MOOG

Jet Pipe Servo Valve Installation and Operation Instruction

Electrohydraulic Servo Valve
Intrinsic Safety Protected

1. INTRODUCTION

This manual provides instructions and procedures necessary to install, operate and troubleshoot the Moog Inc. Jet Pipe intrinsic safety protected industrial servo valve.

The Jet Pipe Servo Valves covered by this manual are electrical equipment for hazardous areas requiring intrinsic safety or non-incendive protection. The identification is Ex II 1G EEx ia IIC T4 KEMA 01ATEX1027 X CE 0344 per ATEX directive 94/9/EC. They are intended for directional, position, velocity, pressure and force control in hydraulic control systems that operate with mineral oil based fluids. Others on request.

2. OPERATION

The Jet Pipe Servo Valve features two-stage proportional flow control with a Jet Pipe first stage. 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).

ELECTROHYDRAULIC VALVE CUT-AWAY

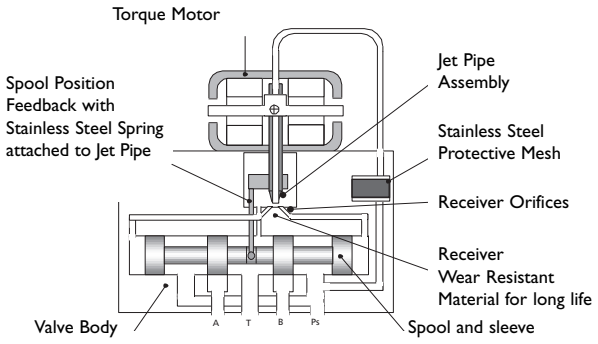


Figure 1 Moog Jet Pipe Servo Valve

CAUTION

DISASSEMBLY, MAINTENANCE, OR REPAIR OTHER THAN IN ACCORDANCE WITH THE INSTRUCTIONS HEREIN OR OTHER SPECIFIC WRITTEN DIRECTIONS FROM MOOG WILL INVALIDATE MOOG'S OBLIGATIONS UNDER ITS WARRANTY AND YIELD THE INTRINSICALLY SAFE PROTECTION PERMIT NULL AND VOID.

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.

3. ELECTRICAL INFORMATION AND INTRINSICALLY SAFE CIRCUIT SAFETY PARAMETERS

a. A wide choice of coils is available for a variety of rated current requirements. The torque motor coil leads are attached to the connector so external connections can provide series, parallel or single coil operation. The valves are equipped either with an MS type connector or with pigtail leads for electrical wiring. Refer to installation drawings of the specific model for details. Servo valve coils should be driven with current to provide consistency throughout the temperature range.

b. The Jet Pipe Servo Valves are approved for intrinsically safe protection per EN 50020. The approved safety parameters are listed in the following table for all the coils used by Jet Pipe Servo Valve. Coil number is marked on the valve nameplate.

Maximum Safe Values:

Coil Configuration	Ui (V)	Ii (mA)
54743-L/R-0250 (single, series, parallel)	11.5	210
54743-L/R-0080 (single, series, parallel)	11.5	210
54743-L/R-1000 (single, series, parallel)	24.4	85
	16	160
55462-L/R-1000 (single)	24.4	85
	16	160

c. When making electric connections to the valve, appropriate measures must be taken to ensure that locally different earth potential do not result in excessive ground currents. When barriers are required for the hazardous location, hazardous area (field) wiring must meet the requirements of the barrier manufacturer. All barriers must be mounted and installed in compliance with the barrier manufacturer's requirements. Twisted pairs of 18-20 gage wire are recommended. If shielded wire is used, connect shield wire to earth ground only at the barrier strip.

4. SPECIAL CONDITIONS FOR SAFE USE

The Jet Pipe Servo Valves must be wired in accordance with wiring diagram C54507 and in accordance with the installation manual. The coil data and the elecrical parameters of the associated intrinsically safe supply circuits must be observed.

Because the enclosure of the apparatus is made of aluminum, it must be installed such that even in the event of rare indicents, ignition sources due to impact and friction sparks are avoided.

5. HYDRAULIC SYSTEM PREPARATION

To prolong servo valve operational life and to reduce hydraulic system maintenance, it is recommended that the hydraulic fluid be kept at a cleanliness level of ISO DIS 4406 Code 16/13 maximum, 14/11 recommended. The most effective filtration scheme incorporates the use of a kidney loop or "off-line" filtration as one of the major filtration components. The filter for the "off-line" filtration scheme should be a $\beta_3 \geq 75$ filter for maximum effectiveness.

Upon system startup and prior to mounting the servo valve, the entire hydraulic system should be purged of built-in contaminating particles by an adequate flushing. The servo valve should be replaced by a flushing manifold and the hydraulic circuit powered up under conditions of fluid temperature and fluid velocity, reasonably simulating normal operating conditions. New system filters are installed during the flushing process whenever the pressure drop across the filter element becomes excessive. The flushing processes should turn over the fluid in the reservoir between fifty to one hundred times.

To maintain a clean hydraulic system, the filters must be replaced on a periodic basis. It is best to monitor the pressure drop across the filter assembly and replace the filter element when the pressure drop becomes excessive. In addition to other filters that are installed in the hydraulic circuit, it is recommended that a large capacity, low pressure $\beta_3 \geq 75$ filter be installed in the return line. This filter will increase the interval between filter element replacements and greatly reduce the system contamination level.

6. INSTALLATION

The Jet Pipe Servo Valves Series Industrial servo valve may be mounted in any position, provided the servo valve pressure, piston and return ports match respective manifold ports.

The mounting pattern, port location and mounting bolts of the servo valve are shown on Figure 4. Apply a light film of oil to the screw threads and torque to 57 inch-pounds.

Wire mating connector for desired coil configuration and polarity. Thread connector to valve.

Series	Mounting Screw Size	Mounting Screw Torque
211A	#10-32 x 2.0"	57 in-lbs
218	1/4-28 x 2.25"	75 in-lbs
225A	5/16-18 x 2.5"	96 in-lbs
240	5/16-18 x 3.0"	96 in-lbs
261	3/8-24 x 2.0"	175 in-lbs

7. MECHANICAL NULL ADJUSTMENT

Moog Jet Pipe servo valves 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 servo valve will be used. Control electronics must be stable and fluid must be at normal operating temperature and pressure.

To determine if the servo valve 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 servo valve null adjustment is not meant to be an absolute zeroing mechanism. Slowing the drift to a minimum allows the control electronics to achieve servo valve zero and maintain drift control throughout system operation.

Adjustment Procedure

Required tools:

1 Screwdriver
1 Allen wrench (1/16")

The servo valve 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.

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 servo valve. Reconnect electrical cable after adjustment is complete.

8. GENERAL SERVICING RECOMMENDATIONS

a. Disconnect electrical lead to servo valve.
b. Relieve hydraulic system of residual pressure.
c. Remove servo valve.

9. TROUBLESHOOTING CHART

The following troubleshooting chart list potential troubles encountered, probable causes, and remedies.

Potential Trouble	Probable Cause	Remedy
Servo valve does not follow input command signal. (Actuator or components are stationary or creeping slowly.)	Plugged inlet filter element.	Replace filter element.
High threshold. (Jerky, possible oscillatory or "hunting" motion in closed loop system.)	Plugged filter element.	Replace filter element.
Poor response. (Servo valve output lags electrical command signal).	Partially plugged filter element.	Replace filter element and check for dirty hydraulic fluid in system.
High Null Bias. (High input current required to maintain hydraulic cylinder or motor stationary.)	1. Incorrect null adjustment 2. Partially plugged filter element.	1. Readjust null 2. Replace filter element and check for dirty hydraulic fluid in system.

10. FUNCTIONAL CHECKOUT AND CENTERING

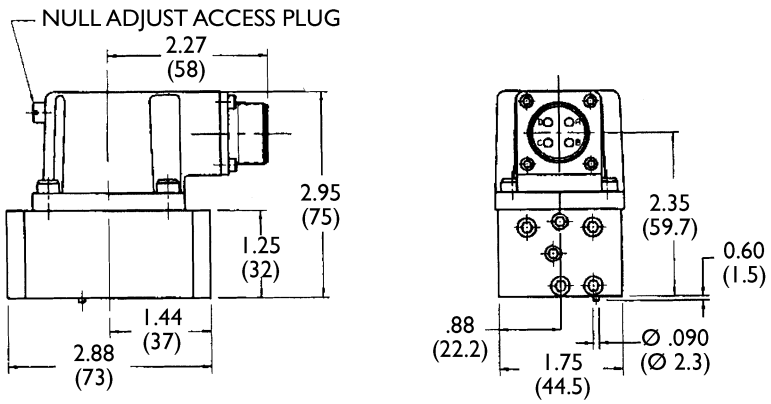
a. Install servo valve on hydraulic system or test fixture, but do not connect electrical lead.
b. Apply required system pressure to servo valve and visually examine for evidence of external leakage. If leakage is present and cannot be rectified by replacing o-rings, remove the discrepant component and return for repair or replacement.
   Note: If the system components are drifting or hardover, adjust the mechanical null of the servo valve.
c. Connect electrical lead to servo valve and check phasing in accordance with system requirements.

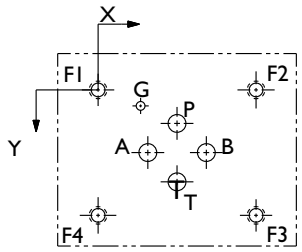
11. AUTHORIZED REPAIR FACILITIES

If servo valve continues to malfunction after all recommended corrective action procedures are performed, defective valve should be returned to Moog for repair. Moog does not authorize any facilities other than Moog or Moog subsidiaries to repair its servo valves. It is recommended you contact Moog at (716) 652-2000 to locate your closest Moog repair facility. Repair by an independent (unauthorized) repair house will result in voiding the Moog warranty and could lead to performance degradation or safety problems.

12. DECLARATION OF MANUFACTURER

An EC Declaration of Conformity according to Council Directive 94/9/EC is supplied with each servo valve.





NOTES

1 Fluid:
Industrial type petroleum base hydraulic fluid, maintained to ISO DIS 4406 Code 14/11 recommended.

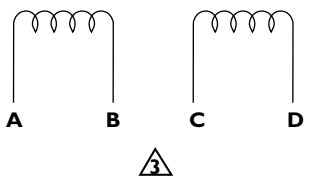
2 Operating Temperature Range:
-20°F [-29°C] to +275°F [+135°C] unless otherwise specified on nameplate.

3 Valve Phasing:
Flow out port B results when Series coils: B & C connected, A+, D-;
Parallel coils: A & C connected, B & D connected; Single coil: A+, B-, or C+, D-.

4 Ports:
See table below left.

5 Surface:
Surface to which valve is mounted requires $\sqrt{}^{32}$ [$\nabla\nabla$] finish, flat within 0.002 [0.05] TIR.

TYPICAL WIRING SCHEMATIC



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
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)
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)
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)

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