

Two-Stage Flapper Type Servo Valve

SF4-140-20-002-10
SF4-100-30-002-10

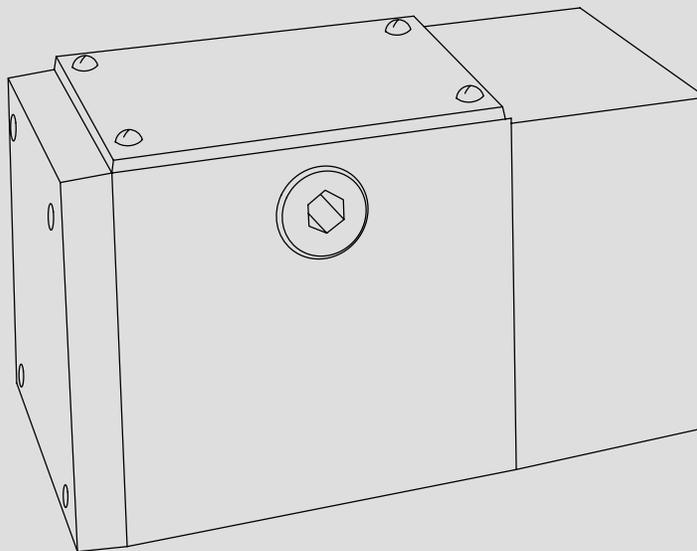


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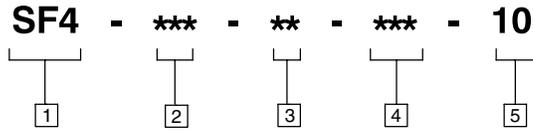
Section I – Introduction

A. Reference Material

Installation dimensions and operating specifications are not contained in this manual. Refer to installation drawing 501170 for that information.

B. Kits

A gasket kit is available for this servo valve. It is recommended that new O-Rings and gaskets be used during overhaul. The part number of the kit is 919529.



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|---|---|---|
| <p>1 Model Series Servo Valve, series, 4-way</p> | <p>3 x 100 Equals Supply Pressure in psi</p> | <p>5 Design No. & Modification</p> |
| <p>2 x 0.1 Equals Flow Rate in gpm</p> | <p>4 Coil Designation - number x 10 Equals Coil Resistance in Ohms</p> | |

Table 1. Model Code Breakdown

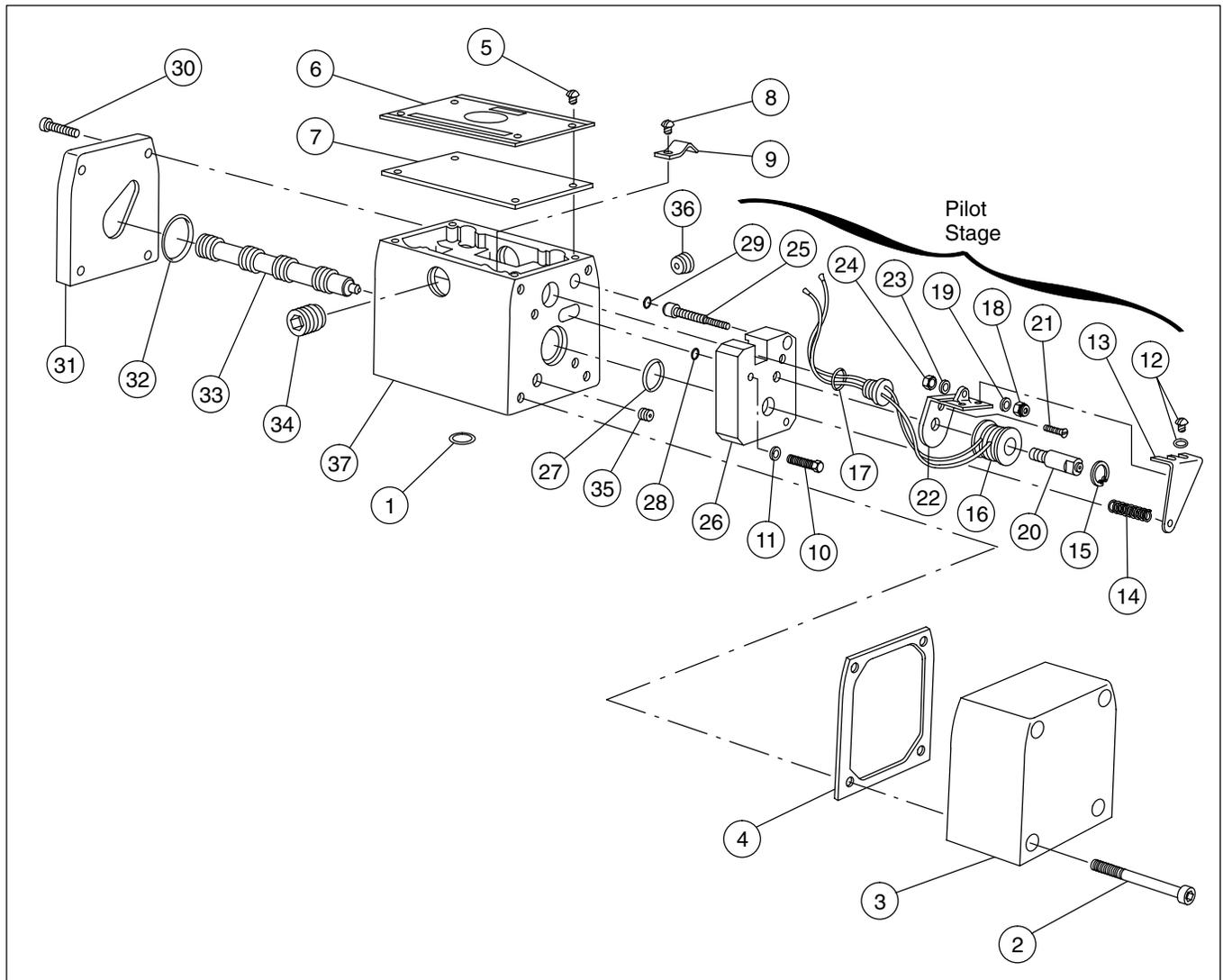


Figure 1. Exploded View of Servo Valve

Legend for Figures 1 thru 4

| Index Number | Part Number | Name | Qty. |
|---------------------|-------------|-------------------------------|------|
| 1 | ▲ 199811 | O-Ring | 5 |
| 2 | 207892 | Screw | 4 |
| 3 | 376706 | Cover | 1 |
| 4 | ▲ 323926 | Gasket | 1 |
| 5 | 174638 | Screw | 4 |
| 6 | - | Nameplate | 1 |
| 7 | ▲ 286122 | Gasket | 1 |
| 8 | 353860 | Screw | 1 |
| 9 | 353859 | Clamp | 1 |
| 10 | 42590 | Screw | 2 |
| 11 | 68904 | Washer | 2 |
| 12 | 344966 | Screw and Lock Washer S/A | 2 |
| 13 | 323931 | Armature Flapper | 1 |
| 14 | 351042 | Spring | 1 |
| 15 | 102671 | Retaining Ring | 1 |
| 16 | 346773 | Coil and Seal | 1 |
| 17 | ▲ 154006 | O-Ring | 1 |
| 18 | 352641 | Lock Nut | 1 |
| 19 | 233106 | Washer | 1 |
| 20 | 351437 | Nozzle (SF4-100-30-002-10) | 1 |
| | 343410 | Nozzle (SF4-140-20-002-10) | 1 |
| 21 | 112201 | Screw | 1 |
| 22 | 323933 | Frame | 1 |
| 23 | 233106 | Washer | 1 |
| 24 | 200345 | Nut | 1 |
| 25 | 351436 | Adjusting Screw | 1 |
| 26 | 343414 | Adapter Plate S/A | 1 |
| 27 | ▲ 157515 | O-Ring | 1 |
| 28 | ▲ 154139 | O-Ring | 1 |
| 29 | ▲ 154004 | O-Ring | 1 |
| 30 | 11012 | Screw | 4 |
| 31 | 323923 | Cover | 1 |
| 32 | ▲ 154140 | O-Ring | 1 |
| 33 | 942070 | Spool S/A (SF4-140-20-002-10) | 1 |
| | 942320 | Spool S/A (SF4-100-30-002-10) | 1 |
| 34 | 64765 | Plug | 1 |
| 35 | 16794 | Orifice Plug | 1 |
| 36 | 7074 | Plug | 1 |
| 37 | 323921 | Body | 1 |
| ▲ 919529 Gasket Kit | | | |

Section II – Overhaul

A. Unit Removal



WARNING

Turn off all electrical power and relieve hydraulic pressure. Block any load that could generate pressure.

1. Remove the unit from the system.
2. Cap all system openings to prevent entry of dirt.

B. Special Tools

The following special tools are needed:

1. Torque wrench rated in lb.in.
2. Flushing plate. Refer to figure 6 for dimensions.
3. 0-500 millimeter.

C. Improvised Tools

No improvised tools are required for overhaul.

D. Disassembly

Periodic maintenance of the valve will generally not require disassembly to the extent described here. However, the sequence can also be used as a guide for partial disassembly. In general, disassembly is accomplished in the item number sequence shown on Figure 1. Special procedures are included in the following steps:

1. Thoroughly clean the exterior of the valve.
2. The valve is full of fluid, so hold it over a container when the cover (3, Figure 1) is removed.
3. Remove parts (1) thru (11) according to sequence.
4. Remove the pilot stage parts (12) thru (26) as a unit by pulling the adapter (26) from the main stage body (37); at the same time, push the coil connector from the body. See Figure 4. Disassemble the pilot stage according to numerical sequence in Figure 1.
5. Remove parts (27) thru (37).

E. Cleaning

All parts must be thoroughly cleaned and kept clean during inspection and assembly. The close tolerance of servo valves makes this requirement more stringent than usual. Use a commercial solvent which is compatible with the system fluid to clean the parts. Compressed air may be used in cleaning the valve but it must be filtered to remove water and contamination. Clean compressed air is particularly useful in cleaning the spool orifices and body passages.

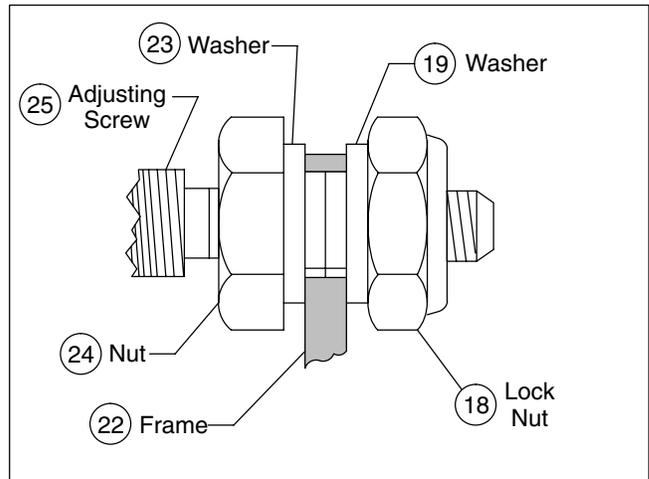


Figure 2. Locating of Adjustment Screw Nuts and Washers

F. Inspection, Repair, and Replacement

Check that all internal passages are clean and unobstructed. Examine all mating surfaces for nicks and burrs. Check the condition of threaded parts and threaded holes. Check the retaining ring (15). Minor burrs can be removed with an India stone.



CAUTION

The spool (33) must not have the land edges broken with the stone. They are held to a very close tolerance.

1. Make sure that the 0.020 hole in the side of the spool (33) and the 0.030 hole in the orifice plug which is screwed in the end of the spool are completely open. (See Figure 5.) The orifice plug in the end of the spool may have to be removed to clean out contaminants that have gathered inside the spool.

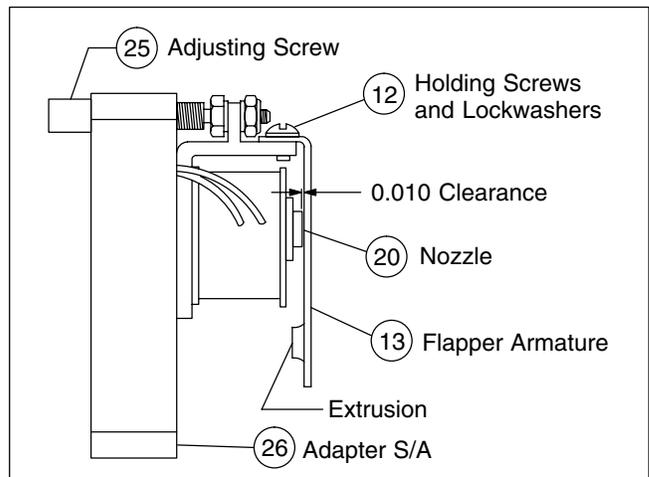


Figure 3. Pilot Stage Servo Valve Adjustment Locations

2. Check the 0.060 hole in the nozzle (20).
3. Check frame (22) for cracks or distortion.
4. Check the feedback spring (14) for distortion.
5. Make a continuity check of the coil and seal subassembly (16). Resistance values should range from 18 to 22 ohms. This test is superficial but a more rigorous test requires special equipment.
6. Check the adapter (26) and spool mating surfaces. Insert the spool into the adapter and rotate the spool. The spool must not bind in any position.

G. Assembly

Replace the gaskets and O-Rings with those supplied in the gasket kit. Apply a light film of clean system fluid to the parts prior to installing them. This will make assembly easier and provide initial lubrication. Special procedures are included in the following steps:

1. Assemble parts (37) thru (35). See Figure 1.
2. Assemble the pilot stage portion of the valve as follows:
 - a. Assemble parts (26), (22), (21) and (20).

- b. Install adjusting screw (25) thru the adapter (26), attach standard nut (24) and washer (23) and turn the nut on until it bottoms against the shoulder of the adjusting screw. See Figures 2 and 3.

- c. Turn the adjusting screw (25) thru the hole on the frame (22) far enough to attach the other washer (19) and lock nut (18).

- d. Turn one of the nuts until it contacts the frame, then tighten the other nut. See Figure 2.

NOTE

After tightening the nuts (18) and (24) against their respective washers, the adjusting screw (25) should turn free and have no end play between the screw and the frame (22).

- e. Assemble parts (17) thru (15). See Figure 1.



CAUTION

Be careful when installing flapper armature (13). The securing screws (12) extend thru the frame (22) and could break the insulation on the coil. See Figure 3.

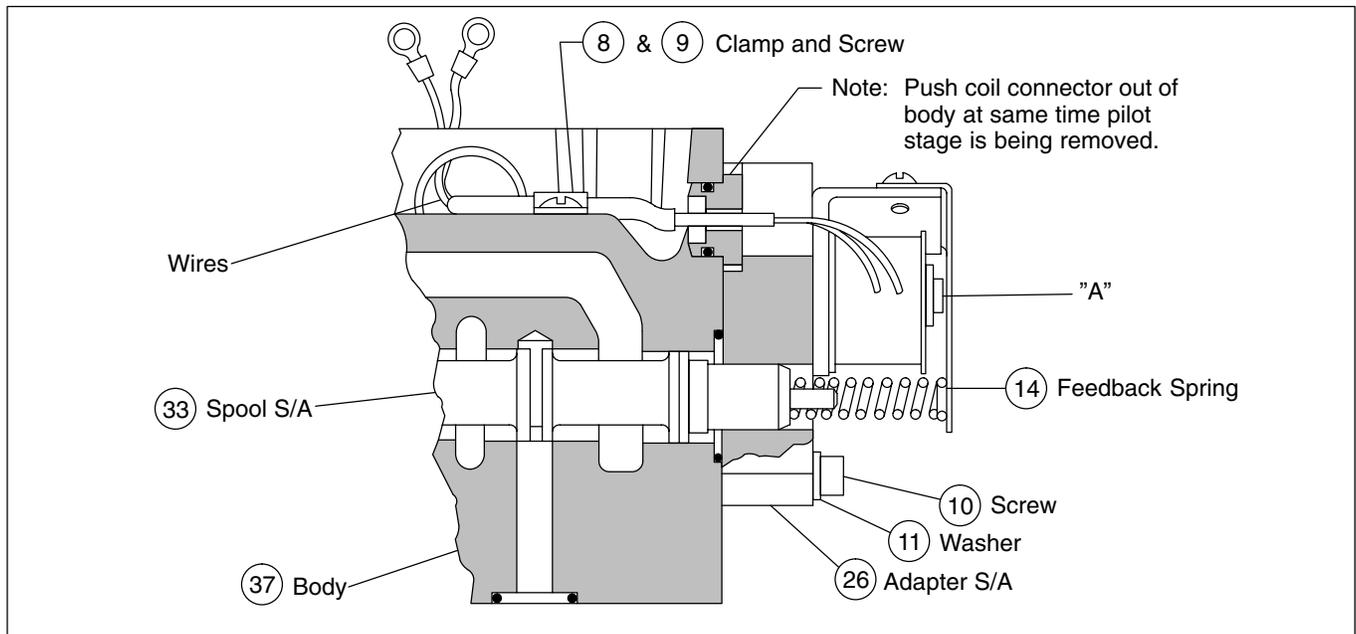


Figure 4. Sectional View

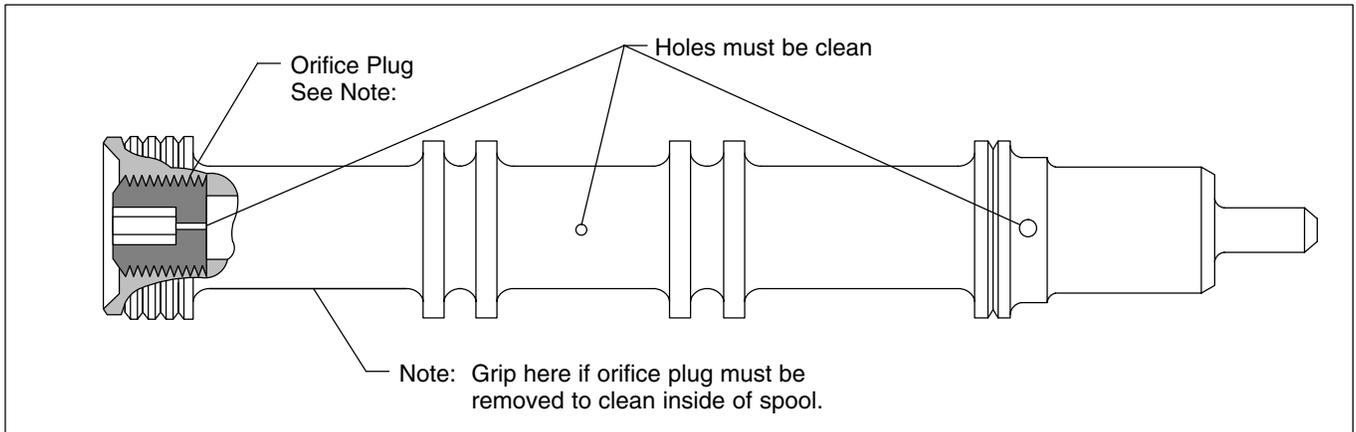


Figure 5. Spool Subassembly

f. Place a 0.010 shim between the flapper armature (13) and the nozzle (20) while tightening the two holding screws and lockwashers (12). See Figure 3.

NOTE

The flapper armature must be square with the nozzle when the operation is completed and have a 0.010 clearance. A change in the setting of the adjustment screw (25) may be required during this procedure to keep the flapper armature square with the nozzle.

3. Install O-Ring parts (29) thru (27) into valve body (37).

4. Insert spool subassembly (33) into body (37). The small end of the spool must extend from the valve approximately one inch. Assemble the pilot stage (adapter subassembly (26)) over the spool for alignment purposes. Guide coil wires thru body hole and align the coil connector with body hole while installing. See Figure 4. Tighten the adapter holding screws (10) and washers (11) alternately until the pilot stage is flush against the valve.

5. Check spool to see that it doesn't bind in the adapter (26) then torque the screws to 16-18 lb. in. Recheck for binding.

6. Assemble the feedback spring (14) to the flapper armature by twisting the spring over the extrusion until the spring is tight against the flapper armature. Use a twisting motion only, lateral force against the flapper armature may bend it. See Figure 4.

7. Assemble parts (34) and (32) thru (30).

8. Turn adjusting screw (25) until light can just be seen between the flapper and orifice, point "A", Figure 4. This is a preliminary null adjustment.

9. Assemble clamp (9) and screw (8) over the wire. Route the wire ends thru the hole to the outside of the valve. See Figure 4.

NOTE

The name plate, gasket, and screws, parts (7) thru (5), should not be installed at this time since a final null adjustment must be made before normal operation can begin.

10. Install parts (4) thru (1). Torque screws (2) to 16-18 lb. in.

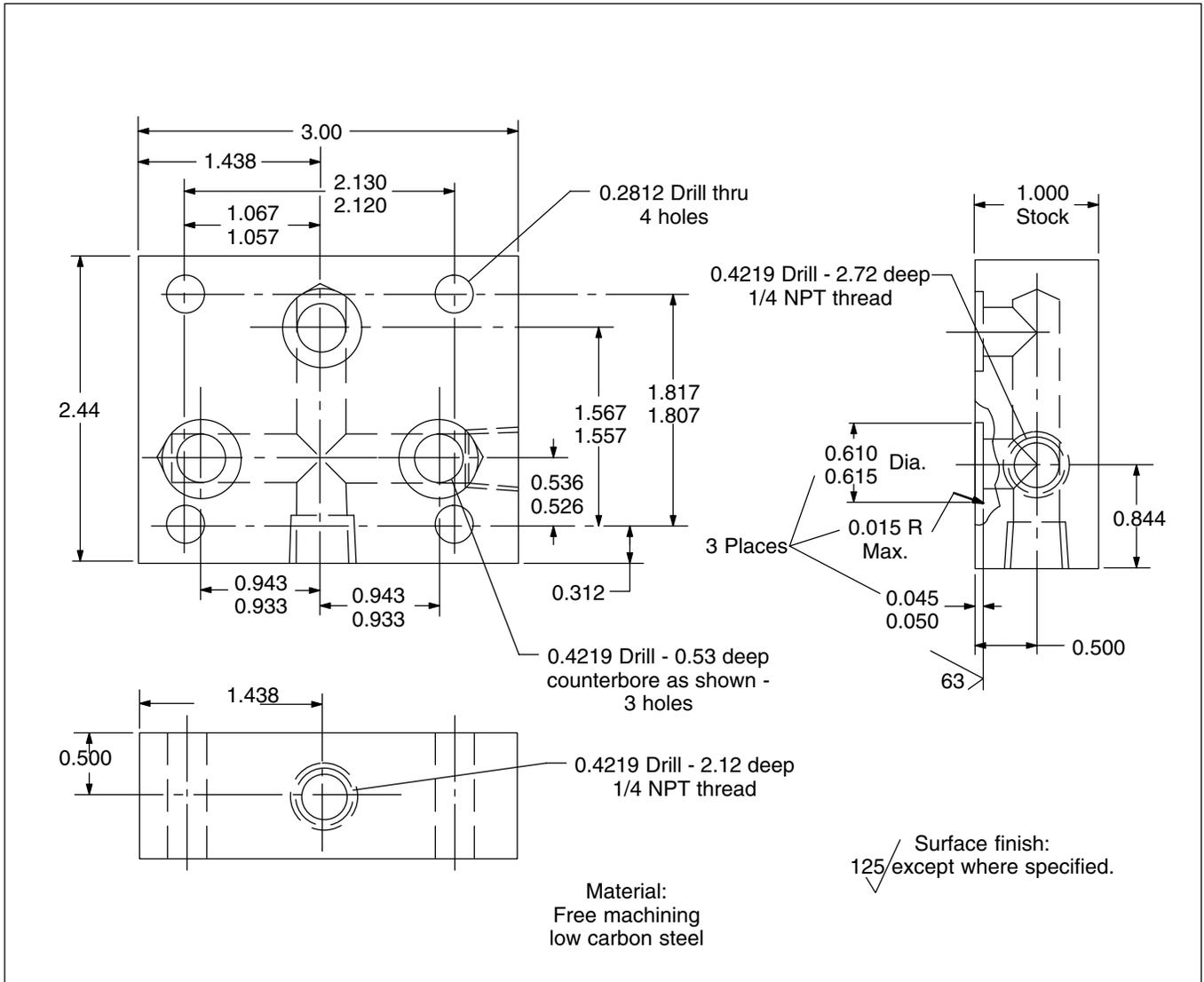


Figure 6. Flushing Plate

H. Unit Installation

Flush the system through 10 micron full flow filters prior to installing the servo valve. A flushing plate can be manufactured. (See Figure 6.) The plate passes the fluid directly to the tank port. Continue flushing until new filters show no sign of contamination. It may be necessary to change the system fluid. If so, filter the new fluid as it is poured into the reservoir and then flush the system as described above. After the system is flushed, remove the flushing plate and install the servo valve. Torque the mounting screws to a maximum of 112 lb.in.

Section III – Test Procedure

A. Test

1. Utilize your present control system to test the servo valve as follows:



CAUTION

Check polarity of 0-500 milliammeter with system polarity prior to installation to prevent meter damage.

- a. Connect meter in system according to Figure 7.
- b. Adjust appropriate system command control until a reading of 190 milliamps is observed on meter.
- c. Energize the hydraulic system and adjust for hydraulic null (no movement of hydraulic motor or cylinder) with adjustment screw (25). See Figure 1.
- d. Slowly vary the system command controls so that current shown on the milliammeter varies from 0-400 milliamps. A smooth transition from zero to maximum flow should occur both sides of center (null) position. Erratic movement may indicate that the servo valve spool is sticking.

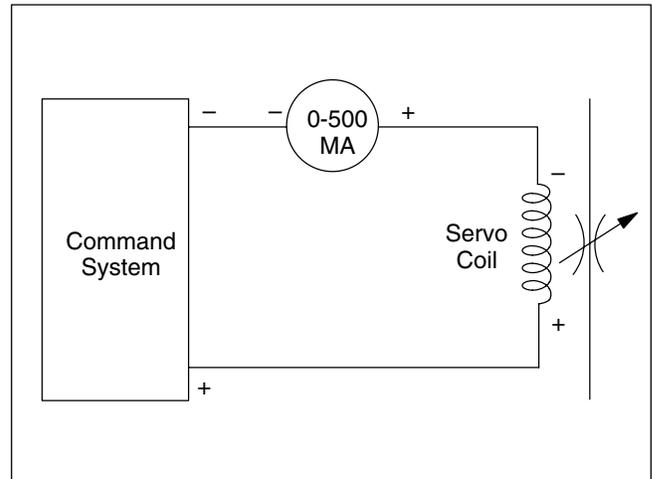


Figure 7. Servo Test Wiring Circuit