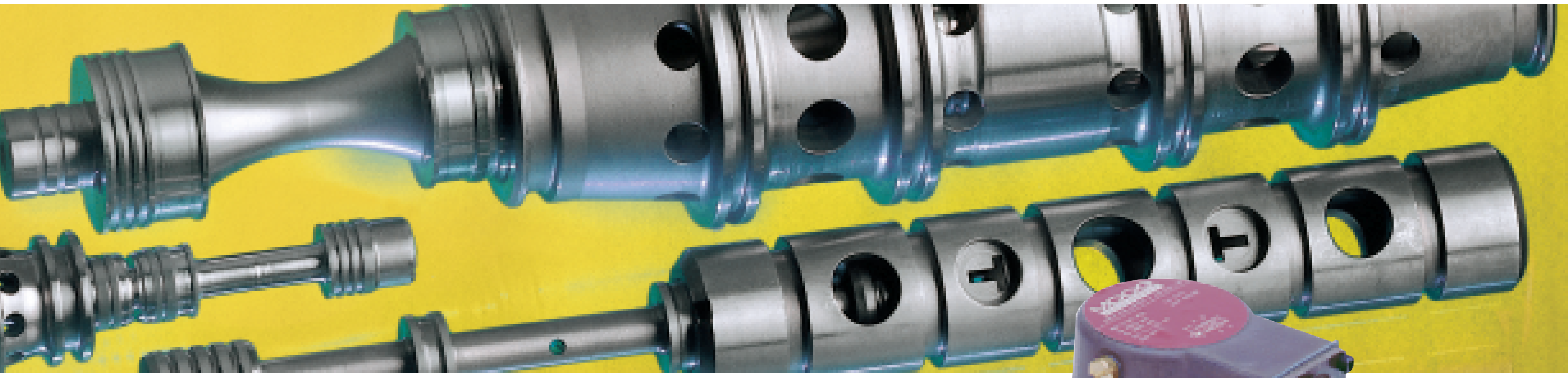
# Jet Pipe Servovalves



## MOOG JET PIPE SERVOVALVES

For over 25 years, Moog has been a premier manufacturer of servovalves for industrial applications. With the addition of the Jet Pipe Product Line, Moog now offers Jet Pipe Servovalve Technology covering a range of flows from 0.1 to 90 gpm at 1000 psi valve pressure drop.

The Jet Pipe Servovalve features two-stage proportional flow control with a Jet Pipe first stage. The first stage includes the torque motor, Jet Pipe and receiver, and the second stage body includes the spool and sleeve assembly. These valves are designed for electro-hydraulic position, speed, pressure, and force control systems with medium dynamic response requirements.

## HISTORY

Atchley Controls was founded by Raymond D. Atchley who pioneered the development of "Jet Pipe" servovalves. With Moog's 1998 acquisition of Raytheon Aircraft's Montek Division, Moog's Industrial Controls Division is now responsible for the Atchley Jet Pipe product lines including both the manufacture of new products and repair of all products.

Our quality management system is certified in accordance with DIN EN ISO 9001.

This catalog is for users with technical knowledge. To ensure that all necessary characteristics for function and safety of the system are given, the user has to check the suitability of the products described herein. In case of doubt, please contact Moog.

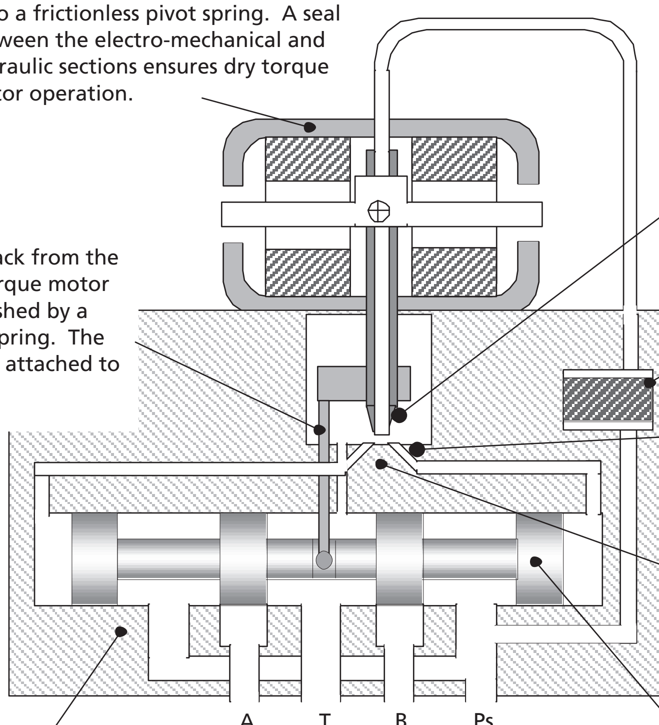
# SERVOVALVE OPERATING PRINCIPLES

The two stage electrohydraulic flow control servovalve converts an electrical signal to precise proportional hydraulic flow.

- ➢ The first stage pilot includes the torque motor, Jet Pipe and receiver
- ➢ The second stage body includes the spool and sleeve assembly.

Hydraulic fluid at system pressure travels through the first stage wire mesh filter into a feedtube and out the projector jet. The projector jet directs this hydraulic fluid stream at two receivers, each of which is connected to the second stage spool end chambers.

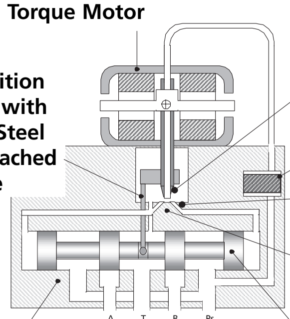
The first stage torque motor receives an electrical signal (current to the coils) and converts it into a mechanical torque on the armature and Jet Pipe assembly. The torque output is directly proportional to the input current. As more current is applied to the valve, greater forces are exerted to rotate the armature assembly around its pivot point.



## OPERATING PRINCIPLE OF THE JET PIPE SERVOVALVE

Hydraulic fluid at system pressure is fed through a filter screen to the Jet Pipe that directs a fine stream of fluid at two receivers. Each receiver is connected to one end of the second stage spool. At null (no signal to the torque motor), the jet stream impinges on each receiver equally, therefore equal pressure is applied at each spool end. All forces on the second stage spool are equal and it remains at the null position.

When an electrical input signal is applied to the coils of the torque motor, an electro-magnetic force is created. This force causes the armature and Jet Pipe assembly to rotate about the armature pivot point, resulting in more fluid impinging on one receiver than the other. The resulting differential pressure between the spool's end chamber triggers spool movement and, in turn, uncovers second stage porting causing fluid to flow to and from, depending on spool direction, the two valve control ports (A and B).




The direction of spool displacement is opposite to the Jet Pipe rotation. As the spool moves, the feedback spring generates a force at the Jet Pipe which opposes the torque motor's force.

The spool continues to move until the force generated by the feedback spring equals the force produced by the torque motor. Then the Jet Pipe position is returned to being centered over the two receivers. A small differential pressure usually remains across the ends of the spool to overcome Bernoulli flow forces that tend to close the valve and feedback spring forces. The spool displacement is proportional to the control current in the torque motor. As the spool moves, fluid is metered proportionally to and from the second stage control ports (A and B). When input signals to the torque motor vary in amplitude and polarity, the second stage spool accurately follows the signals and meters fluid accordingly.

## SERVOVALVE OPERATION

At first stage null, the jet is directed exactly between the two receivers, making the pressures on both sides of the spool equal. The force balance created by equal pressures in both end chambers holds the spool in a stationary position. (See Figure 1a.)

As the jet pipe and armature of the torque motor rotate around the pivot point (the result of input current), the fluid jet is directed to one of the two receivers creating a higher pressure in the spool end chamber connected to that receiver. The differential pressure created across the spool moves it in the direction opposite to the jet displacement (See Figure 1b).

Connected to the spool and jet pipe is a feedback spring assembly, which translates spool position into a force that is applied on the jet pipe in a proportional manner. Increased spool displacement away from null, increases the force exerted on the jet pipe. Forces transmitted from the spool to the jet pipe are opposing the forces trying to turn the armature jet pipe assembly. When the feedback spring force is equal to the forces from the torque motor, the jet is returned to a position exactly between the two receivers. As mentioned before, such a position creates a pressure balance between the end chambers; then the spool will hold its position (See Figure 1c).

Since the torque motor forces are proportional to input current and the feedback forces are proportional to spool position, the resulting spool position is proportional to input current. Increasing current to the torque motor shifts the spool from null position.

Reversing polarity of the applied current, reverses forces on the armature and jet pipe. The hydraulic jet flow impinges on the other receiver, creating an imbalance in spool end chamber forces. The spool moves in an opposite direction until a first stage force balance is achieved by the feedback spring. Jet flow is then directed between the receivers and equal pressure holds the spool in position.

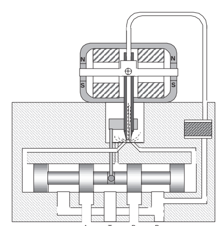



**Figure 1a - At Neutral**

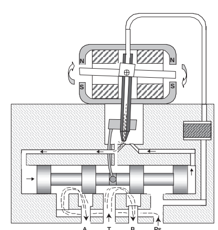



**Figure 1b - With Input Current**

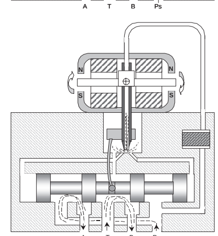



**Figure 1c - Stabilized with Current**

## SPOOL PORTING

Figure 2a illustrates flow out A of a four-way servovalve when the first stage pilot displaces the spool to the right. This movement opens slotted ports in the sleeve and fluid is metered from the supply pressure port to control port A, and from control port B to the return pressure port T.

Reversing spool motion to the left of the null position (Figure 2b) directs fluid from the supply pressure port to control port B, and from control port A to the return pressure port T.

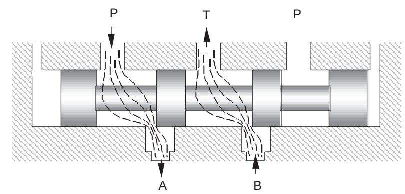



**Figure 2a - Flow out A**

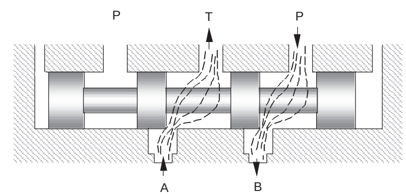



**Figure 2b - Flow out B**

## FLOW OUTPUT

Square slotted ports with the above spool motion gives a proportional flow output. This is demonstrated with Figure 3: Flow vs. Current Plot. Flow output of the servovalve changes in magnitude directly proportional to the level and polarity of the input current.

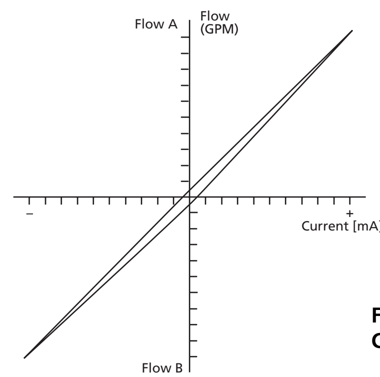



**Figure 3a - Flow vs. Current Plot**

## TORQUE MOTOR SCHEMATIC

The torque motor is located in the servovalve first stage and provides a means of converting an electrical input to a mechanical output. The term “torque” refers to the armature rotational motion around its pivot point, resulting from electrical and magnetic forces. This torque is instrumental in the servovalve electrical to mechanical power transfer.

The torque motor has an armature mounted on a torsion pivot spring and is suspended in the air gaps of a magnetic field (Figure 4a). The two pole pieces, one polarized north and the other south by the permanent magnets, form the framework around the armature and provide paths for magnetic flux flow. When current flows through the coils, the armature becomes polarized and each end is attracted to one pole piece and repelled by the other (Figure 4b). The torque exerted on the armature is restrained by the torsion spring upon which the armature is mounted.

The rotational torque created is directly proportional to the amount of polarization or magnetic charge of the armature - increased armature polarization creates a higher force attraction to the pole pieces. Since the amount of polarization of the armature is proportional to the magnetic flux created by the current through the coils, torque output of the torque motor is proportional to the coil input current. The magnetic flux created by the coils is dependent on two factors: the number of coil wire turns and the strength of current that is applied. In other words, the torque of the motor is dependent on the ampere-turns applied.

When armature polarization is reversed by input current polarity, the armature is attracted to the opposite pole pieces and the jet deflects to the opposite receiver.

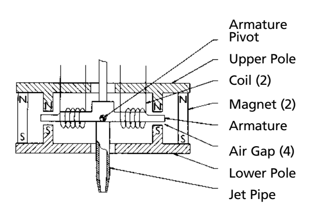



**Figure 4a - Neutral Position**

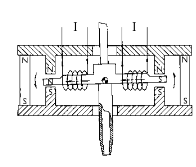


**Figure 4b - Energized Position**

# TECHNICAL DATA

## PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

**Operating Pressure Range**

| | |
|---|---|
| Ports P, X, A and B | 3,000 psi [210 bar] (optional 5,000 psi [350 bar] |
| Port T | up to 3,000 psi [210 bar] |

**Temperature Range**

| | |
|---|---|
| Ambient | -40 °F to +250 °F [-40°C to +121°C] |
| Fluid | -4 °F to +176 °F [-20°C to +80°C] |

**Seal Material** VitonA, others on request

**Operating Fluid** compatible with common hydraulic fluids, other fluids on request

**Viscosity**

Recommended 60 to 450 SUS @ 100°F (38°C)

**System Filtration**

High pressure filter (without bypass, but with dirt alarm) mounted in the main flow and, if possible, directly upstream of the valve.

**Class of Cleanliness**

The cleanliness of the hydraulic fluid greatly effects the performance (spool positioning, high resolution) and wear (metering edges, pressure gain, leakage) of the servovalve.

**Recommended Cleanliness Class**

| | |
|---|---|
| For normal operation | ISO 4406 < 14 / 11 |
| For longer life | ISO 4406 < 13 / 10 |

**Filter Rating** recommended

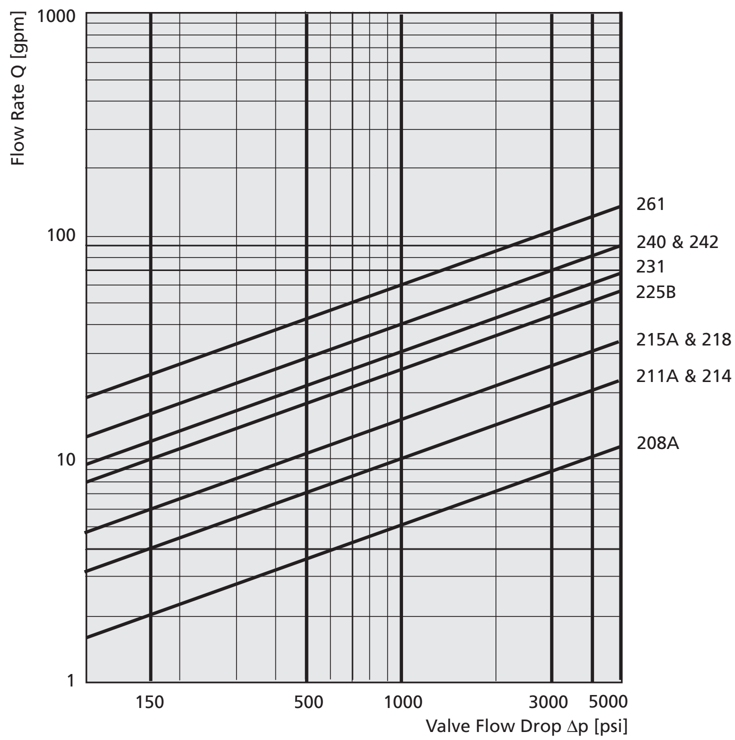
| | |
|---|---|
| For normal operation | $ß_{10} \geq$ 75 (10 µm absolute) |
| For longer life | $ß_5 \geq$ 75 (5 µm absolute) |

**Installation Options** any position, fixed or movable

**Vibration** 30 g, 3 axes

**Degree of Protection** EN50529P: class IP 65, with mating connector mounted

**Shipping Plate** Delivered with an oil sealed shipping plate.




**Valve Flow Diagram**
Valve flow for maximum valve opening (100% command signal) as a function of the valve pressure drop

## STATIC PERFORMANCE

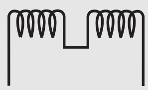
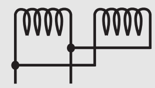
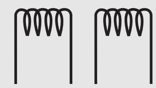
| | |
|---|---|
| **Rated Flow** | @ 1000 psid - ± 10% |
| **Null Bias** | <± 2% |
| **Null Flow Gain** | 50 to 150% nominal |
| **Linearity** | < 7% |
| **Hysteresis** | < 3% |
| **Threshold** | < 0.2% |
| **Temperature Null Shift** | <± 2% with 100°F variation (56°C) |
| **Supply Pressure Null Shift** | <± 2% with 1000 psi change (70 bar) |
| **Return Pressure Null Shift** | <± 2% from 0 to 100 psi (7 bar) |
| **Pressure Gain** | >30% of supply pressure @ 1% rated current |

# ELECTRICAL CHARACTERISTICS



## GENERAL CHARACTERISTICS

A wide choice of coils is available for a variety of rated current requirements. The four torque motor coil leads are attached to the connector so external connections can provide series, parallel or single coil operation. Servovalve coils should be driven with current control to provide consistency throughout the temperature range.

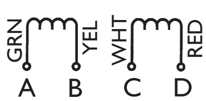
| | Series  | | Parallel  | | Single  | |
|---|---|---|---|---|---|---|
| **Ohms** | **mA** | **V** | **mA** | **V** | **mA** | **V** |
| 27 | 50 | 2.7 | 100 | 1.4 | 100 | 2.7 |
| 80 | 25 | 4.0 | 50 | 2.0 | 50 | 4.0 |
| 250 | 10 | 5.0 | 20 | 2.5 | 20 | 5.0 |
| 1000 | 5 | 10 | 10 | 5.0 | 10 | 10.0 |

## ELECTRICAL STANDARDS

**Rated Current**
50, 20, 10 mA (standard)

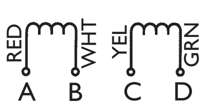
**Coil Resistance**
80, 250, 1000 ohms per coil (standard)

**Connector**
MS3102E-14S-2P




**Polarity**
A+ B- flow out cylinder Port B
C+ D- flow out cylinder Port B

**Connector**
PC02H-8-4P

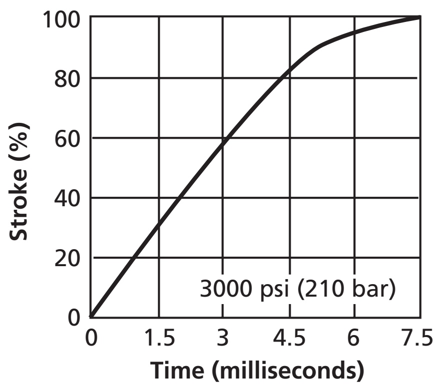



**Polarity**
A+ B- flow out cylinder Port A
C+ D- flow out cylinder Port A

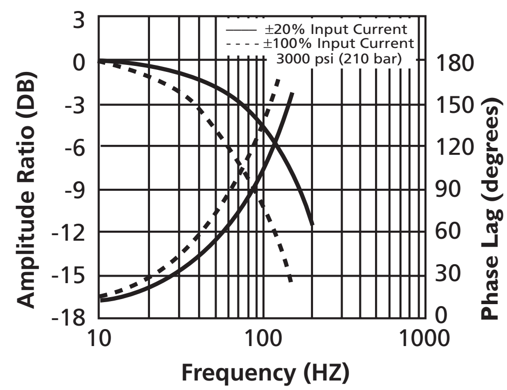
## PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

| | English [Metric] | 208A-505 |
|---|---|---|
| Rated Flow @ 1,000 psi [70 bar] drop | gpm [l/min] | 0.25 - 5.0 [0.95 - 18.9] |
| Internal Leakage @ 1,000 psi [70 bar] | gpm [l/min] | < 0.25 [0.95] |
| Connector Location | | Port B Standard |
| Weight | lb [kg] | 1.1 [0.50] |
| Mounting Bolt | | |
| Thread | | #10-32 UNF (M5) |
| Length | in [mm] | 2.0 [50.0] |

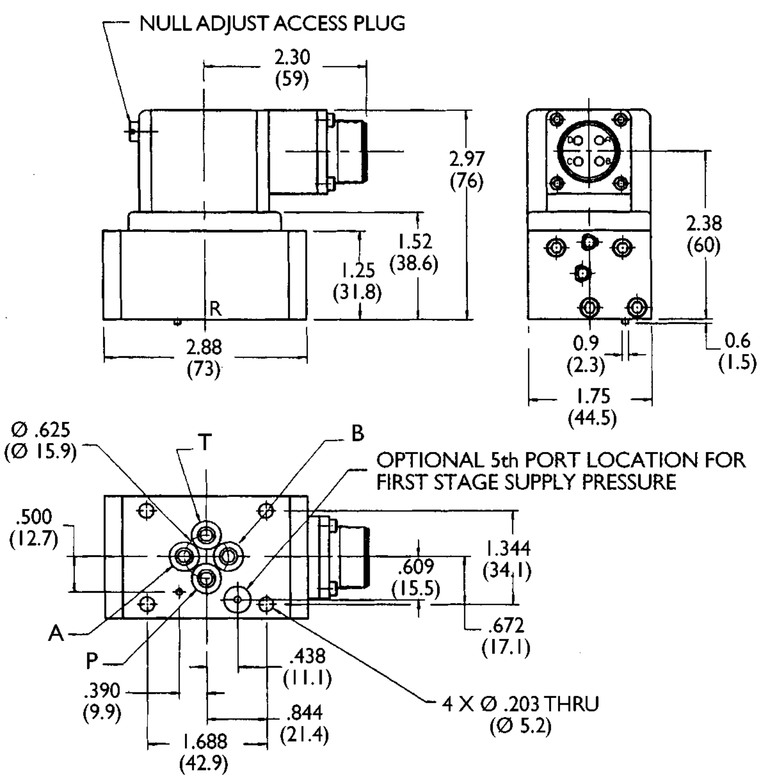
**208A-505**
**Step Response**




**208A-505**
**Frequency Response**




## INSTALLATION DIAGRAM




**Port Size**
Ø 0.173 (Ø 4.4)

**O-Ring**
MS28775-011

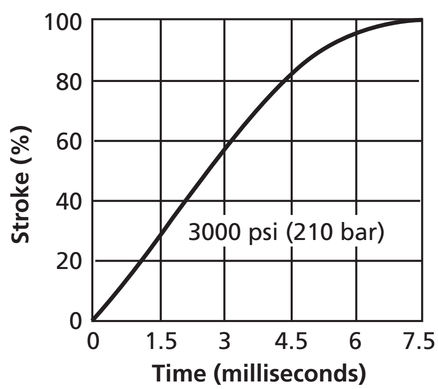
**Pilot Port**
Ø 0.093 (Ø 2.4)

**O-Ring**
MS28775-010

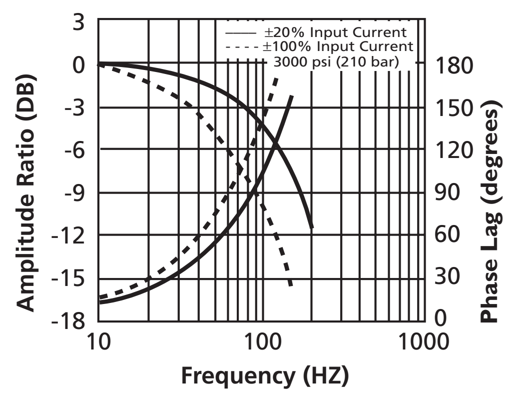
## PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

| | English [Metric] | 211A-510 |
|---|---|---|
| Rated Flow @ 1,000 psi [70 bar] drop | gpm [l/min] | 0.10 - 10.0 [0.38 - 37.9] |
| Internal Leakage @ 1,000 psi [70 bar] | gpm [l/min] | < 0.25 [0.95] |
| Connector Location | | Port B Standard |
| Weight | lb [kg] | 1.1 [0.50] |
| Mounting Bolt | | |
| Thread | | #10-32 UNF (M5) |
| Length | in [mm] | 2.0 [50.0] |

**211A-510**
**Step Response**




**211A-510**
**Frequency Response**

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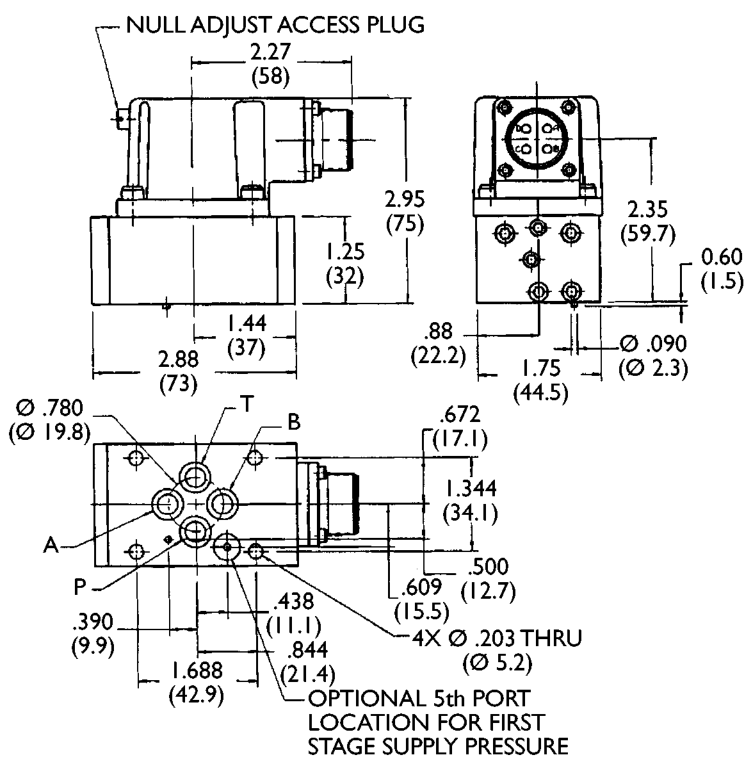



**Port Size**
Ø 0.281 (Ø 7.14)

**O-Ring**
MS28775-011

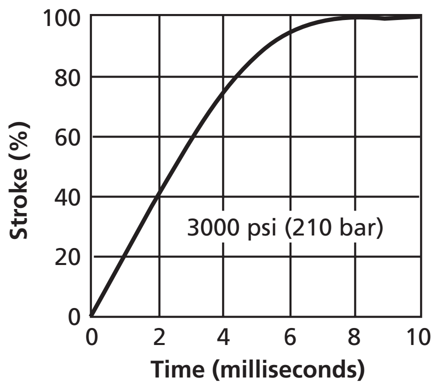
**Pilot Port**
Ø 0.093 (Ø 2.4)

**O-Ring**
MS28775-010

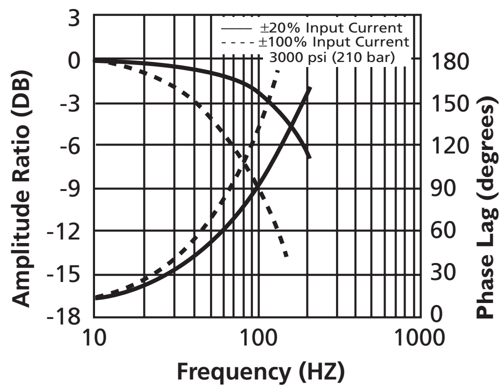
## PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

| | English [Metric] | 214-510 |
|---|---|---|
| Rated Flow @ 1,000 psi [70 bar] drop | gpm [l/min] | 0.10 - 10.0 [0.38 - 37.9] |
| Internal Leakage @ 1,000 psi [70 bar] | gpm [l/min] | < 0.25 [0.95] |
| Field Replaceable Filter - 75 micron absolute | | P/N 55396 |
| Weight | lb [kg] | 0.94 [0.42] |
| Mounting Bolt | | |
| Thread | | #10-32 UNF (M5) |
| Length | in [mm] | 1.5 [40.0] |

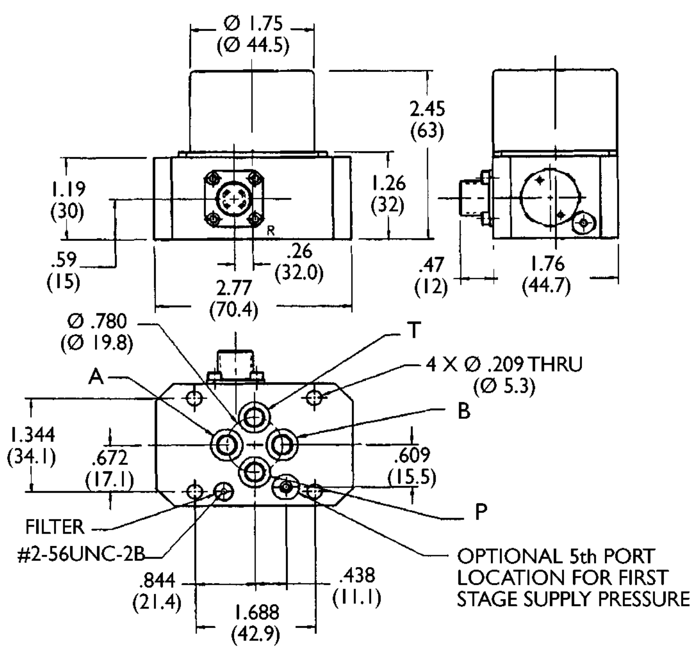
**214-510**
**Step Response**




**214-510**
**Frequency Response**




## INSTALLATION DIAGRAM




**Port Size**
Ø 0.2423 (Ø 6.1)

**O-Ring**
MS28775-011

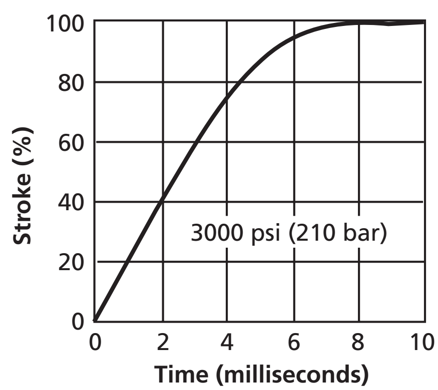
**Pilot Port**
Ø 0.093 (Ø 2.4)

**O-Ring**
MS28775-010

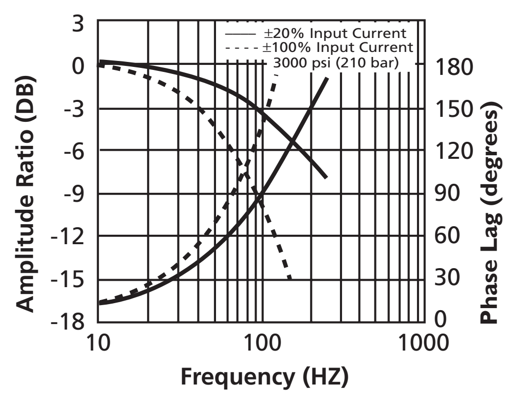
## PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

| | English [Metric] | 215A-515 |
|---|---|---|
| Rated Flow @ 1,000 psi [70 bar] drop | gpm [l/min] | 2.5 - 15.0 [9.5 - 56.8] |
| Internal Leakage @ 1,000 psi [70 bar] | gpm [l/min] | < 0.35 [1.3] |
| Connector Location | | Port B Standard |
| Weight | lb [kg] | 2.0 [0.91] |
| Mounting Bolt | | |
| Thread | | #5/16-18 (M8) |
| Length | in [mm] | 2.0 [50.0] |

**215A-515**
**Step Response**




**215A-515**
**Frequency Response**

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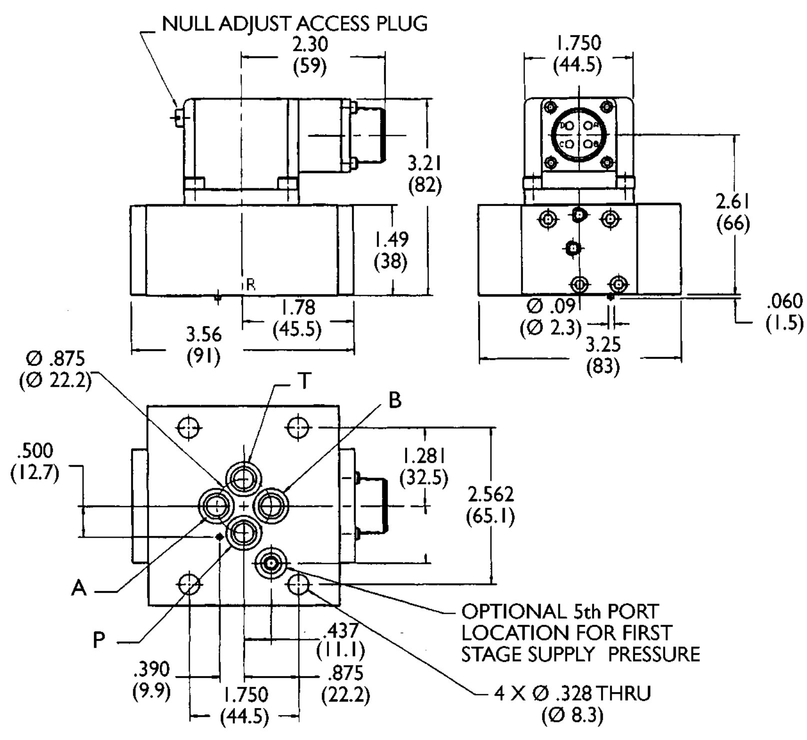



**Port Size**
Ø 0.332 (Ø 8.4)

**O-Ring**
MS28775-013

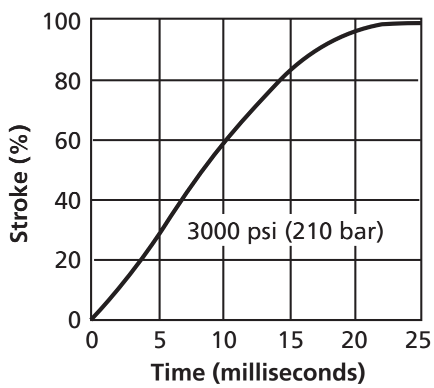
**Pilot Port**
Ø 0.093 (Ø 2.4)

**O-Ring**
MS28775-012

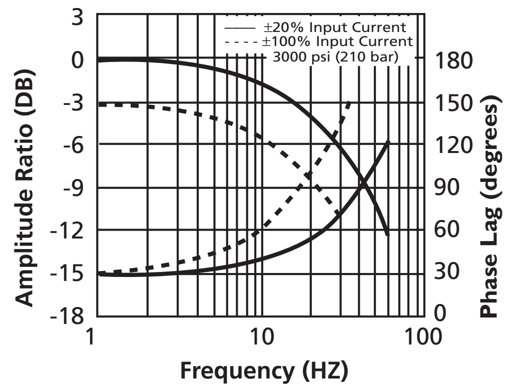
## PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

| | English [Metric] | 225A-525 / 225B-525-5 |
|---|---|---|
| Rated Flow @ 1,000 psi [70 bar] drop | gpm [l/min] | 15.0 - 25.0 [56.8 - 94.7] |
| Internal Leakage @ 1,000 psi [70 bar] | gpm [l/min] | < 0.40 [1.5] |
| Connector Location | | Port A Standard |
| Weight | lb [kg] | 3.0 [1.4] |
| Mounting Bolt | | |
| Thread | | #5/16-18 (M8) |
| Length | in [mm] | 2.5 [60.0] |

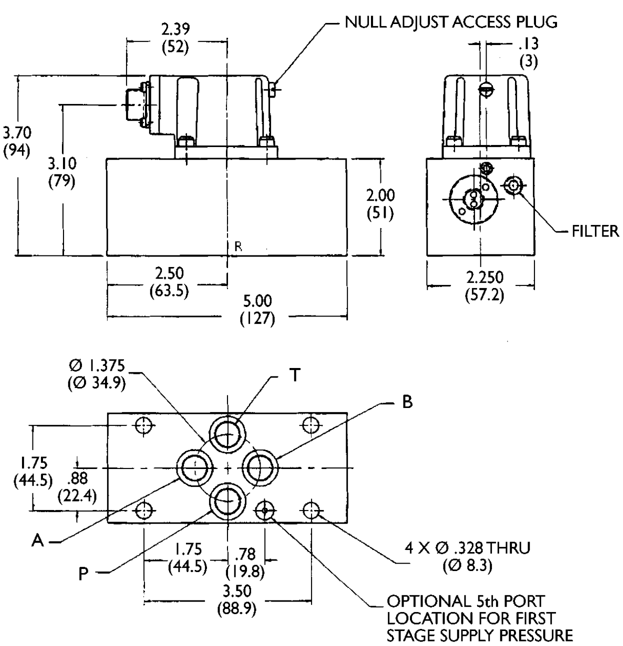
**225B-525-5**
**Step Response**




**225B-525-5**
**Frequency Response**




## INSTALLATION DIAGRAM




**Port Size**
Ø 0.500 (Ø 12.7)

**O-Ring**
MS28775-013

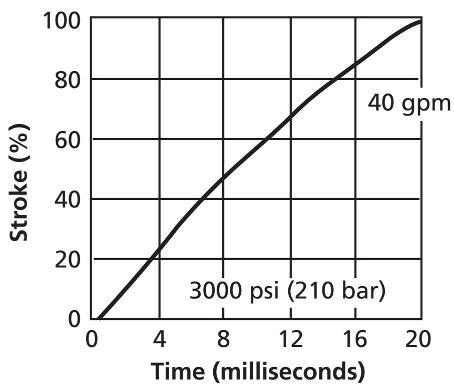
**Pilot Port**
Ø 0.093 (Ø 2.4)

**O-Ring**
MS28775-010

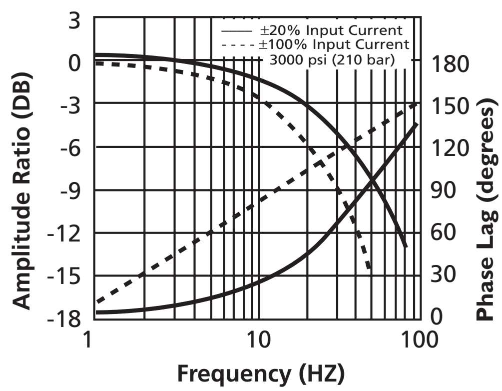
## PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

| | English [Metric] | 231-530 |
|---|---|---|
| Rated Flow @ 1,000 psi [70 bar] drop | gpm [l/min] | 20.0 - 40.0 [75.7 - 151] |
| Internal Leakage @ 1,000 psi [70 bar] | gpm [l/min] | < 0.60 [2.3] |
| Connector Location | | Port A Standard |
| Weight | lb [kg] | 3.8 [1.7] |
| Mounting Bolt | | |
| Thread | | #5/16-18 (M8) |
| Length | in [mm] | 1.5 [40.0] |

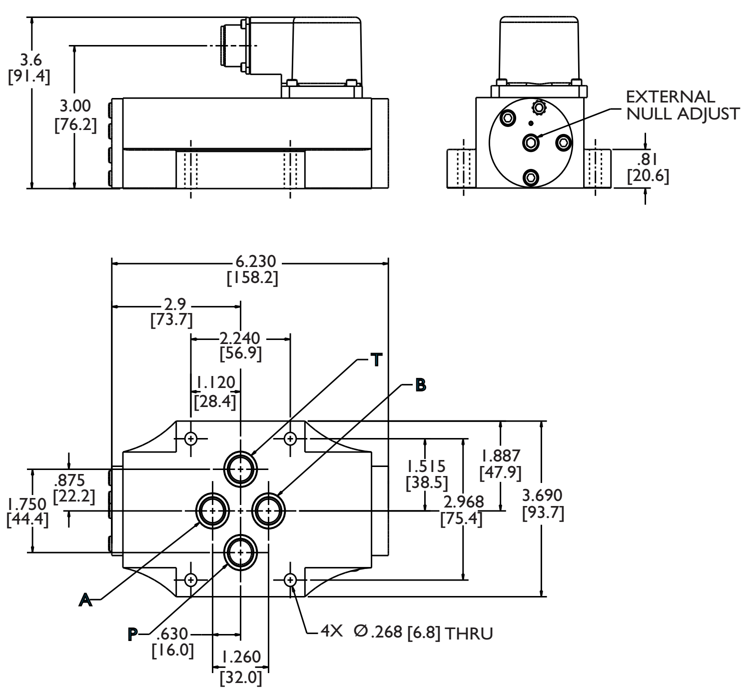
**231-530**
**Step Response**




**231-530**
**Frequency Response**




## INSTALLATION DIAGRAM



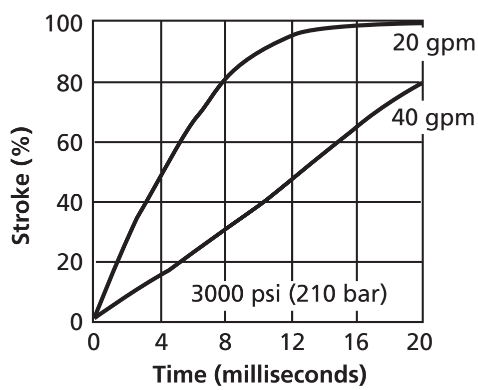

**Port Size**
Ø 0.500 (Ø 12.7)

**O-Ring**
MS28775-016

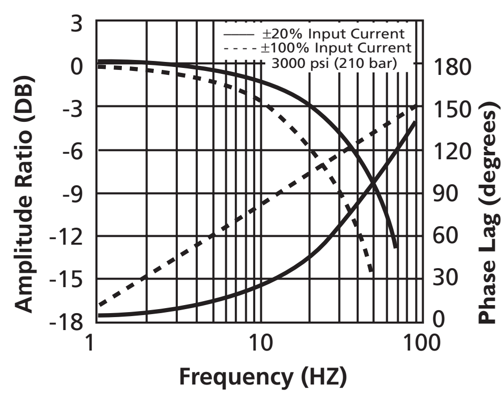
## PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

| | English [Metric] | 240-520 |
|---|---|---|
| Rated Flow @ 1,000 psi [70 bar] drop | gpm [l/min] | 20.0 - 40.0 [75.7 - 151] |
| Internal Leakage @ 1,000 psi [70 bar] | gpm [l/min] | < 0.60 [2.3] |
| Connector Location | | Port B Standard |
| Weight | lb [kg] | 4.7 [2.1] |
| Mounting Bolt | | |
| Thread | | #5/16-18 (M8) |
| Length | in [mm] | 3.0 [75.0] |

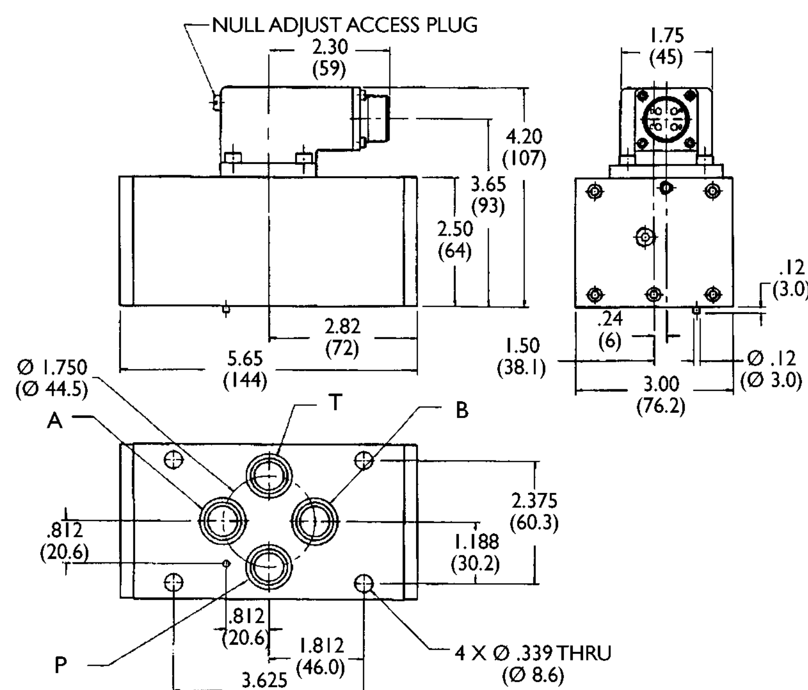
**240-520**
**Step Response**




**240-520**
**Frequency Response**




## INSTALLATION DIAGRAM



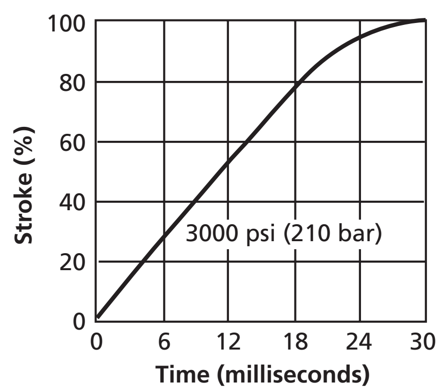

**Port Size**
Ø 0.562 (Ø 14.3)

**O-Ring**
MS28775-018

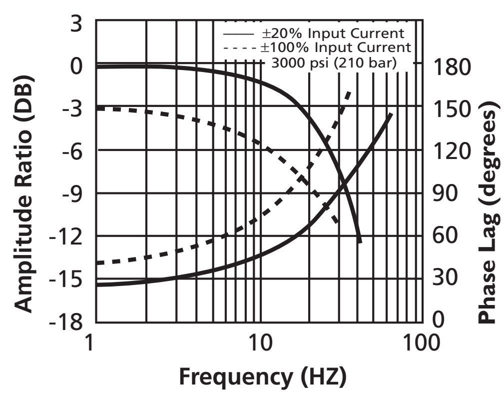
## PERFORMANCE SPECIFICATIONS FOR STANDARD MODELS

| | English [Metric] | 242-540 |
|---|---|---|
| Rated Flow @ 1,000 psi [70 bar] drop | gpm [l/min] | 20.0 - 40.0 [75.7 - 151] |
| Internal Leakage @ 1,000 psi [70 bar] | gpm [l/min] | < 0.40 [1.5] |
| Connector Location | | Port B Standard |
| Weight | lb [kg] | 4.7 [2.1] |
| Mounting Bolt | | |
| Thread | | #5/16-18 (M8) |
| Length | in [mm] | 1.3 [35.0] |

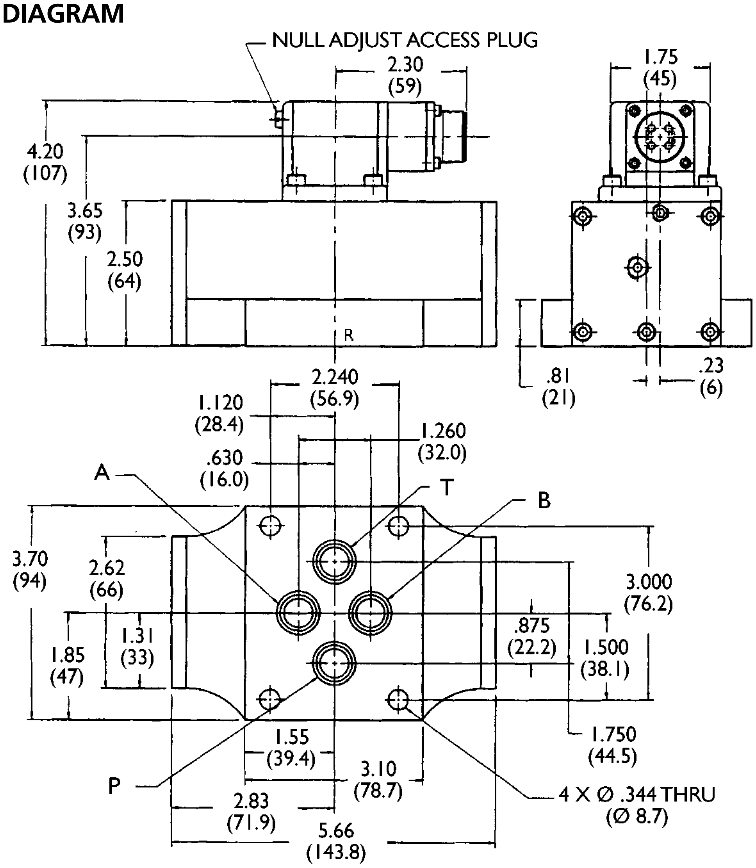
**242-540**
**Step Response**




**242-540**
**Frequency Response**




## INSTALLATION DIAGRAM




**Port Size**
Ø 0.500 (Ø 12.7)

**O-Ring**
MS28775-016

## SYSTEM FLUSHING

Cleaning the hydraulic fluid prior to initial installation of the servovalve onto a new or overhauled servo system, ensures extended valve operating life. Circulating hydraulic fluid through the system filters and manually exercising load actuators, will remove trapped particles and built-in contamination.

A new system is especially susceptible to contamination because particles clinging to new components can break away when initially washed with fluid flow. Hoses must sustain many hours of flow to flush all residue, and piping must be pickled and passivated. Piping with welded joints likely contains unwanted welding beads. Chunks of O-Ring, lint, metal chips and moisture are a few forms of contamination contributing to component failure in a new hydraulic system.

IMPORTANT NOTE

Start-up failures can be substantially reduced by following proper flushing procedures prior to installing servovalves or other sensitive components. A typical flushing procedure incorporates the following:

1. Install a flushing fixture that is servovalve footprint compatible. The flushing fixture should interconnect the control ports (A and B).
2. Install new filter elements.
3. Circulate the hydraulic fluid at system operating pressure for a minimum of 8 hours. The length of system flushing time determines fluid cleanliness.
4. Monitor filter indicators while flushing and change the elements when indicators show excessive contamination levels.
5. Stroking cylinders or motors while flushing dislodges particles trapped in these components.
6. When flushing is complete, remove all filter elements and replace with new ones.
7. Install servovalves.

## ADJUSTING SERVOVALVE NULL

Moog Jet Pipe servovalves are null adjusted at the factory and installation onto a system may require readjustment. Optimum null adjustment can be achieved when done with the equipment upon which the servovalve will be used. Control electronics must be stable and fluid must be at normal operating temperature and pressure.

To determine if the servovalve null needs adjustment, disconnect the electrical cable from the valve. If the actuator drifts excessively either direction, the valve null can be adjusted to stop the drift. It may be impossible to stop actuator drift completely and this should not be a concern. The servovalve null adjustment is not meant to be an absolute zeroing mechanism. Slowing the drift to a minimum allows the control electronics to achieve servovalve zero and maintain drift control throughout system operation.

## PROCEDURE FOR ALL SERVOVALVES EXCEPT 231

Please read “Adjusting Servovalve Null” before starting.
Required tools:

1 Screwdriver
1 Allen wrench (1/16'')

The servovalve null adjustment is located on the valve torque motor and can be reached by using a screwdriver to remove the access hole brass plug on the cover. A 1/16" Allen wrench can be inserted into the null adjustment access hole and, when engaged in the null adjustment, can be rotated in either direction. If turning one direction increases actuator drift speed, reverse turning direction. If actuator drift slows while rotating the Allen wrench, keep turning in that direction until actuator stops moving. If actuator drifts into a stop, it may be necessary to re-connect the electrical cable and bring the actuator to center position again.

IMPORTANT NOTE
Always remember to replace the null adjustment access screw. This keeps dirt from entering the torque motor and extends the operating life of the servovalve.

Re-connect electrical cable after adjustment is complete.

## PROCEDURE FOR MODEL 231

Please read “Adjusting Servovalve Null” before starting.
Required tools:

1 Allen wrench (3/16'')

The servovalve null adjustment is located on the valve body end cap nearest the torque motor. The null adjustment is a 3/16" Allen screw in the center of the spool end cap. A 3/16" Allen wrench can be inserted into the null adjustment and rotated either direction If turning one direction increases actuator drift, reverse turning direction. If actuator drift slows while rotating the Allen wrench, keep turning in that direction until actuator drift stops. Continue adjustment until drift direction changes and then turn Allen wrench in opposite direction until actuator stops moving. If actuator drifts into a stop, it may be necessary to re-connect the electrical cable and bring the actuator to center position again.

IMPORTANT NOTE
Less than one turn is sufficient to null the servovalve. If one turn fails to achieve null, further system troubleshooting is necessary to correct the problem.

Re-connect electrical cable after adjustment is complete.

## OPTIONAL MAGNETIC NULL ADJUSTMENT

Please read “Adjusting Servovalve Null” before starting.
Required tools:

1 Allen wrench (. 050 '')

The servovalve magnetic null adjustment is a knurled knob located on top of the valve torque motor cover. Null adjustment is made by loosening the two locking screws with a .050" Allen wrench and rotating the knurled knob. If turning one direction increases actuator drift, reverse turning direction. If actuator drift slows while rotating the adjustment, keep turning in that direction until actuator drift stops. Continue adjustment until drift direction changes and then turn knurled knob in opposite direction until actuator stops moving. If actuator drifts into a stop, it may be necessary to re-connect the electrical cable and bring the actuator to center position again.

Less than one turn is sufficient to null the servovalve. If one turn fails to achieve null, further system troubleshooting is necessary to correct the problem.

When adjustment is complete, tighten the locking screws to prevent knurled knob from inadvertent rotation. Re-connect electrical cable after adjustment is complete.

## OPTIONS

### Electrical Connectors
- ➢ MS mating connector P/N 91075
- ➢ Bendix Model PC02H-8-4P (mating connector P/N 91716)
- ➢ Bendix Model PC02H-8-4P connector in body (209 & 214 only)
- ➢ Pigtails (4 wires, specify length)

### Coils
- ➢ Intrinsically safe coils (FM certified Class 1, Groups A, B, C and D; Class II, Group G)
- ➢ High Temperature rated coils (350° F)
- ➢ A wide selection of electrical current and resistance combinations
- ➢ Triple redundant coils

### Special Flow Configurations
- ➢ Overlap or underlap
- ➢ Dual flow gain
- ➢ Shaped flow gain

### Conditioning - Underwater Service
- ➢ Vented torque motor cover
- ➢ Pigtails

### Isolated Pilot Supply Pressure Port
- ➢ Accepts external pilot supply

### Rated for 5000 PSI Operation
- ➢ Stainless steel body

### Magnetic Null Adjustment
- ➢ Ease of adjustment
- ➢ Isolates torque motor

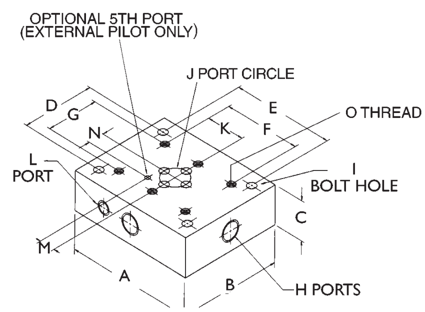
# ORDERING INFORMATION

## MANIFOLD SELECTION - SUBPLATE CHARTS

| Model # | A Length | B Width | C Height | D Mounting | E Mounting | F Mounting | G Mounting | H Ports SAE J514 | I Bolt Hole | J Port Circle |
|---|---|---|---|---|---|---|---|---|---|---|
| **208/209 500-206-X** | 5.0 (127.0) | 4.0 (101.6) | 1.5 (38.1) | 2.875 (73.0) | 4.00 (101.6) | 1.688 (42.87) | 1.688 (42.87) | -4 to -12 | .344 (8.7) | .625 (15.88) |
| **211A/214 500-205-X** | 5.0 (127.0) | 4.0 (101.6) | 1.5 (38.1) | 2.875 (73.0) | 4.00 (101.6) | 1.688 (42.87) | 1.344 (34.14) | -4 to -12 | .344 (8.7) | .780 (19.81) |
| **215A 500-215-X** | 5.0 (127.0) | 4.0 (101.6) | 1.5 (38.1) | 2.875 (73.0) | 4.00 (101.6) | 1.750 (44.45) | 2.562 (65.07) | -4 to -12 | .344 (8.7) | .875 (22.22) |
| **218 500-218-X** | 5.0 (127.0) | 4.0 (101.6) | 1.5 (38.1) | 2.875 (73.0) | 4.00 (101.6) | 1.688 (42.87) | 1.344 (34.14) | -4 to -12 | .344 (8.7) | .937 (23.80) |
| **225 500-225-X** | 5.0 (127.0) | 4.0 (101.6) | 1.5 (38.1) | 3.25 (82.5) | 4.00 (101.6) | 3.500 (88.90) | 1.75 (44.45) | -8 to -12 | .344 (8.7) | 1.375 (34.93) |
| **231/242 500-231-X** | 6.0 (152.4) | 6.0 (152.4) | 2.0 (50.8) | 4.0 (101.6) | 5.0 (127.0) | 2.24 (56.90) | 3.000 (76.20) | -8 to -16 | .344 (8.7) | Diamond |
| **240 500-240-X** | 6.0 (152.4) | 5.0 (127.0) | 1.87 (47.5) | 4.0 (101.6) | 4.5 (114.3) | 3.625 (92.07) | 2.375 (60.32) | -10 to -24 | .390 (9.9) | 1.750 (44.45) |
| **261 500-261-X** | 7.0 (177.8) | 6.0 (152.4) | 2.0 (50.8) | 4.75 (120.6) | 4.5 (114.3) | 2.875 (73.02) | 3.375 (85.72) | -12 to -32 | .531 (13.5) | 2.000 (50.80) |
| **290 500-290-X** | 7.0 (177.8) | 6.0 (152.4) | 2.0 (50.8) | 4.75 (120.6) | 4.5 (114.3) | 2.75 (69.75) | 3.375 (85.72) | -24 to -40 | .531 (13.5) | Diamond |

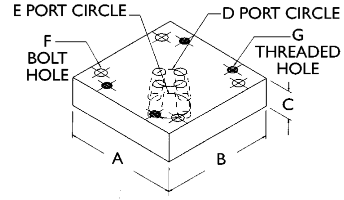
| Servovalve Model Subplate Model | 208/209 500-206-C-X | 211A/214 500-205-C-X | 215A 500-215-C-X | 218 500-218-C-X | 225 500-225-C-X | 242 500-231-C-X | 240 500-240-C-X | 261 500-261-C-X | 290 500-290-C-X |
|---|---|---|---|---|---|---|---|---|---|
| **L SAE J514** | -4 | -4 | -4 | – | -4 | – | – | -4 | -4 |
| **M** | .438 (11.13) | .438 (11.13) | .438 (11.13) | – | .781 (19.84) | – | – | .750 (19.05) | 1.375 (34.93) |
| **N** | .609 (15.47) | .609 (15.47) | .937 (23.80) | – | .875 (22.22) | – | – | 1.500 (38.10) | 1.450 (36.83) |

## SUBPLATE DRAWING




## ADAPTER PLATE

| | A Length | B Width | C Height | D from Port Circle | E to Port Circle | F Bolt Hole | G Thread |
|---|---|---|---|---|---|---|---|
| **Model 53781 from .780 to .875** | 3.25 (82.55) | 2.5 (63.50) | .588 (14.73) | .780 (19.81) | .875 (22.22) | .344 (8.74) | 10-32 |



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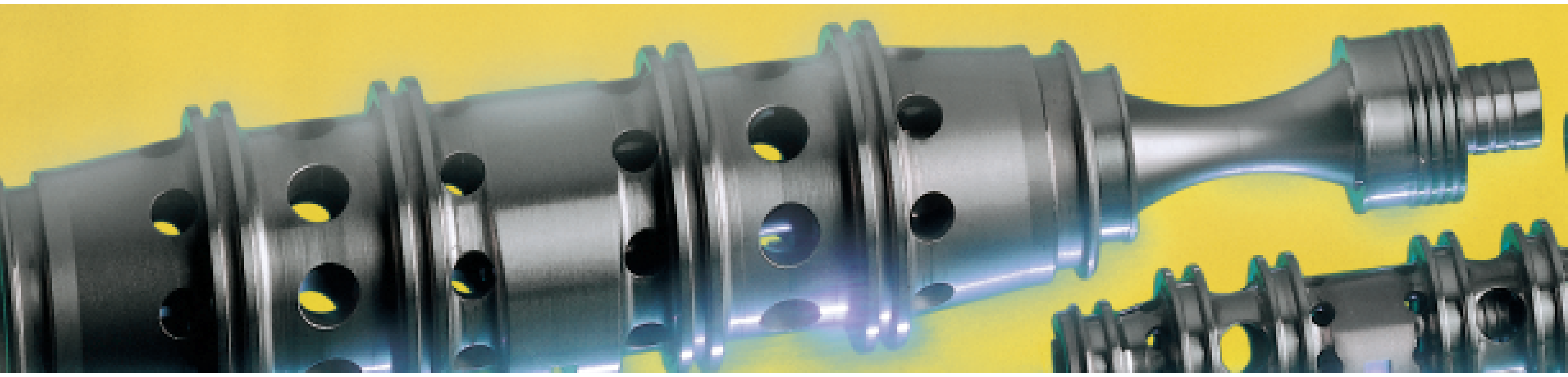
Australia
Austria
Brazil
China
England
Finland
France
Germany



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