MOOG

78N/760N Series Installation and Operation Instruction

Electrohydraulic Servo Valve Explosion Proof

1. INTRODUCTION

This manual provides the instructions and procedures necessary to install, operate, and troubleshoot the Moog 78N and 760N series servo valves. The 78N and 760N series servo valves are electro hydraulic equipment for hazardous locations requiring explosion proof protection. The approved hazardous location markings include:

Ⓔx II 2 G Ex db IIA T3 Gb KEMA 02ATEX2322 X,
CE 0344 per ATEX directive 2014/34/EU
Ex db IIA T3 Gb IECEx DEK 13.0029X
per IECEx certification scheme.

The 78N and 760N series servo valves are also approved by CSA and TIIS for hazardous locations. They are intended for directional, position, velocity, pressure, or force control in hydraulic control systems that operate with mineral based fluids, or others upon request.

2. OPERATION

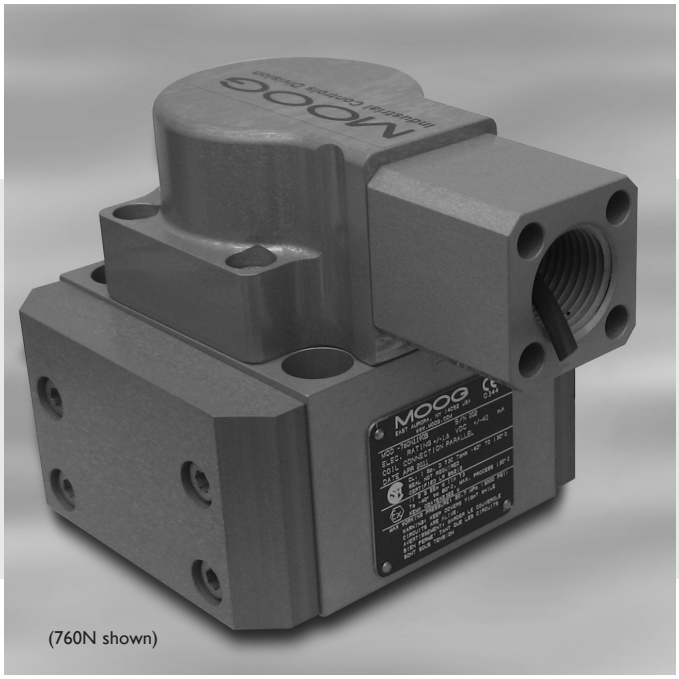
The Moog 78N and 760N Series Industrial Servo valves consist of a polarized electrical torque motor and two stages of hydraulic power amplification. The motor armature extends into the air gaps of the magnetic flux circuit and is supported in this position by a flexure tube member. The flexure tube acts as a seal between the electromagnetic and hydraulic sections of the valve. The two motor coils surround the armature one on each side of the flexure tube.

The flapper of the first stage hydraulic amplifier is rigidly attached to the midpoint of the armature. The flapper extends through the flexure tube and passes between two nozzles, creating two variable orifices between the nozzle tips and the flapper. The pressure controlled by the flapper and nozzle variable orifice is fed to the end areas of the second stage spool.

The second stage is a conventional 4-way spool design in which output flow from the valve, at a fixed valve pressure drop, is proportional to spool displacement from the null position. A cantilever feedback spring is fixed to the flapper and engages a slot at the center of the spool. Displacement of the spool deflects the feedback spring which creates a force on the armature/flapper assembly.

Input signal induces a magnetic charge in the armature and causes a deflection of the armature and flapper. This assembly pivots about the flexure tube and increases the size of one nozzle orifice and decreases the size of the other.

This action creates a differential pressure from one end of the spool to the other and results in spool displacement. The spool displacement transmits a force in the feedback wire which opposes the original input signal torque. Spool movement continues until the feedback wire force equals the input signal force.



(760N shown)

ELECTROHYDRAULIC VALVE CUT-AWAY

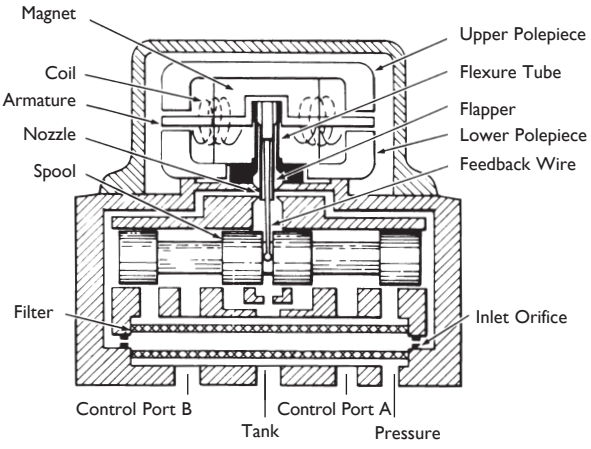


Figure 1 Moog Series 760N

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 EXPLOSION PROOF PROTECTION PERMIT NULL AND VOID.

3. ELECTRICAL INFORMATION

A wide choice of coils is available for a variety of rated current requirements. The torque motor leads are individually attached to a flying lead type explosion proof header so that external connections can provide series, parallel, or single coil operation. Refer to the installation drawing of the specific model servo valve for details. Servo valve coils should be driven with current to provide consistency throughout the temperature range.

The 78N and 760N servo valves shall be installed for use with a metallic conduit for the electrical leads. They are approved for explosion proof operation with rated power of 0.28W maximum.

The 78N/760N servo valves are approved for explosion-proof protection per EN IEC 60079-0 : 2018, EN 60079-0 : 2012 + A11 : 2013, and EN 60079-1 : 2014 for ATEX and IEC 60079-0 : 2017 (Ed. 7) and IEC 60079-1 : 2014 (Ed. 7) for IECEx. Contact Moog for information on the dimensions of the flameproof joints.

The socket head capscrews that attach the electrical connector and the motor cap must have a thread conforming to ISO 262 and be of assembly class fit 6g. The screw property class must be 10.9 minimum. The heads shall conform to ISO 4762.

4. SPECIAL CONDITIONS FOR SAFE USE

The electrical connection of the permanently connected cable shall be made in a certified enclosure in type of explosion protection flameproof enclosure "d" or increased safety "e".

For details on the flameproof joints contact MOOG Industrial Controls Division. All fasteners must be of property class 10.9 minimum.

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 $B_3 \geq 75$ 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 $ß_3 \geq 75$ filter be installed in the return line. This filter will increase the interval between filter element replacement and greatly reduce the system contamination level.

6. INSTALLATION

The Moog 78N and 760N series industrial servo valves may be mounted in any position, provided the servo valve pressure, control and tank ports match respective manifold ports.

The mounting patterns and port locations of the servo valves are shown on Figure 4. The servo valve should be mounted with socket head cap screws. Apply a light film of oil to the screw threads and torque per Table 1.

Wire pigtail leads for desired coil configuration and polarity. Thread conduit fitting to valve.

7. MECHANICAL NULL ADJUSTMENT

It is often desirable to adjust the flow null of a servo valve independent of other system parameters. The "mechanical null adjustment" on the Moog 78N and 760N Series servo valves allows at least ±20% adjustment of flow null.

The "mechanical null adjustor" is an eccentric bushing retainer pin located above the "tank" port designation on the valve body (see Figure 2) which, when rotated, provides control of the bushing position. Mechanical feedback elements position the spool relative to the valve body for a given input signal. Therefore, a movement of the bushing relative to the body changes the flow null.

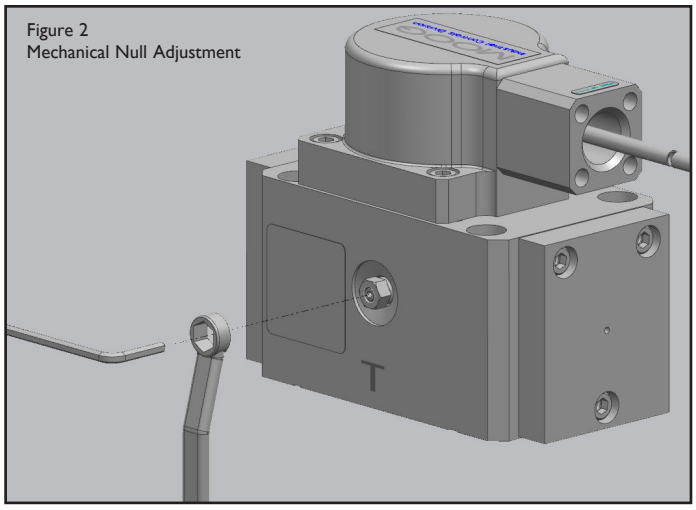
Adjustment Procedure

Using a 3/8 inch offset box wrench, loosen the self-locking fitting until the null adjustor pin can be rotated. (This should usually be less than 1/2 turn). DO NOT remove self-locking fitting. Insert a 3/32 inch Allen wrench in null adjustor pin. Use the 3/32 Allen wrench to rotate the mechanical null adjustor pin to obtain desired flow null. Torque self-locking fitting to 57 inch lbs.

Note:

Clockwise rotation of null adjustor pin produces flow from port P to port B.

Figure 2
Mechanical Null Adjustment



8. GENERAL SERVICING RECOMMENDATIONS

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

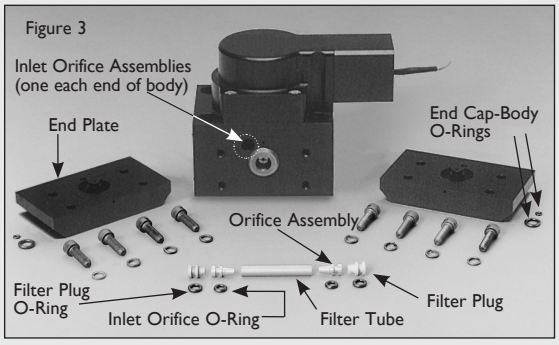
Table 1	78N Series	760N Series
Mounting Screw Size	5/16-18 x 3.00	5/16-18 x 1.75
Torque	120 in-lbs	96 in-lbs

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).	1. Plugged inlet filter element.	1. Replace filter element.
High threshold. (Jerky, possible oscillatory or "hunting" motion in closed loop system).	1. Plugged filter element.	1. Replace filter element.
Poor response. (Servo valve output lags electrical command signal).	1. Partially plugged filter element.	1. Replace filter element. 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.

Figure 3



(Note: 760N shown, 78N similar)

Table 2. Replacement Parts

Series Part Description	Qty.	760N Series Part Number	78NxxxC
Filter Replacement Kit	1	B52555RK004K001	B52555RK052K001
Inlet Orifice to Body Oring (I)	2	-42082-059	-42082-189
Filter Plug to Body Oring (I)	2	-42082-060	-42082-012
End Cap to Bushing ID Oring (I)	2	-42082-042	–
End Cap to Body Oring (I)	2	-42082-001	-42082-007*
Filter Tube (I)	1	-23020	C39486-005-060
Base Orings	4	-42082-022	-42082-021

(I) Included in Filter Replacement Kit

*Not included in 78NxxxD or later kit. P/N B52555RK208K001

10. FILTER ASSEMBLY REPLACEMENT

a. Remove the socket head cap screws that retain the end caps to the body using an Allen wrench, 4 mm for 760N or 5 mm for 78N. Gently pull or pry the end caps from the body.
b. Remove and discard the orings from the end caps.
c. Remove the filter retainer plugs and inlet orifices from both sides of the body. The filter will come out with one of the inlet orifices. Note: A 2-56 screw will thread into each piece so it can be pulled from the body cavity. These parts may be interchanged from side to side.
d. Remove and discard the O-Rings from the retainer plugs and inlet orifices.
e. Discard the used filter.
f. Visually inspect all parts for damage or contamination.
g. Lubricate and install new O-Rings on the inlet orifices and retainer plugs.
h. Remove the new filter from the sealed package being very careful not to introduce contamination into the ID of the filter.
i. Install the new filter on an inlet orifice and insert it into the filter bore. Install the other inlet orifice and the retainer plugs. Note: These parts should go in most of the way without excessive use of force. The end caps will push them fully into place.
j. Lubricate and install end cap to body O-Rings. Carefully position the end caps on the servo valve. Re-install the end cap screws and torque them to 46 in-lbs for 760N, or 90 in-lbs for 78N.

11. 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.

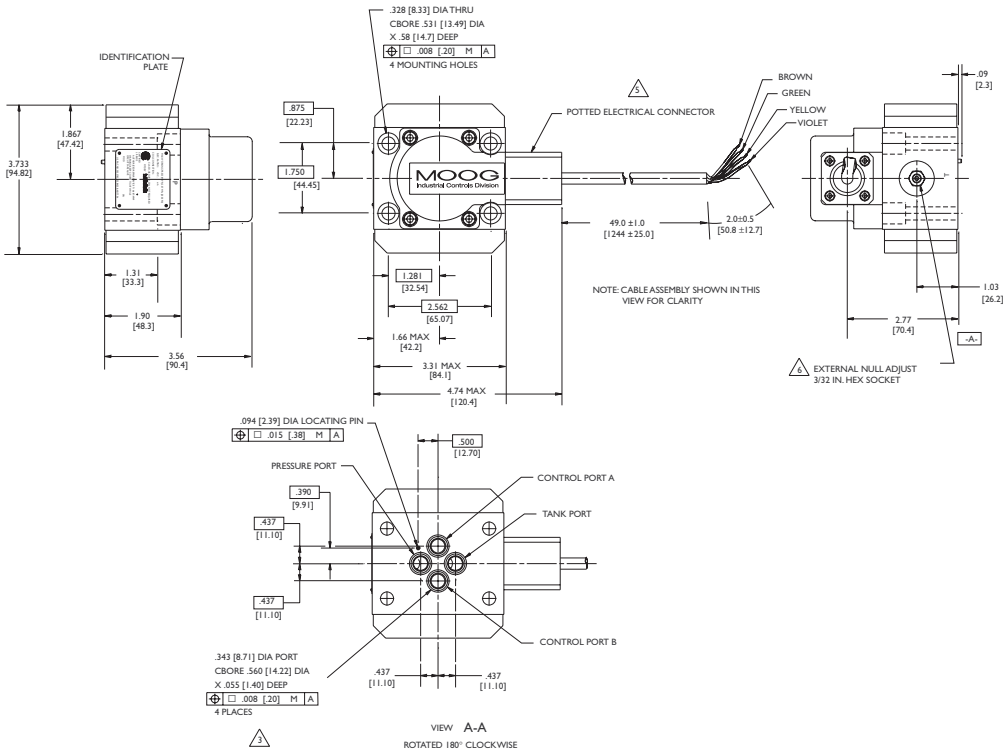
12. AUTHORIZED REPAIR FACILITIES

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.

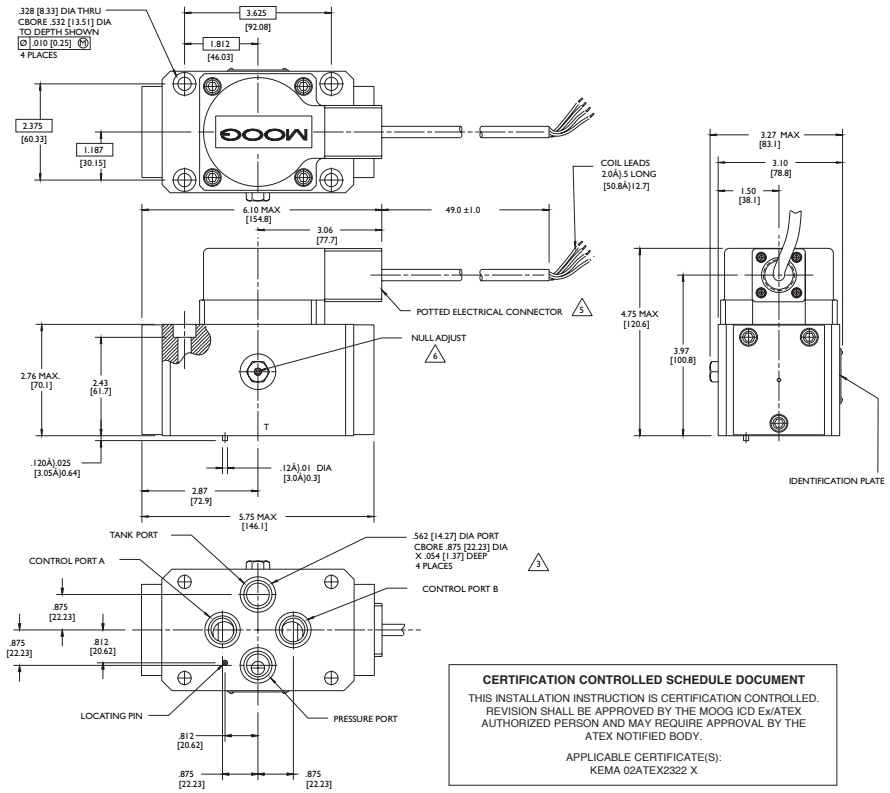
13. DECLARATION OF MANUFACTURER

An EU Declaration of Conformity according to Council Directive 2014/34/EU is supplied with each servo valve.

760N SERIES



78N SERIES



CERTIFICATION CONTROLLED SCHEDULE DOCUMENT

THIS INSTALLATION INSTRUCTION IS CERTIFICATION CONTROLLED. REVISION SHALL BE APPROVED BY THE MOOG ICD Ex/ATEX AUTHORIZED PERSON AND MAY REQUIRE APPROVAL BY THE ATEX NOTIFIED BODY.

APPLICABLE CERTIFICATE(S):
KEMA 02ATEX2322 X

Figure 4

NOTES

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

2 Maximum Supply Pressure All Ports:
3000 psi (210 bar)

3 Base O-Rings for 760N:
0.070 (1.78) sect x 0.426 (10.82) I.D. (Universal dash No. 13)

Base O-Rings for 78N:
0.070 (1.78) sect x 0.695 (17.65) I.D. (Universal dash No. 18)

4 Surface:
Surface to which valve is mounted requires 32 (VV) finish, flat within .001 [0.03] TIR.

5 Electrical Connector:
Mates with 1/2 - 14 NPT fitting.

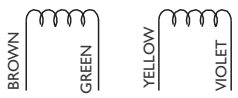
6 Null Adjust:
Flow out of port B will increase with clockwise rotations of null adjust (3/32 hex key). Flow bias is continually varied for a given port as the null adjust is rotated.

7 Mounting Manifold
See 760 or 78 Series standard brochure for manifold information.

8 Operating Temperature Range:
Ambient: -40°C to 80°C
Process: +120°C max.

Dimensions in parenthesis are in millimeters.

TYPICAL WIRING SCHEMATIC



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