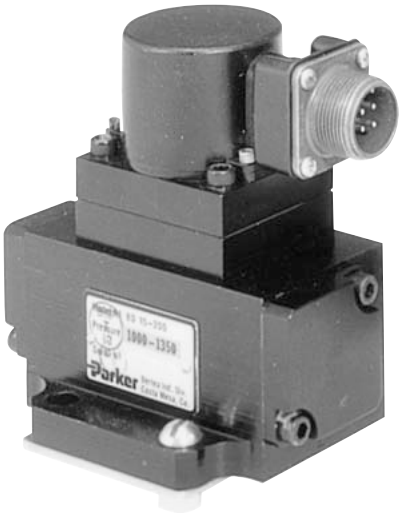
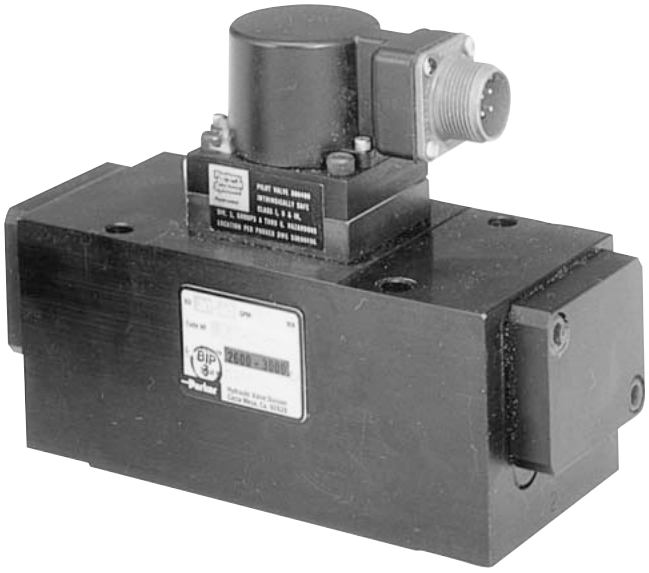
Bulletin HY14-1450-M1/US
Installation and Service Guide

Series BD15 and BD30 Flow Control Servovalves

Effective: October 15, 2006
Supersedes: Catalog No. 1450 ISM, dated 3/96





Description

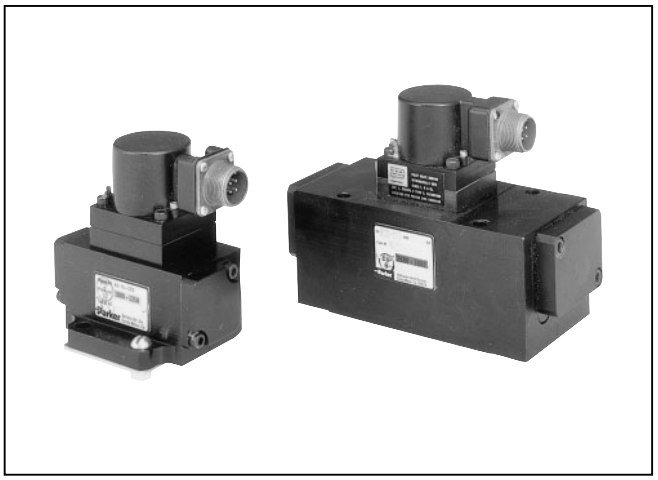
Series BD servovalves provide high resolution in the control of position, velocity and force in motion control applications.

Features

- Rugged reliable trouble-free operation.
- Reduced contaminant sensitivity.
- Linear flow gain characteristics.
- Intrinsically safe model available.
- Explosion proof model available.

Operation

When used in conjunction with Series BD90/95 and BD101 servo amplifiers or a motion controller, Series BD valves will provide accurate control of rotary and linear actuators.



Specifications

Rated Flow @ 1000 PSI ΔP	3.78–151 LPM (1.0 – 40 GPM)
Linearity	≤ 5%
Hysteresis	≤ 3%
Threshold	≤ 0.5%
Fluid	Mineral oil, 60–225 SSU, max. 1000 SSU
Oper. Temp. (Ambient)	–1 to 106°C (30 to +225°F)
Pressure Gain	3% of spool shift
Null Shift with Temperature with Supply Pressure	 < ± 2% per 38°C (100°F) < 2% per 69 Bar (1000 PSI)
Quiescent Flow (Std. Spool Lap)	BD15 – 1.5–2.1 LPM (.40–.55 GPM) BD30 – 2.1–3.78 LPM (.55 – 1.0 GPM)

Step Response Input	Model	Typical Step Response Input
	BD15	10 to 90%, 26 ms
	BD30	10 to 90%, 30 ms

Pressure Ranges

For optimum performance, Parker Servo Valves are designed to operate within specific system supply pressure ranges.

System Supply Pressure

180–210 Bar	(2600–3000 PSI)	48–66 Bar	(700–950 PSI)
138–172 Bar	(2000–2500 PSI)	14–45 Bar	(200–650 PSI)
95–133 Bar	(1400–1950 PSI)	0–210 Bar	(0–3000 PSI)
68–90 Bar	(1000–1300 PSI)		External Pilot

Filtration	SAE Class 3 or better, ISO Code 17/15/12
Protection Class	NEMA 1 (IP54)

Flow–Load Characteristics

Control flow to the load will change with load pressure and valve current as shown in figure 1. These characteristics closely follow the theoretical square–root relationship for sharp–edged orifices as illustrated in the equation below.

$$Q = K\sqrt{\Delta P}$$

Q = Control flow, cubic inches/sec
K = Valve constant
ΔP = Valve pressure drop

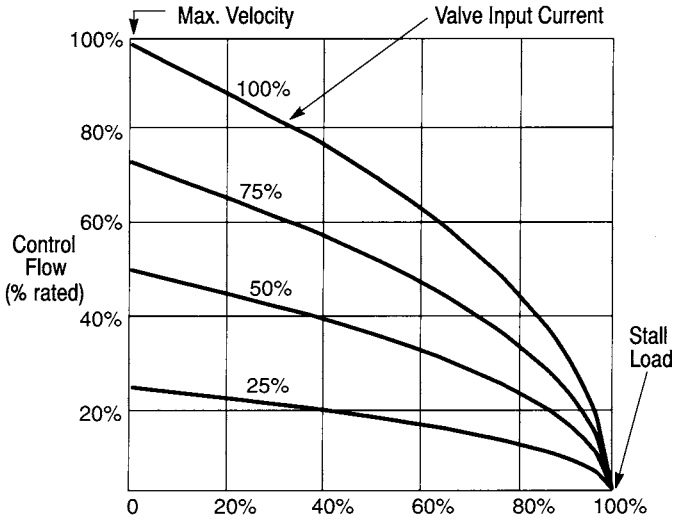


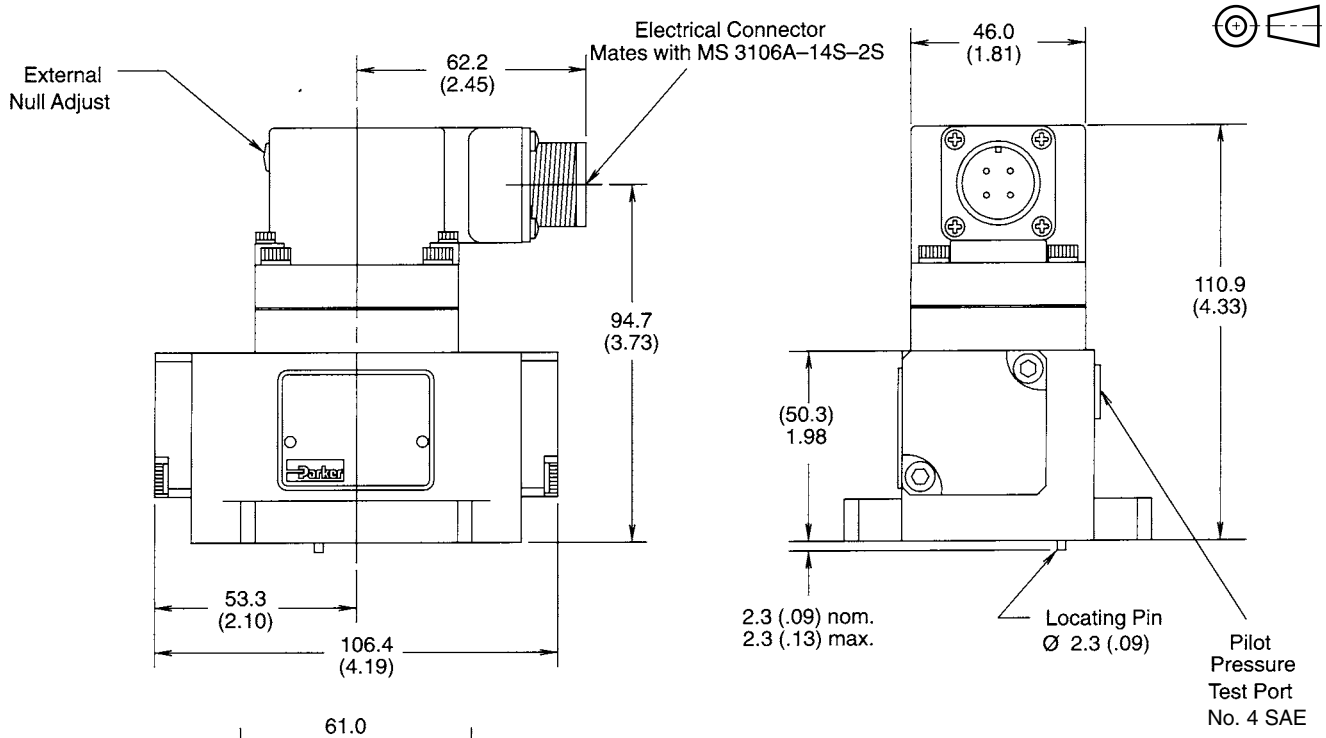
Figure 1. Change in flow with current and load pressure

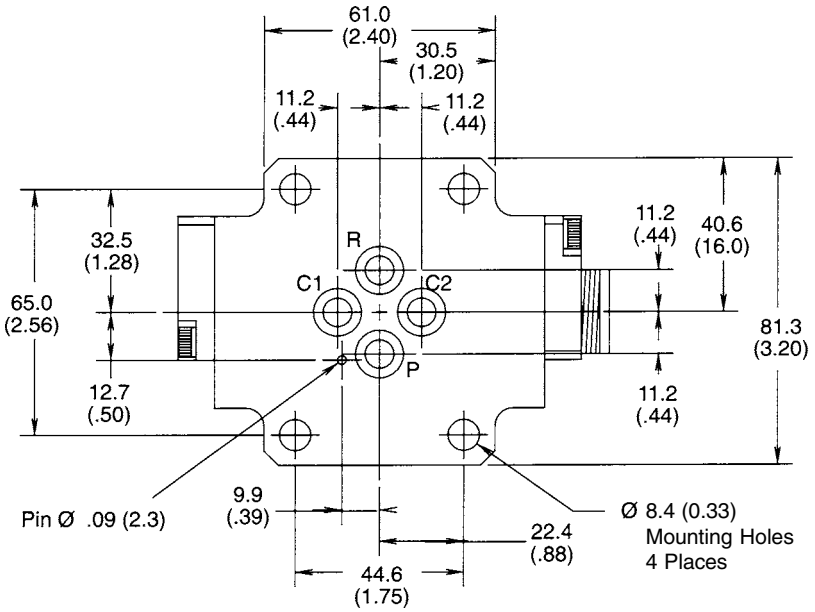
Quick Reference Data Chart

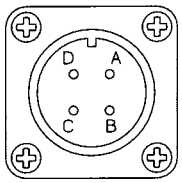
Model	Flow Capacity @ 1000 PSID LPM (GPM)	Max. Pressure Rating	Max. Tank Pressure	Port Circle	Electrical Input (Std.) Single Coil	Coil Resistance (Std.) Each Coil	Weight
BD15	3.8, 9.5, 19, 37, 57, 76 (1, 2.5, 5, 10, 15, 20)	210 Bar (3000 PSI)	14 Bar (200 PSI)	.875	60 mA (Full Flow)	60 ohms	1.2 kg (2.6 lbs.)
BD30	76, 95, 113, 151 (20, 25, 30, 40)	210 Bar (3000 PSI)	14 Bar (200 PSI)	1.75	60 mA (Full Flow)	60 ohms	2.9 kg (6.3 lbs.)

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio, USA

Inch eqivalents for millimeter dimensions are shown in (**)





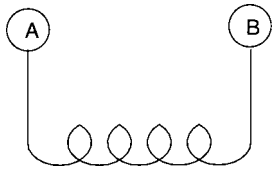


BD15 Installation Data

Mounting Screws, Soc. Hd. Cap	5/16-18 Th x 1.00 long
Torque	110 to 150 in. lbs.
O-ring Grooves	0.560 Dia. x 0.052 deep
O-ring Size	2-013 (70 Durometer)
Elec. Connector Mates with -	MS3106-14S-2S

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 1.

Standard Wiring



Positive current to the Pin “B” yields flow from the C1 port. Other options change polarity or use pin "D" instead of "B". See ordering information page for details.

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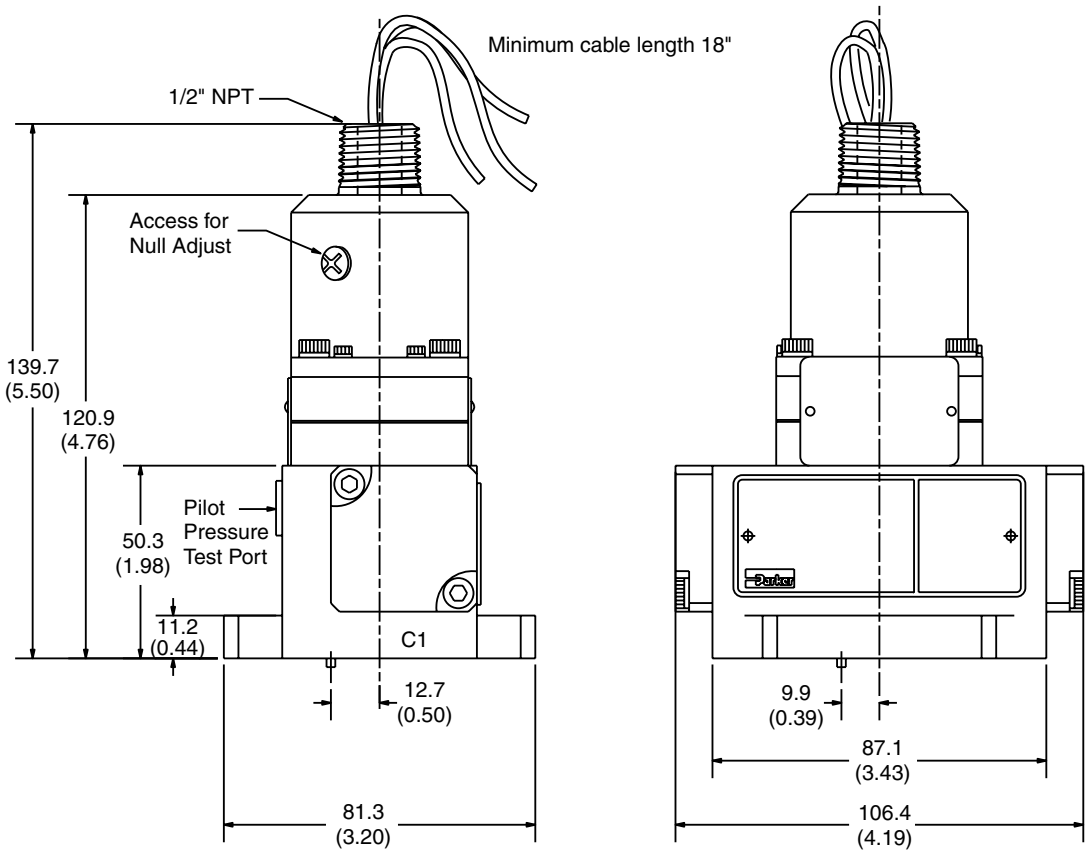

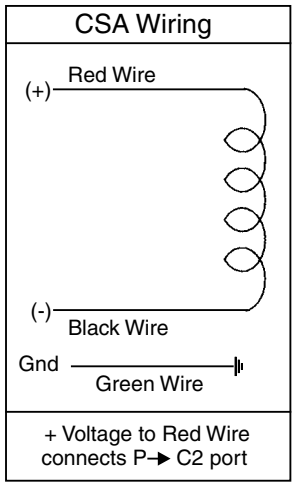

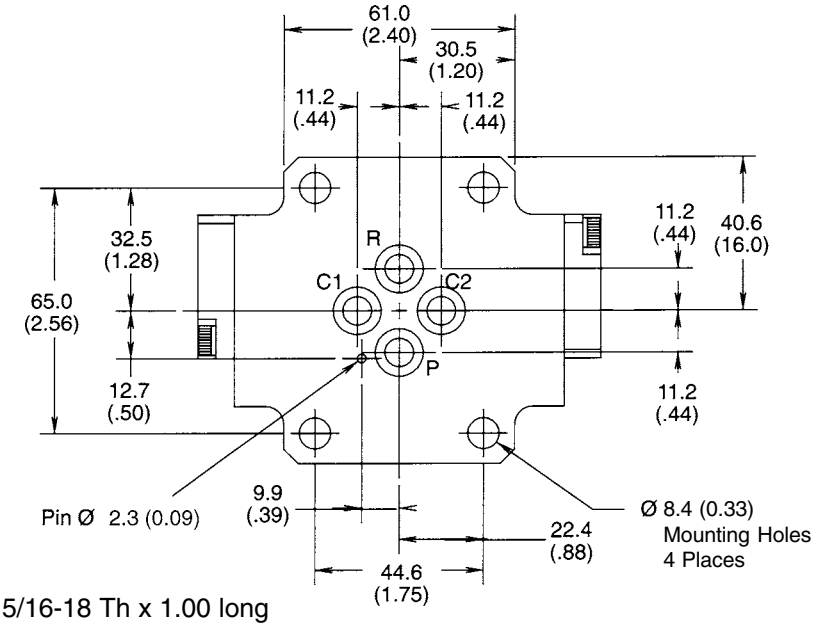

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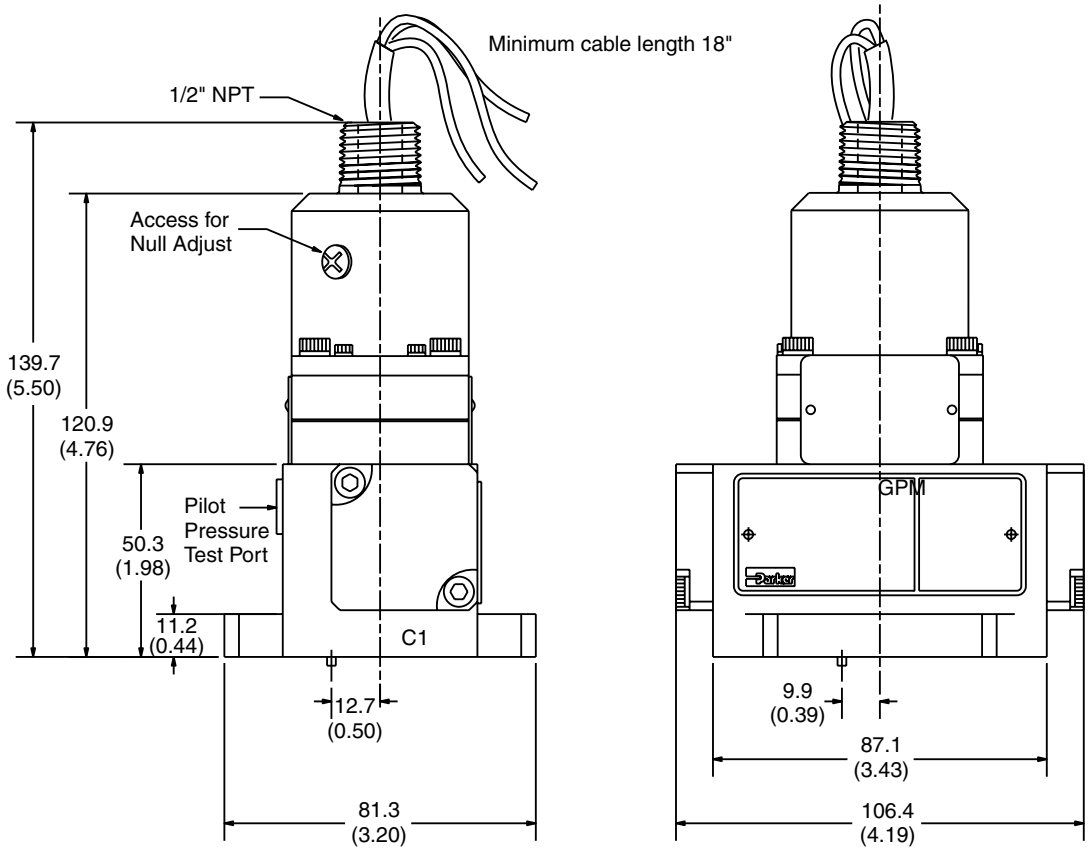

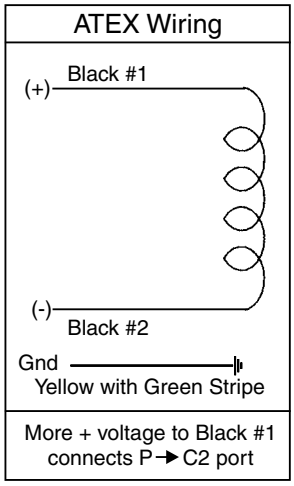

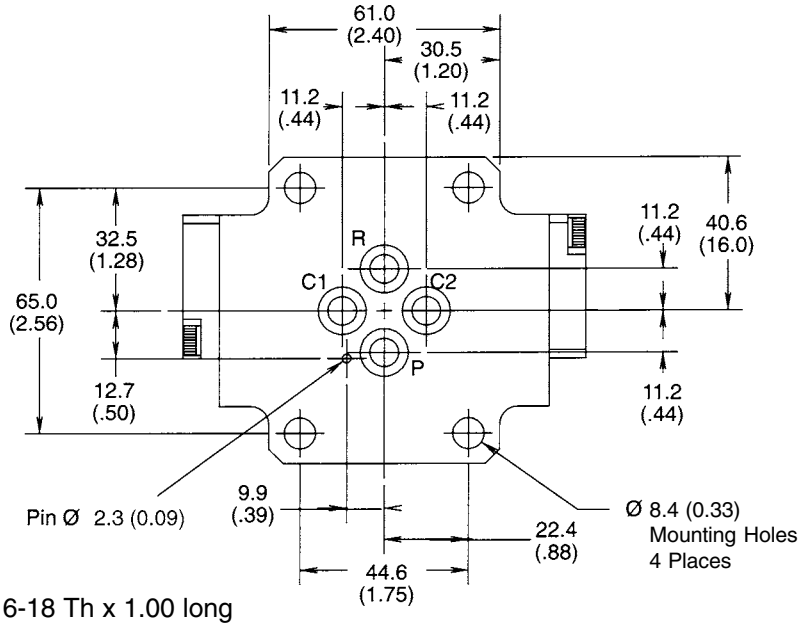

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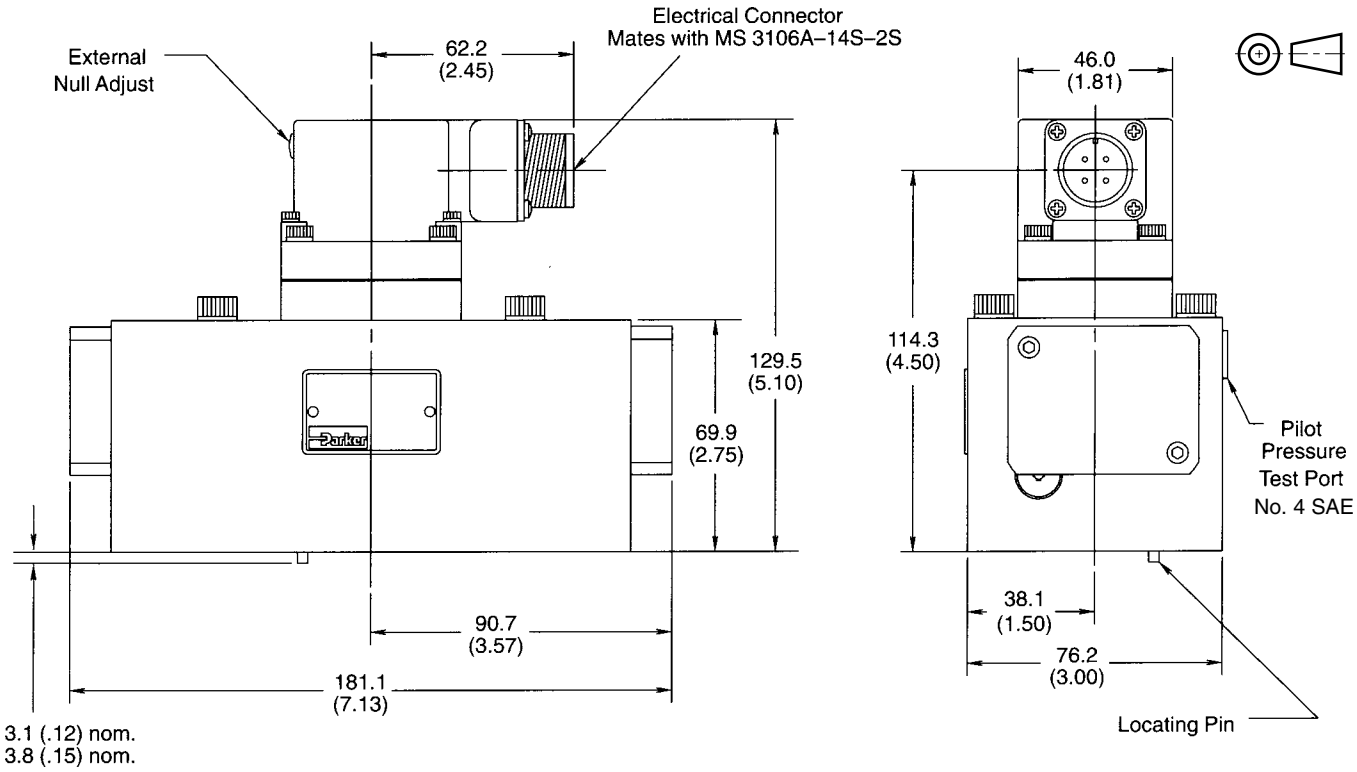
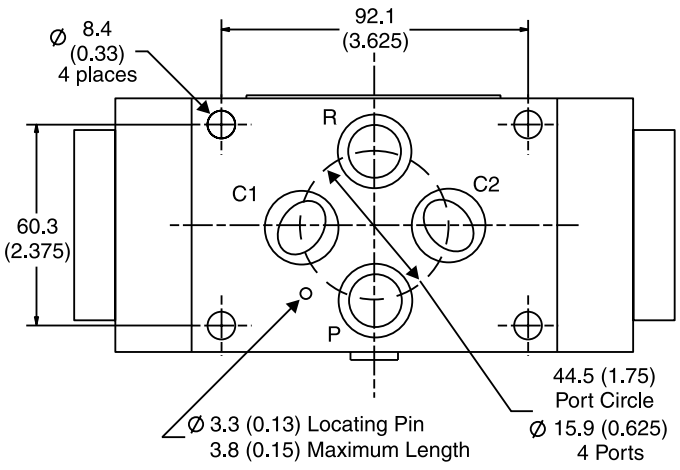
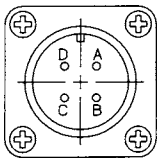




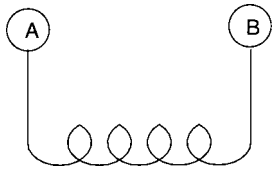


BD30 Installation Data

Mounting Screws, Soc. Hd. Cap	5/16-18 x 3.25 long
Torque	110 to 150 in. lbs.
O-ring Grooves	0.866 Dia. x 0.052 deep
O-ring Size	2-018 (70 Durometer)
Elec. Connector Mates with -	MS3106-14S-2S

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 1.

Standard Wiring



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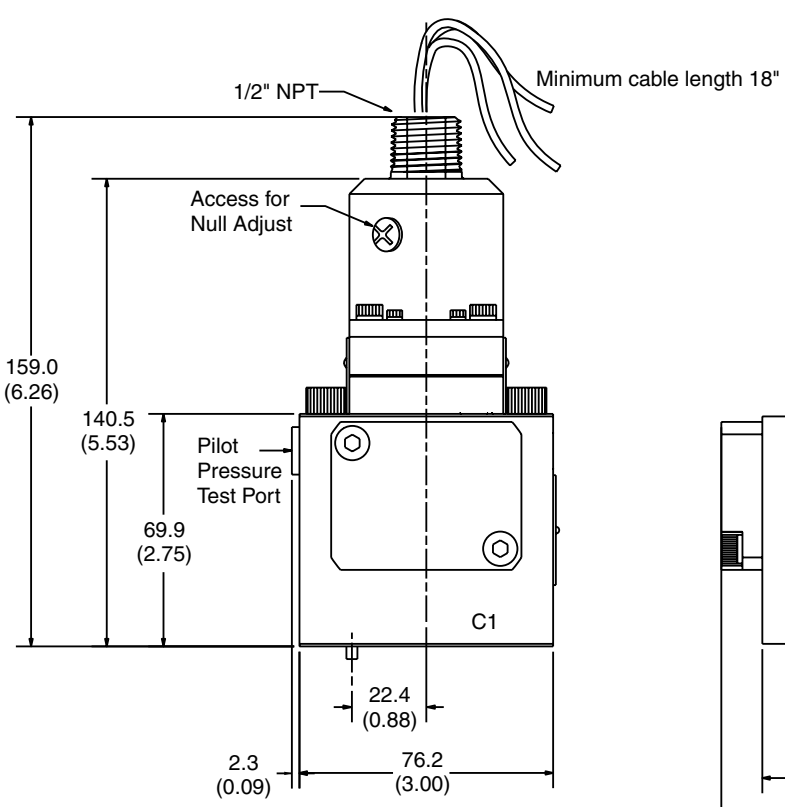

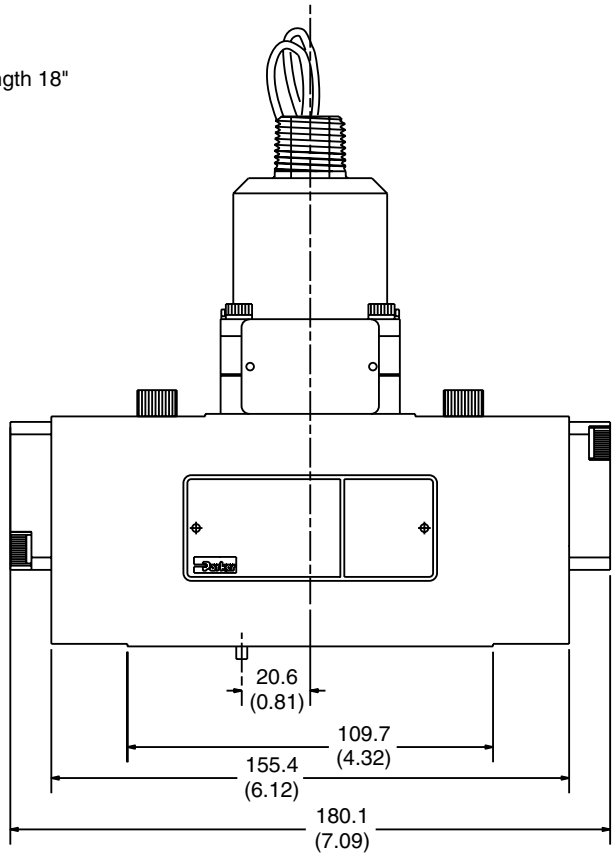

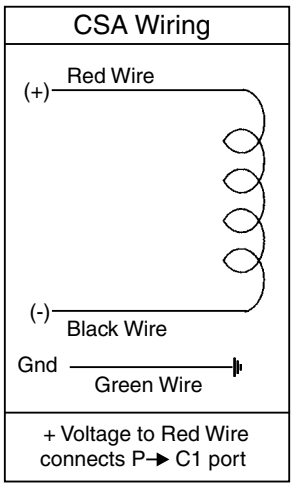

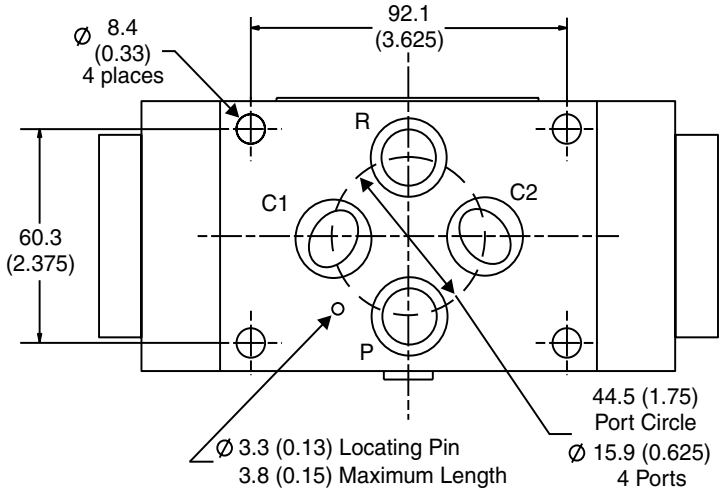

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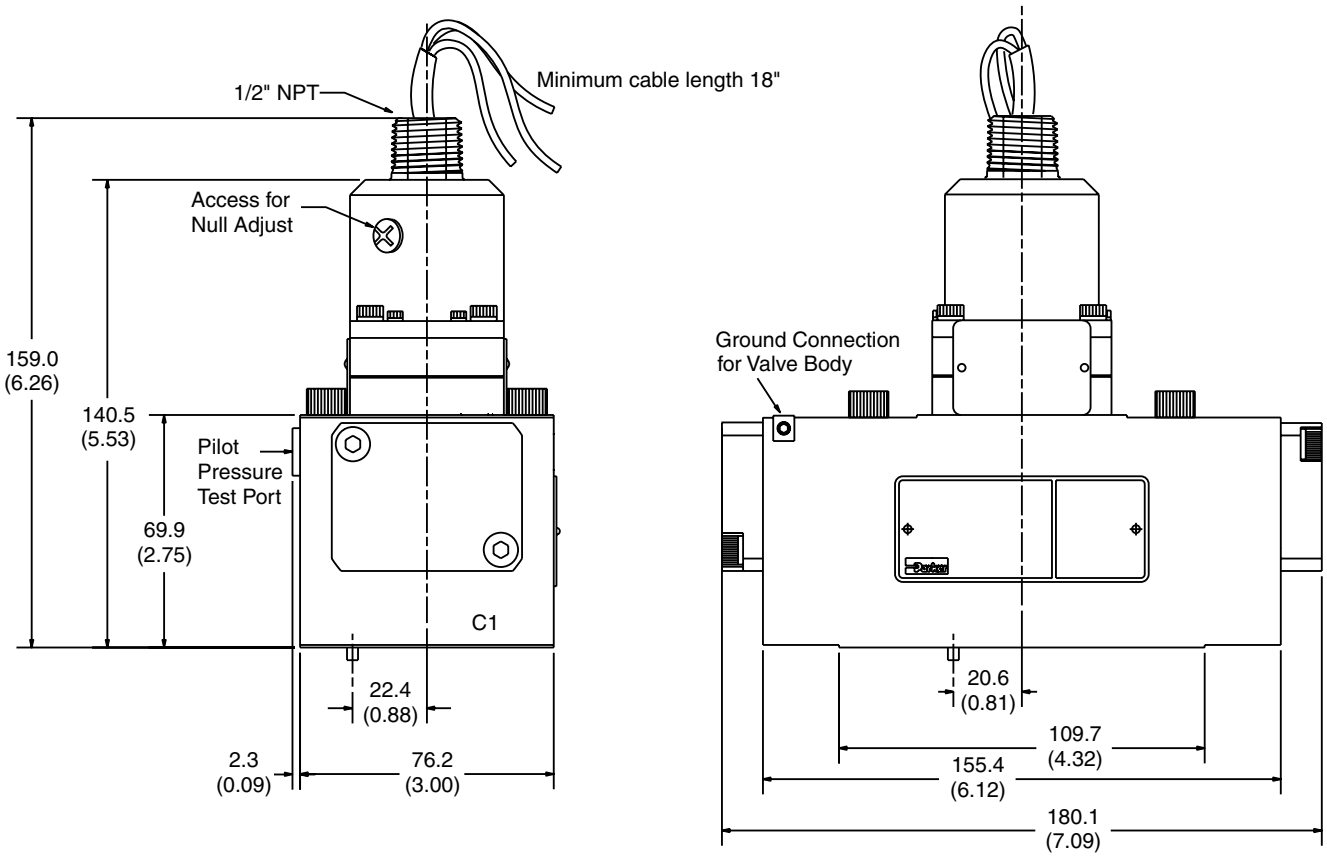

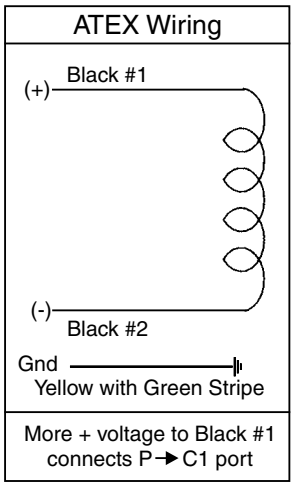

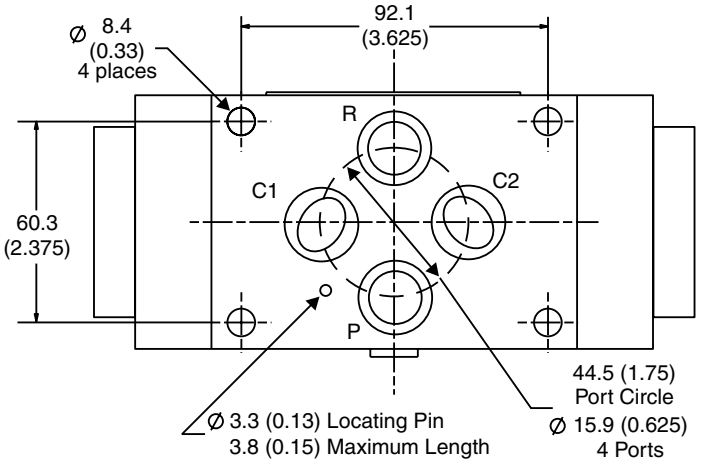

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Contamination Resistant Electrohydraulic Servovalves

The Parker BD series servovalves are ruggedly designed for use in the industrial market place. From its inception, 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 servovalve models substantially increase reliability by reducing problems due to contamination. The second stage is a closed center, four-way spool and sleeve assembly 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 40 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, PC1, and PC2. 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 its diverter blade window. The window edges divert the jet stream to the proper receiver outlet to position the spool to the electrically commanded position.

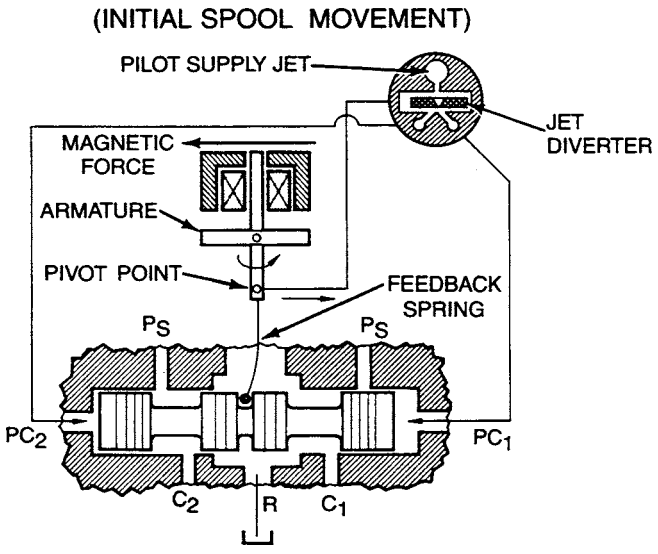

Figure 2. Servovalve Operation - Command for Flow from Control Port C2

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 PC1. See Figure 2. 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 re-centered over the receiving orifices, and the spool motion stops at this position. Flow, proportional to the input electrical current, is then metered out the C2 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 3. Changing the polarity of the current to the coil causes a magnetic force in the opposite direction that results in flow from the C1 port.

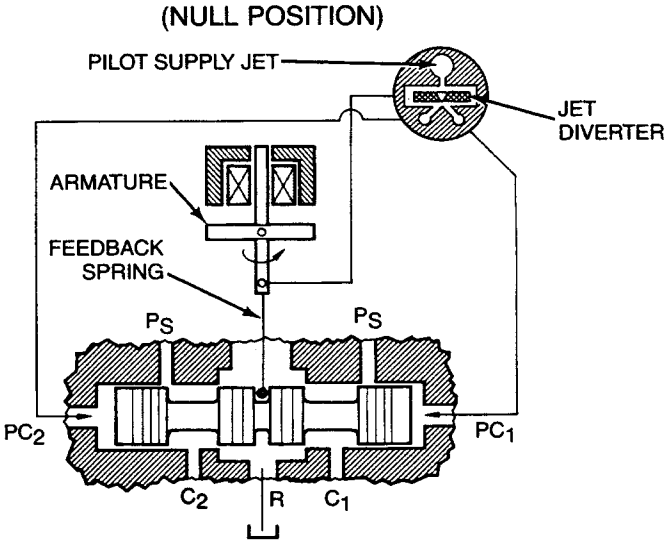

Figure 3. Servovalve Operation - Null Position, Valve in Balance

Servovalve Installation

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

BD15 flushing valve - PN 1200127

BD30 flushing valve - PN 1200128

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 in a preferred direction with electrical power off (electrical failure), a null offset adjustment can be made to make sure the actuator moves in the desired direction. 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 non-ferrous 1/16 inch hex wrench into the access hole and engage the adjusting screw. (A ferrous metal wrench, such as steel, 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 over tightened 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 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 actuator could follow signal in such a way that would wear the seals rapidly. Therefore, care should be exercised 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.

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 is the first thing to check. It can be serviced as follows:

1. Wipe the surface around the 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 the uncovered port flange of the servovalve on a contaminated surface.
3. Inspect the port flange carefully, and if necessary, remove contamination using a clean wipe. Make certain that contamination is prevented from entering open fluid ports.
4. Using the special wrench 820000TF3-1 remove the filter cartridge. See Figure 4.

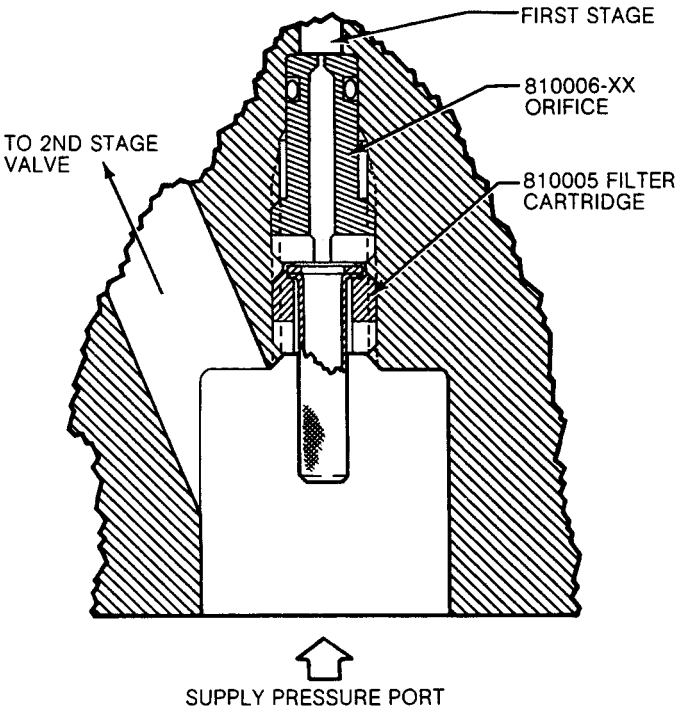

Figure 4. Filter Cartridge Removal

5. Clean the filter by soaking it in trichloroethylene or other suitable solvent for 5 minutes, and blow dry from the inside out using filtered, dry, compressed air.
6. Be sure the cartridge is dry and free from solvent before reinstalling.
7. Inspect the filter for cleanliness and damage to screen.
8. Position the filter in the servovalve cavity using the 820000TF3-1, wrench.
9. Tighten the filter to 15 - 30 in. lb. above run down torque.
10. Install servovalve on the mounting pad. Refer to pages 2 and 5 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 1 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 the orifice in the 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 the filter as described in the **Filter Maintenance** section.

Use of Test Port

The SAE-4 Test port is provided should a verification of pilot valve supply pressure be desired. To use this port, the SAE-4 plug must be removed, and replaced with a SAE-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 25µm 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 with 60 Ohm coil. Valves with other coils should be checked to ±10% of the rated resistance of the coil.

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 Checkout Procedure

1. Remove the electrical cable from the valve and connect pins A & B to a hand held power source. (A 1.5 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 system still exhibits the problem, refer to Table 2 for service suggestions.

Table 1. Orifice Selection

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 te valve name plate. Fluorocarbon O-ring kits are also available; Order Part 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.

BD — Basic Model

Size

Code
15
30

Options

Code	Description
A	Standard Valve
B	Intrinsic Safe, Factory Mutual
C	Explosion Proof, Factory Mutual
J	Explosion Proof, CSA Approved
N	Explosion Proof, ATEX Approved

See Note 1.

Coil

Code	m(A)	Ohm
A	60 (Std.)	60
B	15	1016
C	20	591
D	30	243
E	40	138
F	50	90
G	100	22
H	200	5.7
J*	30/30	118/118
K	80	36

* For intrinsic safe only.

Connector

BD15

Code	Description
A	C_2B (Std.)
B	C_2D
C	C_1B
D	C_1D
J	Intrinsic Safe
L	Explosion Proof

BD30

Code	Description
E	C_2B (Std.)
F	C_2D
G	C_1B
H	C_1D
K	Intrinsic Safe
M	Explosion Proof

See Note 2.

Seals

Code	Description
N	Nitrile (Std.)
V	Fluorocarbon

Supply Pressure

Code	Description
B	2600–3000 (Standard)
C	2000–2500
D	1400–1950
E	1000–1300
F	700–950
G	200–650
H	0–3000 (5th Port)

See Note 3.

Flow

BD 15

Code	Flow (GPM)
1	3.8 LPM (1 GPM)
2.5	9.5 LPM (2.5 GPM)
5	18.9 LPM (5 GPM)
10	37.9 LPM (10 GPM)
15	56.8 LPM (15 GPM)
20	75.7 LPM (20 GPM)

BD 30

Code	Flow (GPM)
20	75.7 LPM (20 GPM)
25	94.6 LPM (25 GPM)
30	113.6 LPM (30 GPM)
40	151.4 LPM (40 GPM)

Mounting Bolt Kit (U.S.)

BD15	BK07 (4) 5/16-18 x 1
BD30	BK46 (4) 5/16-10 x 3 1/4

Note 1: **"B" Intrinsic Safe Option meets** Factory Mutual Intrinsically Safe Class I, II and III, Division 1 Groups A through G. Refer to Parker Bulletin 1452.

"C" Explosion Proof meets:
Factory Mutual Explosion Proof
Class I, II, III, Division 1, Groups A through G

"J" Exposion Proof meets:
Canadian Standards Association
Class I, Groups A through D
Class II, Groups E, F and G
Class III
Refer to Parker Bulletin 1451.

"N" Explosion Proof meets:
ATEX ⟨Ex⟩ II2G EExm II T3 T_{amb} 45°C to -50°C
Request Parker Documentation Package: 1200074

Note 2: Connector Location & Flow Polarity
(Standard connector over C_2 + to B = P to C_1 flow).

C_2B = Connector over Port C_2, + to Pin B = P to C_1 flow.

C_2D = Connector over Port C_2, + to Pin D = P to C_1 flow.

C_1B = Connector over Port C_1, + to Pin B = P to C_1 flow.

C_1D = Connector over Port C_1, + to Pin D = P to C_1 flow.

Note 3: Supply Pressure: Code "H" applies to 5th Port/External Pilot Option. This requires the use of a blank orifice "-00". First stage pressure should be limited to 41.4 Bar (600 PSI) and no less than 27.6 Bar (400 PSI).

Servo valve rated flow at 1000 PSID ±10%.

Table 2. Service Suggestions

Symptom	Possible Cause	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.	1. Check lead and coil resistance. If there is an "open", remove the connector and check it's solder joints. Resolder if required.
	2. Totally plugged supply orifice or filter.	2. Remove and inspect filter and orifice per Maintenance Section.
	3. Spool stuck.	3. Return to factory.
Sluggish valve. (Servovalve output lags electrical command signal or it fails to meet its rated output.)	1. Partially plugged:	1. Clear the blockage
	a. Filter element	a. Inspect filter per Maintenance Section
	b. Orifice	b. Inspect orifice per Maintenance Section.
	c. Pilot Valve	c. Return to factory.
	2. Leaky sleeve o-rings.	2. Investigate excessive internal leakage to tank (bypassing flow sound)
	3. Low pilot supply pressure.	3. Check pilot supply pressure per Maintenance Section.
	4. Cylinder piston ring failure.	4. Check cylinder (listen for bypassing sound.)
	5. Shorted coil.	5. Check coil resistance in accordance with Maintenance Section, Electrical Checkout.
	6. Low supply pressure.	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.	1. Adjust null per Servovalve Maintenance Section.
	2. Partially plugged receiver.	2. Return valve to factory.
Output flow obtained from one port. (Actuator hard over no response to servo command.)	1. Valve improperly phased.	1. Swap the two leads to the valve coil to change the polarity of the current to the coil.
	2. Plugged pilot valve receiver port.	2. Return valve to factory.
	3. Spool stuck.	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 actuator in the closed loop system.	1. Valve drive electronics gain set too high or some other misadjustment.	1. Reset the electronics. See electronics installation manual.
	2. Partially plugged orifice or filter.	2. Check pilot pressure at test port and/or remove, inspect, and clean orifice/filter per Servovalve Maintenance Section.
	3. Sticky spool.	3. Return valve to factory.

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9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

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11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

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Bulletin HY14-1450-M1/US,
10/06, 2M, PHD