongy machine movements, premature wear and failure.

Control of contaminant
The table below prescribes preventive measures relative to the different common types and causes of contamination. For a more comprehensive treatise of the subject ask for the Vickers publication "Effective contamination control in fluid power systems".

Preventive measures	Solid contam.	Fluid degradation by – High temp.	Water	Air
For storage barrels				
☐ Store in cool, dry location.		●		
☐ Ensure that bungs or plugs fully seal-in the fluid.	●			
☐ Wipe away any dirt and moisture from around the bung or plug **before** loosening and emptying.	●			
☐ Use a portable filtration unit for emptying and re-filling.	●			
For storage tanks				
☐ Install in cool, dry location.		●		
☐ Ensure that all covers and stop valves effectively seal-in the fluid.	●			
☐ Keep filling lines clean; cap ends when not in use.	●			
☐ Use a portable filtration unit for filling and emptying.	●			
For hydraulic systems				
☐ Provide fluid filter(s) in location(s) that ensure the requisite protection	●			
☐ The ideal steady-state flow conditions through an off-line filter makes this a "must" for most applications.	●			
☐ Whenever possible, use filters having element condition indicators.	●			
☐ Vented systems must be fitted with an air breather appropriate to the environment(s) in which the machine is to be operated and the requirements of the system.	●		●	●
☐ Fit strainers to pump inlet lines if there is risk of gross contaminant (e.g. string, rag, screws, etc.) entering the lines.	●			
☐ Prevent air entering the system, particularly through pump inlet lines. Ensure air-tight joints in any sub-atmospheric zone of pump inlet lines. Also ensure that those lines and all return and drain lines terminate below the minimum fluid level in the reservoir; pump inlet lines should be sufficiently below to prevent air entering through a vortex at low fluid levels.				
☐ Design for, and maintain, fluid temperatures at optimum levels for the application. Fit coolers if necessary.		●		
☐ Locate or screen hydraulic systems away from high temperature sources e.g. furnaces.	●	●		
☐ Assemble system in clean conditions and by using clean practices.	●			
☐ Pre-clean pipes and reservoir immediately before installation. Cap any ends that cannot immediately be connected to mating components e.g. between shifts.	●			
☐ Remove protective caps only just before connecting mating components.	●			
☐ Use a portable filtration unit to fill the reservoir system.	●			
☐ Flush new systems, and those that have undergone major repairs, before commissioning. Temporarily remove cylinders and semi-rotary motors and replace by bridging pipes. Servo valves and similar high precision units should also be replaced by bridging units for flushing operations. Ensure that cylinders and semi-rotary motors are clean internally before connecting to the system.	●			
☐ Ensure that air breathers and reservoir covers are at all times properly installed and secured tightly.	●			
☐ Stop any leakage of water into the system from coolers or other sources. Make a leak-tight repair.				
☐ By planned maintenance, ensure that fresh filter elements are fitted (or metallic elements cleaned when appropriate) when indicators or visual inspection shows this to be necessary.	●	●		
☐ Take fluid samples periodically and examine to determine whether effects of particle contaminant, heat, water and air indicate need for more control of those factors or the replacement of the fluid fill.	●	●		
☐ Whenever the reservoir is emptied, clean it out thoroughly and remove all residual contaminant. If necessary, restore protective paint or other finishes. On completion, cap all openings unless the system is to be refilled immediately in which case ensure that air breathers, covers etc., are replaced.				

CM93036-2 #1

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS FOR 320 FRAME AND SMALLER MOTORS

WARNING

These instructions must be followed to ensure safe and proper installation, operation and maintenance of the motor. They should be brought to the attention of all persons who install, operate or maintain this equipment.

Failure to follow instructions and safe electrical procedures could result in serious injury or fatality. Disconnect all power and discharge all capacitors before servicing. Install and ground per local and national codes. Consult qualified personnel with questions or if repairs are required.

INSTALLATION

UNCRATING AND INSPECTION

After uncrating, check for any damage which may have been incurred in handling. The motor shaft should turn freely by hand. Repair or replace any loose or broken parts before attempting to use the motor.

Check to be sure that motor has not been exposed to dirt, grit, or excessive moisture in shipment or storage before installation.

Measure insulation resistance (see operation). Clean and dry the windings as required.

Never start a motor which has been wet without having it thoroughly dried.

SAFETY

Motors should be installed, protected and fused in accordance with latest issue of National Electrical Code, NEMA Standard Publication No. MG 2 and local codes

Eyebolts or lifting lugs are intended for lifting the motor only. These lifting provisions should never be used when lifting or handling the motor with other equipment (i e pumps, gear boxes, fans or other driven equipment) as a single unit. Be sure the eyebolt is fully threaded and tight in its mounting hole.

Eyebolt lifting capacity rating is based on a lifting alignment coincident with the eyebolt centerline Eyebolt capacity decreases as deviation from this alignment increases See NEMA MG 2.

Frames and accessories of motors should be grounded in accordance with National Electrical Code (NEC) Article 430. For general information on grounding refer to NEC Article 250

Rotating parts such as pulleys, couplings, external fans, unusual shaft extensions should be permanently guarded. Keep hands and clothing away from moving parts. Electrical repairs should be made by trained, qualified personnel only.

LOCATION

In selecting a location for the motor, consideration should be given to environment and ventilation. A motor with the proper enclosure for the expected operating condition should be selected.

The ambient temperature of the air surrounding the motor should not exceed 40°C (104°F) unless the motor has been especially designed for high ambient temperature applications. The free flow of air around the motor should not be obstructed

The motor should never be placed in a room with a hazardous process, or where flammable gases or combustible material may be present, unless it is specifically designed for this type of service.

1. Dripproof (open) motors are intended for use indoors where atmosphere is relatively clean, dry and non-corrosive.
2. Totally enclosed motors may be installed where dirt, moisture and corrosion are present.
3. Totally enclosed - severe duty motors are recommended for extreme environmental conditions.
4. Explosion proof motors are built for use in hazardous locations as indicated by Underwriters' label on motor. Consult UL, NEC, and local codes for guidance.

FLOOR MOUNTING

Motors should be provided with a firm, rigid foundation, with the plane of four mounting pads flat within .010" for 56 to 210 frame; .015" from 250 through 320 frame. This may be accomplished by shims under the motor feet.

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V-BELT DRIVE

1. Align sheaves carefully to avoid axial thrust on motor bearing. The drive sheave on the motor should be positioned toward the motor so it is as close as possible to the bearing.
2. When adjusting belt tension, make sure the motor is secured by all mounting bolts before tightening belts
3. Adjust belt tension to belt manufacturers recommendations. Excessive tension will decrease bearing life
4. Sheaves should be in accordance to NEMA Spec. MG-1 or as approved by the manufacturer for a specific application.

DIRECT CONNECTED DRIVE

Flexible or solid shaft couplings must be properly aligned for satisfactory operation. On flexible couplings, the clearance between the ends of the shafts should be in accordance with the coupling manufacturer's recommendations or NEMA standards for end play and limited travel in coupling.

Misalignment between direct connected shafts will cause increased bearing loads and vibration even when the connection is made by means of a flexible coupling. Excessive misalignment will decrease bearing life. Proper alignment, per the specifications of the coupling being used, is critical.

ELECTRICAL CONNECTIONS

1. All wiring, fusing, and grounding must comply with National Electrical Codes and local codes.
2. To determine proper rotation and voltage connections, refer to the information and diagram on the nameplate, separate connection plate or decal. If the plate or decal has been removed, contact the manufacturer for assistance.
3. Use the proper size of line current protection and motor controls as required by the National Electrical Code and local codes. Recommended use is 125% of full load amps as shown on the nameplate for motors with 40°C ambient and a service factor over 1.0. Recommended use is 115% of full load amps as shown on the nameplate for all other motors. Do not use protection with larger capacities than recommended. Three phase motors must have all three phases protected.

Wire Size For 115 & 230 Volt Single Phase Circuits								
Distance - Motor To Fuse or Meter Box - Feet								
Motor HP	100 Ft.		200 ft.		300 Ft.		500 Ft.	
	115V.	230V.	115V.	230V.	115V.	230V.	115V.	230V.
1/4	#14	#14	#10	#12	#8	#10	#6	#8
1/3	#12	#14	#10	#12	#6	#10	#4	#8
1/2	#10	#12	# 8	#10	#6	# 8	#4	#6
3/4	#10	#12	# 6	#10	#4	# 8	#2	#6
1	# 8	#10	# 6	# 8	#4	# 6		#4
1-1/2	# 4	#10	# 0	# 8		# 6		#4
2		# 8		# 6		# 4		#2
3		# 8		# 8		# 4		#2
5		# 6		# 4		# 2		#0

THERMAL PROTECTOR INFORMATION

WARNING

Disconnect power before working on motor driven equipment. Motors with automatic thermal protectors will automatically restart when the protector cools. Do not use motors with automatic thermal protectors in applications where automatic restart will be hazardous to personnel or equipment.

Motors with manual thermal protectors may start unexpectedly after protector trips. If manual protector trips, disconnect motor from power line. After protector cools (five minutes or more) it can be reset and power may be applied to motor.

THERMAL PROTECTOR INFORMATION (Continued)

The nameplate will indicate one of the following:

1. Motor is thermally protected
2. Motor is provided with overheat protective device

For example:

1. Motors without thermal protection have nothing stamped on nameplate about thermal protection.
2. Motors equipped with built-in thermal protection have "THERMALLY PROTECTED" stamped on the nameplate. Thermal protectors open the motor circuit electrically when the motor overheats or is overloaded. The protector cannot be reset until the motor cools. If the protector is automatic, it will reset itself. If the protector is manual, press the red button to reset.
3. Motors that are provided with overheat protective device that does not open the motor circuit directly will indicate "WITH OVERHEAT PROTECTIVE DEVICE". See motor connection diagram for details

CHANGING ROTATION

1. Keep hands and clothing away from rotating parts.
2. Before the motor is coupled to the load, determine proper rotation.
3. Check rotation by jogging or bumping. Apply power to the motor leads for a short period of time, enough to just get motor shaft to rotate a slight amount to observe shaft rotating direction.
4. Three phase - interchange any two (2) of the three (3) line leads. Single phase - reconnect per the connection diagram on the motor.

REDUCED VOLTAGE STARTING

Motors used on reduced voltage starting should be carefully selected based upon power supply limitations and driven load requirements. The motors starting torque will be reduced when using reduced voltage starting. The elapsed time on the start step should be kept as short as possible and should not exceed 5 seconds. It is recommended that this time be limited to 2 seconds. Refer to the manufacturer for application assistance.

OPERATION

BEFORE INITIAL STARTING

1 If a motor has become damp in shipment or in storage measure the insulation resistance of the stator winding

$$\text{Minimum Insulation Resistance in Megohms} = 1 + \frac{\text{Rated Voltage}}{1000}$$

Do not attempt to run the motor if the insulation resistance is below this value. Have the motor inspected, dried and/or cleaned. Contact a qualified motor repair shop

2 See that voltage and frequency stamped on motor and control nameplates correspond with that of the power line

3 Check all connections to the motor and control with the wiring diagram.

4 Be sure rotor turns freely when disconnected from the load. Any foreign matter in the air gap should be removed

5 If possible leave the motor disconnected from the load for the initial start. It is desirable to operate the motor without load for about one hour to test for any localized heating in bearings and windings. Check for proper rotation. Check for correct and balanced voltage at the motor terminals. Check no load amps.

ALLOWABLE VOLTAGE AND FREQUENCY RANGE

If voltage and frequency are within the following range, motors will operate, but with somewhat different characteristics than obtained with correct nameplate values.

1. Voltage. Within 10% above or below the value stamped on the nameplate. On three phase systems the voltage should be balanced within 1%. A small voltage unbalance will cause a significant current unbalance.
2. Frequency: Within 5% above or below the value stamped on the nameplate.
3. Voltage and Frequency together: Within 10% (providing frequency above is less than 5%) above or below values stamped on the nameplate

CLEANLINESS

Keep both the interior and exterior of the motor free from dirt, water, oil and grease. Motors operating in dirty places should be periodically disassembled and thoroughly cleaned.

CONDENSATION DRAIN PLUGS

All explosion proof and some totally enclosed motors are equipped with automatic drain plugs, they should be free of oil, grease, paint, grit and dirt so they don't clog up. The drain system is designed for normal floor (feet down) mounting. For other mounting positions, modification of the drain system may be required, consult th manufacturer.

LUBRICATION

NOTE

If lubrication instructions are shown on motor, they will supersede this general instruction.

Motors are properly lubricated at the time of manufacture. It is not necessary to lubricate at time of installation unless the motor has been in storage for a period of 12 months or longer.

SLEEVE BEARINGS: Reoil with 10 drops of 5W30 oil annually, after three years of normal service.

PERMANENTLY LUBRICATED SEALED BALL BEARINGS: Require no attention during the life of the bearing.

BALL BEARINGS: With provision for lubrication - see below.

1. Stop motor. Disconnect power and lock out of service.
2. Wipe clean all grease fittings (Fill and drain.)
3. Remove fill and drain plugs from the bearing hub
4. Free drain hole of any hard grease (use piece of wire if necessary)
5. Add Grease using a low pressure grease gun The amount and type of grease added is very important. The manufacturer's standard grease is Chevron SRI 2 or equivalent Only enough greas should be added to replace the grease used by the bearing Too much grease can be as harmful as insufficient grease. The grease cavity should be filled 1/3 to 1/2 full
6. Start motor and let run for approximately 30 minutes
7. Stop motor, wipe off any drained grease and replace filler and drain plugs
8. Motor is ready for operation

RECOMMENDED RELUBRICATION PERIOD

Speed (RPM)	Frame Size	Standard Conditions	Severe Conditions	Extreme Conditions
1200 RPM or less	140-180	4 5 Years	18 Months	9 Months
	210-280	4 0 Years	16 Months	8 Months
	320	3 5 Years	14 Months	7 Months
1201 to 1800 RPM	140-180	3.0 Years	12 Months	6 Months
	210-280	2.5 Years	10 Months	5 Months
	320	2 0 Years	9 Months	4 Months
Over 1800 RPM	All	6 Months	3 Months	3 Months

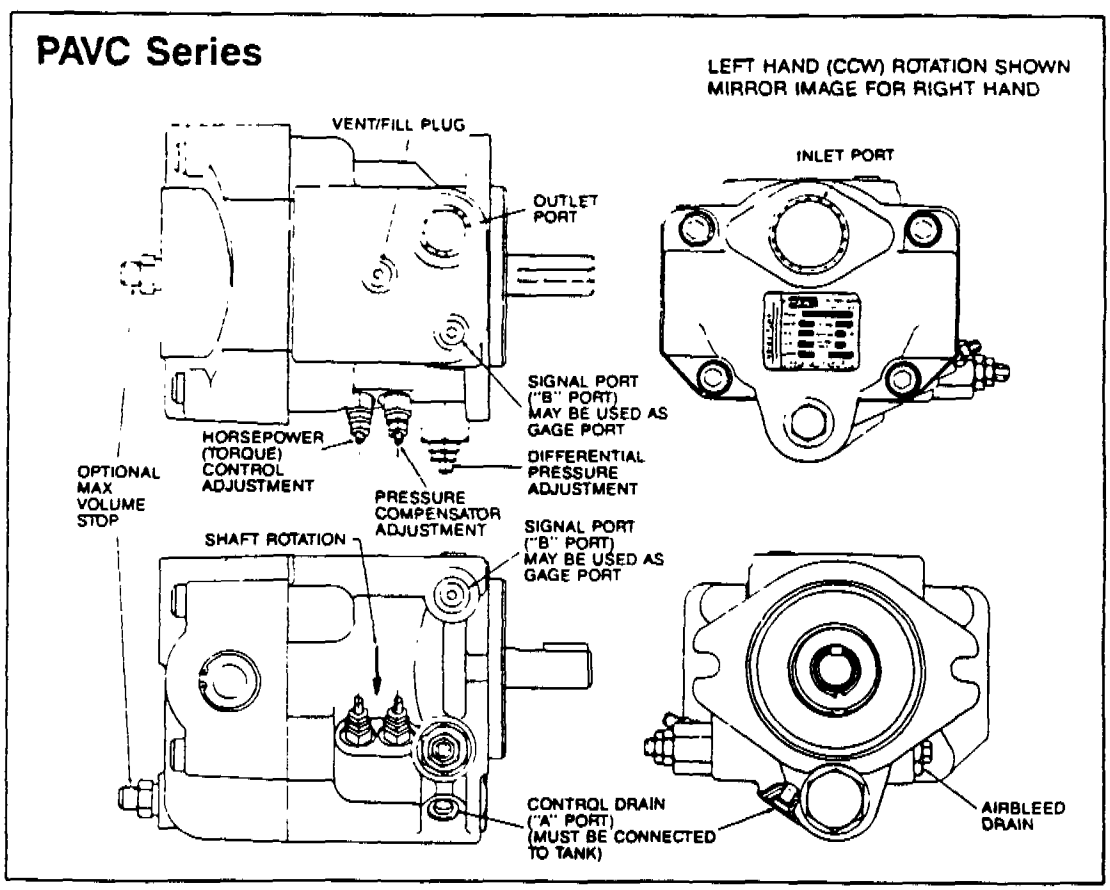
Standard Conditions: Eight hours per day, normal or light loading, clean 100° F maximum ambient
Severe Conditions: Twenty-four hours per day operation, or shock loadings, vibration, or in dirt or dust, or at 100° to 150° F ambient.
Extreme Conditions: Heavy shock or vibration, dirt, moisture, or dust at 100° to 150° F ambient.

CM93036-2 # 2

PAVC Series

RECOMMENDED OPERATING AND INSTALLATION CONDITIONS

Speed	— Minimum 600 RPM — Maximum 3000 RPM PAVC 33/38/65 — Maximum 2600 RPM PAVC 100
Pressure	— Limited by the pressure compensator control in the pump — Maximum allowable setting 3000 psi continuous — Maximum allowable setting 3300 psi intermittent (20% duty) — Minimum obtainable setting 400 psi
Flow	— PAVC 33 @ 1800 RPM — 15 GPM — PAVC 38 @ 1800 RPM — 18 GPM — PAVC 65 @ 1800 RPM — 31 GPM — PAVC 100 @ 1800 RPM — 47 GPM
Inlet Conditions	— Not to exceed 6" Hg vacuum at 1800 RPM on petroleum base fluids. — Inlet pressure not to exceed 25 psi
Filtration	— For maximum pump and system component life, fluid contamination should be limited to a level not to exceed 125 particles greater than 10 micron per milliliter of fluid (SAE Class 4 ISO 16/13). Due to the nature of variable volume pumps, pump inlet conditions, types of fluids and duty cycles must be considered before specifying suction filtration. Contact Parker representative for assistance.
Temperature Range	— 50°F to 160°F — Consult factory for other temperatures
Fluid	— Premium quality hydraulic oil with a viscosity between 150-250-SSU (30-50 cst) at 100°F (38°C). Normal operating viscosity range between 80-1000 SSU (17-180 cst). Maximum start-up viscosity is 4000 SSU (1000 cst). Oil should have maximum anti-wear properties, rust and oxidation inhibitors.
Control Drain	— In full compensation @ 1500 psi control drain flow should be less than 1.0 GPM — Maximum allowable back pressure is 10 psi



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INSTALLATION INSTRUCTIONS

1. When mounting the pump on a system where the fluid level is above the height of the pump (i.e. L-shaped or overhead reservoir) the pump case must be full of fluid before starting. This can be accomplished by loosening the vent/fill plug in the pump case, opening the inlet line and allowing gravity to pre-fill the inlet line and pump case.

   When mounting the pump on a system where the fluid level is below the pump (i.e. JIC reservoir) the following start-up procedure is recommended. Put approximately 2 cups of fluid in the pump case to lubricate parts during priming. Remove plug from airbleed drain port and connect an unrestricted line below minimum fluid level. Start motor and run until pump primes or a maximum of 30 seconds. If pump doesn't prime in 30 seconds, stop motor (shaft not rotating) and repeat until pump primes.

   To insure that the pump remains in the primed condition through succeeding start-ups, the pump should be mounted with the inlet port in the upper position.

2. Do not apply side loads to the pump drive shaft. If side loading is necessary (i.e. indirect drive), consult factory.

3. Pump and motor shaft alignment must be within .010 inch TIR using standard floating coupling (no end loading). An HML series pump motor adapter (available from Parker Pump Div.) and a Lovejoy AL110 coupling or equivalent may be used to maintain this level of alignment.

4. The PAVC series of pumps are uni-directional and must be driven in the direction indicated by the arrow on the side of the front housing.

5. Check all inlet connections to be sure they are air-tight. An air leak in the inlet line can cause the pump case to drain down and cause the pump to loose prime during succeeding start-ups.

6. Port "A" is the control drain and must be connected directly to tank. This line should not be combined with other drain or tank lines as back pressure surges could occur, causing compensator instability. "A" port back pressure is limited to 10 psi.

7. Port "B" is a feedback pilot line (signal port) There are two "B" ports on the pump; either may be used for a signal line. The spare port can function as a gage port.

8. The pressure compensator is factory set and can be lowered for start-up. CW rotation increases the compensator setting. CCW rotation decreases this setting Pump compensator should be set with the system deadheaded.

9. Differential pressure adjustment and Horsepower control adjustment are factory set — readjustment is not recommended, consult factory.

10. Pump does not have or require a case drain.

11. Airbleed is standard on all PAVC Pumps. When required, remove airbleed drain plug (7/16-20 SAE-4) and connect unrestricted to tank below minimum oil level.

PORT SIZES

MODEL	INLET		OUTLET		CONTROL DRAIN "A" PORT STRAIGHT THREAD	SIGNAL PORT "B" PORT STRAIGHT THREAD
	STRAIGHT THREAD	SAE FLANGE	STRAIGHT THREAD	SAE FLANGE		
PAVC 33	1⅝-12 (-20)	1¼"	1 1/16-12 (-12)		7/16-20 (-4)	7/16-20 (-4)
PAVC 38	1⅝-12 (-20)	1¼"	1 1/16-12 (-12)		7/16-20 (-4)	7/16-20 (-4)
PAVC 65	1⅞-12 (-24)	1½"	1 5/16-12 (-16)		9/16-18 (-6)	7/16-20 (-4)
PAVC 100		2"	1⅝-12 (-20)	1¼"	9/16-18 (-6)	7/16-20 (-4)

( ) SAE Fitting Size

Parker Hannifin Corporation
Fluidpower Pump Division • 100 Parker Drive • Otsego, MI 49078
Phone (616) 692-6411 • Telex 22-3506

Printed in U.S.A.

Parker Fluidpower

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G neral Description

All control is achieved by the proper positioning of the swash plate. This is achieved by a servo piston acting on one end of the swash plate working against the combined effect of the off-setting forces of the pistons and centering spring on the other end. The control spool acts as a metering valve which varies the pressure behind the servo piston.

As shown in Figure 1, the amount of flow produced by the Parker Piston Pump is dependent upon the length of stroke of the pumping pistons. This length of stroke, in turn, is determined by the position of the swash plate. Maximum flow is achieved at an angle of 17°.

The rotating piston barrel, driven by the prime mover, moves the pistons in a circular path and the piston slippers are supported hydrostatically against the face of the swash plate. When the swash plate is in a vertical position, perpendicular to the centerline of the piston barrel, there is no piston stroke and consequently no fluid displacement. When the swash plate is positioned at an angle, the pistons are forced in and out of the barrel and fluid displacement takes place. The greater the angle of the swash plate, the greater the piston stroke.

The centerline of the pumping piston assembly is offset from the centerline of the swash plate. Therefore, as shown on the accompanying Figure 1A, the pistons' effective summation force tends to destroke the swash plate to a vertical (neutral) position. This destroking force is balanced as the swash plate is angled by the force of the servo piston

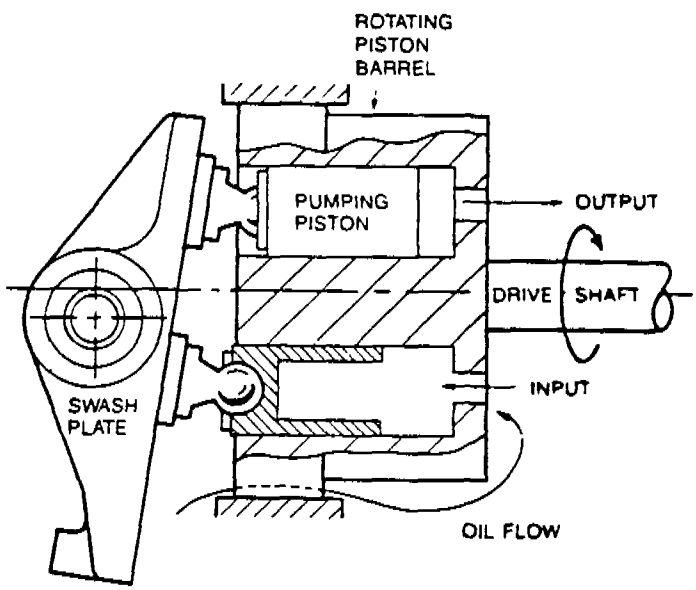


FIGURE 1. Pumping Action

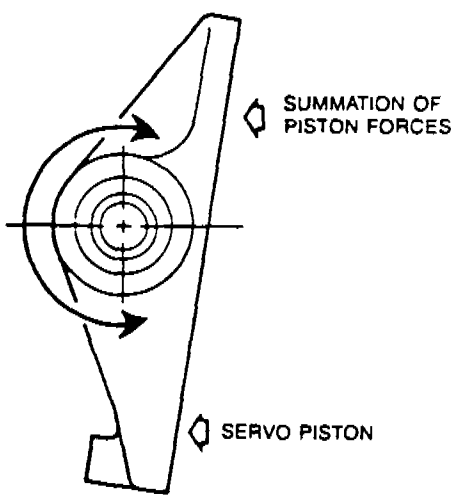


FIGURE 1A.

Pressure Comp nsated Control

Swash plate angle controls the output flow of the pump. Swash plate angle is controlled by the force generated against the swash plate by the pumping pistons and by the force of the servo piston. The force of the servo piston is greater than the force of the pumping pistons when both are at the same pressure.

By means of internal porting, pressure is connected from the output port to the servo piston via orifice (E), and to the control spool via passage (D). Also pressure is applied to the control spool chamber thru orifice (F). As long as the pressures at both ends of the control spool remain equal, the spool will remain offset to the right, due to the added force of the spring.

When pressure reaches the setting of the compensator control, the dart leaves its seat causing the pressure in the spool chamber to be reduced. The spool now moves downward causing pressure in the servo piston cavity to vent via port "A". The reduced pressure at the servo piston allows the servo piston to move to the right. This movement reduces the angle of the swash plate and thereby reduces the pumps output flow.

As pump pressure on the control spool drops below pressure and spring force in the spool chamber, the control spool moves upward to maintain an equal force on both sides of the spool. If pump pressure falls below the compensator control setting the control spool moves up bringing the pump to maximum displacement.

△P Adjustment Of PAVC Pumps

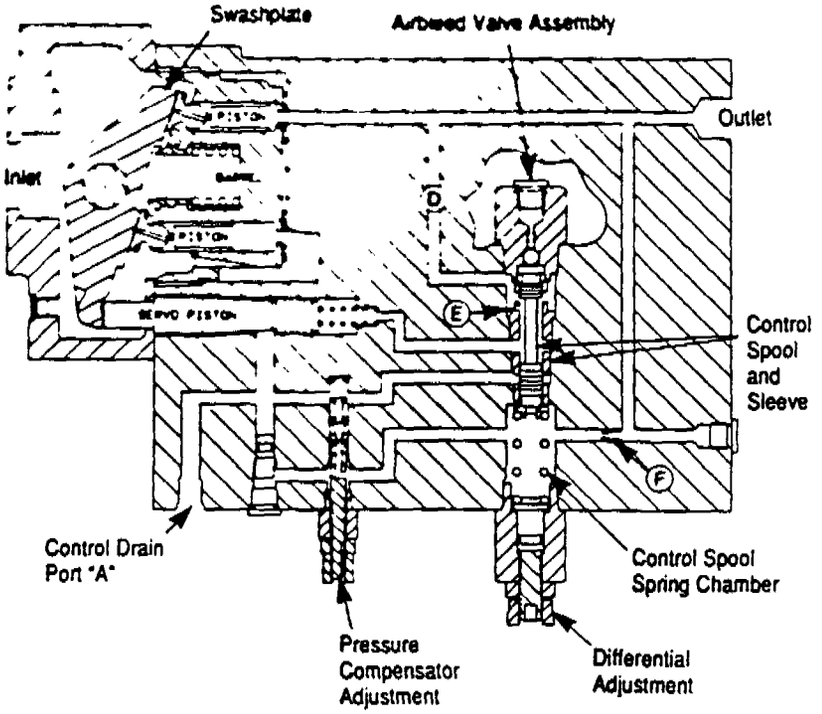
PROCEDURE:

a. **Standard Pressure Compensated Pump**
Pumps are shipped from factory with a differential pressure of 150 PSI (10 Bar) on PAVC 33/38/65, PAVC 100 is 300 PSI (21 Bar) at 50% of maximum swash angle. Differential pressure will not normally change through the life of the pump. If this control has been tampered with, a close approximation of the correct setting can be made as follows:

Dead head the pump (no flow) with a 0-3000 PSI (0-207 Bar) gauge in the OUTLET (not the low signal "B" port), back the pressure control out (full counterclockwise).

The gauge should read between [PAVC 33 300-325 PSI (21-22 Bar), PAVC 38 375-400 PSI (26-28 Bar), PAVC 65 400-425 PSI (28-29 Bar), PAVC 100 550-600 PSI (38-42 Bar)]. If the gauge reads above this, turn the differential adjustment knob counterclockwise until correct PSI figure is reached

Control Option – 'Omit'



Installation Informati n

Use Of A R lief Valve

The use of a relief valve, while not manadatory is recommended in the main circuit to suppress hydraulic shock loads and as additional system protection. If a minimum volume stop is used, the use of a relief valve is mandatory.

Fluid Recommendations

Premium quality hydraulic oil with a viscosity range between 150-250 SSU (30-50 cst.) at 100°F. (38°C.). Normal operating viscosity range between 80-1000 SSU (17-180 cst.). Maximum start-up viscosity is 4000 SSU (1000 cst.).

NOTE: Consult Parker when exceeding 160°F (71°C) operation Oil should have maximum anti-wear properties, rust and oxidation treatment

Filtration

For maximum pump and system component life the system should be protected from contamination at a level not to exceed 125 particles greater than 10 microns per milliliter of fluid (SAE Class 4/ISO 16/13) Due to the nature of variable displacement pumps variations in pump inlet conditions fluid acceleration losses system aeration and duty cycle we do not recommend suction line filters Contact your Parker representative for assistance

Start-Up

On initial start-up the case should be filled with oil pressure should be reduced and the circuit should be open or the air bled from the pump outlet to permit priming See Installation and Mounting Section to connect airbleed

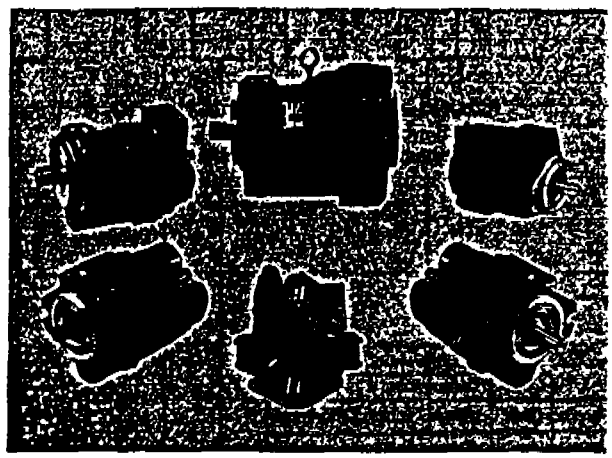
Inlet Conditions

Not to exceed 5 inches Hg Vacuum at 1800 RPM on petroleum base fluids See recommended speed spectrum for specific inlet conditions

Shaft Rotation and Line Up

Pump and motor shaft alignment must be within .010 TIR maximum, using a standard floating coupling Please follow coupling manufacturer's recommended installation instructions to prevent end thrust on pump shaft Turn pump to assure freedom of rotation Pump and motor must be on a rigid base.

The coupling should be sized to absorb the peak horsepower developed



Installation and Mounting

When mounting a PVP Series Pump, the "case drain" must be on top of the pump The "case drain" should be a separate line unrestricted to the reservoir and extend below the oil level as far from the inlet line as possible The "case drain" line must not exceed 10 PSI (.69 Bar) back pressure Suggested maximum line length is 10 feet

When a PAVC Series Pump is mounted above the fluid level the position of the "control drain" is not restricted but the inlet port must not be on the bottom The "control drain" should be a separate line unrestricted to the reservoir and extend below the oil level as far from the inlet line as possible The "control drain" line must not exceed 10 PSI (.69 Bar) back pressure Suggested maximum line length is 10 feet

A built in airbleed is standard on all PAVC 33, 38, 65 and 100 Pumps To connect, remove airbleed drain plug and connect a line unrestricted to reservoir extending below minimum oil level. Back pressure in this line must not exceed 4 PSI (.28 Bar).

Special Installations

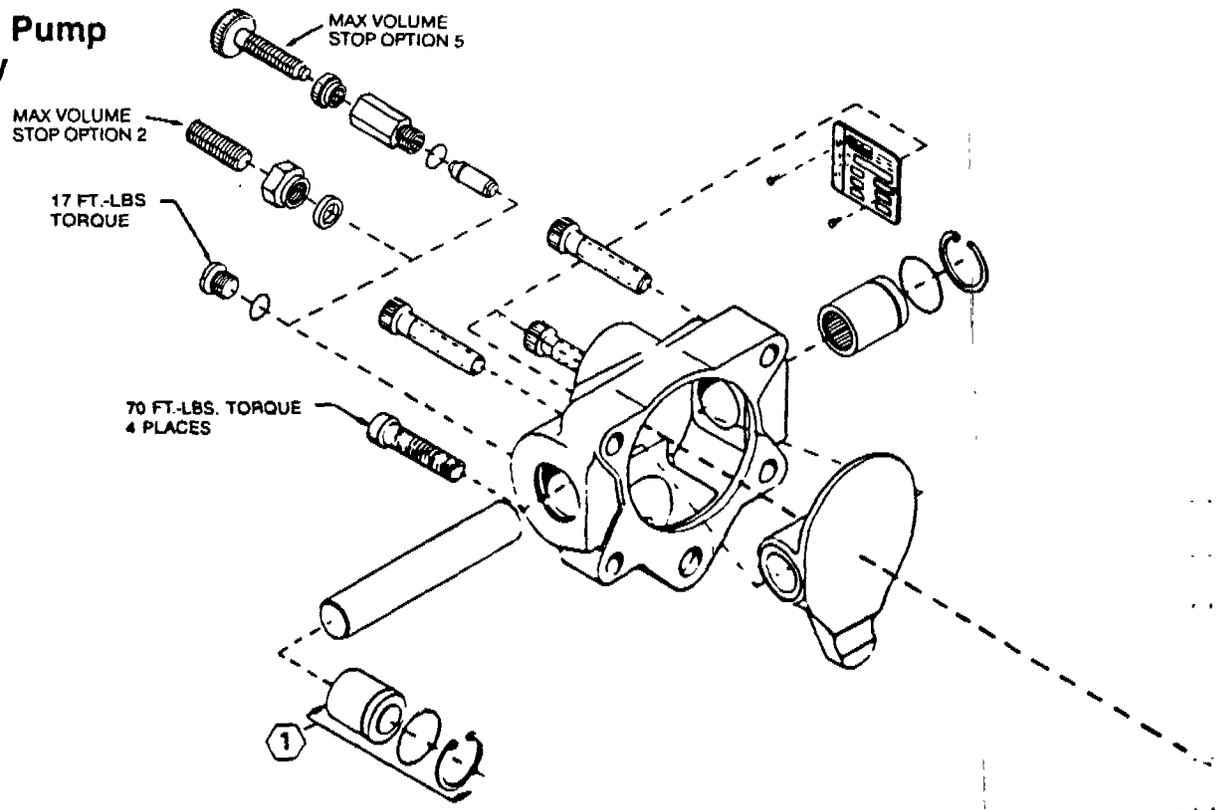
Consult your Parker representative for any application requiring the following

Pressure above rated, drive speed above maximum, indirect drive, fluid other than petroleum oil, oil temperature above 160°F (71°C)

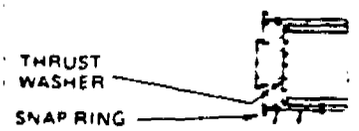
Inlet Pressure

Not to exceed 10 PSI (.69 Bar) on PVP 16, 23/33.
Not to exceed 25 PSI (1.72 Bar) on PAVC 33,38,65,100

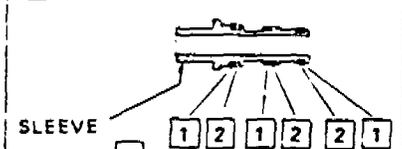
Standard Pump Assembly



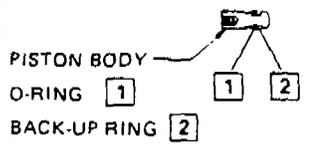
1 TRUNNION CAP ASSY.



2 SLEEVE ASSY.

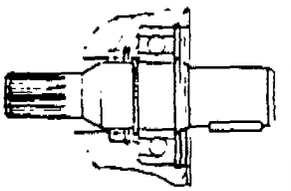


3 PLUG ASSY.



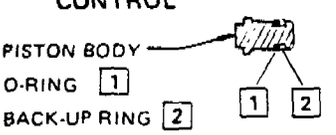
4 RETAINER DETAIL

5 BEARING - SHAFT ASSY.

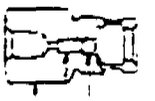


NOTE:
POSITION OF ROUNDED EDGE ON SNAP RING

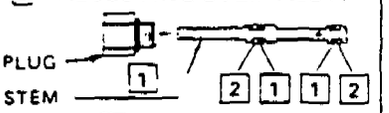
6 PISTON - DIFFERENTIAL CONTROL



7 AIR BLEED ASSY.

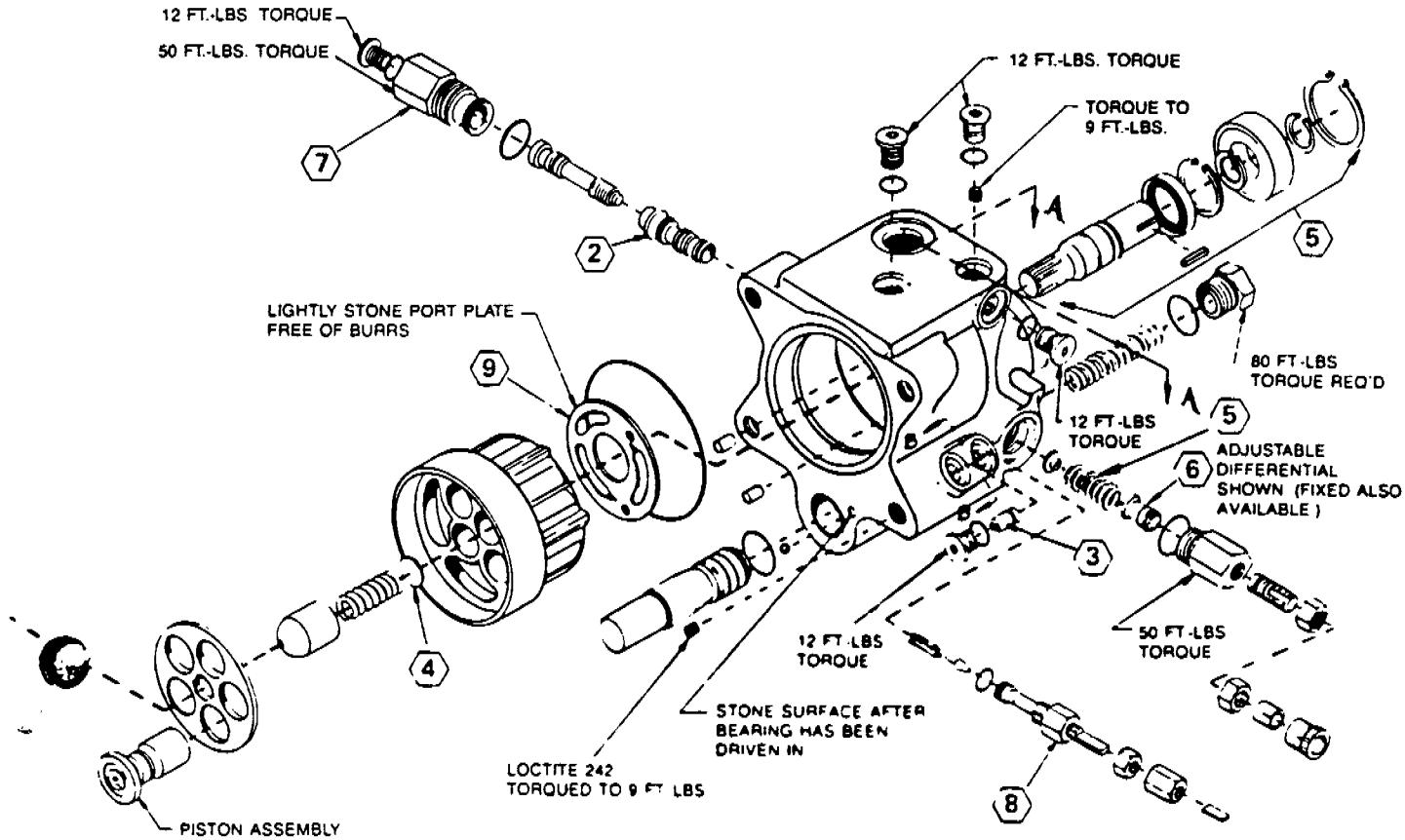


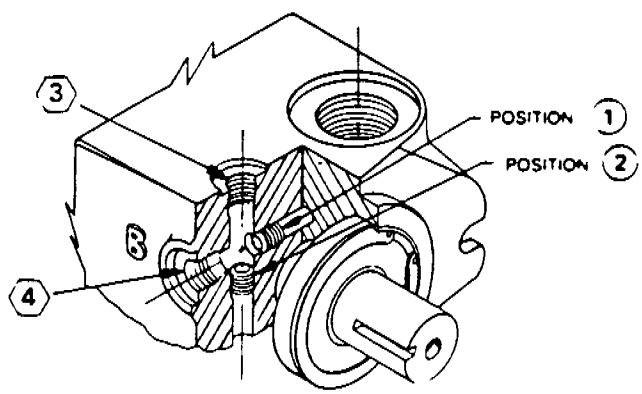
8 ADJUSTING STEM ASSY.



9 PORT PLATE

LEFT HAND (CCW) PORT PLATE SHOWN IN ASSEMBLY (ABOVE) RIGHT HAND (CW) PORT PLATE SHOWN BELOW.





SECTION A-A

(10) — **TORQUE (HP) CONTROL (See next page)**

(11) — **VOLUME SERVO FEEDBACK (See next page)**

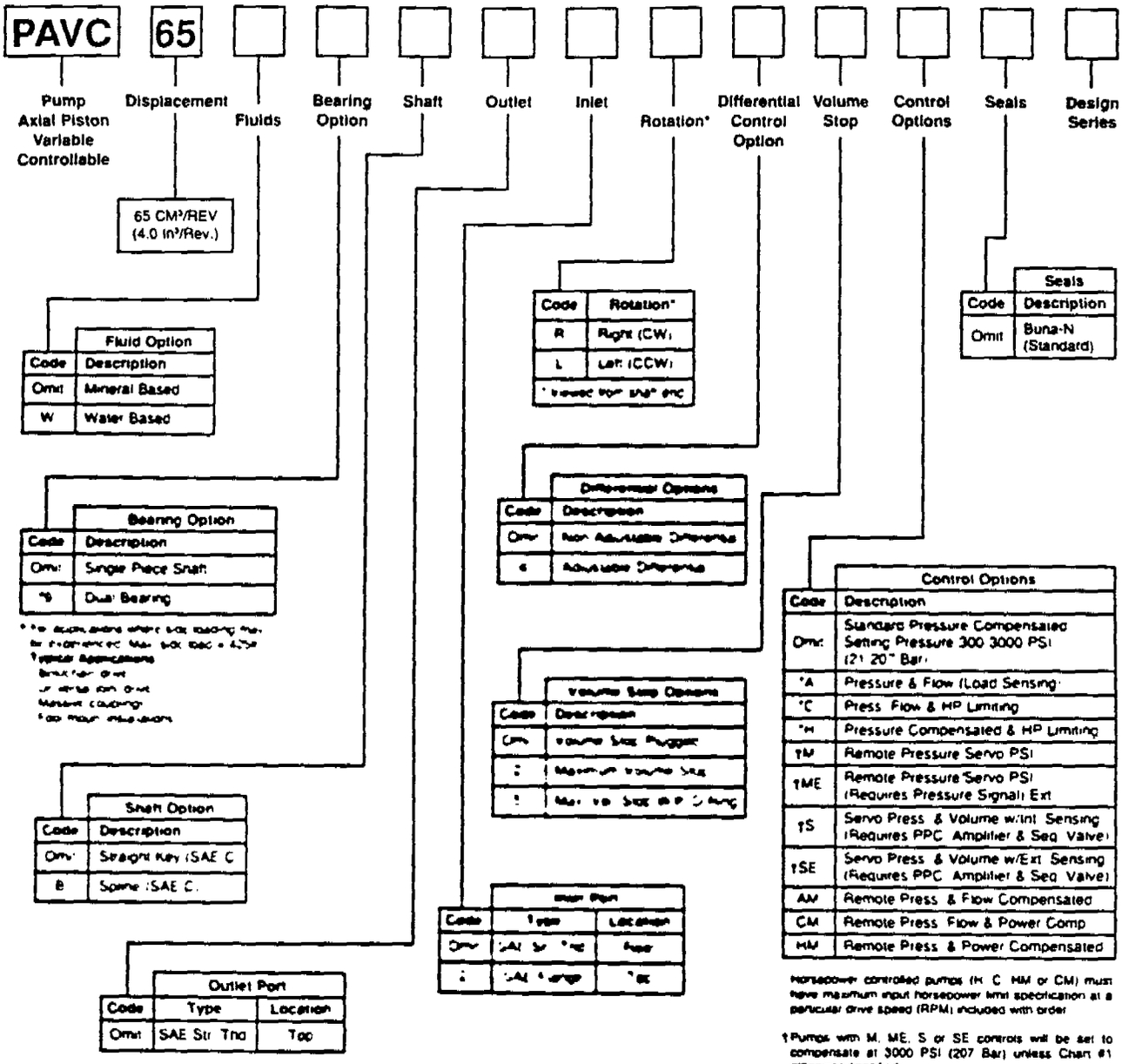
PAVC 33 38 65

CONTROL OPTION	POSITION (1)	(2)	(3)	(4)	(5)	
OMIT*	OPEN	800599	108 X 4	108 X 4	OMIT	
A	102 X 1	800599	OPEN	108 X 4	787474	
C	102 X 1	800599	OPEN	108 X 4	787474	
H	OPEN	800599	108 X 4	108 X 4	OMIT	(10)
M	800599	OPEN	OPEN	109 X 4	OMIT	
ME	102 X 1	800599	OPEN	108 X 4	787474	
S	800599	OPEN	OPEN	108 X 4	OMIT	(11)
SE	102 X 1	800599	OPEN	108 X 4	OMIT	(11)
AM	102 X 1	800599	786635	OPEN	787474	
CM	102 X 1	800599	786635	OPEN	787474	(10)
HM	800599	OPEN	OPEN	108 X 4	OMIT	(10)

PAVC 100

CONTROL OPTION	POSITION (1)	(2)	(3)	(4)	(5)	
OMIT	OPEN	690870	108 X 4	108 X 4	OMIT	
A	102 X 1	690870	OPEN	108 X 4	787474	
C	102 X 1	690870	OPEN	108 X 4	787474	
H	OPEN	690870	108 X 4	108 X 4	OMIT	(10)
M	690870	OPEN	OPEN	109 X 4	OMIT	
ME	102 X 1	690870	OPEN	108 X 4	787474	
S	690870	OPEN	OPEN	108 X 4	OMIT	(11)
SE	102 X 1	690870	OPEN	108 X 4	OMIT	(11)
AM	102 X 1	690870	786635	OPEN	787474	
CM	102 X 1	690870	786635	OPEN	787474	(10)
HM	690870	OPEN	OPEN	108 X 4	OMIT	(10)

Ordering Informati n

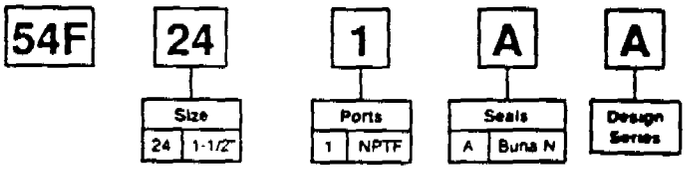


Horsepower controlled pumps (H C HM or CM) must have maximum input horsepower limit specification at a particular drive speed (RPM) included with order

†Pumps with M, ME, S or SE controls will be set to compensate at 3000 PSI (207 Bar) unless Chart #1 otherwise specified

Flange Kit

Kit includes Bolts And O-Ring These Are 4-Bolt SAE Style Flanges
See installation section page 58



Accessories for S & SE Options	
PPC Valve	694586
Amp Single Pump	AP11
Amp Double Pump	AP211
Seq. Valve (40 GPM Max.)	SX6P/SX6V(-)
Seq. Valve (90 GPM Max.)	SX10P/SX10M(-)

Weight and Package Size

Model	Weight In Pounds	Length From Mounting Face In Inches (CM)	Height In Inches (CM)	Width In Inches (CM)
PAVC 65	50	8.82 (22.4)	7.42 (18 8)	8.00 (20.3)

Ordering Notes:

*Unless otherwise specified, pump is shipped at maximum GPM (1800 RPM) and set to 1000 PSI (69 Bar). When factory settings are required, the items shown in Chart #1 must be included with order

Chart #1 Item	
RPM	
PSI	
H.P.	
GPM	

Flexible Drive Couplings by Magnaloy

CM93036-2 #4

Magnaloy is the original lightweight, heavy-duty flexible drive coupling. Light weight magnesium construction makes Magnaloy couplings 76% lighter than cast iron and 36% lighter than aluminum units. . .and they're stronger than either!

The benefits are many. . .Reduced loads on bearings, shafts and pumps, for longer component life. Easier handling and installation. Rust proof and corrosion resistant.

Magnaloy's close machining tolerances (TIR of .002") assures vibration - free operation and easy, accurate alignment without need for special tools. Solid magnesium alloy sand castings are heat treated and offer the highest strength-to-weight ratio available.

The clamp-type coupling utilizes the basic Magnaloy coupling with the addition of the clamp feature. Developed to compensate for variations in spline formation methods and tolerances. Assures centering of the coupling and positive retention on the shaft. The clamp feature is suggested for all spline couplings, but is also available in smooth bored and keyed models.

Coupling Performance Specifications

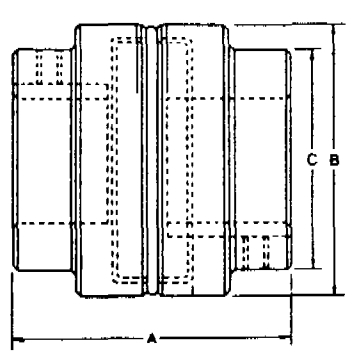
Model Size	Max Bore	Wr² lb/ft²	Insert Number	Rated Torque lb-in	Torsional Rigidity lb-in/Deg	Horse Power Rating@ 100 rpm	1200 rpm	1800 rpm
100	1-1 8	.0046	170N	340 7	42	.55	6 5	9.8
			170U	511.0	53	.82	9 8	14 7
			170H	1,022 1	182	1 65	19 8	29 7
200	1-3 8	.0068	270N	398.3	55	64	7 6	11 5
			270U	597 4	68	96	11 5	17 2
			270H	1,194 9	234	1 92	2 10	34 5
300	1-5 8	022	370N	701 4	81	1 12	1 [illegible]	20 2
			370U	1 052 1	148	1 68	[illegible]	[illegible]
			370H	2 104 2	336	3 36	[illegible]	[illegible]
400	1-7 8	031	470N	1,056 3	138	1 69	[illegible]	[illegible]
			470U	1,584 5	310	2 5	[illegible]	[illegible]
			470H	3 168 9	488	5 1	[illegible]	[illegible]
500	2 3 8	071	570N	2,194 8	314	3 5	[illegible]	[illegible]
			570U	3 292 2	695	5 3	[illegible]	[illegible]
			570H	6 584 4	1 571	10 5	[illegible]	[illegible]
600	2 5 8	16	670N	[illegible]	676	7 9	[illegible]	[illegible]
			670U	7 430 1	1 510	11 9	[illegible]	[illegible]
			670H	14 860 1	[illegible]	23 7	[illegible]	[illegible]
700	[illegible]	34	770N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			770U	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
800	3 7 8	95	870N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			870U	32 8 64 1		52 5	6,561 4	[illegible]
900	[illegible]	4 20	970N	[illegible]	8 428	76 5	[illegible]	[illegible]
			970U	[illegible]		114 8	[illegible]	[illegible]

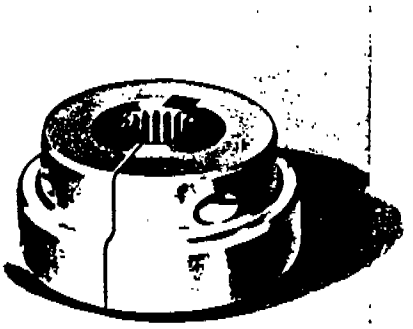
Spline Coupling Specifications

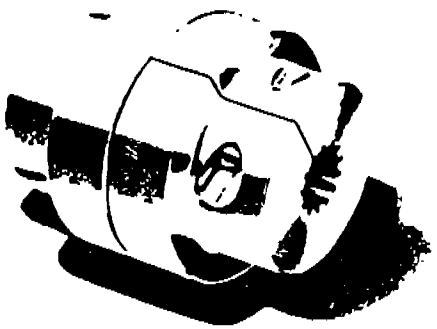
Spline Size		Pressure Angle Degrees	SAE Design	Major Diameter (inches)	Std. Coupling Available Model Sizes	Steel Bushed Coupling Available Model Sizes
Number of Teeth	Pitch					
9	16 32	30	A,AA	625	100-900	200-900
13	8 6	30	D,E	1 750	400-900	600-900
13	16 32	30	B	875	100-900	300-900
14	12 24	30	C	1 250	200-900	500-900
15	8 16	30	F	2 000	500-900	800-900
15	16 32	30	BB	1 00	100-900	400-900
21	16 32	30		1.375	300-900	500-900
23	16 32	30		1.500	300-900	500-900
27	16 32	30		1 750	400-900	600-900
40	16 32	30		2 5625	600-900	800-900

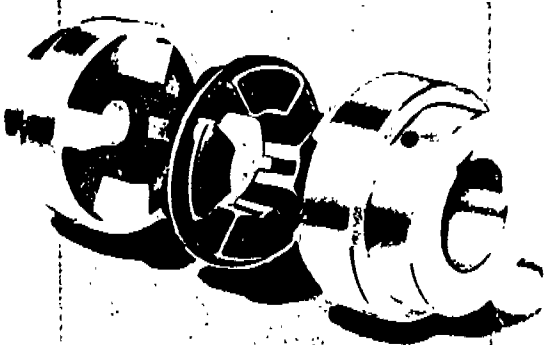
Magnaloy Coupling Dimensions

Model Size	A	B	C
100	2.54	2.600	2.00
200	3.10	2.900	2.25
300	3.58	3.450	2.90
400	4.24	4.000	3.05
500	4.67	4.800	4 00
600	5.98	5.975	4.50
700	6.99	6.900	5.19
800	7.99	8.600	7.00
900	10 15	11.400	8.30









Specify Magnaloys "Flexible Drive Coupling Catalog" for complete specification & installation details.

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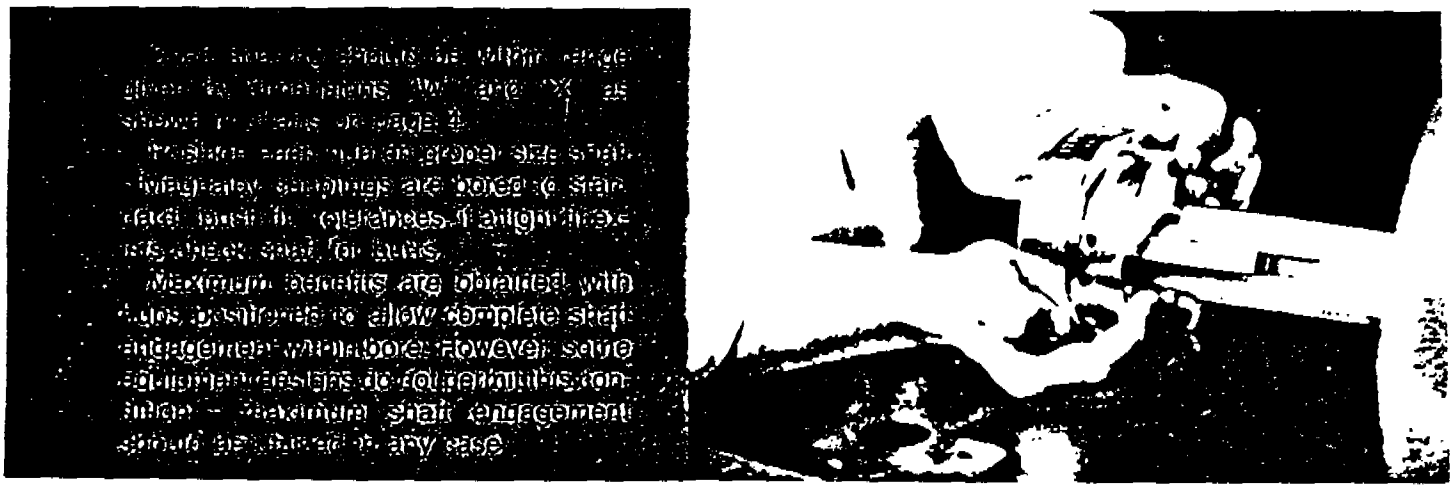
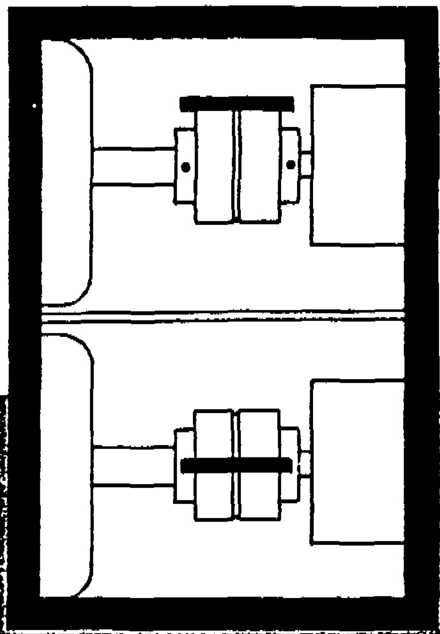
installation instructions



Magnaloy couplings offer four-way flexibility (parallel, angular, axial and torsional) and require no lubrication. They are easily installed and properly aligned without use of special tools or equipment - a straight edge and hex wrench are the only tools required. Magnaloy's insert reduces noise and vibration and permits needed flexibility for proper operation within alignment capabilities.

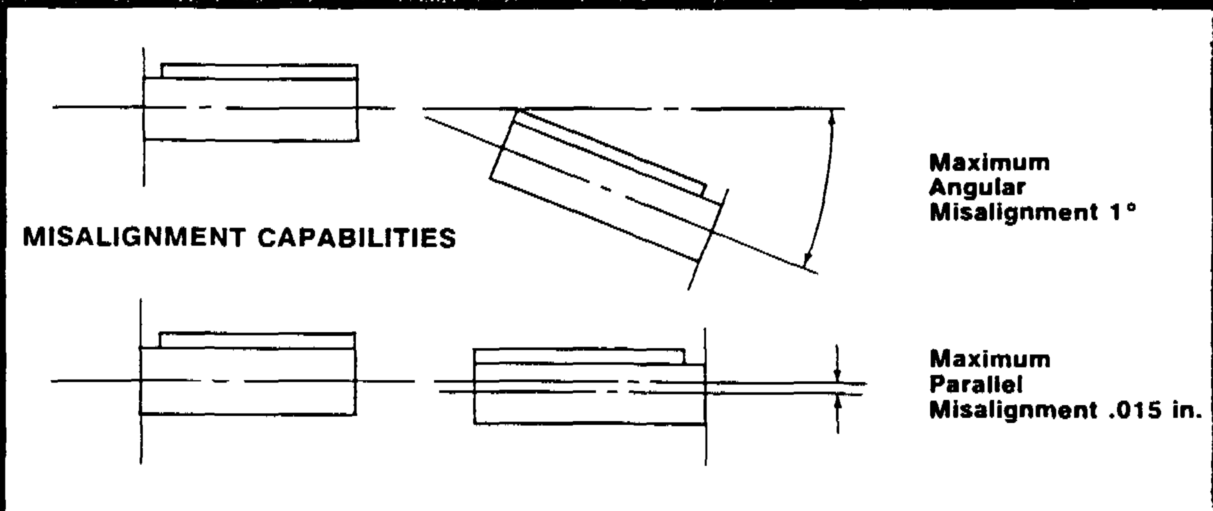


RECOMMENDED TORQUES FOR FASTENERS

MODEL	SET SCREW	CLAMP SCREW
100	60 - 70 in. lbs.	130 - 140 in. lbs.
200	130 - 140 in lbs.	130 - 140 in lbs.
300	130 - 140 in. lbs.	210 - 220 in. lbs
400	190 - 200 in lbs	210 - 220 in. lbs.
500	190 - 200 in. lbs.	300 - 310 in. lbs.
600	190 - 200 in. lbs.	35 - 36 ft. lbs.
700	300 - 310 in. lbs	35 - 36 ft. lbs.
800	300 - 310 in. lbs.	49 - 50 ft. lbs.
900	100 - 110 ft. lbs.	100 - 110 ft. lbs.

Intended as general guide for fastener torques in Magnaloy Couplings.

Perfect alignment of equipment shafts in most cases is impractical to obtain or maintain, and misaligned equipment produces excess stress on bearings and the coupling. Magnaloy's insert design will absorb misalignment strain and, when excessive, will cause insert wear as a visual and audible indication of misalignment problems. However Magnaloy's inserts are inexpensive and easily replaced; under normal conditions the insert seldom requires replacement.



CM93036-2 #5

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS FOR 320 FRAME AND SMALLER MOTORS

WARNING

These instructions must be followed to ensure safe and proper installation, operation and maintenance of the motor. They should be brought to the attention of all persons who install, operate or maintain this equipment.

Failure to follow instructions and safe electrical procedures could result in serious injury or fatality. Disconnect all power and discharge all capacitors before servicing. Install and ground per local and national codes. Consult qualified personnel with questions or if repairs are required.

INSTALLATION

UNCRATING AND INSPECTION

After uncrating, check for any damage which may have been incurred in handling. The motor shaft should turn freely by hand. Repair or replace any loose or broken parts before attempting to use the motor.

Check to be sure that motor has not been exposed to dirt, grit, or excessive moisture in shipment or storage before installation.

Measure insulation resistance (see operation). Clean and dry the windings as required.

Never start a motor which has been wet without having it thoroughly dried.

SAFETY

Motors should be installed, protected and fused in accordance with latest issue of National Electrical Code, NEMA Standard Publication No. MG 2 and local codes.

Eyebolts or lifting lugs are intended for lifting the motor only. These lifting provisions should never be used when lifting or handling the motor with other equipment (i.e. pumps, gear boxes, fans or other driven equipment) as a single unit. Be sure the eyebolt is fully threaded and tight in its mounting hole.

Eyebolt lifting capacity rating is based on a lifting alignment coincident with the eyebolt centerline. Eyebolt capacity decreases as deviation from this alignment increases. See NEMA MG 2.

Frames and accessories of motors should be grounded in accordance with National Electrical Code (NEC) Article 430. For general information on grounding refer to NEC Article 250.

Rotating parts such as pulleys, couplings, external fans, unusual shaft extensions should be permanently guarded. Keep hands and clothing away from moving parts. Electrical repairs should be made by trained, qualified personnel only.

LOCATION

In selecting a location for the motor, consideration should be given to environment and ventilation. A motor with the proper enclosure for the expected operating condition should be selected.

The ambient temperature of the air surrounding the motor should not exceed 40°C (104°F) unless the motor has been especially designed for high ambient temperature applications. The free flow of air around the motor should not be obstructed.

The motor should never be placed in a room with a hazardous process, or where flammable gases or combustible material may be present, unless it it specifically designed for this type of service.

1. Dripproof (open) motors are intended for use indoors where atmosphere is relatively clean, dry and non-corrosive.
2. Totally enclosed motors may be installed where dirt, moisture and corrosion are present.
3. Totally enclosed - severe duty motors are recommended for extreme environmental conditions.
4. Explosion proof motors are built for use in hazardous locations as indicated by Underwriters' label on motor. Consult UL, NEC, and local codes for guidance.

FLOOR MOUNTING

Motors should be provided with a firm, rigid foundation, with the plane of four mounting pads flat within .010" for 56 to 210 frame; .015" from 250 through 320 frame. This may be accomplished by shims under the motor feet.

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V-BELT DRIVE

1. Align sheaves carefully to avoid axial thrust on motor bearing. The drive sheave on the motor should be positioned toward the motor so it is as close as possible to the bearing.
2. When adjusting belt tension, make sure the motor is secured by all mounting bolts before tightening belts.
3. Adjust belt tension to belt manufacturers recommendations. Excessive tension will decrease bearing life.
4. Sheaves should be in accordance to NEMA Spec. MG-1 or as approved by the manufacturer for a specific application.

DIRECT CONNECTED DRIVE

Flexible or solid shaft couplings must be properly aligned for satisfactory operation. On flexible couplings, the clearance between the ends of the shafts should be in accordance with the coupling manufacturer's recommendations or NEMA standards for end play and limited travel in coupling.

Misalignment between direct connected shafts will cause increased bearing loads and vibration even when the connection is made by means of a flexible coupling. Excessive misalignment will decrease bearing life. Proper alignment, per the specifications of the coupling being used, is critical.

ELECTRICAL CONNECTIONS

1. All wiring, fusing, and grounding must comply with National Electrical Codes and local codes.
2. To determine proper rotation and voltage connections, refer to the information and diagram on the nameplate, separate connection plate or decal. If the plate or decal has been removed, contact the manufacturer for assistance.
3. Use the proper size of line current protection and motor controls as required by the National Electrical Code and local codes. Recommended use is 125% of full load amps as shown on the nameplate for motors with 40°C ambient and a service factor over 1.0. Recommended use is 115% of full load amps as shown on the nameplate for all other motors. Do not use protection with larger capacities than recommended. Three phase motors must have all three phases protected.

Wire Size For 115 & 230 Volt Single Phase Circuits								
Distance - Motor To Fuse or Meter Box - Feet								
Motor	100 Ft.		200 ft.		300 Ft.		500 Ft.	
HP	115V.	230V.	115V.	230V.	115V.	230V.	115V.	230V.
1/4	#14	#14	#10	#12	#8	#10	#6	#8
1/3	#12	#14	#10	#12	#6	#10	#4	#8
1/2	#10	#12	# 8	#10	#6	# 8	#4	#6
3/4	#10	#12	# 6	#10	#4	# 8	#2	#6
1	# 8	#10	# 6	# 8	#4	# 6		#4
1-1/2	# 4	#10	# 6	# 8		# 6		#4
2		# 8		# 6		# 4		#2
3		# 8		# 6		# 4		#2
5		# 6		# 4		# 2		#0

THERMAL PROTECTOR INFORMATION

WARNING

Disconnect power before working on motor driven equipment. Motors with automatic thermal protectors will automatically restart when the protector cools. Do not use motors with automatic thermal protectors in applications where automatic restart will be hazardous to personnel or equipment.

Motors with manual thermal protectors may start unexpectedly after protector trips. If manual protector trips, disconnect motor from power line. After protector cools (five minutes or more) it can be reset and power may be applied to motor.

THERMAL PROTECTOR INFORMATION (C ntinued)

The nameplate will indicate one of the following:

1. Motor is thermally protected
2. Motor is provided with overheat protective device

For example:

1. Motors without thermal protection have nothing stamped on nameplate about thermal protection.
2. Motors equipped with built-in thermal protection have "THERMALLY PROTECTED" stamped on the nameplate. Thermal protectors open the motor circuit electrically when the motor overheats or is overloaded. The protector cannot be reset until the motor cools. If the protector is automatic, it will reset itself. If the protector is manual, press the red button to reset.
3. Motors that are provided with overheat protective device that does not open the motor circuit directly will indicate "WITH OVERHEAT PROTECTIVE DEVICE". See motor connection diagram for details

CHANGING ROTATION

1. Keep hands and clothing away from rotating parts.
2. Before the motor is coupled to the load, determine proper rotation.
3. Check rotation by jogging or bumping. Apply power to the motor leads for a short period of time, enough to just get motor shaft to rotate a slight amount to observe shaft rotating direction.
4. Three phase - interchange any two (2) of the three (3) line leads. Single phase - reconnect per the connection diagram on the motor.

REDUCED VOLTAGE STARTING

Motors used on reduced voltage starting, should be carefully selected based upon power supply limitations and driven load requirements. The motors starting torque will be reduced when using reduced voltage starting. The elapsed time on the start step should be kept as short as possible and should not exceed 5 seconds. It is recommended that this time be limited to 2 seconds. Refer to the manufacturer for application assistance.

OPERATION
BEFORE INITIAL STARTING

1. If a motor has become damp in shipment or in storage, measure the insulation resistance of the stator winding

$$\text{Minimum Insulation Resistance in Megohms} = \frac{\text{Rated Voltage}}{1000} + 1$$

Do not attempt to run the motor if the insulation resistance is below this value. Have the motor inspected, dried and/or cleaned. Contact a qualified motor repair shop

2. See that voltage and frequency stamped on motor and control nameplates correspond with that of the power line
3. Check all connections to the motor and control with the wiring diagram.
4. Be sure rotor turns freely when disconnected from the load. Any foreign matter in the air gap should be removed
5. If possible, leave the motor disconnected from the load for the initial start. It is desirable to operate the motor without load for about one hour to test for any localized heating in bearings and windings. Check for proper rotation. Check for correct and balanced voltage at the motor terminals. Check no load amps.

ALLOWABLE VOLTAGE AND FREQUENCY RANGE

If voltage and frequency are within the following range, motors will operate, but with somewhat different characteristics than obtained with correct nameplate values.

1. Voltage: Within 10% above or below the value stamped on the nameplate. On three phase systems the voltage should be balanced within 1%. A small voltage unbalance will cause a significant current unbalance.
2. Frequency: Within 5% above or below the value stamped on the nameplate.
3. Voltage and Frequency together: Within 10% (providing frequency above is less than 5%) above or below values stamped on the nameplate.

CLEANLINESS

Keep both the interior and exterior of the motor free from dirt, water, oil and grease. Motors operating in dirty places should be periodically disassembled and thoroughly cleaned.

CONDENSATION DRAIN PLUGS

All explosion proof and some totally enclosed motors are equipped with automatic drain plugs, they should be free of oil, grease, paint, grit and dirt so they don't clog up. The drain system is designed for normal floor (feet down) mounting. For other mounting positions, modification of the drain system may be required, consult the manufacturer.

LUBRICATION

NOTE

If lubrication instructions are shown on motor, they will supersede this general instruction.

Motors are properly lubricated at the time of manufacture. It is not necessary to lubricate at time of installation unless the motor has been in storage for a period of 12 months or longer.

SLEEVE BEARINGS: Reoil with 10 drops of 5W30 oil annually, after three years of normal service.

PERMANENTLY LUBRICATED SEALED BALL BEARINGS: Require no attention during the life of the bearing.

BALL BEARINGS: With provision for lubrication - see below.

1. Stop motor. Disconnect power and lock out of service.
2. Wipe clean all grease fittings. (Fill and drain.)
3. Remove fill and drain plugs from the bearing hub.
4. Free drain hole of any hard grease (use piece of wire if necessary).
5. Add Grease using a low pressure grease gun. The amount and type of grease added is very important. The manufacturer's standard grease is Chevron SRI 2 or equivalent. Only enough grease should be added to replace the grease used by the bearing. Too much grease can be as harmful as insufficient grease. The grease cavity should be filled 1/3 to 1/2 full.
6. Start motor and let run for approximately 30 minutes.
7. Stop motor, wipe off any drained grease, and replace filler and drain plugs.
8. Motor is ready for operation.

RECOMMENDED RELUBRICATION PERIOD

Speed (RPM)	Frame Size	Standard Conditions	Severe Conditions	Extreme Conditions
1200 RPM or less	140-180	4.5 Years	18 Months	9 Months
	210-280	4.0 Years	16 Months	8 Months
	320	3.5 Years	14 Months	7 Months
1201 to 1800 RPM	140-180	3.0 Years	12 Months	6 Months
	210-280	2.5 Years	10 Months	5 Months
	320	2.0 Years	9 Months	4 Months
Over 1800 RPM	All	6 Months	3 Months	3 Months

Standard Conditions: Eight hours per day, normal or light loading, clean 100° F maximum ambient.
Severe Conditions: Twenty-four hours per day operation, or shock loadings, vibration, or in dirt or dust, or at 100° to 150° F ambient.
Extreme Conditions: Heavy shock or vibration, dirt, moisture, or dust at 100° to 150° F ambient.

VIKING PUMP

which is offset in the pump head, should be properly positioned toward and equal distance between the port connections to allow for proper flow of liquid through the pump.

If it is necessary to disassemble the pump for inspection or repair, first remove the head capscrews and remove the head by tapping the head removing lugs lightly.

CAUTION: WHEN THE HEAD IS BEING REMOVED, THE IDLER USUALLY STAYS ON THE IDLER PIN. AVOID TILTING THE INSIDE OF THE HEAD DOWNWARD, AS THE IDLER MAY SLIDE OFF THE IDLER PIN AND FALL. A FALL ON A HARD SURFACE CAN DAMAGE THE IDLER. IF THE IDLER SHOULD FALL, CHECK CAREFULLY AND FILE OR STONE ALL NICKED OR ROUGH PLACES BEFORE RE-ASSEMBLY.

3 *REMOVE THE HEAD GASKETS.* If a new set is not available, the original gaskets may be reused provided they are not damaged.

4 *REMOVE THE IDLER FROM THE IDLER PIN.* If the idler pin is worn, both the head and idler pin and idler bushing should be replaced.

If the idler bushing is worn, a new bushing is needed.

If the new bushing is carbon graphite, special care must be taken when pressing it into the idler. An arbor press should always be used. Be sure the bushing is started straight. *DO NOT STOP* the pressing operation until bushing is in its proper location. Carbon graphite is brittle, starting and stopping the pressing operation frequently results in a cracked bushing. If cracked in the idler, the bushing will quickly disintegrate.

5 *REMOVE THE ROTOR FROM THE CASING.* The rotor of the two smaller pumps (G and GG sizes) can be removed by pressing on the hollow drive end of the rotor. It will be necessary on the models with mechanical seals (G475 and GG475) to use an arbor press and an arbor of approximately 1-3/8" diameter. The seal will remain in the casing.

The rotor of the three larger size pumps (H, HJ, HL sizes) can also be removed by pushing on the hollow drive end of the rotor. The spring and rotary member of the mechanical seal will come out with the rotor in these pumps.

6. *REMOVE THE MECHANICAL SEAL OR LIP SEALS.* (See Figure 4.) Remove the snap ring in the casing of the two smaller pumps (G and GG sizes) and the complete seal can be removed out of the large flanged end of the casing. In the case of the G & GG size lip seal pumps these have no snap rings and the lip seals can be removed out the large flanged end of the casing. Remove the spring and rotary member from the rotor and the seal seat or lip seals from the pump end of the casing of the three larger size pumps (H, HJ, HL).

Reassembly

Reassembly of these pumps is explained by one of the following sets of instructions. Follow the instructions for the proper pump model.

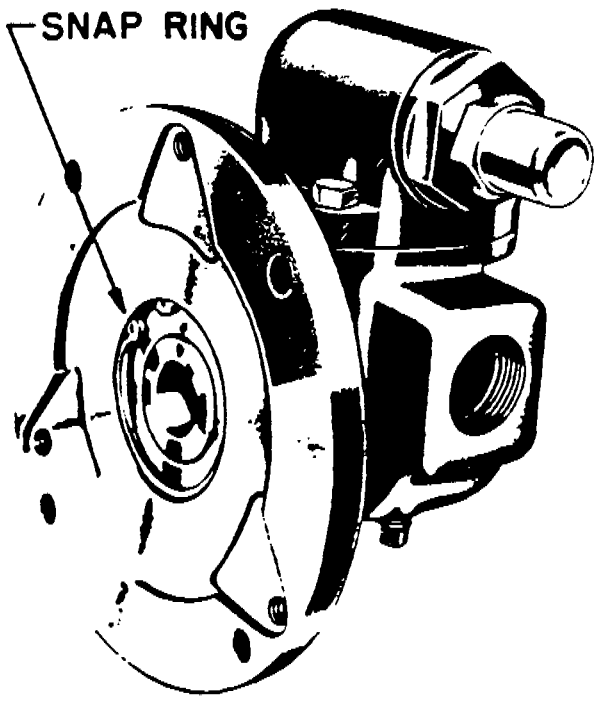

FIGURE 4
VIEW OF FLANGE END OF G AND GG475
MECH. SEAL PUMPS

Before starting to reassemble the pump, clean all parts thoroughly and replace those which show signs of excessive wear or damage.

To Reassemble Model G75 or GG75 Lip Seal Pumps: (see Figure 7)

1. *INSTALL THE LIP SEALS.* The lip seals should be installed in the casing one at a time from the large flanged end. The sealing lips must face away from each other.

   NOTE: Use an arbor press with an arbor of 2-3/16" diameter and press the lip seals in the casing as far as they will go. See Figures 7, 8, 9 and 10 for a cross section of your pump models.
2. *LUBRICATE THE LIP SEALS.* Fill the area between the lips of the lip seals with grease.
3. *INSTALL THE ROTOR.* Flush the rotor hub with light oil (not grease) and insert the rotor in the casing with the hub through the lip seals.

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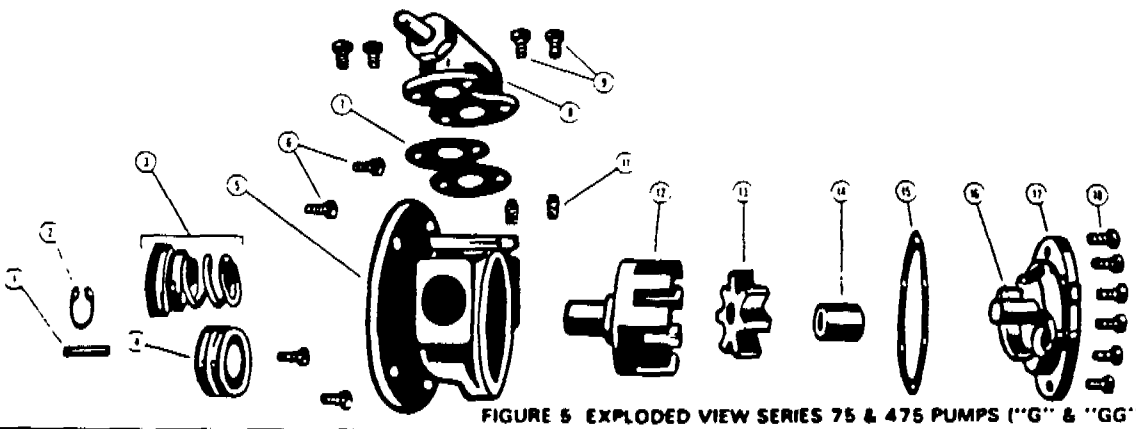

FIGURE 5 EXPLODED VIEW SERIES 75 & 475 PUMPS ("G" & "GG" SIZE)

ITEM	NAME OF PART	ITEM	NAME OF PART
1	Key For Motor Shaft (Full Length)	10	Pipe Plugs–¼"
2	Snap Ring (Used with Mech. Seal Pumps Only)	11	Machine Screw (2 for Mech. Seal Pump, 1 for Lip Seal Pump)
3	Mechanical Seal (Complete)	12	Rotor
4	Lip Seal (2)	13	Idler
5	Casing	14	Idler Bushing
6	Capscrews (Pump to Motor)	15	Gasket (For Head)
7	Gasket (For Relief Valve or Cover Plate)	16	Idler Pin
8	Relief Valve	17	Head
9	Capscrews (For Relief Valve or Cover Plate)	18	Capscrews (For Head)

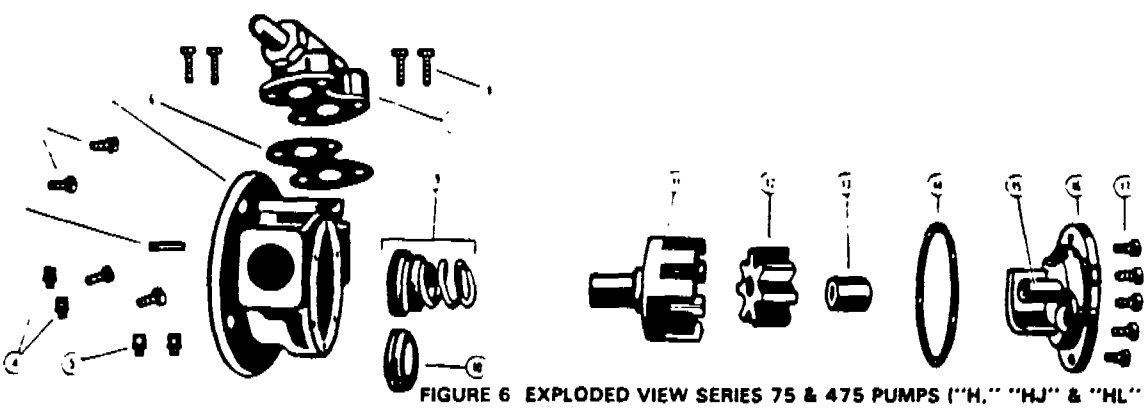

FIGURE 6 EXPLODED VIEW SERIES 75 & 475 PUMPS ("H," "HJ" & "HL" SIZE)

ITEM	NAME OF PART	ITEM	NAME OF PART
1	Key For Motor Shaft (Full Length)	10	Lip Seal (2)
2	Capscrews (Pump to Motor)	11	Rotor
3	Casing	12	Idler
4	Machine Screw (2 for Mech. Seal Pump, 1 for Lip Seal Pump)	13	Idler Bushing
5	Pipe Plugs–¼"	14	Gasket (For Head)
6	Gasket (For Relief Valve or Cover Plate)	15	Idler Pin
7	Relief Valve	16	Head
8	Capscrews (For Relief Valve or Cover Plate)	17	Capscrews (For Head)
9	Mechanical Seal (Complete)		

CAUTION: TURN THE ROTOR BACK AND FORTH AS YOU EXERT ENOUGH FORCE TO PUSH IT THROUGH THE LIP SEAL AND TO THE BOTTOM OF THE CASING. BE CAREFUL NOT TO FOLD UNDER THE LIP OF THE INNER SEAL.

4. *INSTALL THE IDLER.* Put the idler with bushing on the idler pin.
5. *PLACE THE HEAD GASKETS ON THE PUMP HEAD.* The proper amount of gaskets should be used to provide necessary end clearance within the pump so it turns freely with no appreciable end play. Gasket Table 1 gives the normal amount of gaskets used.
6. *THE HEAD CAN NOW BE ASSEMBLED ON THE PUMP.* Tilt the top of the head away from the pump slightly until the crescent enters the inside diameter of the rotor and rotate the idler until its teeth mesh with the rotor teeth. Do not damage the head gaskets. Note correct position of idler and crescent (See Figure 7 and Disassembly Step 2). Tighten the head capscrews and then check the end clearance.

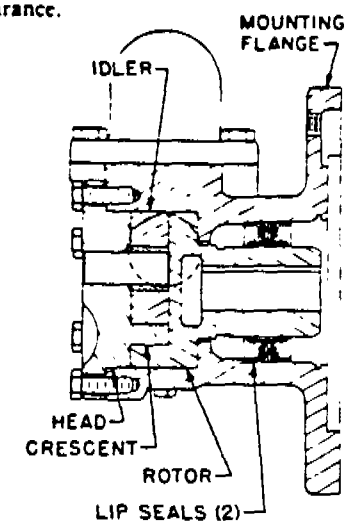

FIGURE 7
SECTIONAL DRG. OF MODELS G75 AND GG75 LIP SEAL PUMPS

7. *CHECK PUMP END CLEARANCE.* Measure the clearance between the back of the rotor and the machined surface in the bottom of the casing by inserting a feeler gauge through the port opening. This is the end clearance; normal amount is 0.003" to 0.005". Add or remove gaskets until this figure is reached.

GASKET TABLE 1

PUMP MODELS	NORMAL AMOUNT USED	ONE SET OF GASKETS CONSISTS OF THE FOLLOWING
G75 and GG75 Lip Seal Pumps	.010" - .015"	2—.005" Plastic 3—.002" Plastic

8. *BOLT THE VALVE TO THE CASING.* Place the valve gasket and valve or coverplate on the pump and fasten securely with the four capscrews.

CAUTION: BE SURE THE ADJUSTING SCREW OF THE RELIEF VALVE POINTS TOWARD THE SUCTION PORT.

9. *ASSEMBLE THE PUMP ON THE MOTOR.* Install the full length key in the keyway of the motor shaft.
   NOTE: Key must be *full* length to avoid misalignment of the pump rotor which could cause serious damage to the pump. Slide the pump on the motor shaft and fasten securely with the four capscrews.

To Reassemble Model H75, HJ75 or HL75 Lip Seal Pumps: (see Figure 8)

1. *INSTALL THE LIP SEALS* The lip seals should be installed in the casing one at a time from the head end. The sealing lips must face away from each other.
   NOTE: Use an arbor press with an arbor of 2-3/16" diameter and press the lip seals in the casing as far as they will go.
2. *LUBRICATE THE LIP SEALS.* Fill the area between the lips of the lip seals with grease.
3. *INSTALL THE ROTOR.* Flush the rotor hub with light oil (not grease) and insert the rotor in the casing with the hub through the lip seals.

CAUTION: TURN THE ROTOR BACK AND FORTH AS YOU EXERT ENOUGH FORCE TO PUSH IT THROUGH THE LIP SEALS AND TO THE BOTTOM OF THE CASING. BE CAREFUL NOT TO FOLD UNDER THE LIP OF THE INNER SEAL.

4. *INSTALL THE IDLER.* Put the idler with bushing on the idler pin.
5. *PLACE THE HEAD GASKETS ON THE PUMP HEAD.* The proper amount of gaskets should be used to provide the necessary end clearance within the pump so it turns freely with no appreciable end play. Gasket Table 2 gives the normal amount of gaskets used.
6. *THE HEAD CAN NOW BE ASSEMBLED ON THE PUMP.* Tilt the top of the head away from the pump slightly until the crescent enters the inside diameter of the rotor and rotate the idler until its teeth mesh with the rotor teeth. Do not damage the head gaskets. Note correct position of idler and crescent. (See Figure 8 and Disassembly Step 2). Tighten the head capscrews and then check the end clearance.
7. *CHECK PUMP END CLEARANCE.* Measure the clearance between the back of the rotor and the machined surface in the bottom of the casing by inserting a feeler gauge through the port opening. This is the end clearance. Nor-

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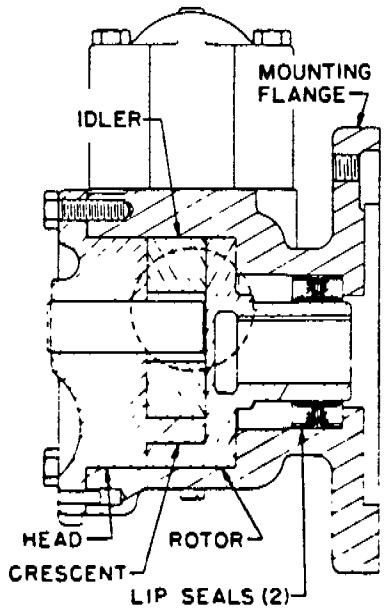

FIGURE 8
SECTIONAL DRG. OF MODELS H75, HJ75 AND HL75 LIP SEAL PUMPS

mal amount is 0.003" to 0.005". Add or remove gaskets until this figure is reached.

GASKET TABLE 2

PUMP MODELS	NORMAL AMOUNT USED	ONE SET OF GASKETS CONSISTS OF THE FOLLOWING
H75 HJ75 and HL75 Lip Seal Pumps	010" - 015"	2-.002" Plastic 3-.006" Paper

8. *BOLT THE VALVE TO THE CASING.* Place the valve gasket and valve or coverplate on the pump and fasten securely with the four capscrews.

CAUTION: BE SURE THE ADJUSTING SCREW OF THE RELIEF VALVE POINTS TOWARD THE SUCTION PORT.

9. *ASSEMBLE THE PUMP ON THE MOTOR.* Install the full length key in the keyway of the motor shaft.

   NOTE: Key must be *full* length to avoid misalignment of the pump rotor which could cause serious damage to the pump. Slide the pump on the motor shaft and fasten securely with the four capscrews.

To Reassemble Model G475 or GG475 Mechanical Seal Pumps: (see Figure 9)

1. *INSTALL THE ROTOR IN THE CASING.*
2. *INSTALL THE IDLER.* Put the idler with bushing on the idler pin.
3. *PLACE THE HEAD GASKETS ON THE HEAD.* The proper amount of gaskets should be used to provide the necessary end clearance within the pump so it turns freely with no appreciable end play. Gasket Table 3 gives the normal amount of gaskets used.

GASKET TABLE 3

PUMP MODELS	NORMAL AMOUNT USED	ONE SET OF GASKETS CONSISTS OF THE FOLLOWING
G475 and GG475 Mech Seal Pumps	010" - 015"	2-.005" Plastic 3-.002" Plastic

4. *THE HEAD CAN NOW BE ASSEMBLED ON THE PUMP.* Tilt the top of the head away from the pump slightly until the crescent enters the inside diameter of the rotor and rotate the idler until its teeth mesh with the rotor teeth. Do not damage the head gaskets. Note correct position of idler and crescent (see Figure 9 and Disassembly Step 2). Tighten the head capscrews and then check the end clearance.

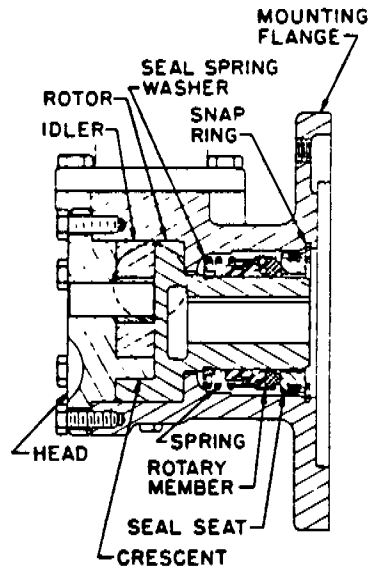

FIGURE 9
SECTIONAL DRG. OF MODELS G475 AND GG475 MECH. SEAL PUMPS

5. *CHECK PUMP END CLEARANCE.* Measure the clearance between the back of the rotor and the machined surface in the bottom of the casing by inserting a feeler gauge through the port opening. This is the end clearance. Normal amount is 0.003" to 0.005". Add or remove gaskets until this figure is reached.

6. *INSTALL THE MECHANICAL SEAL.* Slide the seal spring washer over the rotor hub as far as it will go. Flush the rotor hub and seal housing bore with light oil (not grease) and assemble spring, rotary member and seat of the mechanical seal in position (see Figure 9).

CAUTION: NEVER TOUCH THE SEALING FACES OF THE MECHANICAL SEAL WITH ANYTHING EXCEPT FINGERS OR A CLEAN CLOTH.

7. *INSTALL THE SNAP RING.* Install the snap ring in the groove in the casing. This will hold the seal at its proper working length.
8. *BOLT THE VALVE TO THE CASING.* Place the valve gasket and valve or coverplate on the pump and fasten securely with the four capscrews.

CAUTION: BE SURE THE ADJUSTING SCREW OF THE RELIEF VALVE POINTS TOWARD THE SUCTION PORT.

9. *ASSEMBLE THE PUMP ON THE MOTOR* Install the full length key in the keyway of the motor shaft
   NOTE: Key must be *full* length to avoid misalignment of the pump which could cause serious damage to the pump Slide the pump on the motor shaft and fasten securely with the four capscrews.

To Reassemble Model H475, HJ475 or HL475 Mechanical Seal Pumps: (see Figure 10)

1. *INSTALL THE SEAL SEAT.* Lubricate the outside diameter of the seal seat and the inside of the seal housing bore with light oil (not grease). Start the seal seat in the casing and press into place.

CAUTION: NEVER TOUCH THE SEALING FACES OF THE MECHANICAL SEAL WITH ANYTHING EXCEPT THE FINGERS OR A CLEAN CLOTH.

2. *INSTALL THE ROTARY MEMBER OF SEAL* Flush the rotor hub and the inside of the rotary member with light oil. Slide the spring and rotary member over the rotor hub only far enough to hold the spring in position. Do not compress the spring at this time.
3. *INSTALL THE ROTOR IN THE CASING.*
4. *INSTALL THE IDLER.* Put the idler with bushing on the idler pin.
5. *PLACE THE HEAD GASKETS ON THE HEAD.* The proper amount of gaskets should be used to provide the necessary end clearance within the pump so it turns freely with no appreciable end play. Gasket Table 4 gives the normal amount of gaskets used.

GASKET TABLE 4

PUMP MODELS	NORMAL AMOUNT USED	ONE SET OF GASKETS CONSISTS OF THE FOLLOWING
H475, HJ475 and HL475 Mechanical Seal Pumps	.010" - .015"	2—.002" Plastic 2—.006" Paper

6. *THE HEAD CAN NOW BE ASSEMBLED ON THE PUMP.* Tilt the top of the head away from the pump slightly until the crescent enters the inside diameter of the rotor and rotate the idler until its teeth mesh with the rotor teeth. Do not damage the head gaskets. Note correct position of idler and crescent. (See Figure 10 and Disassembly Step 2). Tighten the head capscrews and then check the end clearance.

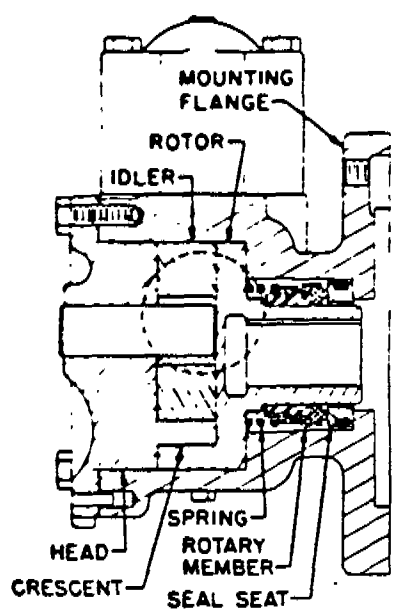

FIGURE 10
SECTION DRG. OF MODELS H475, HJ475 AND HL475 MECH. SEAL PUMPS

7. *CHECK PUMP END CLEARANCE.* Measure the clearance between the back of the rotor and the machined surface in the bottom of the casing by inserting a feeler gauge through the port opening. This is the end clearance; normal amount is 0.003" and 0.005". Add or remove gaskets until this figure is reached.
8. *BOLT THE VALVE TO THE CASING.* Place the valve gasket and valve or coverplate on the pump and fasten securely with the four capscrews.

CAUTION: BE SURE THE ADJUSTING SCREW OF THE RELIEF VALVE POINTS TOWARD THE SUCTION PORT.

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9. *ASSEMBLE THE PUMP ON THE MOTOR.* Install the full length key in the keyway of the motor shaft.
   NOTE: Key must be *full* length to avoid misalignment of the pump rotor which could cause serious damage to the pump. Slide the pump on the motor shaft and fasten securely with the four capscrews.

SAFETY RELIEF VALVE INSTRUCTIONS

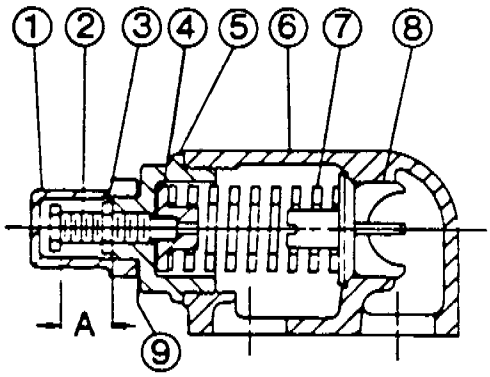

FIGURE 11
VALVE—G, GG, H, HJ AND HL SIZE

LIST OF PARTS

1 Valve Cap	6 Valve Body
2 Adjusting Screw	7 Valve Spring
3 Lock Nut	8 Poppet
4 Spring Guide	9 Cap Gasket
5 Bonnet	

Disassembly

NOTE: Mark valve and head to be sure they are reassembled in the same relative position.

1. Remove valve cap.
2. Measure and record the length of extension of the adjusting screw. See "A" on figure 11.
3. Loosen the lock nut and back out adjusting screw until spring pressure is released.
4. Remove bonnet, spring guide, spring and poppet from valve body. Clean and inspect all parts for wear or damage and replace as necessary.

Assembly

Follow the procedure outlined under disassembly.

If valve is removed for repairs, be sure to replace in same position. The valve cap should point towards the suction port.

PRESSURE ADJUSTMENT

If the pressure setting of the safety relief valve is to be changed from that which the factory has set, the following instructions should be carefully followed: Remove the valve cap which covers the adjusting screw, and loosen the lock nut which locks the adjusting screw so pressure setting will not change during operation of pump. A pressure gauge somewhere in the discharge line must be used for actual adjustment operation. The adjusting screw should be turned in for increasing the pressure or turned out for decreasing the pressure. With the discharge line closed at a point beyond the pressure gauge, the gauge will show the maximum pressure the valve will allow while pump is in operation.

IMPORTANT

In ordering parts for safety relief valve, always be sure to give Model and Serial Number of pump as it appears on name plate and the name of the part wanted. When ordering springs, be sure also to give the pressure setting desired.

VIKING PUMP IMCX

WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, F.O.B. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources which are incorporated into any Viking product are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter this warranty.

DO A 134889
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Installation and Specification Data Model 30P

Specifications

Maximum Allowable Operating Pressure (MAOP): 3,000 psi (207 bar)

Design Safety Factor: 3 to 1

Rated Fatigue Pressure: 2,000 psi (138 bar) per NFPA/T3.10.5.1-Category 2/90

Warning: Maximum absolute system pressure must not exceed filter's rated fatigue pressure (RFP) of 2,000 psi if the system frequently cycles between 0 and RFP. Also, limitations on fittings may restrict operating pressure to less than rated static pressure (RSP) of 3,000 psi. Refer to SAE J1065, Table 2 for fitting recommendations. Please consult Parker Hydraulic Filter Division if you have questions about your application.

Operating Temperatures: 225°F to –40°F (107°C to –40°C)

Element Collapse Rating: 150 psi (10 bar). 03B, 10B—350 psi (24 bar)

High Collapse: 03BH, 10BH—2,000 psi (138 bar). 03BX, 10BX—3,000 psi (209 bar)

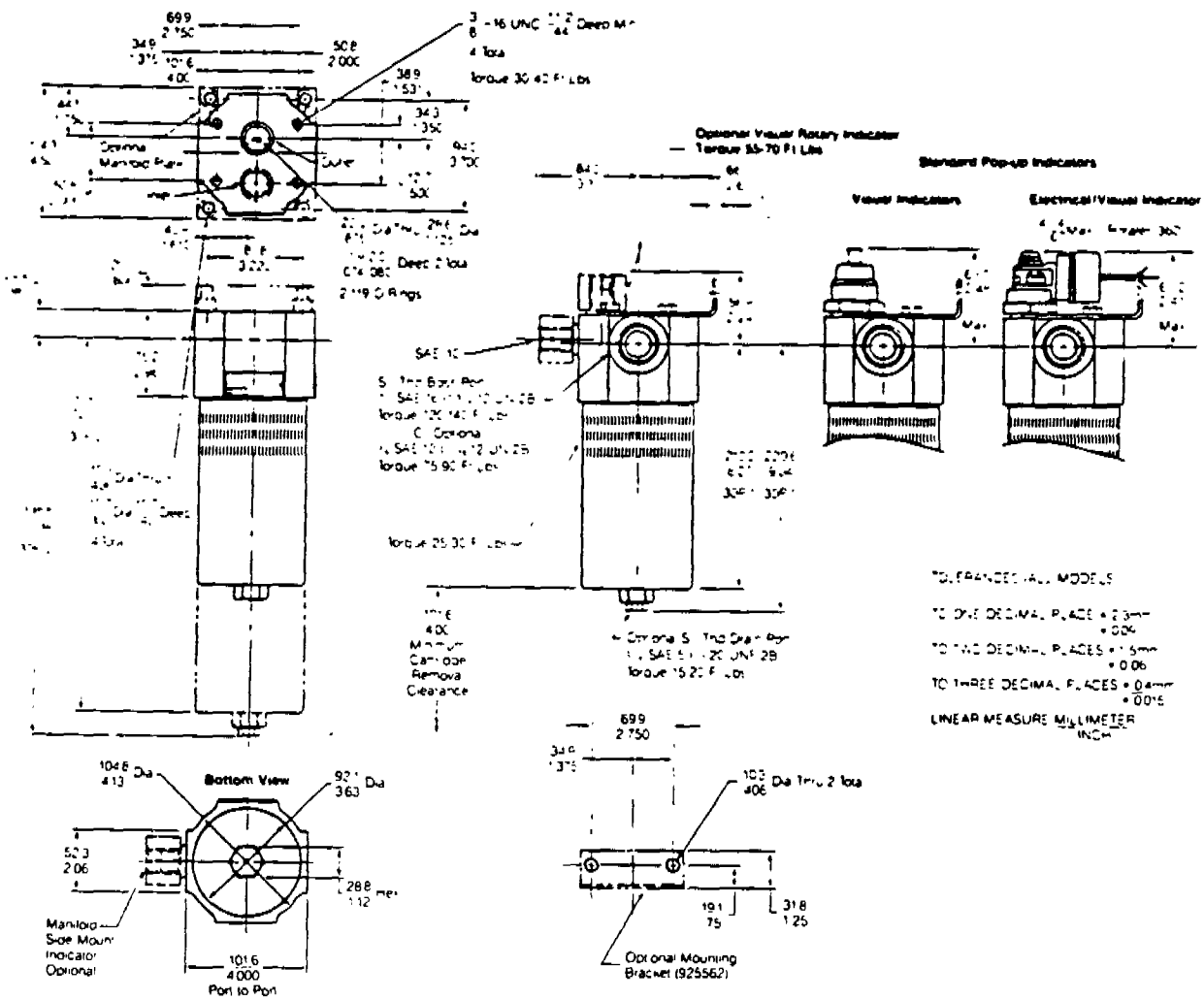
Visual Indicator (optional) Differential pressure type

Electrical Indicator (optional): Electrical Switch rated 5A at 115/230 VAC, 5A resistive and 3A inductive at 28VDC.
Color Coding: White (N.C.), Red (N.O.), Black (common)

Filter Housing: Anodized 6061-T6 Aluminum.

Weights (approximate):

30P-1	6.4 lb. (2.9 kg)
30P-2	8.7 lb. (3.9 kg)
30PD-1	36 lb. (16.3 kg)
30PD-2	40 lb. (18.1 kg)



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

Filter Service

When servicing a filter, use the following procedure:

A. Stop the system's power unit.
B. Relieve pressure in filter line.
C. Rotate bowl counter-clockwise and remove.
D. Remove element from housing Discard all disposable elements These elements are not cleanable.
E. Place new, clean element in housing, centering it in the head
F. Inspect the o-ring seal and replace if necessary.
G. Replace bowl. Rotate clockwise and tighten to specified torque (see pgs 9 and 10).

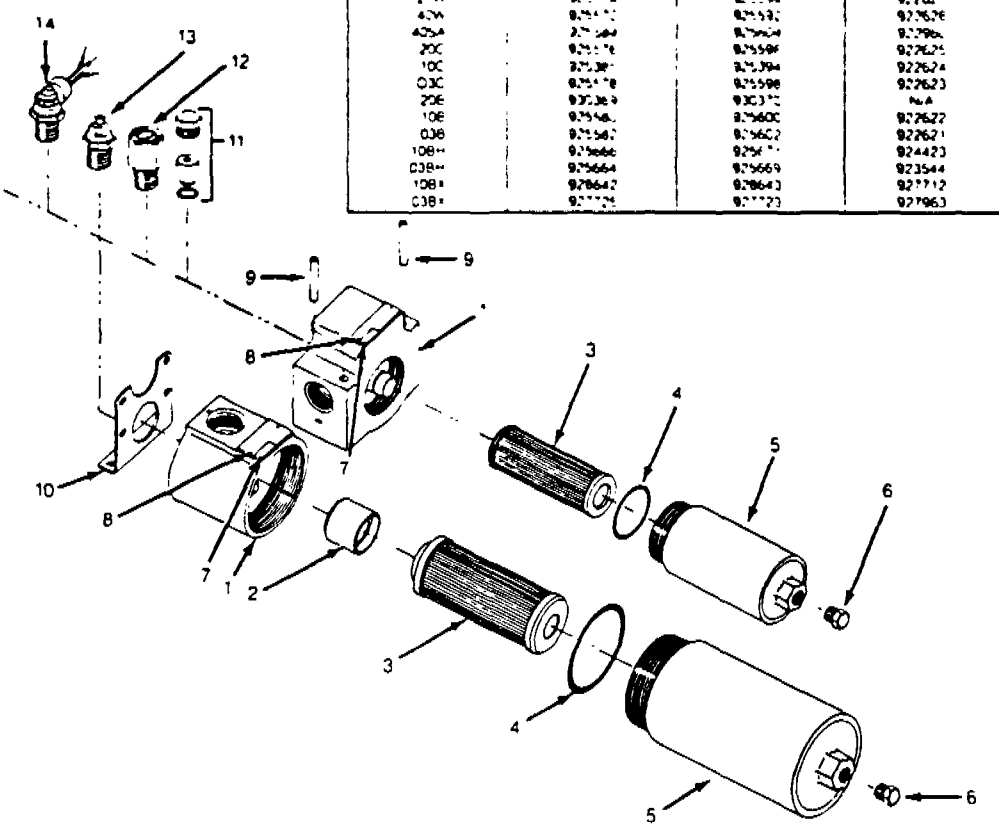
Parts List

INDEX	DESCRIPTION	PART NUMBER 15P	PART NUMBER 30P	QUANTITY
1	**HEAD**			1
	INLINE Porting			
	Bypass indicator port	931136	926518*	
	No Bypass indicator port	926083	926518*	
	MANIFOLD Porting			
	Bypass indicator port	931135	926521*	
	No bypass indicator port	926088	926521*	
2	**BYPASS VALVE ASSEMBLY**			1
	50 psid	N/A	925127	
	No bypass	N/A	925209	
3	**ELEMENTS**			1
	(See Chart Below)			
4	**BOWL O-RING**			1
	Buna N (Nitrile)	N92138	N92151	
	Viton	V92138	V92151	
5	**BOWL**			1
	Standard Single	926102	926038	
	Standard Double	926103	926039	
	W/Drain Single	925953	926040	
	W/Drain Double	925954	926041	
6	**DRAIN PLUG**			Optional
	W/Buna N (Nitrile) o-ring	920462	920462	
	W/Viton o-ring	922521	922521	
7	**NAMEPLATE**	920928	920928	1
8	**DRIVE SCREWS**	903393	903393	2
9	**TUBE, Spacer**	923448	N/A	Optional
10	**MOUNTING BRACKET KIT**	N/A	925563	Optional
11	**BLANK KIT** (Indicator)	925515	925515	Optional
	INDICATOR KIT (Includes o-ring)			Optional
12	Visual Differential Gage	927476	927476	
13	Visual Pop-up	929561	929561	
13	Visual Pop-up w/Electrical Contact	929564	929564	
14	Electrical Visual w/14 MPT Connector and 12" Leads	929587	929587	
14	Electrical Visual w/Terminals	929590	929590	
	MANIFOLD MOUNTING KIT	N/A	925562	Optional

*Does not include indicator assembly.

Replacement Element Part Numbers

Micron	Filter Type 15P-1	15-P2	30P-1	30P-2
25A	925[illegible]	925[illegible]	927627	925832
40A	925[illegible]	925[illegible]	927628	925831
40SA	925[illegible]	925[illegible]	927[illegible]	925833
25C	925[illegible]	925595	927625	925834
10C	925[illegible]	925594	927624	925835
03C	925[illegible]	925598	927623	925836
25E	930[illegible]	930[illegible]	N/A	N/A
10E	925[illegible]	925600	927622	925837
03E	925[illegible]	925602	927621	925838
10E*	925[illegible]	925[illegible]	924423	925839
03E*	925664	925669	923544	925840
10E+	928642	928643	927712	927965
03E+	927[illegible]	927[illegible]	927963	927964



Model Code for 15P, 30P AND 30PD FILTERS

How to Order
Select the desired symbol (in the correct position) to construct a model code.

BOX 1	BOX 2	BOX 3	BOX 4	BOX 5	BOX 6	BOX 7	BOX 8	BOX 9
F3	30P	1	10C	MS	50	NN	19	

BOX 1: SEALS

SYMBOL	DESCRIPTION
None	Buna N (Nitrile)
†F3	Viton (Optional)

BOX 2: BASIC ASSEMBLY

SYMBOL	DESCRIPTION
15P	Pressure Filter (¾" nom.)
30P	Pressure Filter (1" nom.)
30PD	Duplex Style 30P

BOX 3: LENGTH

SYMBOL	DESCRIPTION
1	Single
2	Double

BOX 4: ELEMENT MEDIA

SYMBOL	DESCRIPTION[1]
40W	Wire mesh
25W	Wire mesh
40SA	Synthetic fiber
20C	Cellulose
10C	Cellulose
03C	Cellulose
10B[2]	Microglass
03B[2]	Microglass

[1]See "Element Performance" data in catalog for filtration ratings
[2]For high collapse rated (2000 psid) elements add "H" behind 10B or 03B. For 3000 psid collapse rated elements add "X" behind 10B or 03B.

BOX 5: INDICATOR

SYMBOL	DESCRIPTION
N	No indicator, no pressure port
P	Port plugged, top mounted
PS	Port plugged, side mounted
M	Pop-up, top mounted.
MS	Pop-up, side mounted.
M1	Pop-up with thermal lockout, top mounted
MS1	Pop-up with thermal lockout, side mounted
R	Rotary dial top mounted
RS	Rotary dial, side mounted
E	Electrical indicator top mount with ½-14 NPT connection and 12" leads
ES	Same as "E" except side mounted

BOX 6: BYPASS OR INDICATOR SETTING

SYMBOL	DESCRIPTION[3]
50	50 psid [3]If "no bypass" option (–11) and an indicator is selected "50" denotes indicator calibration

NOTE Military, automotive and DIN connectors are also available. Please contact the filter division.

†Option affects price of filter

BOX 7: PORTS

FILTER MODEL	SYMBOL	DESCRIPTION
15P	MM	SAE-12 (Standard)
15P	XX	¾"—manifold porting
30P	NN	SAE-16 (Standard)
30P	XX	1"—manifold porting[4]

[4]Customer supplies subplate adaptor, or purchases optional Parker subplate

BOX 8: OPTIONS

SYMBOL	DESCRIPTION
1	None
†11	No bypass
†19	SAE-5 drain port on bowl
†21	No bypass & drain port

BOX 9: DESIGN NUMBER
Applied to filter assembly by Parker Filter Division. Use the full filter model code including the design number when ordering replacement parts, elements and cartridges.

Accessories Kits

Mounting Spacers (15P) Two required	925650
Mounting Bracket Kit (30P)	925563
Subplate Kit (30P)	925562

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

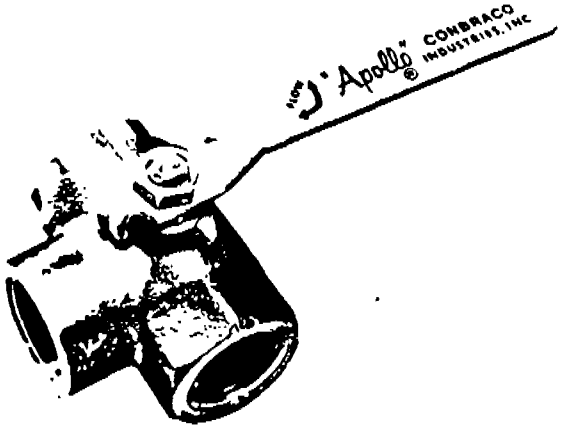
70-600 Series

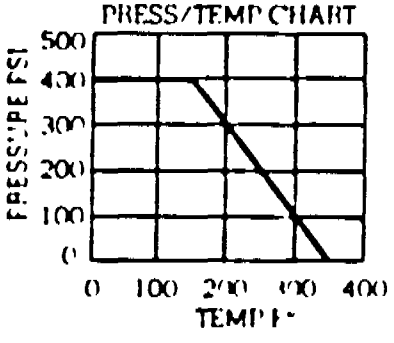
CM93036-2 #8

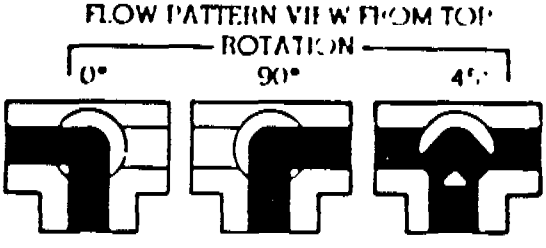
The Bronze 3-Way Diversion Apollo®

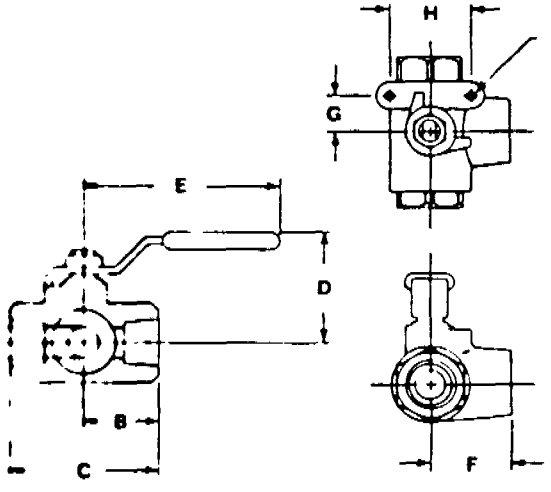
FEATURES

- Reinforced TFE seats and seals
- Chromium plated balls
- Large ports
- 400 WOG rated
- 90° operation
- 100% tested air under water









NOTE: OPEN PORT PRESSURE MUST EXCEED CLOSED PORT PRESSURE

BRONZE 3-WAY

NUMBER	SIZE	A	B	C	D	E	F	G	H	I	Cv*
70-603	½	.50	1.09	2.25	1.75	3.87	1.18	.87	1.37	10-24	6
70-604	¾	.68	1.50	3.00	2.25	4.87	1.62	.87	1.37	10-24	12
70-605	1	.81	1.59	3.18	2.25	4.87	1.71	.87	1.37	10-24	14
70-606	1¼	1.00	1.97	3.95	2.69	5.50	2.01	.93	1.50	¼-20	22
70-607	1½	1.25	2.21	4.40	2.87	5.50	2.38	—	—	—	30
70-608	2	1.50	2.34	4.69	3.00	5.50	2.50	—	—	—	50

*The Cv factor is the gallons of water per minute that the valve will pass with 1 PSI pressure drop.

DO A 134893
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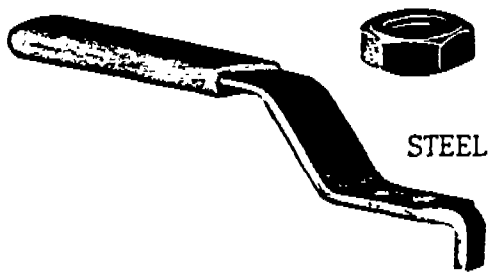
Standard Apollo® Ball Valve Components Breakdown

COOL VINYL GRIP FOR HIGH TEMPERATURE INSTALLATIONS



STEEL OR 18-8 STAINLESS STEEL HANDLE WITH HOLE FOR TAGGING

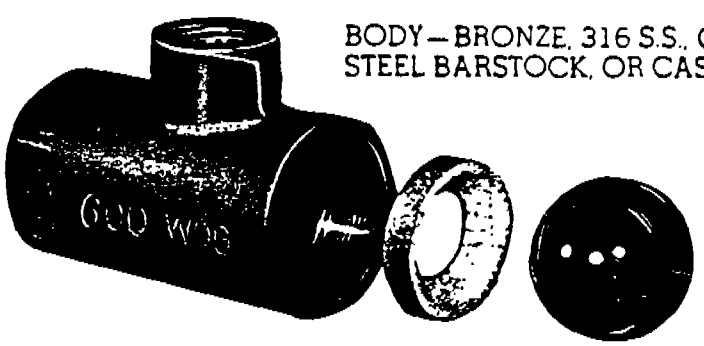
STEM GLAND SCREW—ADJUSTABLE FOR WEAR

REINFORCED TFE STUFFING BOX RING

STEM—BLOW OUT PROOF DESIGN

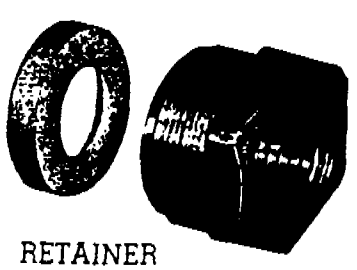
REINFORCED TFE THRUST-SEAL WASHER

BODY—BRONZE, 316 S.S., CARBON STEEL BARSTOCK, OR CAST CARBON STEEL



BALL—CHROME PLATED BRONZE OR STEEL AND STAINLESS STEEL

REINFORCED TFE SEATS ARE STANDARD



RETAINER

 CM93036-2 #9

Valves

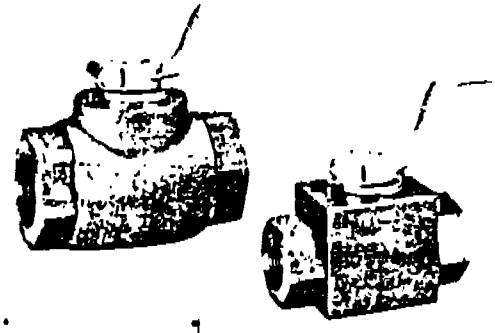
LHA

Ball Valves — High Pressure

HBV Series

Specifications

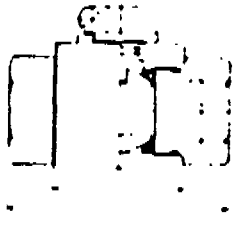
- Steel body
- Steel, hard chromium plated ball
- Ball seals — Delrin
- 'O'-Rings — Viton
- Aluminum handles on larger sizes

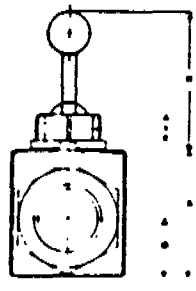


Options

- Sizes from ¼"-2" NPT
- SAE
- Steel handles on 04, 06 and 08 sizes

Dimensions





Part No.	Ports NPT	Ports SAE	Working Pressure (psi)	L in	L mm	I in	I mm	B in	B mm	H in	H mm	h in	h mm	m in	m mm	V in	V mm	SW in	SW mm	K in	K mm	Wt. lb
HBV-04	¼"	7/16-20	9000	2.7	69	1.4	36	1.0	26	1.7	43		32	0.5	12.5	0.4	11	0.4	9	4.6	118	0.7
HBV-06	⅜"	9/16-18	7250	3.1	79	1.7	43	1.3	32	1.7	43	1.5	38	0.7	17.5	0.4	11	0.4	9	4.6	118	1.1
HBV-08	½"	¾-16	5800	4.1	104	1.9	48	1.4	35	1.7	43	1.6	40	0.75	19	0.4	11	0.4	9	4.6	118	1.7
HBV-12	¾"	1 1/16-12	4500	4.3	109	2.4	62	1.9	49	2.3	58	2.2	57	1.0	24.5	0.6	14	0.6	14	7.2	182	1.7
HBV-16	1"	1 5/16-12	4500	4.6	117	2.6	66	2.3	58	2.3	58	2.6	65	1.2	29.5	0.6	14	0.6	14	7.2	182	5.1
HBV-20	1¼"	1⅝-12	4500	4.3	110	3.2	80	3.0	76	2.3	59	3.3	84	1.5	38	0.6	15	0.7	17	8.5	218	7.0
HBV-24	1½"	1⅞-12	4500	5.1	130	3.3	85	3.6	92	2.3	59	3.9	99	1.8	46	0.6	15	0.7	17	8.5	218	9.5
HBV-32	2"	—	4500	5.5	140	3.9	100	4.2	106	2.3	59	4.4	111	2.1	53	0.6	15	0.7	17	8.5	218	22.0

Ordering Information

HBV — 04 N

Product Type	
HBV	Ball Valve — High Pressure

Thread Type	
N	NPT
S	SAE

Thread Size	
04	¼"
06	⅜"
08	½"
12	¾"
16	1"
20	1¼"
24	1½"
32	2"

Replacement Parts

Handles	Seal Kit	Valve Size
HBVH-040608	HBV-SK04	04
HBVH-040608	HBV-SK06	06
HBVH-040608	HBV-SK08	08
HBVH-1216	HBV-SK12	12
HBVH-1216	HBV-SK16	16
HBVH-202432	HBV-SK20	20
HBVH-202432	HBV-SK24	24
HBVH-202432	HBV-SK32	32

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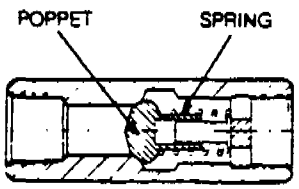
Colorflow® Service Parts

CM93036-2 #1(

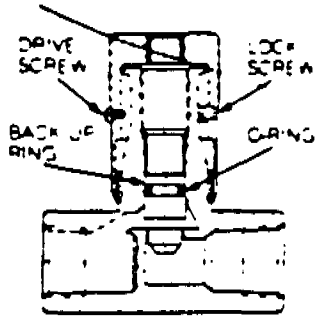
SERIES C



Check Valves

BODY SIZE	POPPET (SOFT SEAL)			SPRINGS	
	METAL	BUNA	VITON	5 PSI	65 PSI
C 200	013155-3	013320-N7	013320-V7	013151	013215
C 400 C 620	001490-3	001839-N7	001839-V7	001516	001585
C 600 C 820	004374-3	004917-N7	004917-V7	004394	004496
C 800 C 1020	007300-3	007596-N7	007596-V7	007310	007379
C 1200 C 1220	010353-3	N/A	N/A	010371	010453
C 1420	0103533	N/A	N/A	010371	010453
C 1600	025299-3	N/A	N/A	025314	N/A
C 1620	025299-3	N/A	N/A	025314	N/A
C 2000	022195-3	N/A	N/A	022192	N/A
C 2020	022195-3	N/A	N/A	022192	N/A
C 2400	026143-3	N/A	N/A	026139	N/A
C 2420	026143-3	N/A	N/A	026139	N/A
C 3200	030166-3	N/A	N/A	030158	N/A
C 3220	030166-3	N/A	N/A	030158	N/A

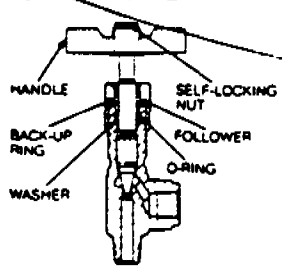
SERIES N



Needle Valves

BODY SIZE	O-RING		BACK UP RING	DRIVE SCREW	LOCK SCREW
	BUNA	VITON			
N 200	2010N-7	2010V-7	NONE	013300	001832
N 400 N 620	2008N-7	2008V-7	107X6	001830	001832
N 600 N 820	2008N-7	2008V-7	107X8	004677	004691
N 800 N 1020	2010N-7	2010V-7	107X10	007523	007524
N 1200 N 1220	2011N-7	2011V-7	107X11	010673	010678
N 1420	2012N-7	2012V-7	107X12	010673	010678
N 1600 N 1620	2112N-7	2112V-7	107X112	025543	025544
N 2000	2112N-7	2112V-7	107X112	025543	025544
N 2020	2113N-7	2113V-7	107X113	025543	025544

SERIES MV



Metering Valves

BODY SIZE	O-RING		BACK-UP RING	FOLLOWER	WASHER	HANDLE	SELF-LOCKIN NUT
	BUNA	VITON					
2**	2010N-7	2010V-7	400004-1	014012-2	014013-2	014083-6	45400
4** 620	2011N-7	2011V-7	400004-2	002028-2	002023-2	002118-6	45400
6** 820	2012N-7	2012V-7	400004-3	005017-2	005012-2	005065-6	45700
8** 1020	2111N-7	2111V-7	400004-4	008013-2	008014-2	008079-6	45900
12** 1220	2112N-7	2112V-7	400004-5	011013-2	011014-2	011066-6	45900

Parker Fluidpower

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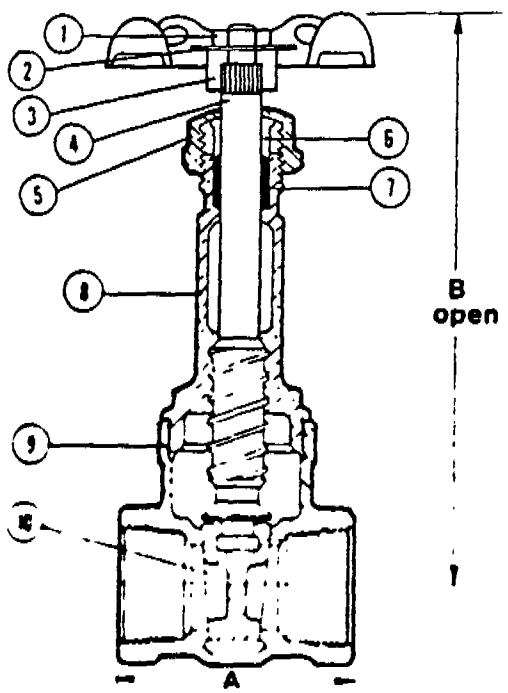
CM93036-2 #11

Figure No. 3010 125# Bronze Gate Valve ¼"-3"
Figure No. 3010 SJ 125# Bronze Gate Valve ½"-3"

125 PSI Saturated Steam, 200 PSI Non-Shock Cold Water, Oil, or Gas
Rising Stem



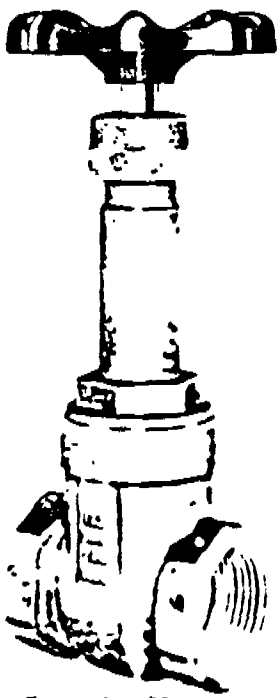


Figure No. 3010
Threaded

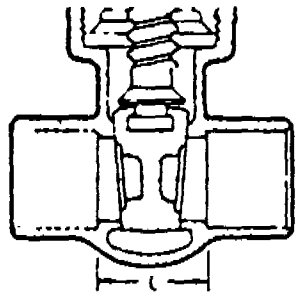


Figure No. 3010SJ
Copper to Copper

Conforms to Federal Specification WW-V-54 Class A, Type II & MSS-SP-80

Screwed Bonnet • Rising Stem
Solid Wedge Disc

Material List

Part	Specification
1. Handwheel Nut	Zinc Plated Steel with Clear Chromate
2. Identification Plate	Aluminum
3. Handwheel	Aluminum ASTM B-85 Alloy A03800
4. Stem	Silicon Bronze ASTM B-371 Alloy C69400 or B-99 Alloy C65100 H04
5. Packing Nut	Bronze ASTM B-62 or ASTM B-584 Alloy C84400
6. Packing Gland	Bronze ASTM B-62 or ASTM B-584 Alloy C84400 or ASTM B-282 or B-16
7. Packing	Non-Asbestos/Graphite/ Aramid Fiber
8. Bonnet	Bronze ASTM B-62
9. Body	Bronze ASTM B-62
10. Wedge	Bronze ASTM B-62

Dimensions — Weights

Nominal Size	Dimensions			Approx. Net Wt. Fig. 3010	Approx. Net Wt. Fig. 3010SJ
	A	B	C		
¼†	1 11/16	4 5/8	—	.6	—
⅜†	1 11/16	4 5/8	11/16	.6	.6
½†	1 15/16	4 7/8	3/4	.7	.6
¾	2 1/16	5 13/16	7/8	1.0	.9
1	2 7/16	7 3/32	1	1.7	1.5
1¼	2 5/8	8 1/8	1 3/16	2.4	2.1
1½	2 7/8	9 13/16	1 1/4	3.3	3.1
2	3 1/16	11 9/16	1 5/16	5.0	4.7
2½	4 1/8	14 5/16	1 13/16	10.5	9.4
3	4 1/2	16 1/2	1 15/16	15.0	13.3

† No packing gland, packing only in these sizes.

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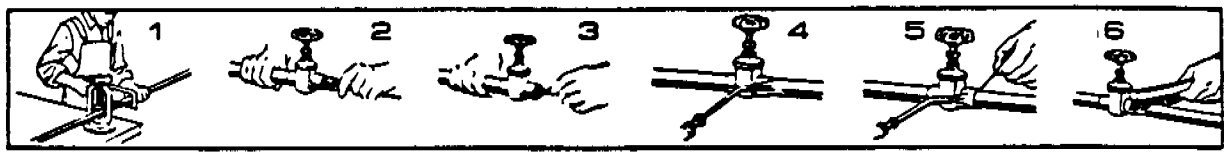
valve installation tips



SOLDERING AND SILVER BRAZING

Analyze the application to determine which valve is best suited for installation keeping in mind the service for which the valve is recommended. Before installing the correct valve review the manufacturer's instructions to prevent damage to the valve and assure its maximum efficiency.

1. Cut tube end square. Ream burr and size.
2. Use sand cloth or steel wire brush to clean both tube and cup to bright metal. Steel wool is not recommended.
3. Apply flux to outside of tube and inside of solder cup. Surfaces to be joined must be completely covered. Use flux sparingly.
4. Be sure that valve is fully open. Apply heat to tube first. Transfer as much heat as possible through tube into valve. Avoid prolonged heating of valve itself.

4a. Silver Brazing Method
Assemble parts to be brazed. If fluxed parts are allowed to stand, the water in the flux will evaporate and dried flux is liable to flake off exposing metal surfaces to oxidation. Assemble joint by inserting tube into socket hard against the stop. The assembly should be firmly supported so that it will remain in alignment during the brazing operation.

NOTE: On one inch and larger valves it is difficult to bring the whole joint up to temperature at one time. It will frequently be found desirable to use a double tip torch to maintain the proper temperature over the larger area. A mild pre-heating of the whole socket area is recommended. Apply heat to parts to be joined. The preferred method is by oxy-acetylene flame. Heat tube first, beginning one inch from edge of valve. Sweep flame around tube in short strokes up and down at right angles to run of tube. To avoid burning through tube the flame should be in continuous motion and not allowed to remain on any one point.

Apply flame to valve at base of socket. Heat uniformly sweeping flame from valve to tube until flux on valve becomes quiet. Avoid excessive heating of valve.

When flux appears liquid and transparent on both tube and valve start sweeping flame back and forth along axis of joint to maintain heat on parts to be joined, especially toward base of valve socket.

5. Use just enough solder: with wire solder, use ¼" for a ½" valve, etc. If too much solder is used, it may flow past tube stop and clog sealing area. When joint is filled, a continuous run of solder or brazing alloy will be visible.

5a. Silver Brazing Method:
Apply brazing wire or rod at point where tube enters valve socket. Keep flame away from rod or wire as it is fed into the joint. Move flame back and forth as alloy is drawn into joint. When the proper temperature is reached, alloy will flow readily into space between tube outer wall and valve socket. When joint is filled, a continuous run of brazing alloy will be visible.

6. Remove excess solder with small brush while plastic, leaving a fillet around end of valve as it cools.

SILVER BRAZING

The strength of a brazed joint does not vary appreciably with the different brazing materials but depends to a large extent upon the maintenance of proper clearance between the outside of the tube and the valve socket. The interior dimensions of silver brazing valve sockets are machined to the closest tolerances and finished smooth to promote full capillary attraction.

NOTE: Care should be observed in cleaning and in removing residues of the cleaning medium. Attempting to braze a contaminated or improperly cleaned surface will result in an unsatisfactory joint. Silver brazing alloys will not flow over or bond to oxides. Oily or greasy surfaces repel fluxes, leaving bare spots which oxidize and result in voids and inclusions.

THREADING

Dirt, dust or any foreign matter accumulated in the pipe can hinder efficient valve operation and seriously damage vital valve parts. Thoroughly clean pipe thoroughly with air or steam.

When threading pipe, gauge pipe threads for size and length to avoid jamming pipe against seat and disc. Thoroughly clean threaded end to remove any harmful steel or iron deposits. For a good joint, use teflon tape or pipe dope. If pipe dope is used, apply sparingly on pipe threads, never on valve threads. Do not allow any pipe dope into valve body in order to avoid damage to disc and seat.

Before installation, check line of flow through valve so that valve will function properly. Close valve completely before installation. Apply wrench to hex next to pipe and guard against possible distortion. After installation of valve, support line; a sagging pipe line can distort the valve and cause failure.

FLANGED

There are several steps to follow to make sure that a flanged joint will be properly assembled. First clean the joint carefully. Then loosely assemble the joint by putting in the bottom two or three bolts. Then carefully insert the gasket into place. The bottom bolts will help locate the gasket and hold it in position. Then insert the rest of the bolts into place and tighten all of the bolts evenly – not in rotation, but by the cross over method to load the bolts evenly and eliminate concentrated stresses. The bolts should be checked for tightness after an appropriate interval of use and retightened if necessary.

New
Just released!

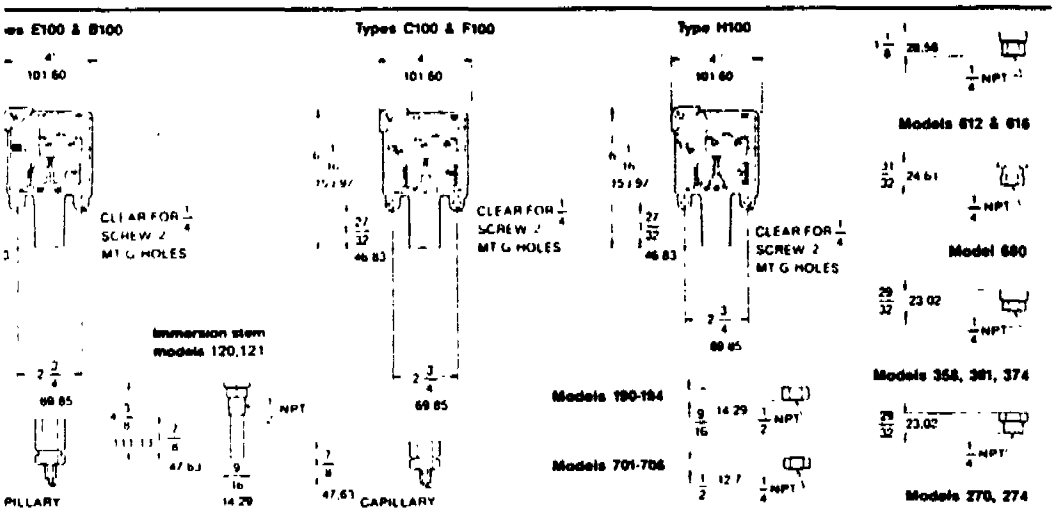
Switches for NEMA 4, CM93036-2 General Purpose Service #13

- Introducing a family of low-cost pressure and temperature switches for the process plant or OEM
- Wide selection of adjustable ranges within 3-5000 psi and -180 to 1000°F
- SPDT switch output; optional hermetic seal switch and terminal block for Div. II service.
- Internal reference scales and adjustment lock
- Enclosure design permits safe and easy access for wiring
- Many models available from stock

Specifications

Approvals:	UL listed (except model 706). CSA certified (except model 706). Optional Class I Div 2 Groups A,B,C,D; Class II Group G (consult UE)
Storage Temperature	-65 to + 160 F
Ambient Temperature limits	-40 to + 160 F, except models 701-706, 0 to 160 F. Set point typically shifts less than 1% of range for a 50 F (28 C) ambient temperature change
Shock	Set point repeats after 15 G, 10 millisecond duration
Vibration	Set point repeats after 2.5 G, 5-500 CPS
Enclosure Classification	NEMA 4, 4X when used with option M335
Set point Repeatability	Temperature Models: ± 1% of adjustable range. Pressure Models: 701-706, 270-376: ± 1% of adjustable range. 190-194, 612-680: ± 1% of adjustable range
Switch output	[illegible] may be wired "normally open" or "normally closed"
[illegible]	[illegible] 250/480 VAC resistive
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Temperature Repeatability	Typically [illegible] of range under laboratory conditions [illegible] ambient circulating bath at rate of [illegible] per minute change
[illegible]	[illegible] amp Hermetic Seal switch and terminal block for Div II service. Consult UE
Heat Tracing Freeze Protection	Switches designed specifically for heat tracing and freeze protection applications. Available with types B100 and E100. Specifications are the same as above except B100-13546 includes 22 amp switch with a stainless steel stem. E100-13545 includes 22 amp switch and 10 feet of stainless steel capillary

C100
B100



Maintenance Instructions

emperature C ntr ls

00, E100, F100

IM-T100-.

ie case and wire directly to the switch ter- ocal and national electrical codes. Bring the from the rear of the case allowing enough ct switch movement when making setting ad- s are supplied, color coding is as follows

SPDT	DPDT SWT 1	DPDT SWT 2
Violet	Violet	Yellow
Black	Black	Red
Blue	Blue	Orange

lamp (cast in symbol) is provided and meets p the wire as short as possible to prevent damage and when provided the adjustable

ustments

stments and recalibration connect control ture source and stabilize unit

has screw adjustment inside enclosure. If ffer from actual temperature, adjust set- ature setting turn the screw in (clockwise) g turn the screw out (counterclockwise) nts do not exceed the maximum tempera- .

ith reference scale

brated for maximum accuracy at the mid-

locked at any set point using a 3/32" Allen s located below the index pointer.

o desired set point. If the actual tempera- ature do not agree, turn adjustment screw ounterclockwise to lower set temperature

Procedures

actory authorized replacement parts and

onnect supply circuits before removing

DO A 134899
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'e is the highest temperature to occasionally operated without ıtion and repeatability

limits stated in literature must ies in the system. Occasional emperature is acceptable (e.g. tion should be restricted to the

ounting screws, switch and

ch terminal
PART II
e enclosure and recalibrate per

ɔL MBLY (T/A)

nits upside down (T/A on Top)

100

g a 7/8" wrench
ice

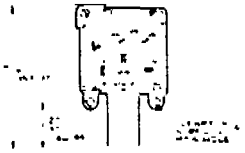
ɔL MBLY (T/A)

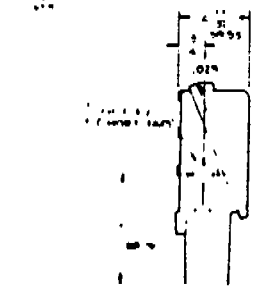
00

1 1/8" wrench
on new T/A bellows
ace

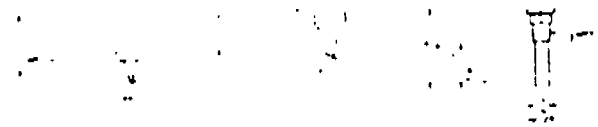
Types E100 & B100

Types C100 & F100



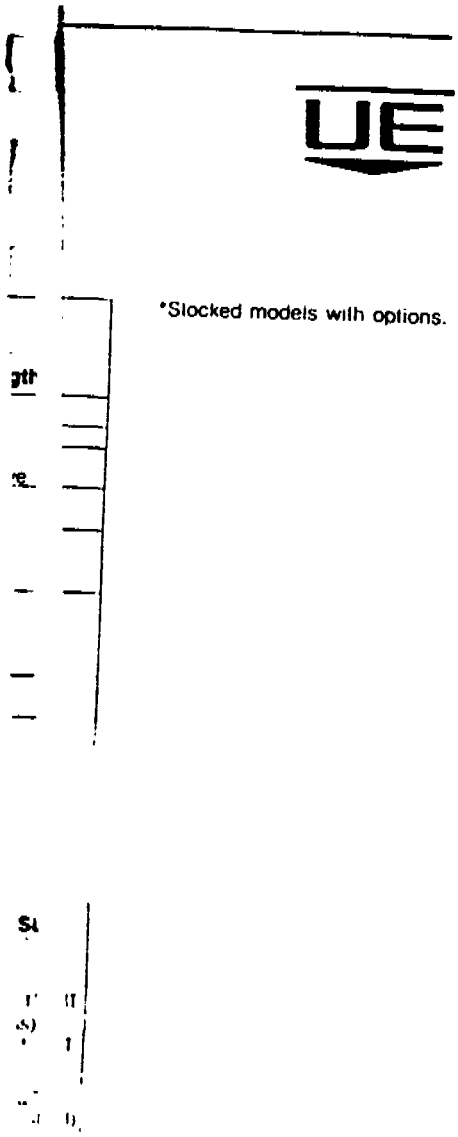


Immersion stem
Models 120 & 121



E100 & B100 C100 & F100

Dimensions



*Stocked models with options.

...mends careful consideration of the following factors when specifying and installing UE temperature ...tion and maintenance instructions provided must be read and understood

...and maximum temperature limits stated in literature and on nameplates must never be exceeded. Even ...nd up to proof pressure or maximum temperature is acceptable on a limited basis (i.e., start-up testing), ...cted to the designated adjustable range. Excessive cycling at proof pressure or maximum temperature

...s where damage to a primary unit could endanger life, limb or property. A hi or low limit switch is neces... ...us runaway condition could result

...so that incorrect, inadvertent or malicious settings at any range point cannot result in an unsafe system

...ambient temperature fluctuations will not damage unit or affect operation. Orient unit so that moisture ...trical conduit connection

...for shipment. Consult UE if modification is necessary

...signs of possible damage to unit, such as drift in set point. Check unit immediately

...testing is necessary for critical applications where damage to unit could endanger property or personnel

...should be tested before use

...and on nameplate must not be exceeded. Overload on a switch can cause damage, possibly on the first ...national electrical codes, using wire size recommended in installation sheet

...ent parts and procedures

...ture exceeding published limits

ED ELECTRIC CONTROLS COMPANY

...OL STREET · WATERTOWN · MASS 02172 · U.S.A. · 617/926-1000
TELEX: 092-2445

10M MAP 286

DO A 134900
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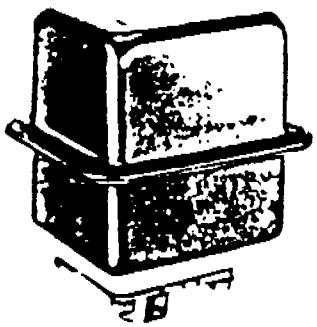
P-SERIES Pressure Switches

CM93036-2 #14

General Purpose Enclosure



Watertight Enclosure

How to Select [illegible] order

ASCO P-Series [illegible] consist of two components, the switch unit [illegible]

How to Select

1. Select the adjustable operating range based on desired actuation pressure.
2. Check that proof pressure is sufficient.
3. Read across and select the desired P-Series switch unit with the proper enclosure.
4. Continue across and select a matching transducer unit compatible with the fluid.

Order P-Series pressure switch

PA Switch Unit

Single-Stage Adjustable Deadband units allow independent adjustment of the set and reset points over the full operating range of the switch. The minimum difference between set and reset points is the deadband listed below; the maximum difference is the full range of the switch.

Open Frame

PB Switch Unit

Single-Stage Fixed Deadband units have an adjustable set point and a non-adjustable automatic reset point.

Open Frame

Specifications		Adjustable Deadband				Fixed Deadband			
Adjustable Operating Range (psig)	Proof Pressure (psig)	Adjustable Deadband Maximum Full Scale Minimum At Mid-Range (psig) ①	Open Frame Catalog No	General Purpose Catalog No	Watertight Enclosure Catalog No	Fixed Deadband At Mid-Range (psig) ①	Open Frame Catalog No.	General Purpose Catalog No.	Watertight Enclosure Catalog No.
Vacuum									
0-30" HG	50	4"Hg	PA36A	PA30A	PA31B	1"Hg	PB36A	PB30A	PB31B
Compound									
30" Hg-14 psig	50	6"Hg	PA26A	PA20A	PA21B	1"Hg	PB26A	PB20A	PB21B
Pressure									
0-4	60	—	—	—	—	0.05	PB46A	PB40A	PB41B
0-9	60	1.2	PA36A	PA30A	PA31B	0.4	PB36A	PB30A	PB31B
2-18	60	1.8	PA26A	PA20A	PA21B	0.4	PB26A	PB20A	PB21B
2-18	100	2.5	PA36A	PA30A	PA31B	0.6	PB36A	PB30A	PB31B
4-36	150	4.0	PA26A	PA20A	PA21B	0.7	PB26A	PB20A	PB21B
6-60	150	5.4	PA16A	PA10A	PA11B	0.9	PB16A	PB10A	PB11B
10-100	200	9	PA16A	PA10A	PA11B	1.5	PB16A	PB10A	PB11B
20-200	400	18	PA16A	PA10A	PA11B	3.0	PB16A	PB10A	PB11B
30-300	450	27	PA16A	PA10A	PA11B	5.0	PB16A	PB10A	PB11B
40-400	500	36	PA16A	PA10A	PA11B	6	PB16A	PB10A	PB11B
60-600	2000	54	PA26A	PA20A	PA21B	12	PB26A	PB20A	PB21B
100-1000	2000	90	PA16A	PA10A	PA11B	15	PB16A	PB10A	PB11B
160-1650	5000	250	PA26A	PA20A	PA21B	100	PB26A	PB20A	PB21B
270-2700	5000	300	PA16A	PA10A	PA11B	125	PB16A	PB10A	PB11B
600-6000	9000	650	PA16A	PA10A	PA11B	200	PB16A	PB10A	PB11B

All switch units [illegible] delivery.

① Values shown are nominal. ② Rated proof pressure on RF10A71 is 150 psig and on RG10A71 is 300 psig.

[illegible] — Simply order the switch and transducer unit by catalog number joined by a slash (/), e.g., PA36A/RD30A11.

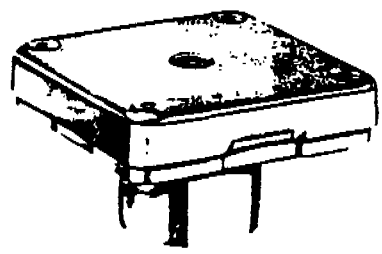
[illegible] — Simply order the switch and transducer unit separately by individual catalog number, e.g., one PA36A and one RD30A11.

Options — Add appropriate suffix for desired option (see pages 34-35).

Important Note: The third digit of each of the catalog numbers must be identical e.g., PA[3]6A and RD[3]0A11.

Select PA, PB or PC unit below

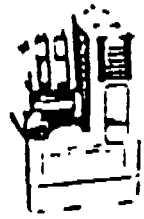
Select transducer unit below



Standard connection is 1/4" NPT
(optional 1/2" NPT add suffix "B" to catalog number)

PC Switch Unit

Two-Stage Fixed Deadband units consist of two separate snap-action switches, each with an independently adjustable set point and non-adjustable reset point. The difference between the set and reset points of each switch is the deadband listed below. The minimum difference between the set points of the two switches is the separation.



Open Frame

Transducer Unit

[illegible] gauge pressure type transducers provide for one [illegible] connection in the bottom of the transducer. They are diaphragm-piston type transducers using an [illegible] in contact with the fluid, backed by a piston [illegible]. This allows high sensitivity for low pressures and [illegible] for high pressures.

Two-Stage Fixed Deadband					Transducer Units				
	Separation				Air or Gas	Air, Oil or Gas	Water, Air, Oil or Gas	Corrosive Fluids	
Fixed Deadband At Mid-Range (psig) ①	Maximum Full Scale Minimum At Mid-Range (psig) ①	Open Frame	General Purpose	Watertight Enclosure	Nylon & Buna "N"	Aluminum & Buna "N"	Brass & Buna "N"	All 316 SS ③	316 SS & Viton ④
		Catalog No	Catalog No	Catalog No	Catalog No	Catalog No	Catalog No.	Catalog No.	Catalog No.
2.7"Hg	3"Hg	PC36A	PC30A	PC31B	—	RV34A11	RV34A21	—	RV34A32
4.3"Hg	6"Hg	PC26A	PC20A	PC21B	—	RV24A11	RV24A21	—	RV24A32
—	—	—	—	—	RD40A71	RD40A11	RD40A21	—	RD40A42
0.6	1.0	PC36A	PC30A	PC31B	RD30A71	RD30A11	RD30A21	—	RD30A42
0.8	1.8	PC26A	PC20A	PC21B	RD20A71	RD20A11	RD20A21	—	RD20A42
1.2	1.8	PC36A	PC30A	PC31B	—	—	—	RE30A44	—
2.0	3.6	PC26A	PC20A	PC21B	RE20A71	RE20A11	RE20A21	RE20A44	RE20A42
2.4	6.0	PC16A	PC10A	PC11B	RE10A71	RE10A11	RE10A21	RE10A44	RE10A42
4	10	PC16A	PC10A	PC11B	RF10A71	RF10A11	RF10A21	RF10A44	RF10A42
8	20	PC16A	PC10A	PC11B	RG10A71	RG10A11	RG10A21	RG10A44	RG10A42
12	30	PC16A	PC10A	PC11B	—	RH10A11	RH10A21	RH10A44	RH10A42
16	40	PC16A	PC10A	PC11B	—	RJ10A11	RJ10A21	RJ10A44	RJ10A42
30	60	PC26A	PC20A	PC21B	—	—	RL20A21	—	RL20A42
40	100	PC16A	PC10A	PC11B	—	—	RL10A21	—	RL10A42
200	300	PC26A	PC20A	PC21B	—	—	RN20B21	—	RN20B42
250	400	PC16A	PC10A	PC11B	—	—	RN10B21	—	RN10B42
400	600	PC16A	PC10A	PC11B	—	—	—	—	RQ10B42

[illegible] on stock for immediate delivery.

③ 316 SS transducer deadbands are approx. 50% greater than listed. ④ Transducers ending in 32 have 303 SS process connection, not 316 SS.

Enclosures

ASCO TRI-POINT switches are available in either a general purpose or watertight enclosure, in addition to open frame construction. These enclosed units are made in accordance with NEMA and UL standards. These standards define the protection level an enclosure gives and the tests it must pass to meet a particular design.

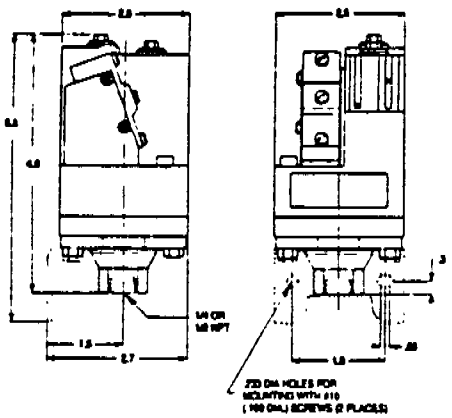
General purpose — Type 1. These enclosures are designed for indoor use to protect personnel from accidental contact with the equipment . P-Series general purpose enclosures are painted, zinc-coated steel and have a 7/8" diameter hole at the top for electrical entry.

Watertight — Type 4. Watertight and dust-tight enclosures are intended for use indoors and outdoors to protect the enclosed equipment against splashing or falling water, windblown dust and water, hose directed water, and severe external condensation. P-Series watertight switch enclosures are epoxy-painted, zinc-coated steel with a 1/2" conduit hub in the side of the lower housing for electrical entry. (For optional 316 SS watertight enclosure see page 13.)

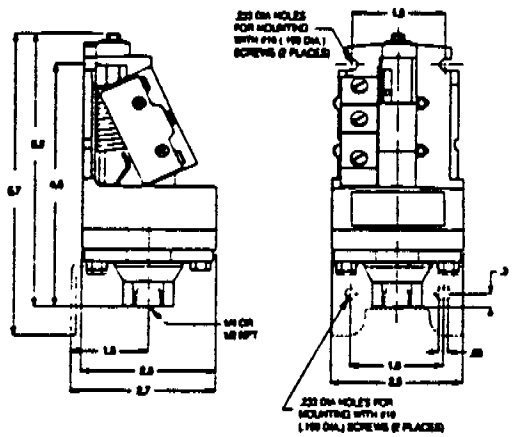
Dimensions (inches)

P-Series Pressure (Mounting brackets optional)

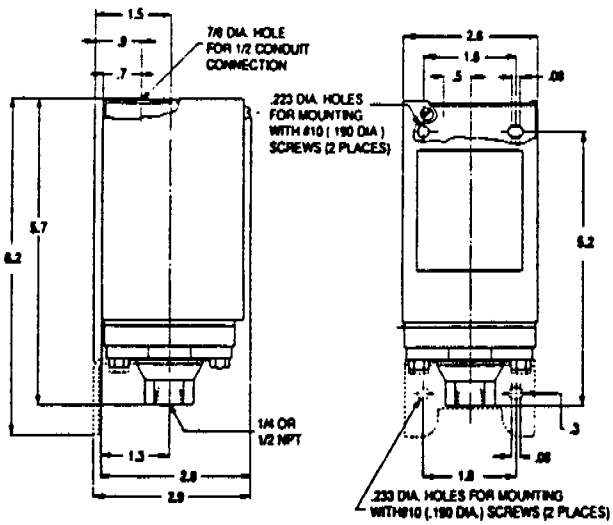
Open Frame PA and PC Switch Units with Transducer Unit



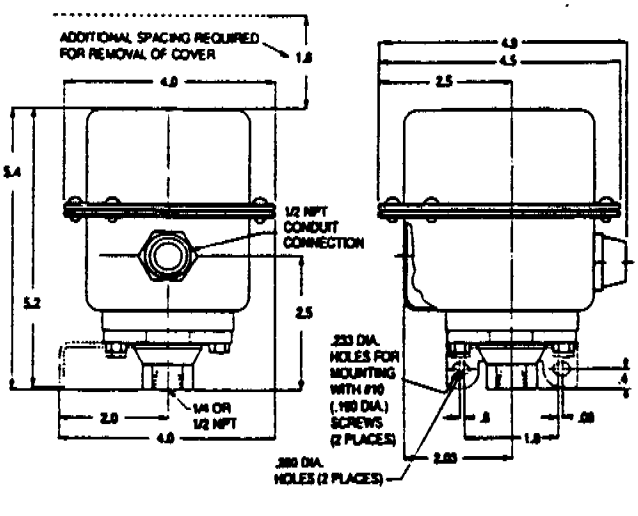
Open Frame PB and PG Switch Units with Transducer Unit



Type 1 General Purpose Switch Unit with Transducer Unit



Type 4 Watertight Switch Unit with Transducer Unit



DO A 134903
CONFIDENTIAL

 CM93036-2 #15

LHA

Suction Strainers 100 Mesh— 140 Micron

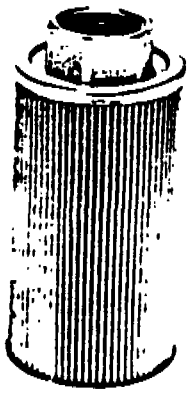
SEH Series

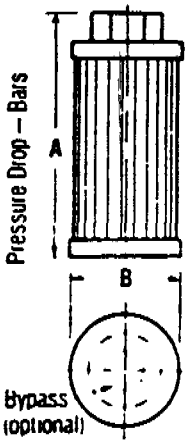
Specifications

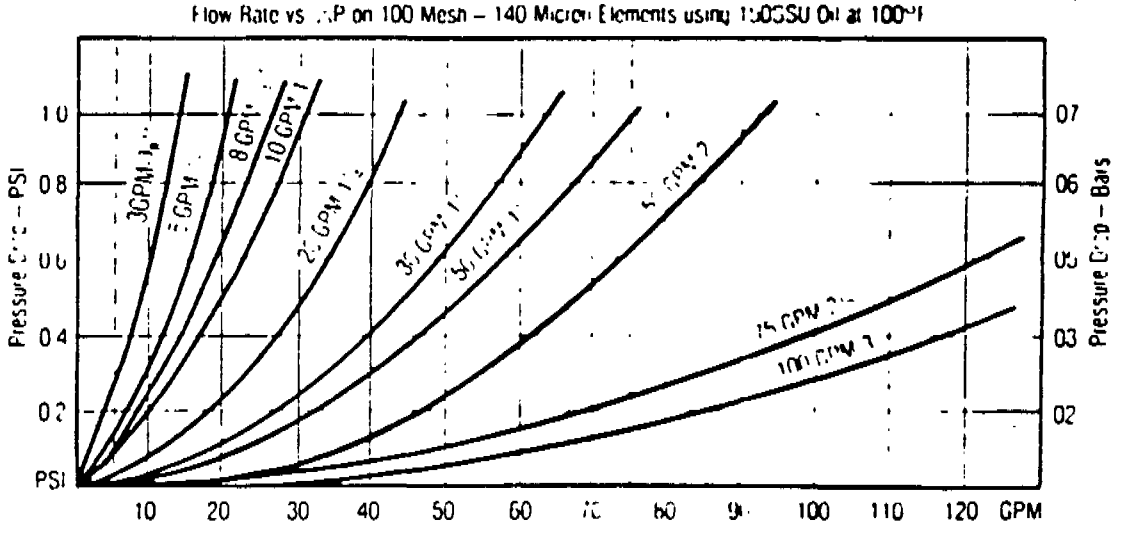
- Stainless steel mesh
- Re-usable
- Epoxy bonded joints for compatibility with all fluids
- Rugged steel inner support
- Nickel plated steel end caps

Options

- Custom sizes with 60 and 200 mesh screens are available upon request
- No by-pass or 3 psi by-pass available (RV3)







Ordering Information

Metal Hex	Model Number	Nominal Flow GPM	Nominal Flow L/min	Port (NPT.)	Filter Area in.²	Filter Area cm²	Weight lbs.	Weight kg.	Dimensions A in.	Dimensions A mm	Dimensions B in.	Dimensions B mm
*SEH	3-⅜-100	3	11	⅜"	34	220	0.3	0.14	2.5	64	1.9	48
SEH	5-½-100	5	19	½"	62	400	0.5	0.23	3.1	78	2.6	67
SEH	8-¾-100	8	31	¾"	62	400	0.5	0.23	3.5	89	2.6	67
SEH	10-1-100	10	38	1"	110	710	0.7	0.32	5.4	136	2.6	67
SEH	20-1¼-100	20	88	1¼"	162	1050	1.0	0.45	6.9	174	3.4	86
SEH	30-1½-100	30	120	1½"	225	1450	1.2	0.54	8.1	204	3.4	86
SEH	50-1½-100	50	198	1½"	340	2190	1.4	0.82	10.0	225	3.9	100
SEH	50-2-100	50	198	2"	340	2190	1.8	0.82	10.0	225	3.9	100
SEH	75-2½-100	75	283	2½"	400	2580	2.3	1.04	10.1	257	5.1	130
SEH	100-3-100	100	379	3"	500	3230	3.0	1.36	11.8	298	5.1	130

To Specify By-Pass Option Add -RV3

*By-pass not available on this model.

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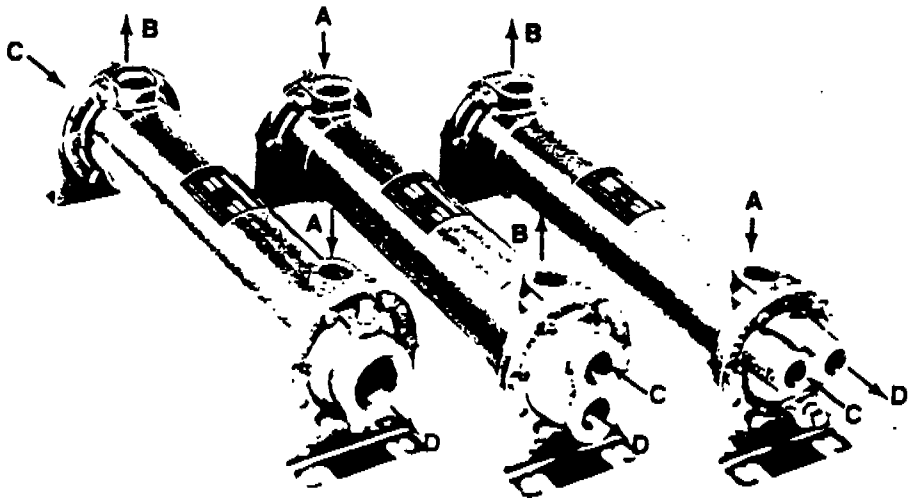
CM93036-2 #18

American Industrial Heat Transfer Inc.

PIPING HOOK-UP



Unit Coding Model: AB - 120 - 4 - C4 - TP

- AB — Standard Construction
- 120 — Shell Diameter
- 4 — Effective Tube Length
- C4 — Baffle Spacing
- TP — Tube Side Passes

A .... Hot fluid to be cooled
B ..... Cooled fluid
C ..... Cooling water in
D ..... Cooling water out

SP ..... Single Pass
TP ..... Two Pass
FP ..... Four Pass

INSTALLATION:

The following steps should be taken at the time of installation in order to insure maximum efficiency and long lasting use of the Heat Exchanger.

1 - Connect the hot fluid (and most viscous fluid) lines and the cooling water lines in accordance with the piping instructions above.

2 - If the source of cooling water is from other than a municipal water supply it is recommended that water strainers be installed ahead of the cooler, in order that dirt and debris may not enter cooler and plug the water passages

3 - When an automatic water regulating valve is used, place it on the inlet end of the heat exchanger Arrange the water outlet piping so that the cooler remains flooded with water, but at little or no pressure

4 - To protect the Heat Exchanger from high flow and pressure surges of hot fluids, a fast acting relief valve or a bypass check valve may be installed in the inlet line to the cooler.

Note:

A For steam service–single pass heat exchangers should be used, pressure of 75 psi (maximum) and temperatures to 350°F (maximum). Vertical mounting is recommended. If mounted horizontal a slight pitch is recommended to permit condensation drainage.

B As an option, all models are offered with 90/10 copper/nickel or stainless steel tubing, brass end bonnets and SAE ports.

Table A – Flow Rate for Shell & Tube Side

Shell Dia. Code	Maximum liquid flow – Shell side					Liquid flow – Tube side					
	Baffle Spacing					SP		TP		FP	
	A	B	C	D	E	Min.	Max.	Min.	Max.	Min.	Max.
400	10	–	–	–	–	3.5	28	–	–	–	–
700	17	29	30	–	–	9	71	4.5	30	2.2	17
1000	24	48	68	70	–	20	120	10	70	5.0	30
1200	28	56	100	110	120	30	250	15	120	7.5	60
1600	38	70	150	200	220	57	460	29	180	14	115

DO A 134905
CONFIDENTIAL

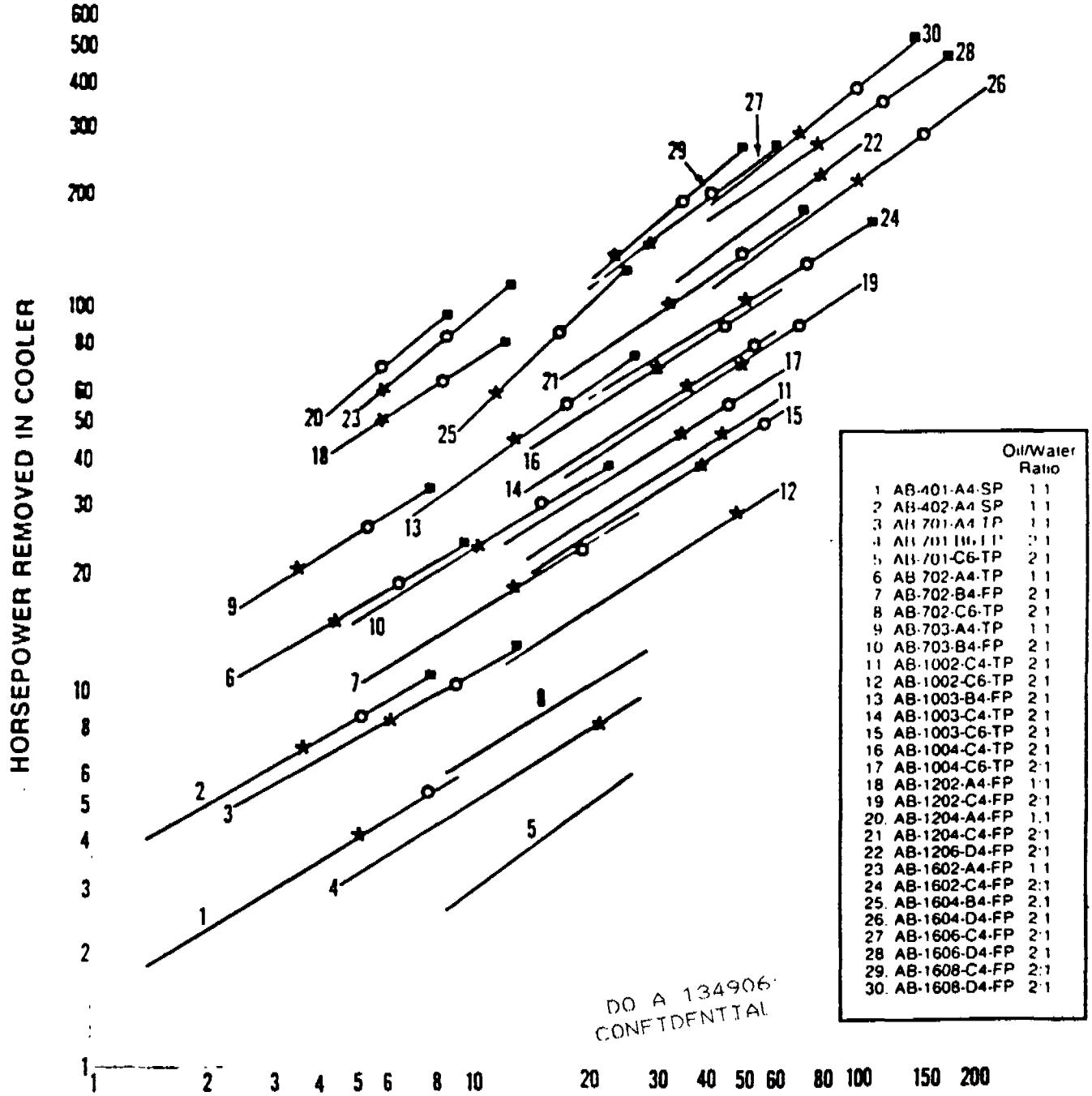
PERFORMANCE

American Industrial Heat Transfer Inc.

Sizing Notes:

1) Curves based on 40°F approach temperature. Example: oil leaving cooler at 125°F using 85°F cooling water (125 – 85 = 40).
2) The oil to water ratio of 1:1 or 2:1 means that for every gallon of oil circulated, a minimum of 1 or ½ gallon (respectively) of 85°F water must be circulated to obtain the curve results.
3) Curve performance based on oil with an average viscosity of 100 SSU.
4) Oil pressure drop coding: ★ = 5 psi; ▲ = 10 psi; ■ = 20 psi. Curves having no pressure drop code symbol means that the oil pressure drop is less than 5 psi to the maximum recommended flow rate for that model cooler.
5) Corrections for approach temperatures:
H.P. = H.P. curve × $\left(\frac{\text{Actual Approach}}{40}\right)$

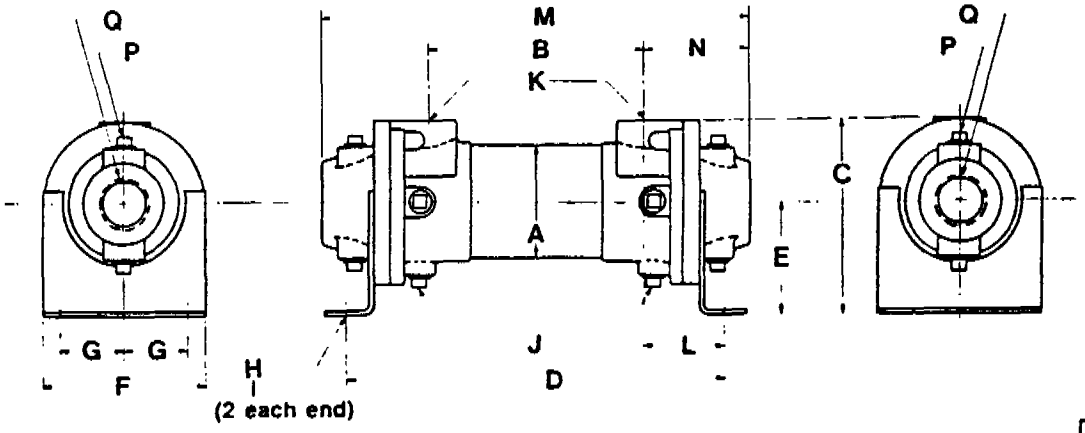
HEAT ENERGY DISSIPATION RATES (Basic Stock Model)



		Oil/Water Ratio
1	AB-401-A4-SP	1:1
2	AB-402-A4-SP	1:1
3	AB-701-A4-TP	1:1
4	AB-701-B4-TP	2:1
5	AB-701-C6-TP	2:1
6	AB-702-A4-TP	1:1
7	AB-702-B4-FP	2:1
8	AB-702-C6-TP	2:1
9	AB-703-A4-TP	1:1
10	AB-703-B4-FP	2:1
11	AB-1002-C4-TP	2:1
12	AB-1002-C6-TP	2:1
13	AB-1003-B4-FP	2:1
14	AB-1003-C4-TP	2:1
15	AB-1003-C6-TP	2:1
16	AB-1004-C4-TP	2:1
17	AB-1004-C6-TP	2:1
18	AB-1202-A4-FP	1:1
19	AB-1202-C4-FP	2:1
20	AB-1204-A4-FP	1:1
21	AB-1204-C4-FP	2:1
22	AB-1206-D4-FP	2:1
23	AB-1602-A4-FP	1:1
24	AB-1602-C4-FP	2:1
25	AB-1604-B4-FP	2:1
26	AB-1604-D4-FP	2:1
27	AB-1606-C4-FP	2:1
28	AB-1606-D4-FP	2:1
29	AB-1608-C4-FP	2:1
30	AB-1608-D4-FP	2:1

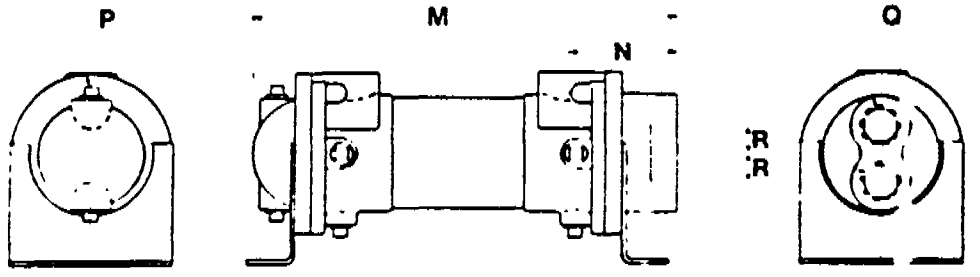
Dimensions and Weights: STANDARD MODELS

SINGLE PASS



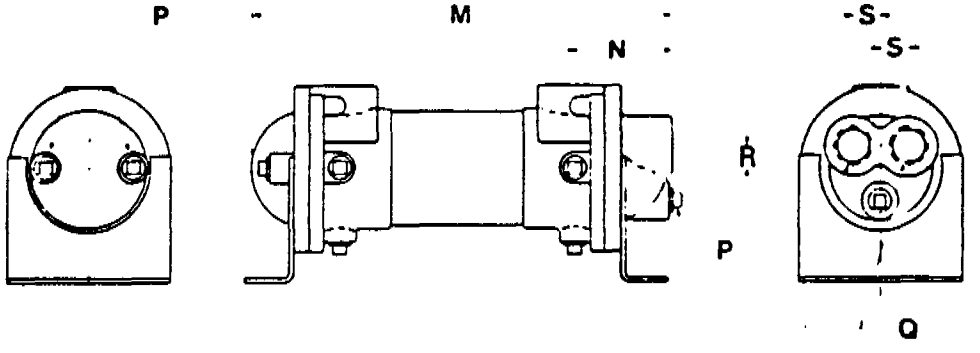
MODEL	M	N	P NPT	Q NPT
AB-401	11 24	1.81	—	1.00
AB-402	20 24			
AB-701	13 47	3.24	(4) .38	1.50
AB-702	22 47			
AB-703	31 47			
AB-1002	23.60	4.06	(4) .38	2.00
AB-1003	32.60			
AB-1004	41.60			
AB-1202	24.38	4.88	(4) .50	3.00
AB-1203	33.25			
AB-1204	42.12			
AB-1205	51.12			
AB-1206	60.25			
AB-1207	69.25			
AB-1208	78.12			
AB-1602	26 62	6.52	(4) .50	4.00
AB-1603	35 62			
AB-1604	44 62			
AB-1605	53 62			
AB-1606	62 62			
AB-1607	71 62			
AB-1608	80 62			

TWO PASS



MODEL	M	N	P NPT	Q NPT	R
AB-401	—	—	—	—	—
AB-402	—	—	—	—	—
AB-701	13 28	3.30	(2) .38	1.00	.88
AB-702	22 28				
AB-703	31 28				
AB-1002	23 28	3.80	(2) .38	1.50	1.19
AB-1003	32 28				
AB-1004	41 28				
AB-1202	24 84	4.56	(2) .50	2.00	1.44
AB-1203	33 81				
AB-1204	42 88				
AB-1205	51 88				
AB-1206	60 81				
AB-1207	69 81				
AB-1208	77 88				
AB-1602	25 10	6.08	(2) .50	2.50	1.88
AB-1603	34 10				
AB-1604	43 10				
AB-1605	52 10				
AB-1606	61 10				
AB-1607	70 10				
AB-1608	79 10				

FOUR PASS



MODEL	M	N	P NPT	Q NPT	R	S
AB-401	—	—	—	—	—	—
AB-402	—	—	—	—	—	—
AB-701	13 42	3.24	(2) .38	.75	.62	.88
AB-702	22 42					
AB-703	31 42					
AB-1002	21 55	4.06	(2) .38	1.00	.75	1.34
AB-1003	32 55					
AB-1004	41 55					
AB-1202	24 44	4.88	(2) .38 (1) .50	1.50	1.12	1.40
AB-1203	33 31					
AB-1204	42 19					
AB-1205	51 19					
AB-1206	60 31					
AB-1207	69 31					
AB-1208	78 19					
AB-1602	26 66	6.19	(2) .50	2.00	1.38	1.88
AB-1603	35 66					
AB-1604	44 66					
AB-1605	53 66					
AB-1606	62 66					
AB-1607	71 66					
AB-1608	80 66					

DO A 134907
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STANDARD DIMENSIONS (In Inches)

MODEL	A	B	C	D	E	F	G	H	J NPT	K NPT	L	WEIGHT (LBS)	MODEL
AB-401	2 125	7 62	3 50	11 06	1 94	2 62	.88	.41 Dia	—	.50	1 72	7	AB-401
AB-402		16 62		20 06								10	AB-402
AB 701	3 656	7 00	6 25	12 38	3 62	5 25	1 50	44 X 1 00	(2) .38	1 00	2 69	17	AB-701
AB-702		16 00		21 38								25	AB-702
AB-703		25.00		30 38								30	AB-703
AB-1002	5 125	15 50	7 38	21 62	4 00	6 75	2 00	44 x 1 00	(6) .38	1 50	3 06	40	AB-1002
AB 1003		24 50		30 62								50	AB-1003
AB-1004		33 50		39 62								60	AB-1004
AB 1202	6 125	14 62	8 81	21 50	4 75	7 50	2 50	44 X 88	(6) .38	2 00	3 44	55	AB-1202
AB-1203		23 50		30 38								70	AB-1203
AB-1204		32 38		39 25								90	AB-1204
AB 1205		41 38		48 25								110	AB-1205
AB-1206		50 50		57 38								130	AB-1206
AB-1207		59 50		66 38								150	AB-1207
AB-1208		88 38		75 25								170	AB-1208
AB-1602	8 00	13 60	12 13	22 38	6 50	8 62	3 50	44 X 1 00	(6) .38	3.00	4 38	105	AB-1602
AB-1603		22 60		31 38								140	AB-1603
AB-1604		31 60		40 38								205	AB-1604
AB-1605		40 60		49 38								245	AB-1605
AB-1606		49 60		58 38								258	AB-1606
AB-1607		58 60		67 38								270	AB-1607
AB 1608		67 60		76 38								290	AB-1608

ZINC annode available — as optional extra

NOTE: We reserve the right to make reasonable design changes without notice.

CM93036-2 #19

STERLCO

56-T TEMPERATURE ACTUATED REGULATING VALVE

- **Thermostatic COOLING CONTROL valve**
  Built for the most rugged machine tool and hydraulic applications
  Six temperature ranges to meet your requirements
- **Quick response to temperature changes**
- **Extra heavy-duty direct-acting bellows for longer service**

The Type 56-T Valve gives smooth regulation of water and other fluids not harmful to brass. It's designed for the most rugged applications — hydraulic power package equipment, hydraulic presses and plastic molding equipment . . . anywhere reliability in temperature control is demanded.

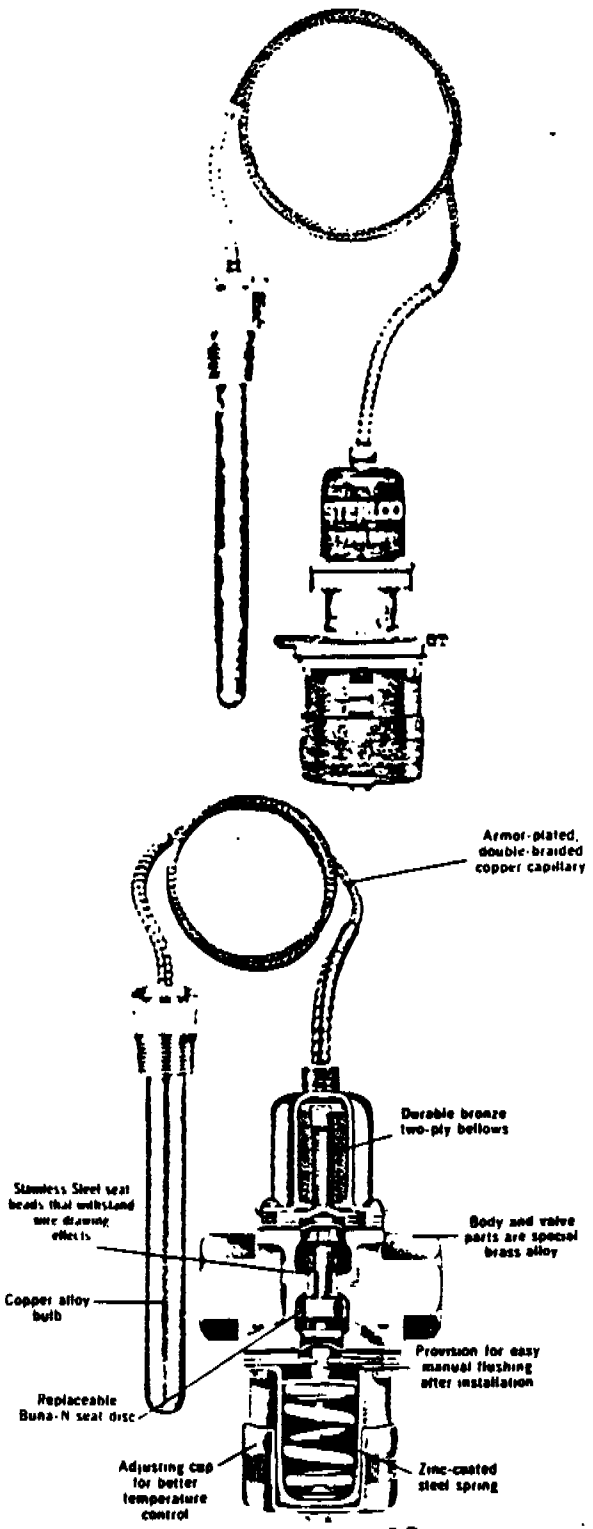
Specify the Sterlco Type 56-T Valve in any one of six temperature ranges from 40°F. to 275°F. It can be adjusted for opening at any point within the temperature range selected. A simple turn of the bottom adjusting cup accomplishes the adjustment.

The 56-T is a better designed product that won't bind or chatter. To insure dependability, every valve is factory tested three times in different temperature baths. Extra performance can be expected of the bellows, also. They are direct acting with sturdy cap and the spring is zinc coated steel. Stainless steel seat beads, main extra years of service because of their resistance to the erosive effects of wire drawing.

Other features include a Buna-N seat disc, mountable in any position, and manual flushing.

SPECIFICATIONS

Sizes	⅜", ½", ¾", 1" FPT
Fluid pressure range	Up to 125 psi
Standard temperature ranges	(Opening point adjustment may be anywhere within the standard ranges shown.) 40 — 100° F., 60 — 140° F., 100 — 175° F., 125 — 200° F., 140 — 240° F., 200 — 275° F.
Body	Brass alloy casting
Valve parts	Brass alloy
Standard capillary length	6 ft. For other lengths available consult factory
Standard bulbs	*For ⅜" and ½" valve sizes* ⅜" x 6" with ¾" union connection *For ¾" and 1" valve sizes* ½" x 6½" with ¾" union connections
Special bulbs	*All valve sizes:* ⅜" x 3½" with ½" union connection, ⅜" x 6½" with ½" union connection. Available on large quantity orders, consult factory
Standard bulb mounting	¾" union
Seat disc	Buna-N — replaceable
Seat bead	Stainless Steel — replaceable
Valve mounting	Any position
Temperature adjustment	To adjust for lower temperature, turn adjusting cup counterclockwise. To adjust for higher temperature, turn adjusting cup clockwise.



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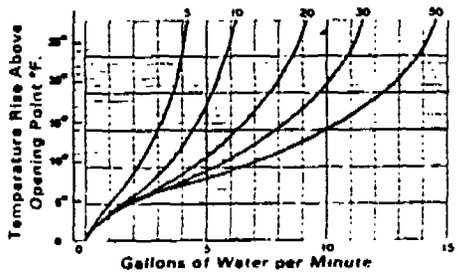
STERLCO

56-T TEMPERATURE ACTUATED REGULATING VALVE

Note the excellent flow characteristics of the Type 56-T

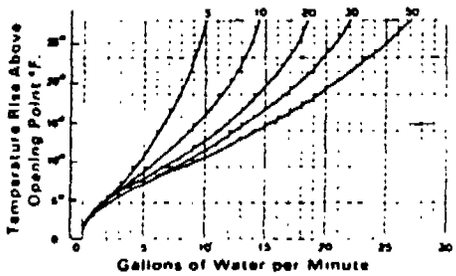
⅜" FLOW CHART

Water Pressure Drop Across Valve psi



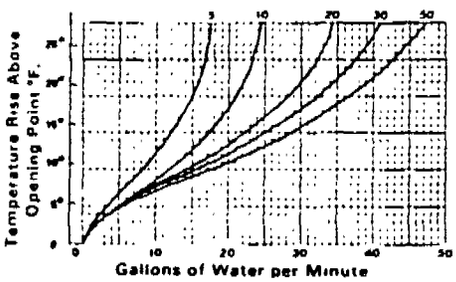
½" FLOW CHART

Water Pressure Drop Across Valve psi



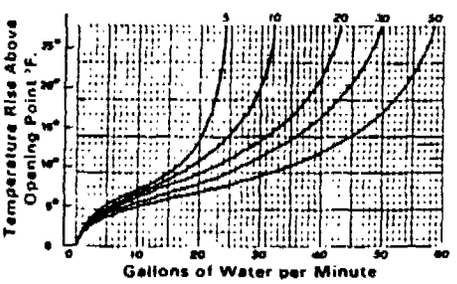
¾" FLOW CHART

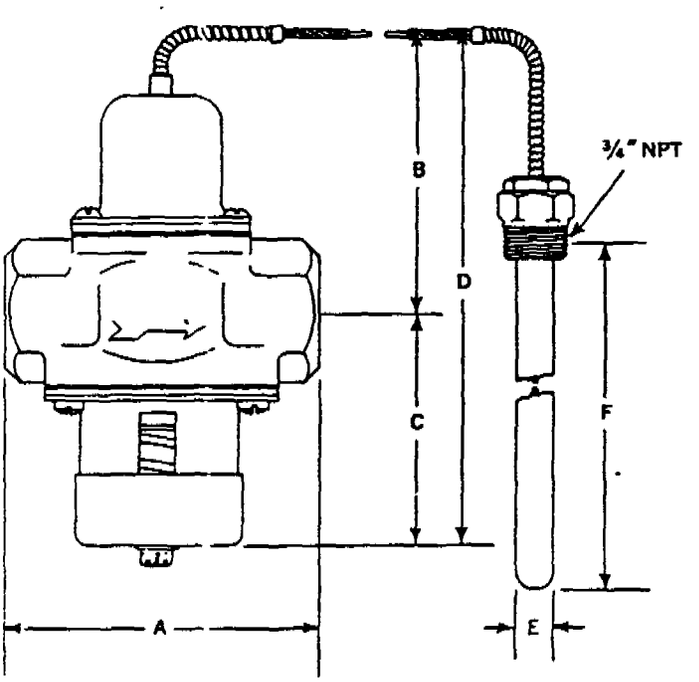
Water Pressure Drop Across Valve psi



1" FLOW CHART

Water Pressure Drop Across Valve psi





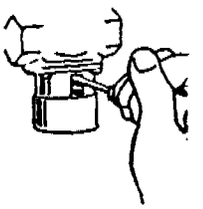
DIMENSIONS

	⅜"	½"	¾"	1"
A	2"	3 1/32"	3 ⅜"	4 ¾"
B	3"	3 11/32"	4 1/16"	4 5/16"
C	2"	3 1/32"	3 ¼"	3 21/32"
D	6"	6 ⅜"	7 5/16"	8 1/16"
E	⅜"	⅜"	⅜"	⅜"
F	6"	6"	8 ¼"	8 ¼"
Width	2"	2 ⅛"	2 ⅛"	2 ¾"
Net Weight	2 lb. 2 oz.	2 lb. 6 oz.	3 lb. 6 oz.	6 lb. 2 oz.

ADJUSTMENT AND SERVICING

To decrease flow or raise temperature (reduce water consumption) turn adjusting cup clockwise. To increase flow or lower temperature turn adjusting cup counterclockwise. After making adjustment give the regulator time to adjust itself against temperature change. To remove adjusting cup remove retainer ring.

The Type 56-T valve may be flushed manually after installation to remove dirt and grit from the line. To flush valve, place sturdy screwdriver on top of push plate and spring assembly. (Opening in lower housing provides ample room to insert screwdriver). Compress and release spring assembly several times.



ORDERING INFORMATION

Stock Number	Size
505	⅜"
506	½"
507	¾"
508	1"

Sterling, inc.

5200 WEST CLINTON AVE • P.O. BOX 23435 • MILWAUKEE, WIS 53223
Phone 414-354-0970 Telex. 2-6805

Litho in U.S.A. 10-84

DO A 134909
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INSTALLATION AND OPERATION
STERLCO TEMPERATURE CONTROL VALVES

HANDLE GENTLY!

Temperature control valves are instruments, not pipe fittings. A dent in the body or a sharp bend in the capillary may prevent them from operating. Don't use pipe wrenches. Do not subject controls to water-hammer conditions or excessive pressures.

BULB LOCATION

This is perhaps the most important factor in good installation. The entire bulb, not just part of it, must be exposed to the fluid of which the temperature is to be controlled. In a circulating system, the bulb must be directly in the line of flow. In a tank, it must be in a representative location, not in a corner which may be warmer or cooler than the rest of the tank. The temperature at the bulb is the only one which can be controlled.

BULB WELLS

Should be used when needed to prevent corrosion or for removing the bulb without draining the tank or system.

VALVE LOCATION (HEATING OR DIRECT ACTING CONTROL)

In supply line close to inlet. When heating with steam, always use a Sterlco float and thermostatic trap at the condensate outlet from the heating equipment. Don't install the control valve at the condensate outlet; water-hammer or poor control may result.

VALVE LOCATION (COOLING OR REVERSE ACTING CONTROL)

Close to the cooling equipment. When cooling air in a heat exchanger, valve should be in the cooling water outlet line rather than the supply line. This keeps the exchanger filled with water and prevents the control from being affected by extreme variations of cooling water temperature.

VALVE POSITION

Preferably with adjusting screw at top, but can be used in any other position. If mounted for capillary run downward from valve to bulb. All valve bodies have arrows showing direction of flow. If installed backward, they will be noisy or inoperative.

CAPILLARY LOCATION

Not next to a steam line or in a cold draft. If the capillary is exposed to extreme temperatures, it may be desirable to wrap it with insulating material.

STRAINERS

A Sterlco 20Y or 18Y Strainer should always be installed just ahead of each control valve to protect it from large particles of dirt. And the system must be kept free of sediment, scale, etc.

ADJUSTMENT

Temperature adjustment, within the range of the control, is made by simply turning an adjusting screw in the direction indicated on the valve body or nameplate. Turn the screw only a little at a time, then let temperatures reach equilibrium before adjusting further.

OPERATION

Remember that this is a modulating control. It does not alternately open wide and shut tight like an electrical control device. It opens gradually wider and wider, in relation to the difference between the actual bulb temperature and the bulb temperature at which the valve is closed. In normal operation, the control valve remains in a constant, partially open position which is automatically adjusted whenever conditions require it.

MAINTENANCE

The only servicing normally required is to keep the control clean. The valve can be inspected and cleaned by access through the inlet and outlet, without disassembly. The bulb must not become coated with any substance which interferes with the transmission of heat.

If repairs are needed, we recommend that these controls be returned to our factory for reconditioning. Skilled workmen, with proper tools, replacement parts, and testing facilities, will do a good job more economically than it can be done in the field. These controls are simple to disassemble and assemble for a person who is familiar with them. But an inexperienced worker will sometimes damage them by incorrect handling. And usually replacement parts, which are not available in the field, will be required. If for any reason it is necessary to disassemble one of these controls, please write us for detailed assembly drawings and instructions.

If a control has to be returned for repairs, please tell us as much as possible about what appears to be wrong, and ship it "as is" without disassembling it and possibly damaging good parts. This will help us to do the best and most economical work, and to advise you how to avoid further trouble.

TROUBLE-SHOOTING

If the control does not appear to be holding temperatures steady, or if not enough heating or cooling is obtained, first check for external conditions which may prevent the control from operating correctly. Examples are: low or fluctuating steam or water supply pressure; damaged or obstructed valves, traps, strainers or other accessories; supply piping too small; dirty bulb or poor bulb location.

If the valve will not close, check for dirt or foreign matter between disc and seat. The valve can be inspected through the inlet and outlet openings without disassembly, and can usually be cleaned out with an air hose.

If overheating results because a direct-acting (heating) valve stays open or a reverse-acting (cooling) valve stays closed regardless of the temperature at the bulb, the thermostat may have lost its fill and become inoperative. To check this, remove valve and bulb from the line, set the control at about the middle of the range, and insert the bulb in water hotter than the maximum of the range. If the direct-acting control does not close or the reverse-acting control does not open, factory repairs to the thermostat are required.

If there is a leak to the exterior of the body, some part may be loose or partially disassembled. Otherwise, a seal bellows may be damaged requiring factory replacement.

If the valve chatters, this usually means a loose or disassembled interior part. Chattering is sometimes caused by other devices near the control, and can sometimes be eliminated by changing piping arrangements, valve position, or supply pressure.

STERLING, INC., MILWAUKEE, WIS.

CM93036-2 # 20

S ri R

Relief, Pilot Operated
Valves, Pressure Control

Ord ring Information

R — RELIEF VALVE

SIZE

6P	3/4" NPTF Inline
6S	1-1/16 - 12 Str. Thd.
6V	3/4" Subplate (Ind. St'd.)
10P	1-1/4" NPTF Inline
10M	1-1/4" Subplate (Ind. St'd.)
10S	1-5/8 - 12 Str. Thd.

RANGE

H	150 to 3000 PSI
F	150 to 2000 PSI
M	150 to 1000 PSI

VENT STYLE

Omit	Low Vent (Std.)
8	High Vent

SEALS

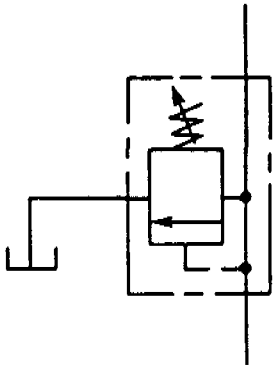
Omit	Nitrile
V	Viton

* — DESIGN SERIES

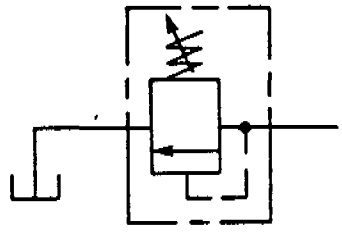
* NOTE: NOT REQ'D. WHEN ORDERING

UNIT WEIGHT:

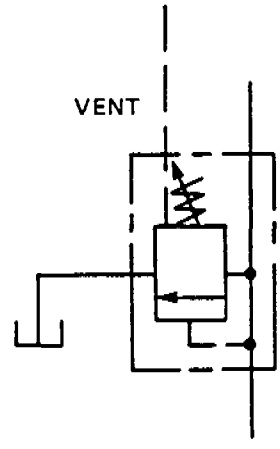
VALVE	WEIGHT
R6P	9 LBS. (4.0 Kg)
R6V	15 LBS. (6.8 Kg)
R6S	9 LBS. (4.0 Kg)
R10P	17 LBS. (7.7 Kg)
R10M	21 LBS. (9.5 Kg)
R10S	17 LBS. (7.7 Kg)



INLINE MOUNTED RELIEF VALVE



SUBPLATE MOUNTED RELIEF VALVE



INLINE MOUNTED RELIEF VALVE USING VENT CONNECTION

E

Installation Information

Pressure Control Valves

FOR MAXIMUM VALVE RELIABILITY, ADHERE TO THE FOLLOWING INSTALLATION INFORMATION.

The following is important installation information which applies to all pressure control valves.

MOUNTING

R2P Series valves are inline and panel mounted. The UR Series valves are offered in the subplate mounted versions only. All other pressure control valves are in-line, and subplate mounted. Subplates are designed to NFPA standards. The valves will operate mounted in any position (i.e., vertically, horizontally, etc.). For subplate mounted valves see installation information "Recommended Mounting Surface".

FLUID RECOMMENDATIONS

Premium quality hydraulic oil with a viscosity range between 150-250 SSU (32-54 cst.) at 100°F (38°C). Normal operating viscosity range between 80-1000 SSU (16-220 cst.). Oil should have maximum anti-wear properties and rust and oxidation treatment.

FLUIDS AND SEALS

Valves using synthetic, fire-resistant fluids require special seals. When phosphate esters or its blends are used – VITON seals are required. Water-glycol, water-in-oil emulsions, and petroleum oils may be used with STANDARD SEALS.

FILTRATION

For maximum valve and system component life, the system should be protected from contamination at a level not to exceed 125 particles greater than 10 microns per milliliter of fluid (SAE Class 4/ISO 16/13).

SPECIAL INSTALLATIONS

Consult your Parker representative for any application requiring the following:

- Pressure above rated.
- Fluid other than those specified.
- Oil temperature above 160°F. (71.1°C.).

MOUNTING PATTERNS

Size*	NFPA
3 (3/8")	P03
6 (3/4")	P06
10 (1-1/4")	P10

*Refers to models PR3, PR6, PR10 etc. for B, S, ULR Series. R Series reliefs meet the industry standard pattern.

TORQUE SPECIFICATIONS

The recommended torque values are for the bolts which mount the valve to the mounting surface are as follows:

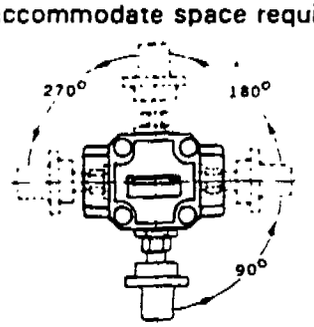
Size*	Torque
3 (3/8")	25 Ft. Lbs.
6 (3/4")	25 Ft. Lbs.
10 (1-1/4")	45 Ft. Lbs.

*Refers to models PR3, PR6, PR10 etc. for R, B, S, ULR, and UR Series.

PILOT CAP ROTATION

Series R, PR, S, ULR valve pilot caps come with adjusting knob positioned as shown on dimension pages, but can be turned 90, 180, or 270° to accommodate space requirements. (3/8" and 3/4" sizes only)

NOTE: B Series valve pilot cap assembly is positioned as shown on dimension pages. The pilot cap assembly cannot be rotated to accommodate space requirements.



VALVE ADJUSTMENT

All pressure control valves may be adjusted by loosening the jam nut (shown on dimension pages) and rotating the adjusting knob. Turn knob clockwise (CW) to increase pressure, counter-clockwise (CCW) to decrease pressure. After adjustment, hold knob and retighten jam nut.

Installation Information

Pr ssure Control Valves

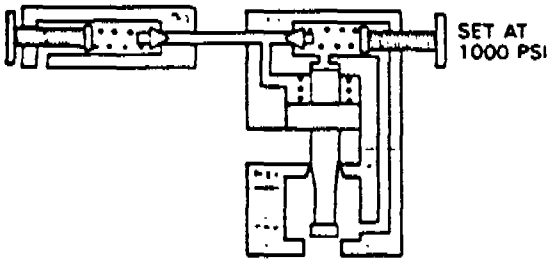
FOR MAXIMUM VALVE RELIABILITY, ADHERE TO THE FOLLOWING INSTALLATION INFORMATION.

The following is important installation information which applies to specific valve series or types.

SERIES R2P, DIRECT OPERATED RELIEF VALVES

TANK LINE
The tank line of these valves should be connected directly to the tank, terminating below the oil level. Any pressure in the tank line will affect valve operation.

REMOTE OPERATOR
R2P Series direct operated valves are identical in peration to the pilot stage of a pilot operated relief valve. When the direct operated relief valve is used as a remote operator for a pilot operated relief valve, pipe the direct operated valve to the vent line of the pilot operated valve as shown in the following diagram:



The remote operator can only control up to the setting of the pilot valve in the main valve. The remote operator in the diagram would not be effective once it passes a setting of 1000 PSI. To be the controlling pilot, the remote operator must always be set lower than the main pilot.

VALVE SETTING
To conserve energy and reduce stress on system component, the relief valve should be set as low as possible. A good general rule is to set it 150 PSI above calculated system pressure.

SERIES R, PILOT OPERATED RELIEF VALVES

TANK LINE
The tank line of these valves should be connected directly to tank, terminating below the oil level. Any pressure in the tank line will affect valve operation. Tank pressure should never exceed system pressure.

VENTING
Connecting the vent port to tank allows the relief valve to divert flow at minimum pressure. Venting during the idle portion of the machine cycle is desirable in reducing heat.

REMOTE CONTROL
When using remote control, the main valve should be set 150 PSI higher than the remote pilot setting.

VALVE SETTING
To conserve energy and reduce stress on system components, the relief valve should be set as low as possible. A good general rule is to set it 150 PSI above calculated system pressure.

Valve adjustment knobs are factory set at 100 PSI above maximum pressure ordered. Once installed, the valve cannot be adjusted past the point of maximum pressure, thus ensuring system component protection against damage due to over-adjustment:

NOTE: This design feature should be considered when specifying valve adjustment range.

SERIES PR, PRESSURE REDUCING VALVES

VENTING
Connecting the vent port to tank allows the reducing valve to go to minimum setting. Since there is usually a pressure differential between inlet and outlet of a pressure reducing valve, heat is generated as fluid passes through the valve (main and drain flow). Heat must be dissipated by the system or with a heat exchanger.

DRAIN LINES
The drain line of a pressure reducing valve should be connected directly to tank (normal operation) terminating below the oil level. Any pressure in the drain line is additive to the valve setting.

In special applications, pressurizing or restricting the drain can be helpful. If, for example, full pressure is applied to the drain, the reducing valve is locked open and there is no reduction in pressure. In some instances such valve action may be desirable, however, always exercise caution when using the product in applications that are unusual or outside the range of normal usage. Drain line pressure on PR6M and 3M is limited to 1000 PSI.

VALVE SETTING
All secondary pressure controls (reducing valves) should be set a minimum of 150 PSI below system primary pressure controls (relief valves) to minimize the possibility of valve interaction and instability.

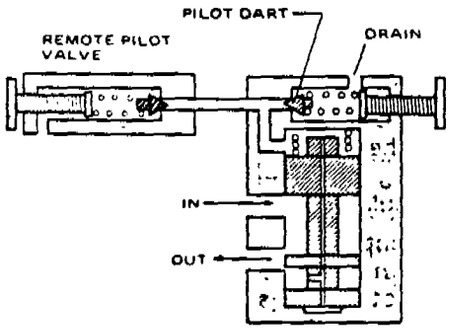
E

Installation Information

SERIES PR, PRESSURE REDUCING VALVES (cont.)

REMOTE CONTROL

Remote pilot operation of a pressure reducing valve is illustrated in the following diagram:



When the pressure reducing valve is remote controlled, the adjustment on the main valve should be set 150 PSI higher than the setting on the remote pilot.

SERIES B, COUNTERBALANCE VALVES

DRAIN

All counterbalance valves are internally drained.

AUXILIARY REMOTE PILOT

The 1-1/4" B Series counterbalance valve has an auxiliary pilot port which will open the valve at low pressure. The low pressure override feature can be advantageous in certain applications. Pressure required at the auxiliary remote pilot port is 1/10 that of the normal setting on H, F and M range, and 1/5 on B range. The low-pressure override option is not available on L and Z ranges.

HORSEPOWER LOSS

Counterbalance valves have a pressure differential between inlet and outlet, therefore, heat is generated by fluid flow through the valve (main and drain flow). This heat must be dissipated by the system or with a heat exchanger.

VALVE SETTING

Counterbalance valves should be set slightly higher than the pressure required to stabalize the load e.g., if 500 PSI is required to lift a given load, a counterbalance pressure setting of 550 to 600 PSI will be sufficient to balance the load.

SERIES S, SEQUENCE VALVES

DRAIN LINE

The drain line of S Series sequence valves must be connected directly to tank (normal operation) terminating below the oil level. Any pressure in the drain line is additive to the valve setting.

In special applications, pressurizing or restricting the drain can be helpful. If, for example, full pressure is applied to the drain, the sequence valve is locked in the closed position. In some instances such valve action may be desirable, however, always exercise caution when using the product in applications that are unusual or outside the range of normal usage. Drain line pressure on 3M and 6M limited to 1000 PSI.

HORSEPOWER LOSS

Sequence valves usually have a pressure differential between inlet and outlet, therefore heat is generated by fluid flow through the valve (main and drain flow). This heat must be dissipated by the system or with a heat exchanger.

VALVE SETTING

All secondary pressure controls (sequence valves) should be set a minimum of 150 PSI below system primary pressure controls (relief valves) to minimize the possibility of valve interaction and instability.

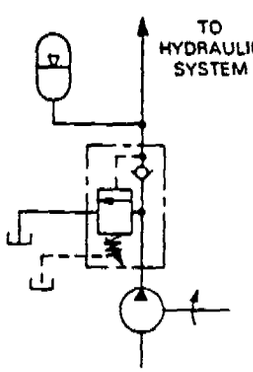
SERIES UR, UNLOADING RELIEF VALVES

DRAIN LINE

The drain line of these valves should be connected directly to tank, terminating below the oil level. Any pressure in the drain line will affect valve operation.

VALVE SETTING

UR Series valves should be set 15% higher on "H" style and 30% higher on "M" style than minimum system pressure required. Thus, even at cut-in pressure, the system will always be properly pressurized.



ACCUMULATOR CIRCUIT – TYPICAL INSTALLATION

CM93036-2 #23

MECHANICAL

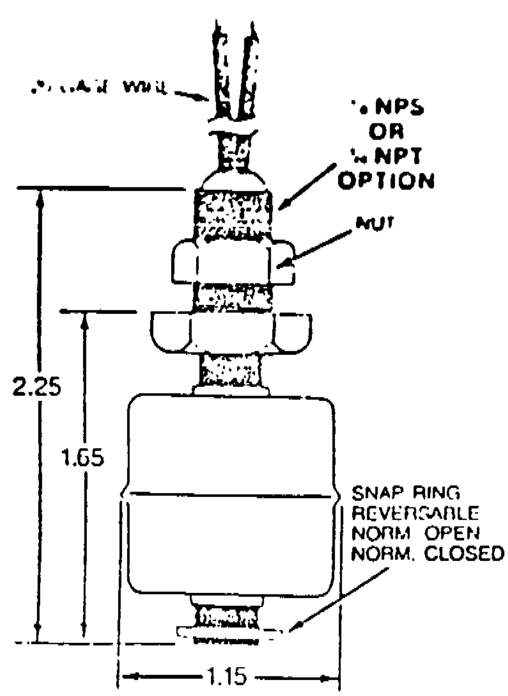
FLOAT MATERIAL	ALL STAINLESS STEEL, HI TECH PLASMA WELDED
STEM AND THREADS	ALL STAINLESS STEEL, WELDED HEX
OPERATING TEMP.	−40 F. TO 250 F. (OPTION −60 F. TO 300 F.)
PRESSURE RATING	TO 300 PSI IN LIQUID OR COMPRESSED AIR
SPECIFIC GRAVITY	0.75 — OPTION 0.5
LEVEL REPEATABILITY	0.01 INCH
ENCAPSULATION	"RESIN" — HERMETICALLY SEALED WIRE AND CONTACTS
PLATING	NONE — HIGH POLISH ONLY

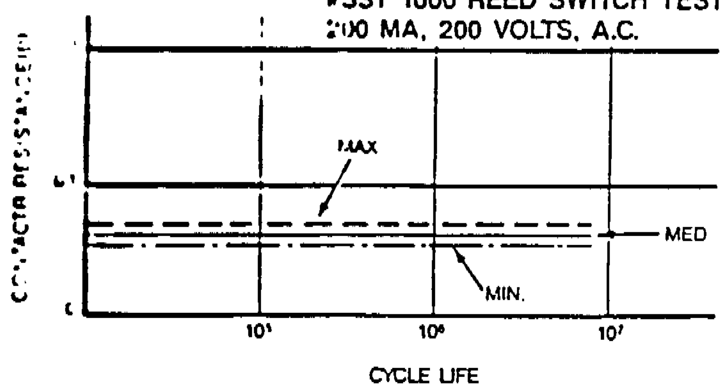
ELECTRIC DATA — REED SWITCH PER UL NO. FIL-E-70063

OPERATING VOLTAGE	.1 TO 300 VOLTS AC OR DC
CONTACTING RATING	* 50 VA MAX
MAX. SWITCH CURRENT	* .5 AMPS AC OR DC
MAX. CARRY CURRENT	2.5 AMPS AC OR DC
DIELECTRIC STRENGTH	600 VDC
LIFE CYCLE	6,000,000 CYCLES AT [illegible] V AND 200 MA
CONTACT MATERIAL	RHODIUM
CONTACT RESISTANCE	0.09 M. OHMS
SHOCK MAX.	30G TEST PER [illegible] 213B
VIBRATION MAX	20G TEST PER [illegible] 210A
TEMPERATURE	−40 C TO 125 C

NOTE • A higher degree of [illegible] and accuracy [illegible] the #SST 1000 direct acting contacts, whereby amplifiers or converters, etc. are not required for direct activation of indicator lights, relays or programmers, etc.

[illegible] RATE OR OVER [illegible] HIGH AND LOW [illegible]





* NON INDUCTIVE - WHEN SWITCHING HIGH INDUCTIVE LOADS, CONSULT FACTORY FOR PROPER RECOMMENDATIONS AND/OR TESTING THE COMPATABILITY OF COMPONENTS. FOR CUSTOM AND/OR MILITARY APPLICATIONS, CONTACT FACTORY.

The SST1000 Stainless Steel Level Sensor

61211

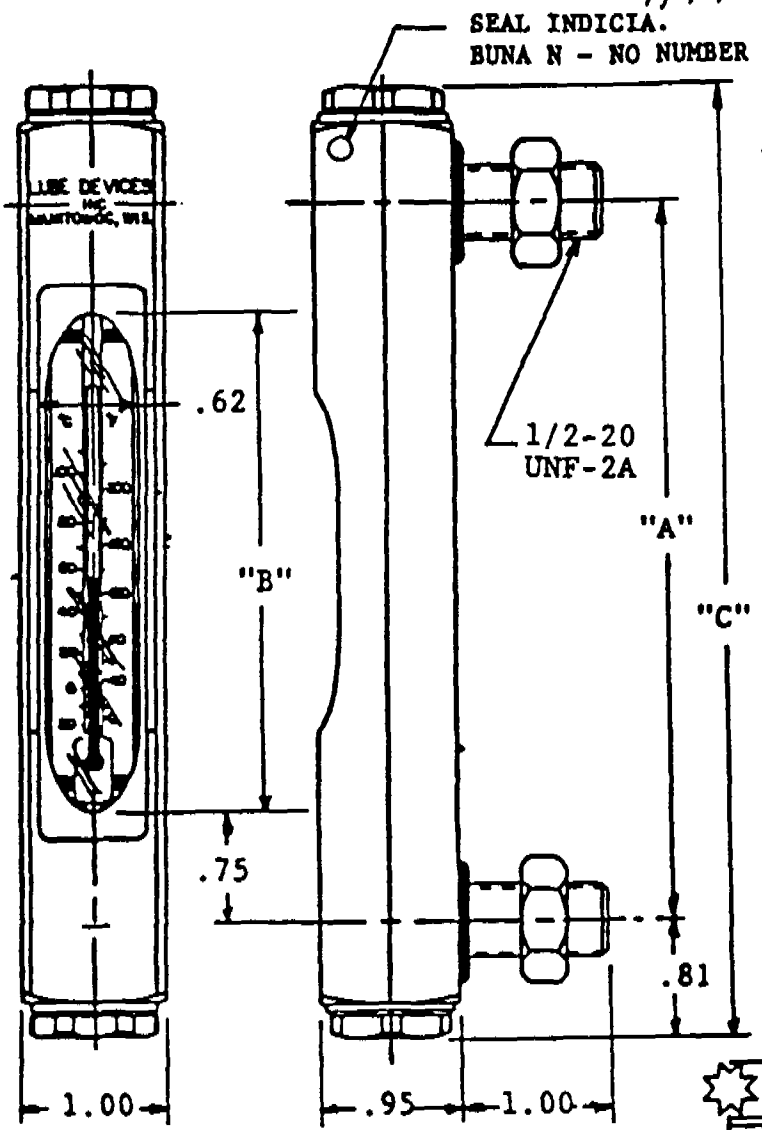
APPROVED PURIFICATION CORPORATION
STAMFORD, CT • (203) 357-0141 • FAX (203) 356-1697

DO A 134915
CONFIDENTIAL

ATTN: Kendall CM93036-2

LIQUID LEVEL GAGE BACK MOUNT

#24 NEW!!



- Back mounting gage is the most popular of the card thermometer gages. It has the lowest profile with a wide sight opening to maximize viewing and is tamper resistant in the field.
- Pyrex sight is crystal clear and has no initial color or tint of its own. It does not change color due to immersion in fluid, time or temperature. It is not affected by hydraulic fluids.
- Access to reservoir interior is necessary to tighten nuts supplied with gage. Spacer sleeves available to space gage away from reservoir and conical sleeves for cylindrical tanks.
- 20 psi maximum pressure.
- 250° F. maximum temperature.
- To order:

  Select catalog number

  G1620-10-A-1
  - 1 — Buna N seals
  - A — Aluminum const.
  - 10 — 10" centers
  - G1620 — Gage series

BUNA N SEALS - NO INDICIA.

CATALOG NO.	"A"	"B"	"C"
G1620-03-A-1	3.00	1.50	4.62
G1620-05-A-1	5.00	3.50	6.62
G1620-10-A-1	10.00	8.50	11.62

VITON A SEALS (3) INDICIA.

G1620-03-A-3	3.00	1.50	4.62
G1620-05-A-3	5.00	3.50	6.62
G1620-10-A-3	10.00	8.50	11.62

OPTIONS

EPDM seals - Specify -4 in place of -1 or -3 in catalog number.

5/8-18 mounting studs - Specify -5 after seal number.

- Blue fluid in thermometer - Specify "B" after seal number.

5/8 thread and blue fluid - Specify 5/8B after seal number.

LIQUID LEVEL GAGE
BACK MOUNT
WITH CARD THERMOMETER

F327-1620 8/89

LUBE DEVICES OFFERS THE LARGEST SELECTION OF LIQUID LEVEL OBSERVATION DEVICES IN THE HYDRAULIC ACCESSORY INDUSTRY. THERE ARE 24 SERIES OF CLOSED CIRCUIT LIQUID LEVEL GAGES; 15 STYLES OF VENTED OIL GAGES AND 9 TYPES OF LUBESIGHT CHECK GAGES (ALSO CALLED SIGHT PLUGS OR OBSERVATION WINDOWS)

ASK FOR CATALOG LL0989.

DO A 134916
CONFIDENTIAL

CM93036-2
#27 & 28

Maintenance Instructions For

Hydraulic Accumulators

Installation

Most accumulators shipped from the factory will not be pre-charged. However, in some cases they will be shipped with some amount of nitrogen charge, the value of which will be stamped on the nameplate.

Keep the hydraulic port covered to keep out foreign material until ready to make the hydraulic connections.

The accumulator can be mounted in any orientation. However, it should be rigidly mounted using any combination of the mounting holes provided at the hydraulic cap or proper clamps. The hydraulic circuit, which contains a connection to the accumulator should be designed so that it automatically discharges all hydraulic fluid from the accumulator when the equipment is turned off.

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

Pre-Charging

Use an inert gas such as nitrogen for pre-charging accumulators.

If water pumped nitrogen is not available, oil-pumped nitrogen may be used. (C.G.A. standards: Nitrogen gas bottles for water pumped nitrogen has a right-hand valve thread which requires charging and gauging assembly 1445950000 for units up to 3000 psi. Oil-pumped nitrogen requires a left-handed valve thread (Use 1445960000). For accumulators rated over 3000 psi up to 5000 psi, use assembly #1449120000 (See Figure 3).

If equipment other than the above listed is used, make sure it is compatible with the gas valve assembly. Nitrogen source and all components must be rated for a pressure at least as high as the nitrogen source. It is strongly recommended that the nitrogen bottle used have a high pressure regulator.

Make sure nitrogen supply is shut off. Attach hose to nitrogen bottle. If accumulator has a gas valve as shown in Figure 5 follow steps A thru J and skip steps AA thru HH. If accumulator has a gas valve as shown in Figure 6, skip steps A thru J and follow steps AA thru HH.

Accumulator having gas valve as per Figure 5.

(A) Remove gas valve guard and gas valve cap.

(B) Back gas chuck "T" handle all the way out (counter clockwise) before attaching charging assembly to accumulator gas valve.

(C) Close bleed valve

(D) Making sure not to loop or twist the hose, attach swivel nut to gas valve and tighten (10-15 in. lb.)

(E) Turn gas chuck "T" handle all the way down. This will depress core in gas valve.

(F) Crack open nitrogen bottle valve and **slowly** fill accumulator. Shut off when gage indicates desired pre-charge.

(G) Let the pre-charge set for 10 to 15 minutes. This will allow the gas temperature to stabilize. If the desired pre-charge is exceeded, close nitrogen bottle valve, then slowly open bleed valve (Figure 1). Do not reduce pre-charge by depressing valve core with a foreign object. High pressure may rupture rubber valve seat.

(H) When finished pre-charging accumulator, turn "T" handle all the way out on gas chuck (Figure 1), then open bleed valve,

(I) Hold gas valve for turning, loosen swivel nut, remove assembly.

(J) Replace gas valve cap (10-15 in. lbs.) and valve guard.

Accumulator having gas valve as per Figure 6.

(AA) Remove gas valve guard and gas valve cap.

(BB) Close bleed valve and making sure not to loop or twist the hose, attach swivel nut to gas valve and tighten (10-15 in. lb.).

(CC) Hold gas valve at point "C" with one (1) wrench while unscrewing hex nut at point "D" with a second wrench. This will open the poppet inside the gas valve. Note: four (4) turns will fully open the valve.

(DD) Crack open nitrogen bottle valve and **slowly** fill accumulator. Shut off when gage indicates desired pre-charge.

(EE) Let the pre-charge set for 10 to 15 minutes. This will allow the gas temperature to stabilize. If the desired pre-charge is exceeded, close nitrogen bottle valve, then slowly open bleed valve until desired pressure is reached (Figure 3).

(FF) With a wrench, tighten hex nut at point "D" to close internal poppet (5-8 ft. lbs.).

(GG) Hold gas valve at point "C", with wrench and remove swivel nut assembly.

(HH) When pre-charging has been completed, replace gas cap and tighten (10-15 in. lb.), install gas valve guard.

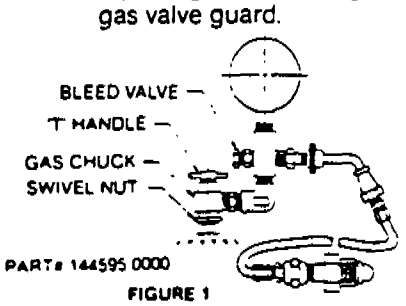
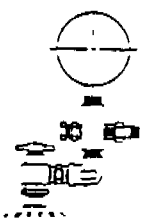


FIGURE 1


PART# 085122 0000
FIGURE 2

3000 PSI UNITS

Part Number	Charging and Gaging Assembly for 3000 PSI
144595 0000 (Std) (Right Hand)	Charging and Gaging Assembly consists of 10' charging hose with standard right-hand thread nitrogen fittings adapter incorporating gas valve bleeder valve and gas chuck (less gage) for left hand thread nitrogen bottle fitting specify part number 144596 0000

Part Number	Gaging Assembly for 3000 PSI
085122 0000	Gaging device consisting of adapter incorporating gas valve bleeder valve and gas chuck (less gage)

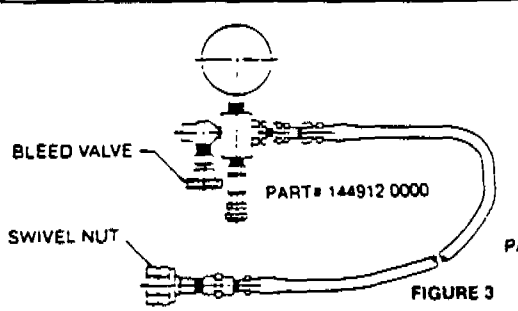
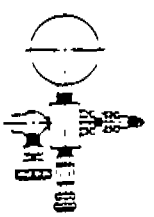


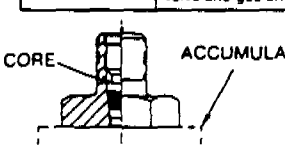
FIGURE 3


PART# 144961 0000
FIGURE 4

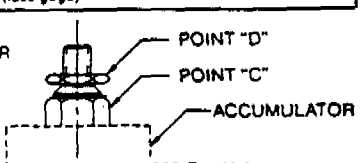
5000 PSI UNITS

Part Number	Charging and Gaging Assembly for 5000 PSI
144912 0000	Charging and Gaging Assembly consists of 10' charging hose with standard right-hand thread nitrogen fittings (1.035-14 NGO female) adapter incorporating gas valve bleeder valve and gas chuck (less gage)

Part Number	Gaging Assembly for 5000 PSI
144961 0000	Gaging device consisting of adapter incorporating gas valve bleeder valve and gas chuck (less gage)



PART# 532364 0000 Gas valve with high pressure core for 3000 psi service
FIGURE 5



PART# 612433 0000 Gas Valve with poppet for ASME units 7, 9, 12 bore and all 5000 psi units
FIGURE 6

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500 So. Wolf Road
Des Plaines, IL 60016
708/298-2400

Regional Plants
- Santa Fe Springs, CA 310/698-0985
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- Atlanta, GA 404/349-0563
- Goodland, IN 219/297-3182
- Plymouth, MI 313/455-1700
- Hillsborough, NC (Accum) 919/732-6183
- Hillsborough, NC 919/732-9371
- Akron, OH 216/253-4500
- Portland, OR 503/285-0684
- Owen Sound, Ont. Can 519/371-2662
- Toronto, Ont. Can 416/255-4567
- Lachine, Quebec, Can 514/631-3995

Parker Motion & Control

Maintenance

Repair Kits, (see Parts List), are available for all accumulator models. When ordering repair kits, state complete model number from nameplate. Also specify fluid and temperature at which used.

Occasional replacement of v-o-ring seal on the piston is generally the only maintenance required. Replacement of other seals on end caps and gas valve is recommended (See kit numbers).

Periodic checking of pre-charge pressure will detect whether v-o-ring wear is sufficient to begin reducing sealing performance. Allowing for temperature difference, if any, from time of its pressure checking, pre-charge pressure will rise if oil gathers in the gas side and will fall if gas leaks into the oil side or out past gas end seals. It is suggested that a check be made a week after installation, and thereafter once a month.

Pre-charge Checking Procedure

Using appropriate valve in the hydraulic system, discharge all oil from accumulator and allow piston to bottom against hydraulic end cap.

For accumulators rated for 3000 psi or less use gaging assembly as shown in Figure 2 (Part #0851220000). For accumulators rated over 3000 psi up to 5000 psi use assembly as shown in Figure 4 (Part #1449610000)

Accumulators having gas valve as per Figure 5

(1) Remove gas valve guard and gas valve cap.

(2) Back gas chuck "T" handle all the way out (counter clockwise) before attaching charging assembly to accumulator gas valve.

(3) Close bleed valve.

(4) Attach swivel nut to gas valve and tighten (10-15 in.lb.)

(5) Turn gas chuck "T" handle all the way down. This will depress core in gas valve and check pressure

(6) To remove gaging assembly turn "T" handle all the way out on gas chuck (Figure 1), then open bleed valve.

(7) Hold gas valve from turning, loosen swivel nut, remove assembly.

(8) Replace gas valve cap (10-15 in.lbs.) and valve guard.

Accumulators having gas valve as per Figure 6.

(9) Remove gas valve guard and gas valve cap.

(10) Close bleed valve.

(11) Attach swivel nut to gas valve and tighten (10-15 in.lb.).

(12) Hold gas valve at point "C" with one (1) wrench while unscrewing hex nut at point "D" with a second wrench. This will open the poppet inside the gas valve. Turn 2-3 times and read precharge.

(13) With a wrench, tighten hex nut at point "D" to close internal poppet (5-8 ft. lbs.).

(14) Hold gas valve at point "C", with wrench and remove swivel nut assembly.

(15) Replace gas cap and tighten (10-15 in.lb.), and install gas valve guard.

Remove From Hydraulic System

Shut equipment down and make certain that hydraulic pressure at the accumulator is at zero. At this point the piston will be bottomed at the hydraulic end.

For accumulators having gas valve as shown in Figure 5, attach gaging assembly as shown in Figure 2 following Steps 1 thru 5. Then, open bleed valve until all gas pre-charge is relieved from accumulator. Then remove gaging assembly and gas valve.

For accumulators having gas valve as shown in Figure 6, remove gas valve guard and gas valve cap. Then hold valve at point "C" with one (1) wrench while unscrewing hex nut at point "D" with a second wrench. Wait until all gas pre-charge is relieved from the accumulator and then remove gas valve.

Remove accumulator from hydraulic system. Threaded holes in hydraulic cap may be used as a means of attachment for lifting, or use a sling around the body.

Disassembly of Accumulator

Lay the accumulator horizontal and hold down with a strap wrench or in a vise. Some accumulators may have both end caps threaded into the body and some units may only have the gas cap threaded into the body. IN BOTH CASES ALWAYS REMOVE THE GAS CAP FIRST (end cap which contained gas valve). To remove cap or caps, install three (3) pins into the holes in the cap, then using a long bar working against the pins unthread the cap from the body. Remove o-rings and back-up rings from end cap.

Remove piston by pushing from hydraulic end with a bar. NEVER TRY TO REMOVE PISTON BY APPLYING COMPRESSED AIR AT OPPOSITE END. To remove v-o-ring from piston, lift seal with small smooth screw driver or similar tool, moving the tool around the piston several times while using the other hand to work ring off the piston.

Cleaning

Thoroughly clean metal parts in solvent and dry with compressed air. Clean bore of body with a clean lint-free cloth soaked in clean solvent. Bore must be clean of any visible particles or particles detectable to touch.

Inspection

Inspect piston for cracks, burrs around o-ring grooves, or damage. Examine body bore, using a light, for scratches or scoring. Inspect end caps for damaged threads or burrs on o-ring grooves.

Repair and Replacement

Minor nicks, scratches or light scoring of the body bore can be removed by using crocus cloth. Dress bore until all apparent imperfections have been removed. Replace teflon wear rings, v-o-rings, o-rings and their respective back up washers if the original assembly contained them.

Reassembly

Coat all internal parts with clean hydraulic fluid before reassembly.

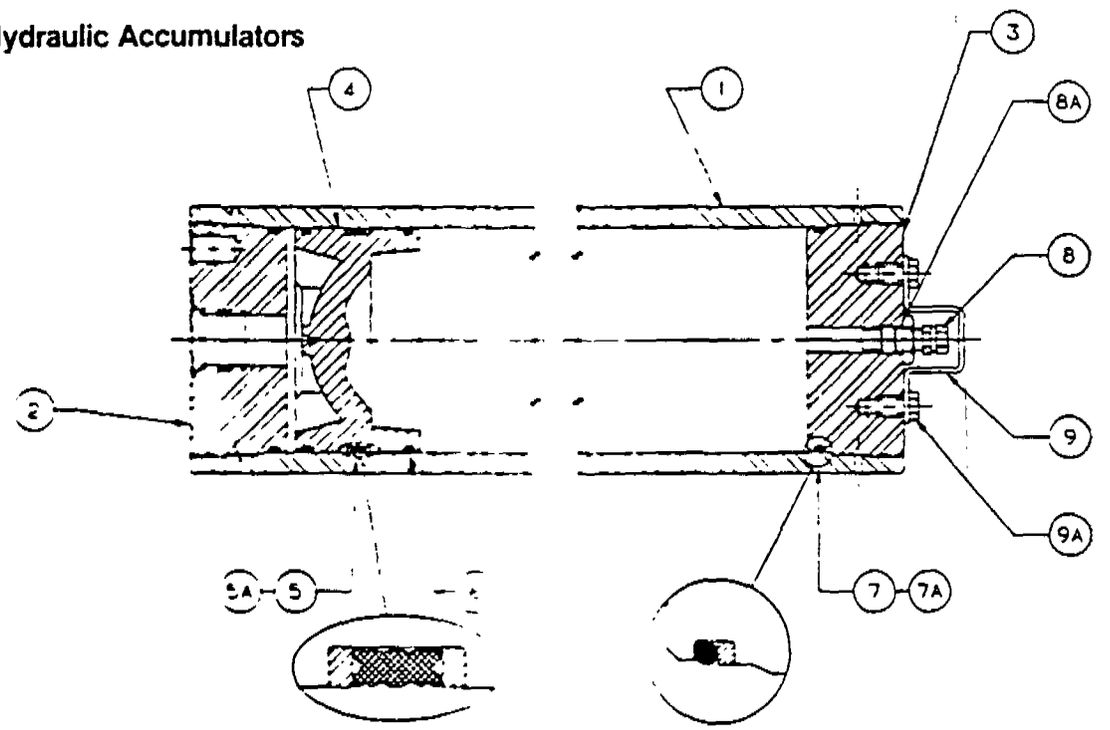
With new v-o-ring and Teflon rings on piston, install piston, hollow side toward gas end, in bore of body. Do not let v-o-ring drag on threads. Piston must go into bore exactly square and very slowly. (V-o-ring will compress as it rides up the chamfer if done slowly, but may be damaged if forced quickly.) Piston will fit snug. Use hammer and wood block to tap piston into place until all of piston is 2 inches below beginning of honed bore. Keep force against piston while tapping v-o-ring through the bore chamfer, otherwise piston will bounce back, damaging the o-ring. Cover port opening to keep out dirt.

Install new back-up ring first, then a new o-ring on threaded end cap or caps and install into body bore. Care should be exercised not to drag o-ring over threads. End cap will stop against chamfer leading into honed bore (extreme tightness not required — o-ring sealing is not dependent upon cap tightness). Cap should be flush with end of body within 1/16" to 3/32" above or below.

Install gas valve after replacing the o-ring.

Remount accumulator and connect to hydraulic system. Pre-charge accumulator using procedure outlined on page 2 (where space is a problem it may be necessary to pre-charge accumulator before connecting it to the hydraulic system).

Parts List — Hydraulic Accumulators



Item	Part Description
1	Body
2	Hydraulic Cap
3	Gas Cap
4	Piston
5	v-O-Ring
5A **	v-O-Ring Back-Up Washers
6	Teflon Ring (Piston)
*	O-Ring
*A**	O-Ring Back-Up Washer
8A	Gas Valve
8A	Gas Valve O-Ring
9	Gas Valve Guard
9A	Screw

*Some units may have these two components welded together

**Not used on 2" 4" and 5 3/4" bore units

***Not used on 2" bore units

▲ A S M E Units 7" 9" and 12" bore sizes units rated above 3000 PSI up to 5000 PSI use valve per figure 6 on page 2 (Part No 61243300000). Other units will have gas valve per figure 5 on page 2 (Part No 53238400000) which will contain gas valve core Part No 56722200000. Use tool (Part No 56244100000) to remove and replace new core

⚠ WARNING

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

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

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

SEAL KIT NUMBERS (Includes items 5, 5A, 6, 7, 7A, 8A)

	Bore Size					
Material	2"	4"	5-3/4"	7"	9	12
(Standard) Buna-N	592850K000	592851K000	666025K000	656100K000	716017K000	816126K000
Viton	592850E000	592851E000	666025E000	656100E000	716017E000	816126E000
EPR	592850D000	592851D000	666025D000	656100D000	716017D000	816126D000
Carboxylated Nitrile	592850J000	592851J000	666025J000	656100J000	716017J000	816126J000
Low Temp Nitrile	592850Q000	592851Q000	666025Q000	656100Q000	716017Q000	816126Q000

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- Hillsborough, NC 919/732-9371
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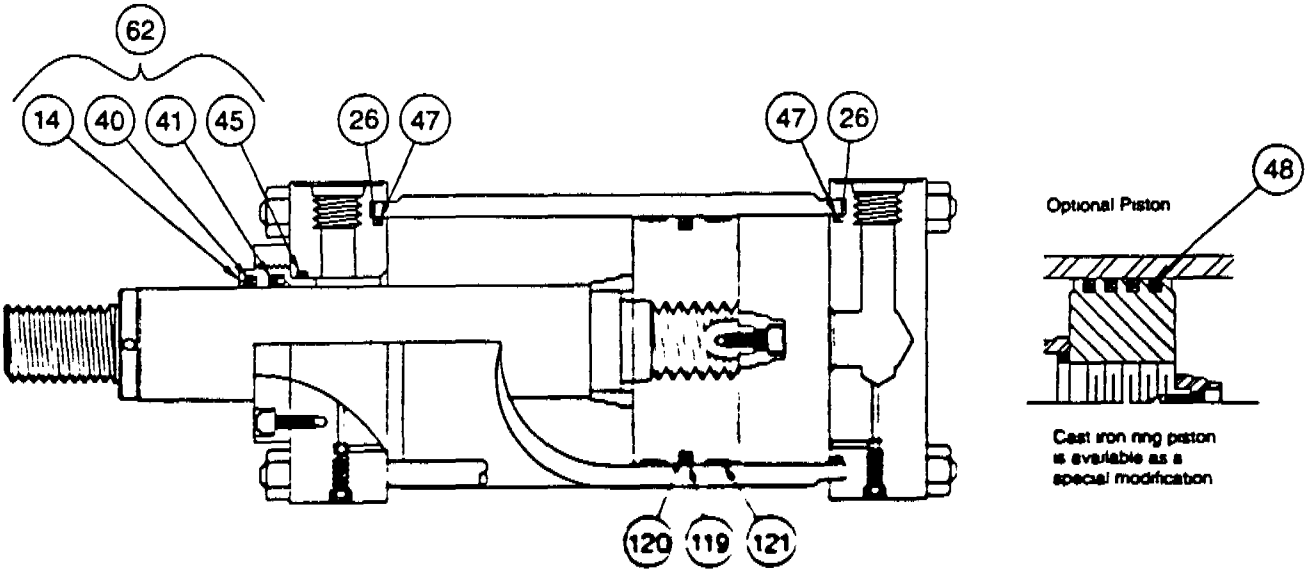
- Portland, OR 503/285-0884
- Owen Sound, Ont. Can. 519/371-2662
- Toronto, Ont. Can. 416/255-4567
- Lachine, Quebec, Can. 514/631-3995

Parker Motion & Control

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

Parts Identification and Maintenance Instructions

Dwg #
1145291



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

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

Standard Seals — Class 1 Service Kits are standard and contain Teflon^ fabric and Polyurethane seals. These seals are suitable for use when hydraulic (mineral-type) oil is the operating medium.

Parts Identification

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

Class 1 Hydraulic Service Only*

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

*For other classes of service, refer to Bulletin 0995-M3C.

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

Viton^ Seals — Class 5 Service Kits contain viton seals and are especially suited for elevated temperature service or for some fire resistant fluids (for specific fluids not listed in current catalog consult factory). Viton seals (Class 5) should be used for high temperature service within a temperature range of -10°F (-23°C) to +250°F (+121°C). Viton seals may be operated to +400°F (+204°C) with limited service life. For temperatures above +250°F (+120°C) the cylinder must be manufactured with a pinned piston to rod connection.

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

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

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

Bore Size	Cylinder Body Seal Kit	Piston Seal Kits†	
	CB	PR	Hi-Load
	Includes 2 ea. Symbol 47 & 26	Includes 2 ea. Sym. 47 & 26 4 ea. Sym. 48	Includes 2 ea. Sym. 26, 47 & 121; 1 ea. 119 & 120
7	CB703H0001	PR703H0001	PK703HK001
8	CB803H0001	PR803H0001	PK803HK001

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

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

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

Parts Identification and Maint nanc Instructions

To Service R d Gland Seals — The rod gland cartridge, Symbol 62, is removable without disassembly of the cylinder on all Series 3H 7" & 8"bore hydraulic cylinders. To remove the gland, loosen the retainer screws and remove the gland retainer. It is recommended that the used gland be replaced by a complete gland cartridge kit, Symbol 62. Later the used gland can be inspected, and if the bearing surface is still satisfactory and not out-of-round, it can be repacked with replacement seals and stored for future use.

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

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

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

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

The hi-load piston is supplied with one continuous Teflon outer nng Symbol 119, which is preloaded by a synthetic rubber inner nng Symbol 120, and two split fabric-phenolic wear nngs. Symbol 121 To service the hi-load piston, remove old seals and wear nngs and clean all piston surfaces Install the inner nng in groove as shown Install the wear nng in the longer groove at each end of piston, also as shown Heat the Teflon outer nng in boiling water and stretch it by hand until it will fit over the O.D of the wear nng Push outer nng over the wear nng and into the seal groove. With outer ring in its groove, compress it with ring compressor or use a starting sleeve having an I.D. same size as cylinder bore and tapered at one end.

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

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

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

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

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⚠ WARNING

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Table A
Tie Rod Nut
Torque — Foot Pounds
Series 3H, 7" & 8" Bore Cylinders

Cylinder Bore	7"	8"
Ft Lbs	790	1160

Table B
Retainer Bolt Torque
For Cylinders with Round or Small Square Gland Retainer

Bolt Dia.	Torque
3/16"	15 In. Lbs.
1/4"	60 In. Lbs.
5/16"	10 Ft. Lbs.
3/8"	20 Ft. Lbs.
7/16"	35 Ft. Lbs.

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- Atlanta, GA 404/349-0563
- Goodland, IN 219/297-3182
- Plymouth, MI 313/455-1700
- Hillsborough, NC (Accum) 919/732-6183
- Hillsborough, NC 919/732-9371
- Akron, OH 216/253-4500
- Portland, OR 503/285-0884
- Owen Sound, Ont. Can. 519/371-2662
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