Installation, Operation, & Maintenance Manual

WJTECV-001.02

Welker Jet® Top Entry Control Valve

The information in this manual has been carefully checked for accuracy and is intended to be used as a guide to operations. Correct operating and/or installation techniques, however, are the responsibility of the end user. Welker reserves the right to make changes to this and all products to improve performance and reliability.

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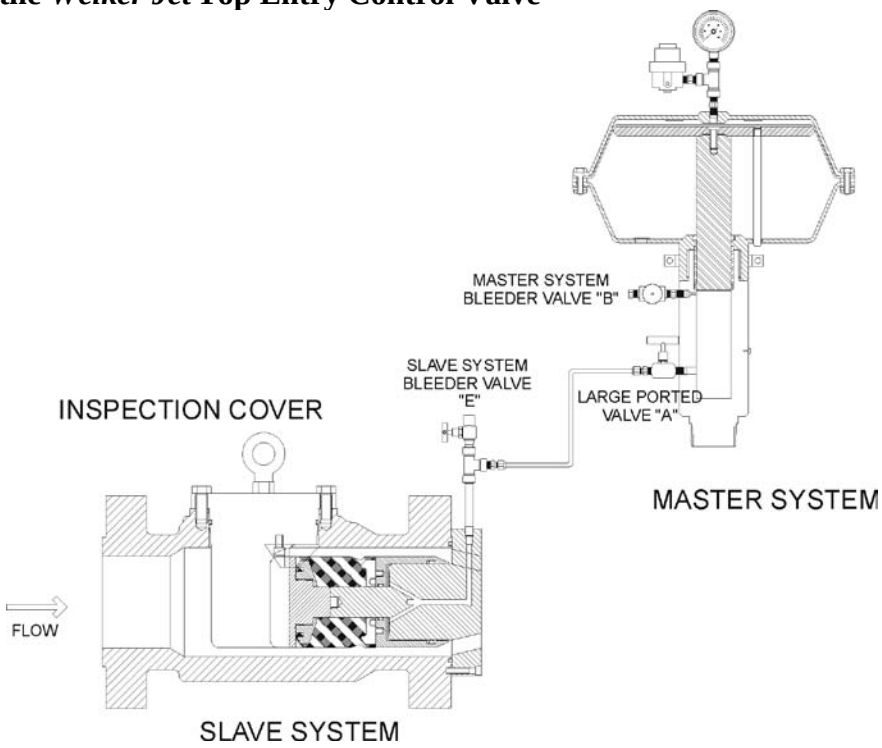
Installing the *Welker Jet* Top Entry Control Valve



After unpacking the unit, check to make sure all equipment ordered is complete and check for possible damage**. If damaged, carrier must be notified immediately**. Make sure all required equipment is available for installation.

Welker Jet Top Entry Control Valves are normally installed in pipelines the same size as the Control Valve. If expanding pipe size downstream, reference capacity and noise prediction from Welker Jet sizing program. Listed below are the flanged models and the pipeline sizes they are normally fitted to.

MODEL	PIPE SIZE	TE STYLE O.A.L. DIM		
		150 ANSI	300 ANSI	600 ANSI
WJ-2TE	2" pipe	10" (254)	10.5"(266.7)	11.25(285.8)
WJ-4TE	4" pipe	13.875"(352.4)	14.5"(368.3)	5.5" (393.7)
WJ-6TE	6" pipe	25" (635)	25" (635)	25" (635)
WJ-8TE	8" pipe	32" (812.5)	32" (812.5)	32" (812.5)

The *Welker Jet* Top Entry Control Valve spool is installed (Figure 1, page 4) in the pipeline. An inspection spacer ring 1/2" is recommended (not required) upstream of the Control Valve spool to assist in rolling out the spool (if required) for Control Valve maintenance. A $^{1}/_{4}$" pipe nipple extends from the downstream end of the Control Valve slave system body (this is not to be used as a lifting or leverage point). Special care should be taken to install the Control Valve spool in the proper direction for flow. Bolt the Control Valve spool and inspection spacer ring in place with the pipe nipple extending vertically (pointing up) and the proper gaskets in place. The master system should be placed as close to the Control Valve spool as possible so as to keep associated hydraulic lines within four feet for easy filling. The master system has a 2" NPT male thread on its cylinder to be used for pipe mounting. Install stainless steel tubing, ($^{3}/_{8}$" .035 wall as min.), rated for 4,000 psig or higher from the T-fitting

below valve “E” on the Control Valve slave body to valve “A” on the master system cylinder to serve as a hydraulic line (Figure 1, page 4). For best results, slope the hydraulic line downward from the master cylinder to the Control Valve spool. When long lengths of tubing are used for a hydraulic line, an oil fill pot is recommended for filling the hydraulic system (see methods #2 and #3 - pages 6-12). Welker recommends not mounting the master to the Control Valve spool (reference Figure 1).

Filling the Hydraulic System

If, at any point, assistance or instruction clarification is required please call the Welker Service Department at 1-800-776-7276, international 1-281-491-2331.

Welker Jet Top Entry Control Valves should be filled with aircraft hydraulic fluid. New Control Valve slave systems and master systems are shipped pre-filled from the factory, but connection lines must still be purged of air. When reinstalling a Control Valve after maintenance, the Control Valve assemblies should be filled according to the most suitable of the methods outlined in this section (pages 3-12).

VERY IMPORTANT

The hydraulic system operates at optimum level when an absolute minimum of air is trapped within it. There are three methods of filling the hydraulic system in a manner that traps little or no air. The method used would be dependent upon the size of the valve and the installation.

Note: It is preferred the pipeline be depressurized when filling the hydraulic system.

Method #1 For Filling Hydraulic System less than 4 feet (Figure 1, Pages 5-6)

The first method of filling the hydraulic system is intended for systems with relatively short runs of hydraulic tubing from the master system to the slave system.

Method # 2 For Filling Hydraulic System over 4 feet (Figure 2, Pages 7-9)

The second method of filling the hydraulic system is intended for systems when the hydraulic tubing runs are relatively long from the master system to the slave system and a vacuum pump is not available, or when it’s not practical to remove the master system diaphragm motor assembly as in the case of a 6” or 8” Control Valve.

Method # 3 For Filling Hydraulic System over 4 feet (Figures 4 & 5, Pages 9-13)

The third method of filling the hydraulic system is intended for systems with relatively long runs of hydraulic tubing or when it’s not practical to remove the diaphragm motor assembly from the master system as in the case of a 6” or 8” Control Valve.

This method uses the Welker Manual Vacuum Pump and OFP-1, Oil Fill Pot in conjunction with each other to efficiently pull a vacuum and to put a positive oil charge on the entire Master and Slave System of the *Welker Jet* Top Entry Control Valve.

Method #1 For Filling Hydraulic System under 4 feet (Figure 1, Pages 5-6)

The first method of filling the hydraulic system is intended for systems with relatively short runs of hydraulic tubing from the master system to the valve body. If valve "E" on the slave system is positioned higher than master system valve "A", it is recommended that the master system be raised or that method #2 or method #3 (using the oil fill pot) be used for filling the hydraulic system.

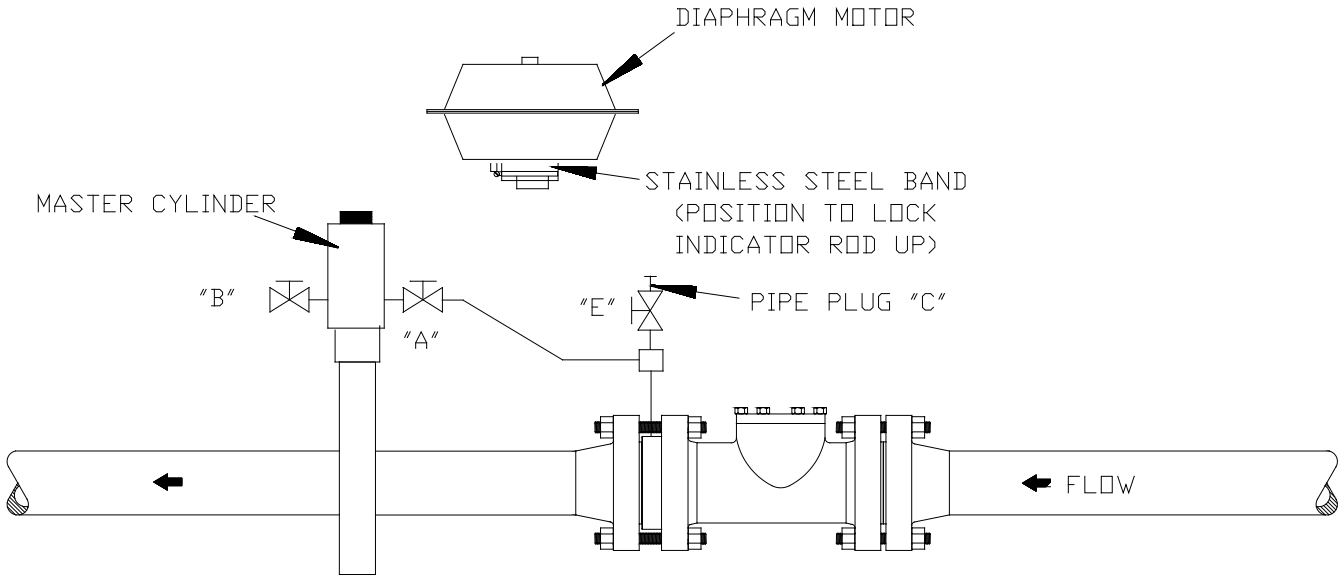


Figure 1

1. Shut off air/gas supply and disconnect instrument air/gas tubing to the top of motor Valve "B" should already be closed.

2. Position the collar or stainless steel band below the indicator rod, underneath the diaphragm motor assembly (Figure 1, page 4). This is to lock the indicator rod in the up position. Secure the indicator locking device with screwdriver.

3. Close valve "A" and depressurize the pipeline.

4. To remove the diaphragm motor, remove the pipe plug from bleeder valve "B" and slightly open the valve "B" (**Caution should be used when opening this valve, in case pipeline pressure has migrated into hydraulics)** to relieve pressure on the system and to relieve the vacuum in the master cylinder thus allowing the motor piston to be removed (Be sure to close off valve "B" once motor is removed). The motor comes off the master cylinder in one piece by turning it counterclockwise. It will be necessary to use a back-up wrench on the master cylinder when removing the diaphragm motor. Turn motor upside down with the master piston facing up. Push downward on the master piston and readjust the stainless steel band or collar under the indicator rod (noted in step 2). This will lock the motor piston in the correct position for reassembly. Be sure to remove bearing (Figure 14, page 25) and to make sure it moves freely on the master piston. Slide the bearing into its proper position in the master cylinder.

5. Remove pipe plug "C" from valve "E" attached to the Control Valve slave body.

6. Open valve "E" fully (**Caution should be used when opening this valve, in case pipeline pressure has migrated into hydraulics)**.

7. Open valve "A" fully. The oil in the master cylinder will drain into the tubing.

Note: *With the master cylinder valve "A" positioned higher than the slave body valve "E", pour hydraulic oil into the master cylinder slowly, until the fluid starts to flow out of valve "E". Close valve "E", replace pipe plug "C" securely, using PTFE tape or pipe dope, and fill the master cylinder to within 1/8 inch of the crown seal (Figure 14, page 25).*
Note: *When sealing fittings with PTFE tape, refer to the proper sealing instructions for the tape used.*

8. Replace diaphragm motor assembly to the top of the master cylinder and begin to screw the diaphragm back down (being careful not to cross thread the connection. As you screw the diaphragm motor, pressure could begin to build in the hydraulic system, if so crack valve"B". Slightly cracking valve "B" will allow the excess oil to escape, thus keeping the hydraulic at the correct level and pressure. The pressure should be at or near zero. Once the diaphragm motor is hand tightened to the master cylinder, close valve "B" immediately. Do not tighten the diaphragm motor to the master cylinder with a wrench. Metal to metal hand tight is good. Once the diaphragm motor assembly is assembled to the master cylinder, loosen stainless steel band or collar (Figure 12, page 24) and position the band so it will not restrict movement of the indicator.

Note: *When replacing diaphragm motor, do not build too much pressure on the master cylinder (10 to 20 psig is acceptable and pressure can be checked by placing a 0-200# gauge temporarily in valve "B").*

9. Securely close valve "B". A pipe plug should be installed into the outlet of valve "B" to ensure against leaks. Valve "A" remains fully open for operation.

10. Apply and relieve pressure to diaphragm motor (stroking the motor piston down

fully). This action will indicate if the air has been removed or trapped in the tubing. You are looking for the indicator rod to be repeatable, moving from fully open to fully closed using the stainless steel band or collar to check repeatability. If the indicator rod does not continue to return to the same position after pressure is relieved from the diaphragm motor, repeat steps 1-8.

Method # 2 For Filling Hydraulic System over four feet (Figure 2, Pages 6-8)

The second method of filling the hydraulic system is intended for systems when the hydraulic tubing runs are relatively long from the master system to the slave system and a vacuum pump is not available, or when it's not practical to remove the master system diaphragm motor assembly as in the case of a 6" or 8" Control Valve.

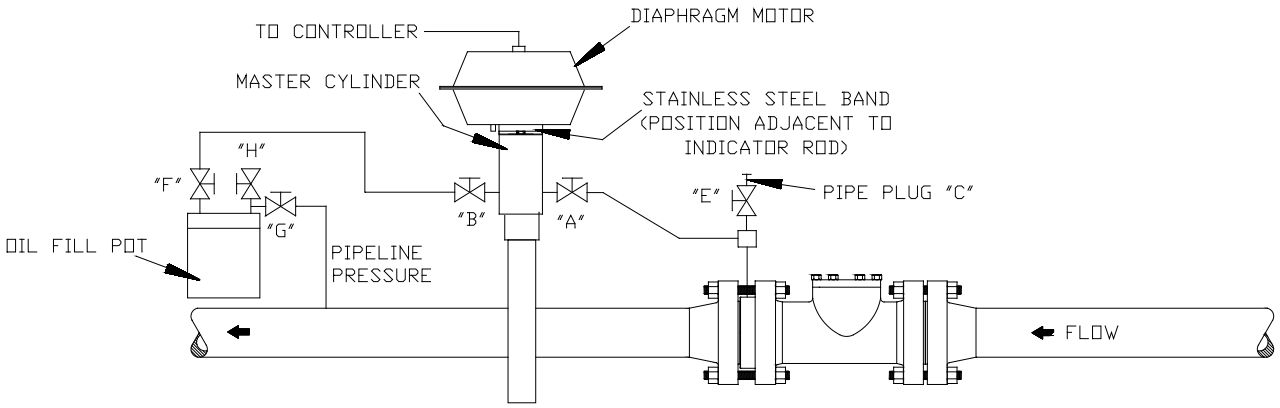


Figure 2

This method of filling the hydraulic system involves the use of an oil fill pot (Welker part number OFP-1).

With this method, the diaphragm motor assembly remains attached to the master cylinder.

Note: *Make sure there is no instrument pressure on the diaphragm motor. It is recommended to disconnect the instrument supply to the diaphragm.*

Note: *Make sure the stainless steel band or collar (Figure 12, page 24) has been loosened and the raised portion of the band has been moved out from under the indicator rod or lock ring is position correctly. Retighten S.S. band in position adjacent to indicator rod or position the collar. This will allow the S.S. band or collar to be used as a reference point indicating full open position of the Control Valve and will aid in troubleshooting the hydraulic system in step 18.*

1. Open the oil pot and fill within ½" of the female threads (be sure you start with a full oil fill pot). Fill with fresh or new unused aircraft hydraulic oil, as needed.

2. Attach top to oil fill pot and close valves "F", "G", and "H".

Note: *Control valve assemblies have been filled with hydraulic fluid at the factory and associated valves and plugs must remain closed and in place until instructions are given in this procedure to open or remove them.*

3. Connect pressure line, preferably regulated pipeline pressure (200 psig or 13.3 bar), to valve "G" (Figure 2, page 6). Use either high pressure S.S. tubing or high-pressure flexible tubing.

Note: *If pressure is too high and the pressure on the hydraulic system is not relieved to 10 to 20 psig max after the hydraulic system has been purged of air, the inner valve can be pre-compressed and the Control Valve will not be able to obtain full flow capacity.*

4. Open valve "G" fully.

5. Run <u>high pressure</u> (rated for at least full pipeline pressure), flexible tubing from valve "F" to valve "B", tighten the tubing only at valve "F", leaving the tubing connection at "B" loose. Note: Valve "B" is the smaller of the two valves on the master cylinder.

6. Purge tubing between the oil pot and master cylinder by slightly cracking open valve "F". When hydraulic fluid emerges from the loosened fitting of valve "B" tighten valve "B" tubing connection and close valve "F".

Note: *Do not let the oil level in the oil fill pot get below the downcomer tube in the oil pot.*

7. Remove pipe plug "C" from valve "E" and open valves "A", "B", and "E".

8. Using instrument output, stroke the master system motor piston down fully. Note: When indicator is fully extended, This will be an indication there is no hydraulics in the master cylinder. The newer diaphragm motors, (May 2004) will have a divet to indicate that location. In the older models, it would be good to mark that location. Be sure to attach tubing to valve "E" and collect oil that may be left in the master cylinder. Close valve "E".

9. Close valve "A" and remove all diaphragm pressure.

10. Slightly open valve "F". The pressure in the oil pot will force the master

piston and indicator rod up. Close valve “F” securely when the motor piston reaches the top of its travel.

11. Connect tubing to valve “E” to collect the excess oil from the purging cycle. This will also allow viewing of the removal of the air in the system.

12. Reopen valve “A” and “E”.

Note: *Do not let the oil level in the oil fill pot get too low.*

13. Slightly open valve “F”. When fluid flows from valve “E”, close valve “F”. Repeat steps 10-13 several times to insure that all air has been removed from hydraulic system.

14. Close valve “E” and replace pipe plug “C”. Use PTFE tape or pipe dope to seal the threads.

15. Securely close valve “B”.

16. Apply and relieve pressure to diaphragm motor (stroking the motor piston down fully) so as to be able to check for indicator rod, stainless steel band position repeatability. If the indicator rod does not continue to return to the same position after pressure is relieved from the diaphragm motor, unplug and open valve “E”. Repeat steps 9-13. If the indicator rod does continue to return to the same position after pressure is relieved, all air has been removed from the hydraulic system.

17. Close valve “G” securely and vent pressure in the oil pot through the vent valve “H”. The oil pot assembly may be removed if desired.

18. Slightly open valve “B” to allow excess oil pressure to escape (Be ready to close the valve quickly). This pressure will escape immediately when the valve is opened. **Do not allow indicator rod to lower itself from diaphragm case as this would mean you have not only purged excess oil pressure but have also lost necessary oil. Make sure pressure on hydraulic system does not exceed 10 to 20 psig. The system pressure can be checked by temporarily placing a gauge in valve “B”. Note: When checking hydraulic pressure be sure to use a gauge that is equal to pipeline pressure or greater. Also check pressure without pressure on the diaphragm.**

19. Securely close valve “B”. A pipe plug should be installed into the inlet of valve “B” to ensure against leaks. Valve “A” remains fully open.

Method # 3 For Filling Hydraulic System (Figures 3 & 4 , Pages 8-12)

The third method of filling the hydraulic system is intended for systems with relatively long runs of hydraulic tubing or when it’s not practical to remove the

diaphragm motor assembly as in the case of a 6" or 8" valve. This method fills the both hydraulic master and slave system without any disassembly.

This method uses the Welker Manual Vacuum Pump and Welker OFP-1, (Oil Fill Pot) in conjunction with each other to efficiently pull a vacuum and to put a positive oil charge on the entire Master and Slave System of the *Welker Jet*Top Entry Control Valve .

By using the vacuum pump and oil fill pot together, any air that could be trapped within the hydraulic system will be eliminated (the OFP oil fill pot alone, may not evacuate all the trapped air in the system).

Once the air has been eliminated, the Control Valve response time will be faster. When there are changes that affect the rate of flow or pressure, the optimum design benefits of the Control Valve will be experienced.

Installation of Vacuum Pump and Oil Fill Pot Assembly (Figure 3, Page 10):

Note: *Before connecting Flex line to Valve "F" of the oil fill pot, ensure that the oil fill pot has been filled and all the air is out of downcomer and ready for use.*

1. Connect the vacuum pump to the oil pot by connecting the flex line from outlet valve "F" on the oil pot to valve "J" on the pump (Figure 3).

2. Connect the flex line from the vacuum pump to valve "B" on the master cylinder. The OFP-1 oil pot will need a regulated pressure source to prime the system with oil. The regulated source should not be more than 200 psig (10 bar) and will connect to valve "G". Valve "H" is used to bleed the system and vent off the supply pressure in the oil pot once oil has been added to the hydraulic system.

3. Leave valve "G" on the OFP-1 closed. Valve "G" will allow supply pressure into the OFP-1 to compress the oil into the master and slave system. Leave outlet valves "F" and "H" on the OFP-1 oil pot closed. Be sure the hydraulic line from the master system to the Control Valve slave system is connected, and that valve "A" on the master cylinder is open.

Note: *Due to the fact that both assemblies of the Welker Jet Top Entry Control Valve are filled with hydraulic fluid prior to being shipped from the factory, a piece of tubing or hose should be connected to the vent port on the vacuum pump. This will allow the collection of any hydraulic oil that may be in the Control Valve assemblies, prior to pulling a vacuum on the system, and will allow a safe means of draining it into a receptacle. If kept clean, the hydraulic fluid (oil) can be reused.*

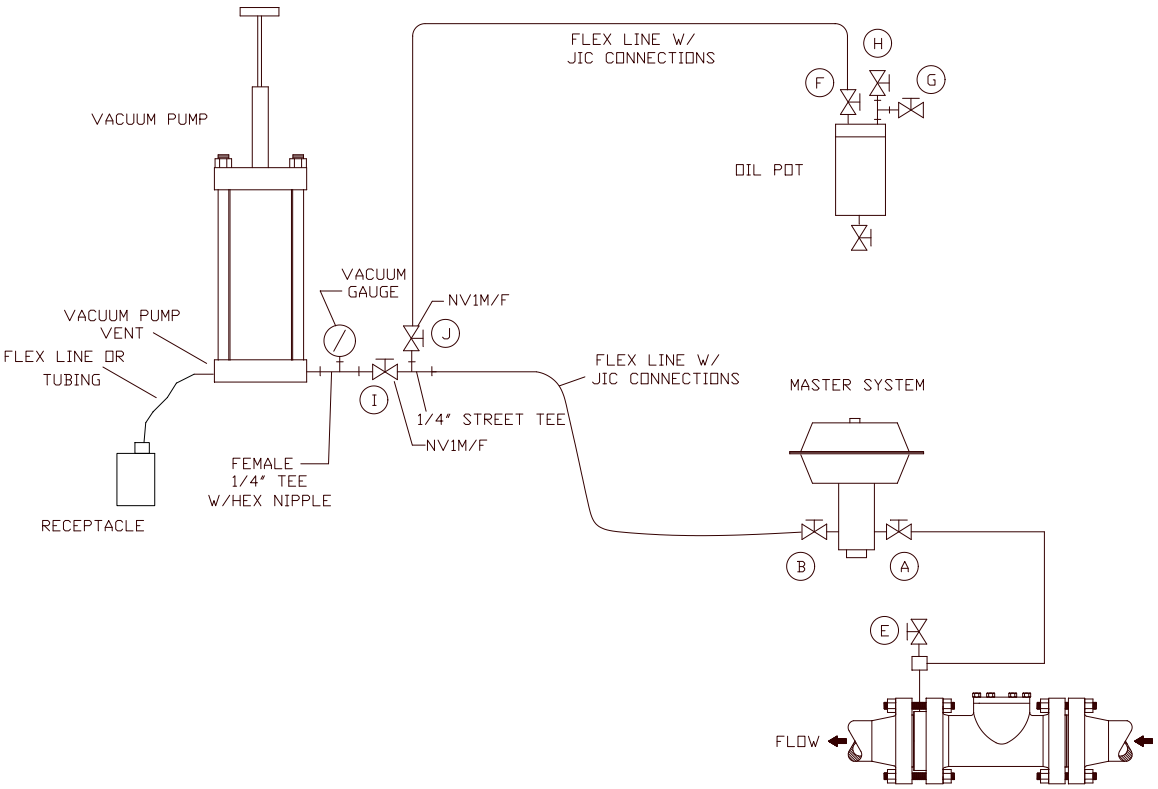


Figure 3

Operation of Vacuum Pump and Oil Fill Pot Assembly:

Filling Operation

With this method, the diaphragm motor assembly remains attached to the master cylinder.

Note: *Make sure there is no instrument pressure on the diaphragm motor or the pipeline.*

Note: *Make sure the stainless steel band or collar (Figure 2, page 6) has been loosened and has been moved out from under the indicator rod. Retighten band in position adjacent to indicator rod. This will allow the band to be used as a reference point in step 1 of the "Purging Operation" (below) indicating full open position of the Control Valve and will aid in troubleshooting the hydraulic system.*

1. Open valves "A", "B", "J", and "I" (valves "E", "F", "G" and "H" must be closed). By opening and closing the valves as noted, all the air can be removed from the hydraulic system by following steps 2 - 4.

2. Stroke the vacuum pump until the vacuum gauge shows a complete vacuum (27" of Hg). Close valve "I" on the vacuum pump. **Closing valve "I" will prevent damaging the pump, gauge, and preventing the pump handle from flying up. Remember when filling the Control Valve hydraulic system with oil, you are**

using high pressure gas (200 psig). All fittings on system must be tight to attain a true vacuum. Be sure the system holds a vacuum for 2 to 3 minutes before continuing.

3. Slowly open valve “G” to allow a “blanket” of pressure to fill the oil pot.

4. Open valve “F” on the oil pot to allow oil to fill the hydraulic system. **(Be sure to have the air supply port on top of the diaphragm motor assembly vented or disconnected.) Don’t let oil pot get low.**

Purging System of Excess Pressure and Disconnect Operation

1. Once the system has been filled with oil, (the indicator rod will be in the full open position) close supply pressure valve “G” and open vent valve “H” to bleed the additional pressure off the system.

2. Be sure to open all valves on oil fill pot except for valve “G”. By opening all oil pot valves except for valve “G”, pressure will be released from the hydraulic system. This release of higher pressures will keep the inner valve from being pre-compressed and restricting your flow.

Note: Do not allow indicator rod to lower itself from diaphragm case as this would mean you have not only purged excess oil pressure but have also lost necessary oil. Try to keep 10 to 20 psig (.7 to 1.4 bar) pressure on the hydraulic system. Make sure pressure on hydraulic system does not exceed 10 to 20 psig (.7 to 1.4 bar).

3. Once pressure has been vented, close valve “B” quickly on your master cylinder, and valve “F” on the oil fill pot.

4. Reconnect the supply to the diaphragm motor and apply and release pressure to diaphragm motor (stroking the motor piston downfully) so as to be able to check for indicator rod for repeatability. If the indicator rod does not continue to return to the same position after pressure is relieved from the diaphragm motor, repeat steps 1-3 of the “Installation of Vacuum Pump Operation”, steps 1-4 of the “Filling Operation” and steps 1-3 of the “Purging Operation”. Reposition the S.S. band or collar to the close position.

5. Connect a piece of tubing or hose to the vent port on the vacuum pump (Figure 4) if this has not already been done. This will allow for the collection of any oil that may be in the flex lines and will allow for safe drainage into a receptacle. Open vacuum pump valve “I” (Figure 4, page 12).

6. Stroke the pump to pull out any additional oil in the flex lines.

7. Once this has been completed, close valves “I” and “J”. The oil pot and vacuum pump may be disconnected and the Control Valve may be put into service (prior to putting Control Valve in service, make sure valve “B” is closed and plugged and that valve “A” remains open).

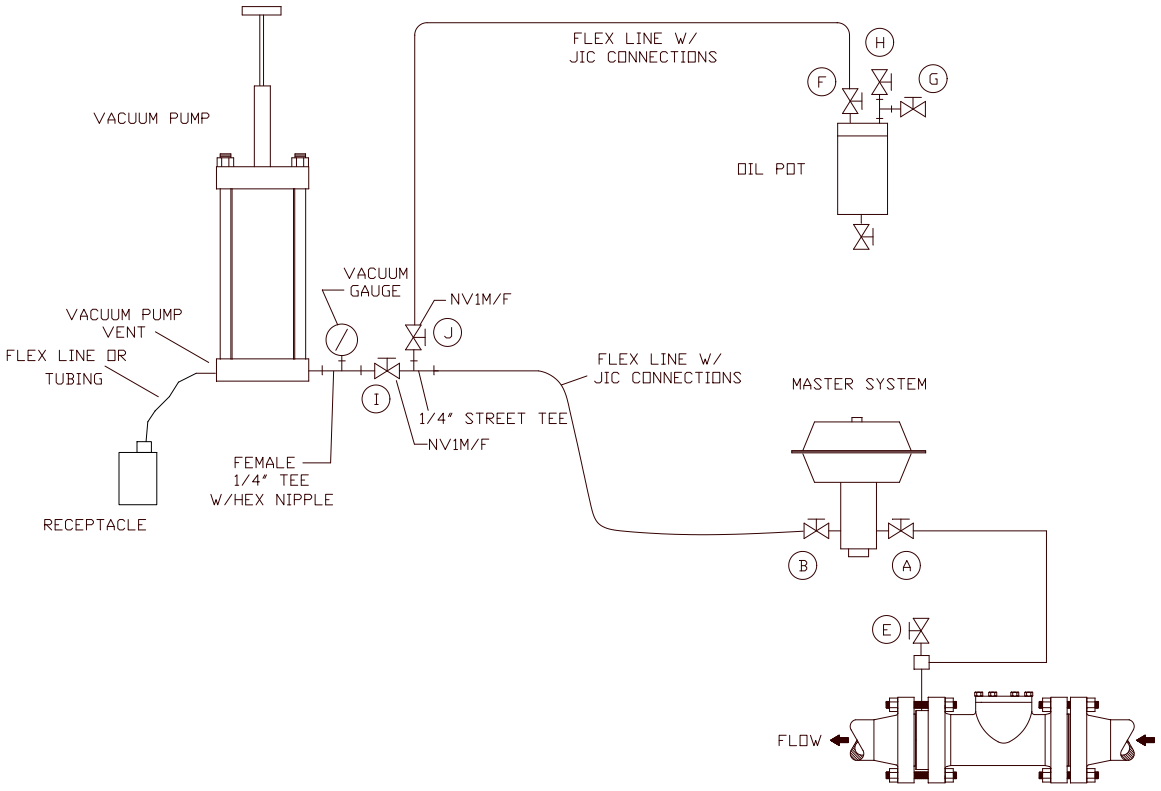

FLEX LINE W/
JIC CONNECTIONS
H
F
G
VACUUM PUMP
OIL POT
VACUUM
GAUGE
NV1M/F
J
VACUUM PUMP
VENT
FLEX LINE OR
TUBING
FLEX LINE W/
JIC CONNECTIONS
MASTER SYSTEM
I
1/4" STREET TEE
NV1M/F
FEMALE
1/4" TEE
W/HEX NIPPLE
RECEPTACLE
B
A
E
FLOW

Figure 4

Setting the Correct Instrument Supply for the *Welker Jet* Operation

Care should be taken when setting instrument supply gas to the controller. **It is best not to arbitrarily use a 20 or 30 psig (1.4 bar or 2 bar) supply because in some cases this might be twice the pressure required for the "wide seal" positive shutoff.** Therefore, it will cause higher stresses in the inner valve and hydraulic system than is necessary for the operation. The correct method for setting instrument supply is to raise this pressure until there is an initial shutoff with the maximum operating pressure drop. The initial shutoff is a narrow seal as shown in Figure 5.

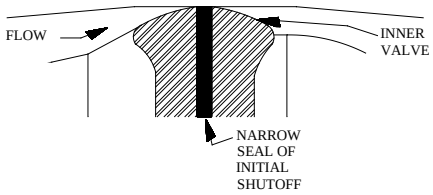


Figure 5

The narrow seal (Figure 5) does not ensure a positive shutoff if the inner valve must seal off around welding slag, etc. Therefore, it is recommended that 3-4 psig (.2 bar) be added to the supply pressure so that the inner valve will give a "wide seal" type shutoff, as shown in Figure 6.

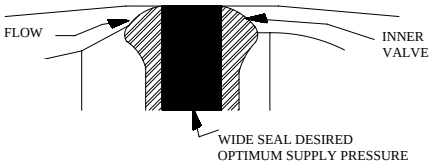


Figure 6

- An example is shown in Figure 7 of what happens to the inner valve when considerably more instrument supply pressure is put into the instrument than is necessary. ***Note: This type of pressure could and will shorten the life of the inner valve if not damage it.***

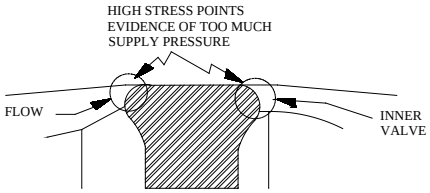


Figure 7

- It is recommended that each *Welker Jet* installation be set up with that specific station's pressure conditions in mind (maximum operating pressure drop). After a time the inner valve may become easier to shut off. At that time an adjustment should be made to the lock pressure setting from the controller or amplifier, this will lengthen the life of the inner valve.

- In some cases, the *Welker Jet* may be put into service when the pressure drop is less than the maximum expected. An estimated supply should be used that is capable of handling all pressure conditions. It can be adjusted at a later date if necessary.

- With pressure on the pipeline and correct instrument supply set for positive shut-off, the stainless steel band or lock collar can be positioned on the master cylinder so as to be used as a reference point. To indicate lock-up position (positive shutoff) of the Control Valve, the raised portion of the stainless steel band or lock collar can be set adjacent to the bottom of the indicator rod when the valve is completely closed.

Adjusting Supply Pressure

First- and second-stage regulators are used to regulate the supply to the controller. The first-stage regulator should be set at 100 psig (6.9 bar). This provides a regulated supply for output relays if needed (see requirement for amplifying output pressure relays - page 15).

The second-stage regulator takes the 100 psig (6.9 bar) and regulates it down to the pressure to be supplied to the controller, up to 30 psig (2 bar) for the 6-30 psig output range controller or 20 psig for the 3-15 psig output range controller.

Pressure to the controller should be adjusted according to the pressure needed to achieve shutoff of the Control Valve under maximum expected load conditions. If possible, a test should be made to determine shut-off pressure. This would be done by supplying pressure to the Control Valve diaphragm motor assembly, temporarily bringing the line into service, and adjusting the pressure to determine where shut-off occurs.

To determine the setting of the second stage-regulator, take the pressure required to achieve shut-off and add 3 to 4 psig (.2 bar). If the setting is determined with maximum differential pressure, add only 2 psig (see setting the correct instrument supply for the *Welker Jet* operation – page 15).

Four-, six-, and eight-inch *Welker Jet* instruments could require instrument supplies above 30 psig depending on the pressure drop. In these cases, amplifying pressure relays are used (see requirement for amplifying output pressure relays - page 15).

Requirement for Amplifying Output Pressure Relays

Amplifying pressure relays are necessary when the pressure required by the master system to achieve shut-off of the Control Valve under maximum expected conditions (i.e. the maximum operating pressure drop) is greater than the controller output.

If the pressure required is between 30 and 60 psig (2 bar to 4 bar), a 1:2 amplifying output relay should be used and the second-stage regulator should be set to a pressure determined by taking the initial shut-off pressure, adding 4 psig (.26 bar), and dividing by 2.

With a 1:2 amplifying output relay:

$$\frac{\text{initial shut-off pressure + 4}}{2} = \text{pressure setting for second-stage regulator}$$

EXAMPLE: $\frac{\text{32\# initial shutoff pressure + 4\#}}{2}$ = 18 psig pressure setting for second-stage regulator

If the pressure required is above 60 psig, a 1:3 amplifying output relay should be used and the second-stage regulator should be set to a pressure determined by taking the initial shut-off pressure, adding 4, and dividing by 3.

With a 1:3 amplifying output relay:

$$\frac{\text{initial shut-off pressure + 4}}{3} = \text{pressure setting for second-stage regulator}$$

EXAMPLE: $\frac{\text{62\# initial shut-off pressure + 4\#}}{3}$ = 22 psig pressure setting for second-stage regulator

Note: Supply pressure being supplied to the Amplifier should not exceed the maximum pressure required to close the Control Valve.

Requirements when using I/P Relays

I/P devices take an electrical signal of 4-20 ma, and give output of either a 3 to 15 psig (.2 bar to 1 bar) or 6 to 30 psig (.4 bar to 2 bar). When using this type of equipment in conjunction with amplifying relays, it is recommended you use a bias relay between the I/P and the amplifying relay. This will lower the output signal of the I/P to the amplifying relay; keeping the *Welker Jet* inner valve from being pre-compressed when output is asking for the Control Valve to be fully open. Setting of the supply pressure and pressure to the amplifying relays remains the same as above.

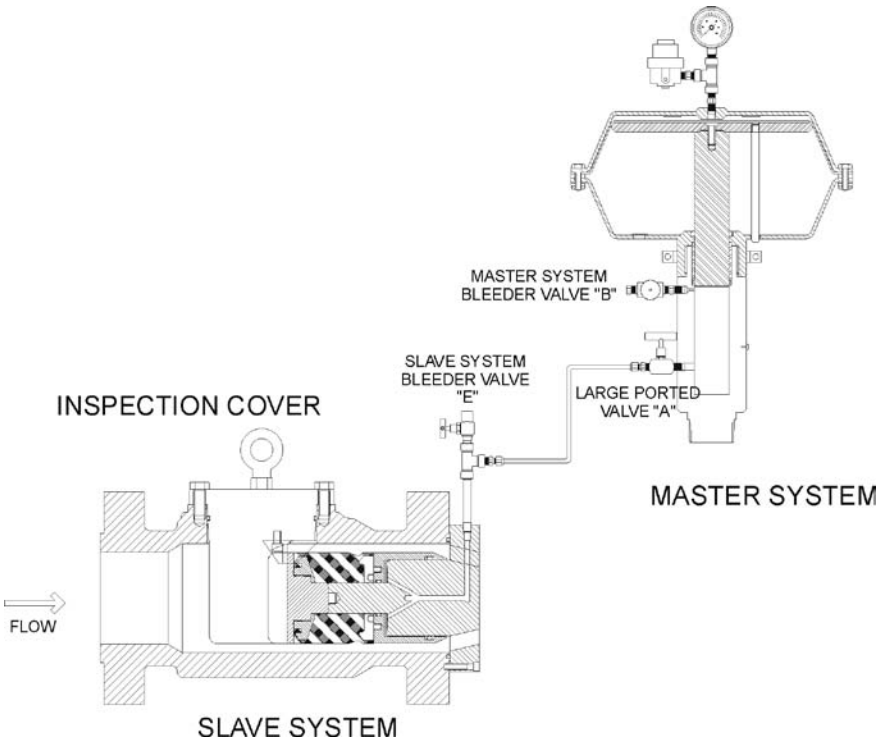


Figure 8 (*Welker Jet* Top Entry Control Valve*)*

1. Disconnect the instrument air line from top of the master system diaphragm motor assembly to be sure there is no pressure on the diaphragm motor.

2. Do not depressurize pipeline at this time. Make sure valve “E” on slave system body is closed and plug is removed.

3. If a small hand-held pump is available for relieving pressure on control valve hydraulic system, go to step 3a. If a small hand-held pump is not available, go to step 3b.

Caution: **Never remove the inspection cover on the Control Valve spool while pressure is on pipeline.**

3a. Hook up hand-held oil pump to the slave system bleeder valve “E”, located on the *Welker Jet* Control Valve slave body (Figure 8). **Slowly open valve “E”** allowing the trapped oil and hydraulic pressure to enter the pump (if hydraulic seal are damaged in slave cylinder there will be pipeline pressure present). Most small, hand pumps are see-through or have a glass reservoir. The oil can be seen as it enters and leaves the pump. These pumps also have a pressure-relieving plug on top to release any trapped pressure. If foam is present in hydraulic fluid, all of the air was not purged from the hydraulic system originally or one or both of the

hydraulic seals is leaking. If the hydraulic seals are leaking, pipeline pressure should create a bubbling effect in the hydraulic fluid.

3b. Attach a 0-2000# gauge to master system bleeder valve “B” (Figure 8, page 16). Open valve “B” slowly and check for excessive pressure. Pressure should be approximately 10 to 20 psig (.6 bar to 1.3 bar). If there is pressure on the hydraulic system, relieve pressure by opening slave system bleeder valve “E”. If no pressure is found, close valve “B” and remove gauge from valve.

4. If a little clear (non-foaming) oil came out and then stopped, the hydraulic seals are OK and the clean oil indicates that the slave cylinder **does not** need to be removed for repair. If oil came out foamy, then all of the air was not removed from the hydraulic fluid originally or one or both of the hydraulic seals on the slave cylinder is leaking. If foam was accompanied with bubbling while the pipeline was under pressure, remove the slave cylinder and replace the seals while the Control Valve inspection cover is off.

5. After checking the oil consistency, close valve “A”, and valve “B” (Figure 8, page 16).

Remove the hand pump or gauge used in steps 3a and 3b. Close the slave system bleeder valve “E”.

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Control Valve Body & Slave System Inspection / Reassembly Procedure / Seal Replacement

1. Remove all instrument supply from diaphragm motor.

2. Open bleed valve and relieve all pressure from oil system.

3. After relieving all oil pressure, depressurize pipeline.

4. Remove the Top Cap bolts (Figure 9, page 20). Using the cover jack bolts (2), "jack" the Top Cap straight up (making sure O-ring is not damaged, if so, replace). Set cover aside on a clean rag.

5. Remove the inner valve by sliding the nose cone and inner valve assembly forward off the slave piston stem and then lifting back and out. Both hands are required to remove the 6" and 8" inner valves due to their weight. After removal, unscrew the nose cone from the inner valve (Figure 9, page 20).

6. If the oil consistency on the hydraulic system is solid (no foam present), the slave cylinder does not need to be removed. Go to step 5. If the oil is foamy, thus indicating a hydraulic system leak or someone feels there is reason to replace the slave system seals, go to step 4a.

6a. Using the slave cylinder removal tool - blue in color (Figure 10, page 21), remove the slave cylinder. Be sure bleed valve "E" is open on the slave system body (Figure 8, page 16) or you will be trying to remove the cylinder under a vacuum.

Slave Cylinder Removal Tool Procedure - Figure 10, Page 21

A. Screw short, threaded end of studs (2) into face of slave cylinder.
B. Place piston cap, into recessed area, on the end of the slave piston.
C. Assemble jack screw / support plate assembly to studs.
   (jack screw should be almost fully retracted through support plate.)
A. Turn jack screw in clockwise motion to pull slave cylinder off piston.

6b. Clean slave cylinder, lubricate and replace the crown seals or O-rings and back up (Figure 9, page 20).

6c. Carefully reinstall the slave cylinder using the slave cylinder replacement tool - red in color (Figure 11, page 22).

Slave Cylinder Replacement Tool Procedure - Figure 11, Page 22

A. Screw studs (2) into face of slave cylinder.
B. Assemble support plate to studs.
C. Insert cylinder / plate assembly (plate end first) into inspection port.

D. Push plate end of assembly in Control Valve spool away from slave piston.
E. Once cylinder end of assembly has cleared inspection port, move assembly (cylinder end first) back toward slave piston.
F. Position cylinder / support plate assembly on slave piston.
G. Position jack screw nut on jack screw at base of hex head.
H. Place bushing on jack screw against jack screw nut.
I. Insert jack screw through hole in support plate.
J. Screw jack screw into threaded hole in slave piston (fully engaged).
K. Turn jack screw nut clockwise to carefully push the slave cylinder down over the slave piston.
L. Continue to turn jack screw nut until support plate reaches slave piston or until jack screw nut will no longer turn.
M. Turn jack screw nut counterclockwise 1/4 turn.
N. Turn hex head of jack screw counterclockwise until it disengages from slave piston. Remove jack screw from Control Valve spool.
O. Remove nuts from studs (2) and remove support plate from Control Valve spool.
P. Unscrew studs (2) and remove from Control Valve spool.

7. Lubricate and replace O-ring in nose cone groove, and screw nose cone onto new inner valve (Figure 9, page 20).

8. Place inner valve back on slave piston stem by reversing step 3. Be sure and go into inspection port with nose cone end of assembly first (Figure 9, page 20).

9. Lubricate and replace the Top Cap O-ring and slip cover back into position (make sure the correct orientation of top cap). Replace and tighten inspection cover bolts (Figure 9, page 20). Use a star or cross bolt pattern to tighten.

10. If step 3a was used to relieve the pressure on the hydraulic system and to check the consistency of the hydraulic fluid, go to step 11. If step 3b was used to relieve pressure on the hydraulic system and to check the hydraulic fluid consistency, the diaphragm motor must be reassembled to the master cylinder (go to step 9).

11 Because the hydraulic system possibly has air in it at this point, refer back to method #1 for “Filling the Hydraulic System” (pages 3-4) while the motor assembly is off, or continue and use method #2 or #3 after the motor assembly has been remounted to the master cylinder.

12. Slowly replace diaphragm motor assembly. If at any time during replacement there is any resistance, stop and release hydraulic pressure through valve “B”. Continue to tighten the diaphragm motor assembly to the master cylinder. Once diaphragm motor assembly is assembled to master cylinder, loosen stainless steel band or lock collar (Figure 12, page 23) and turn band on master cylinder body so the raised part of the band is not under the indicator rod but is adjacent to it. This will allow the band to be used as a reference point indicating full open position of the Control Valve.

13. The inspection and reassembly procedure is now complete. To refill the hydraulic system with fluid and purge the system of air, refer back to “Filling the Hydraulic System” (pages 3-12).

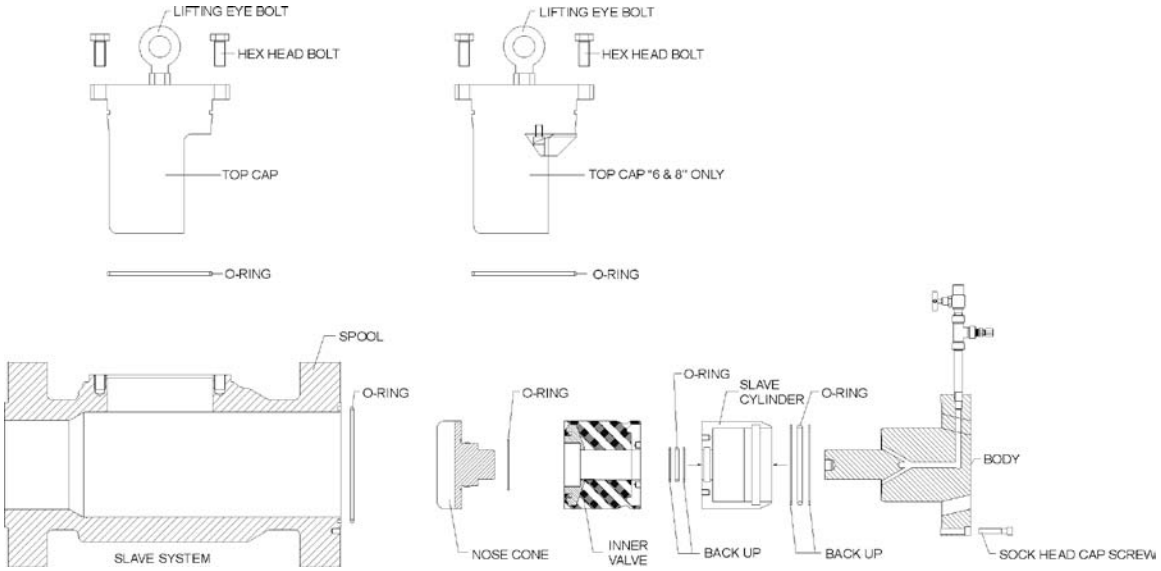
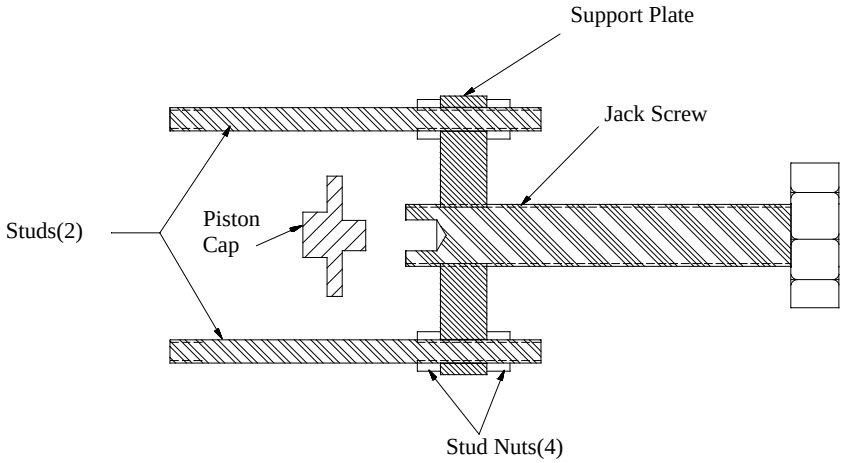
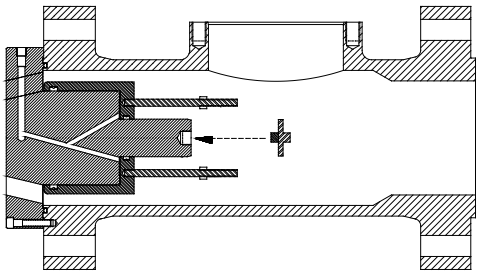
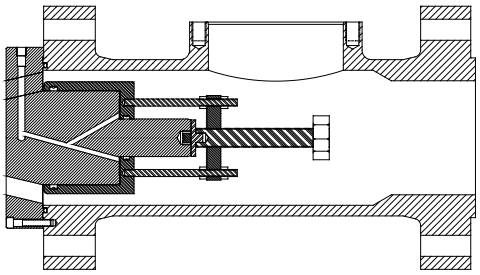

LIFTING EYE BOLT
HEX HEAD BOLT
TOP CAP
O-RING
LIFTING EYE BOLT
HEX HEAD BOLT
TOP CAP "6 & 8" ONLY
O-RING
SPOOL
O-RING
SLAVE SYSTEM
O-RING
NOSE CONE
INNER VALVE
O-RING
SLAVE CYLINDER
O-RING
BACK UP
BACK UP
BODY
SOCK HEAD CAP SCREW

Figure 9

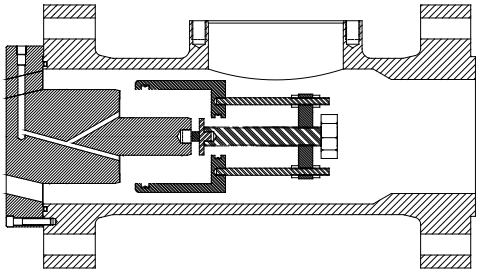




Steps A , B



Step C



Step D

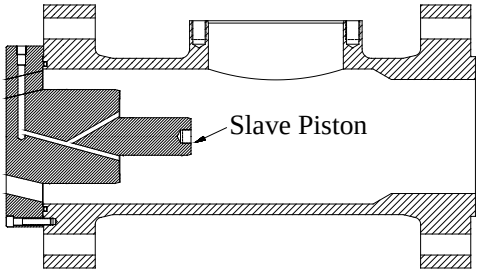
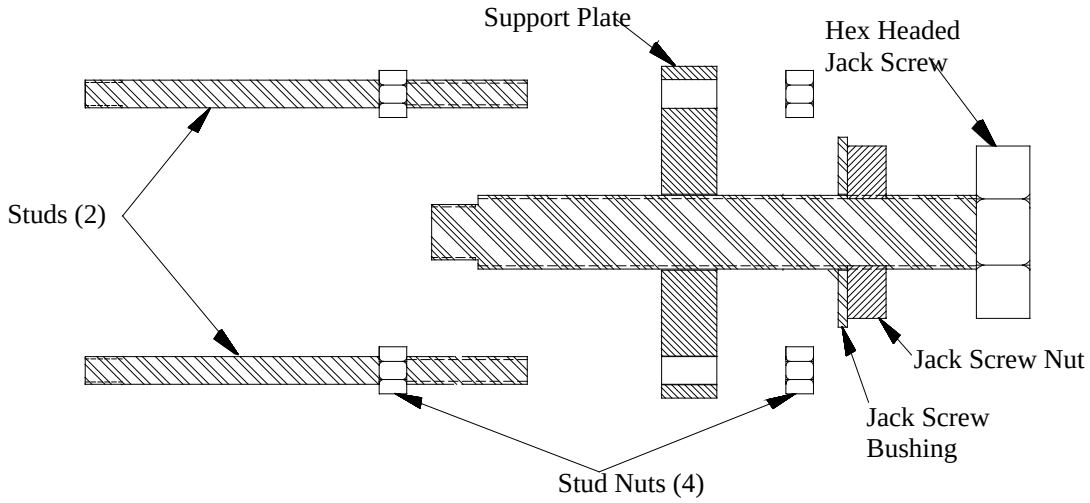
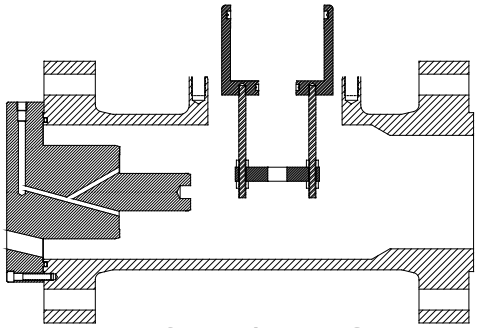
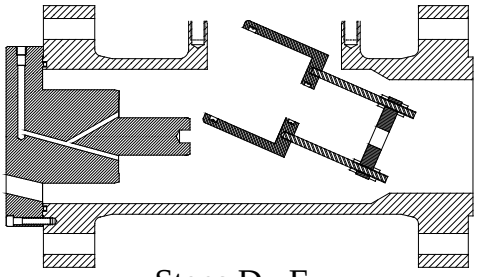


Figure 10 (Slave Cylinder Removal & Tool)

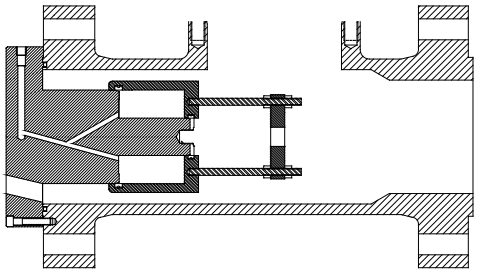




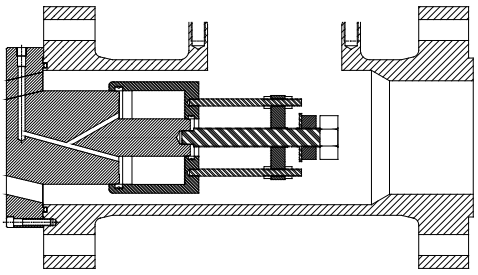
Steps A , B , C



Steps D , E



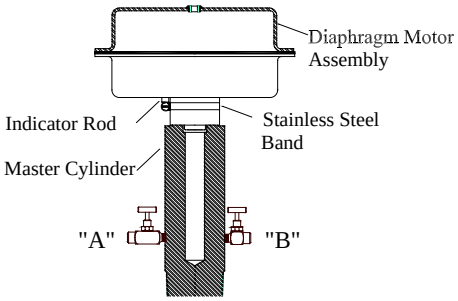
Step F



Steps G , H , I , J

Figure 11 (Slave Cylinder Replacement & Tool)

Diaphragm Motor & Master Cylinder Inspection / Reassembly Procedure



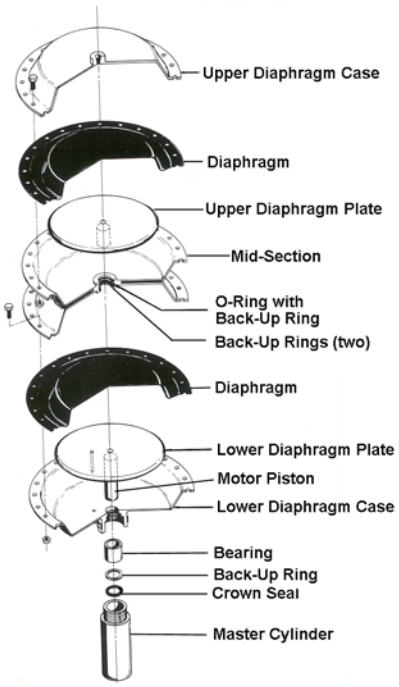


Figure 12 (Master System) **Figure 13 (Tandem Motor Master System)**

Disassembly & Inspection

1. Disconnect the instrument air supply from the top of the diaphragm motor assembly.

2. Position the raised part of the stainless steel band or lock collar on the master cylinder directly under the indicator rod (Figure 12). This is to lock the diaphragm motor in the raised position. Secure the band or collar with a screwdriver. For single diaphragm motor units, proceed to step 7.

3. On tandem diaphragm motors, disconnect the instrument air line from the upper and lower diaphragm motor, remove all bolts that hold the two halves of the top motor together, and remove the top half and diaphragm of the top motor.

4. Open master cylinder bleed valve “B” (Figure 12) to relieve any pressure.

5. On tandem diaphragm motors, lift out the upper diaphragm plate and the connected drive shaft. A set of back-up rings (3) and an O-ring in the mid-section will be exposed for inspection and replacement if necessary. Care must be taken to place the new O-ring and back-up rings in the proper positions. Refer to the cutaway drawing of the tandem diaphragm motor in Figure 13. Care should be taken to keep all parts clean and scratch free.

6. Remove the lower diaphragm, inspect for damaged (replace if required). Remove diaphragm plate inspect to insure the diaphragm plate is smooth. Inspect the Master Piston for scratches (polish piston if required use 600-grit sandpaper).

7. Refer to step 10.

8. On tandem diaphragm motors, lubricate the motor piston with silicone grease and place the diaphragm plates and drive shaft and master piston assembly back in proper position. Reattach the diaphragm and top cover and securely bolt the two halves together. Reattach the instrument air supply line to the bottom diaphragm motor.

9. Make sure connecting valve “A” (Figure 8, page 16) between the master cylinder and the slave system is closed. Open valve “B” and purge hydraulic system. Firmly grip and unscrew the diaphragm motor assembly from the master cylinder (a back-up wrench on the master cylinder will be required). It may be necessary to remove the pipe plug from master system bleed valve “B” (Figure 8, page 16) and slightly open the valve to relieve the vacuum in the master cylinder thus allowing the motor piston to be removed. After the diaphragm motor is removed, close bleed valve “B” but do not yet replace the pipe plug.

10. Lift the bearing out of the master cylinder (Figure 14). A solid back-up ring and a crown seal or O-rings with back-ups will be exposed and should be replaced. Refer to Figure 14 of the master system for proper placement of the crown seal and back-up. Care should be taken to keep all parts as clean as possible.

Note: *Figures 13 and 15 are of a master system with a tandem diaphragm motor assembly.*

11 After replacing the lower crown seal and back-up ring (the crown seal must be placed in first) or O-rings and back-ups, reinsert the bearing and fill the master cylinder slightly below the crown seal or O-rings and back-ups with unused aircraft hydraulic oil.

Note: *If air has been inadvertently introduced into the hydraulic system, remove the used oil and refer to “Filling the Hydraulic System” Procedures / pages 3-12.*

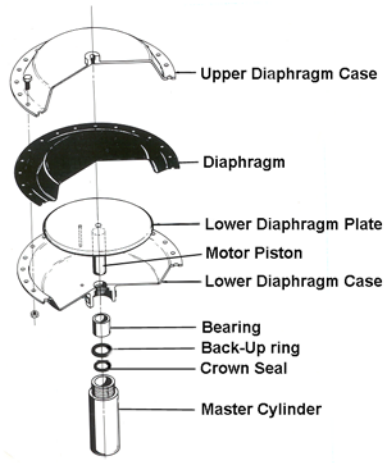


Figure 14 (Single Motor Master System)

Note: Any scratches or marks on the master cylinder must be polished smooth or the seals will be destroyed upon reassembly.

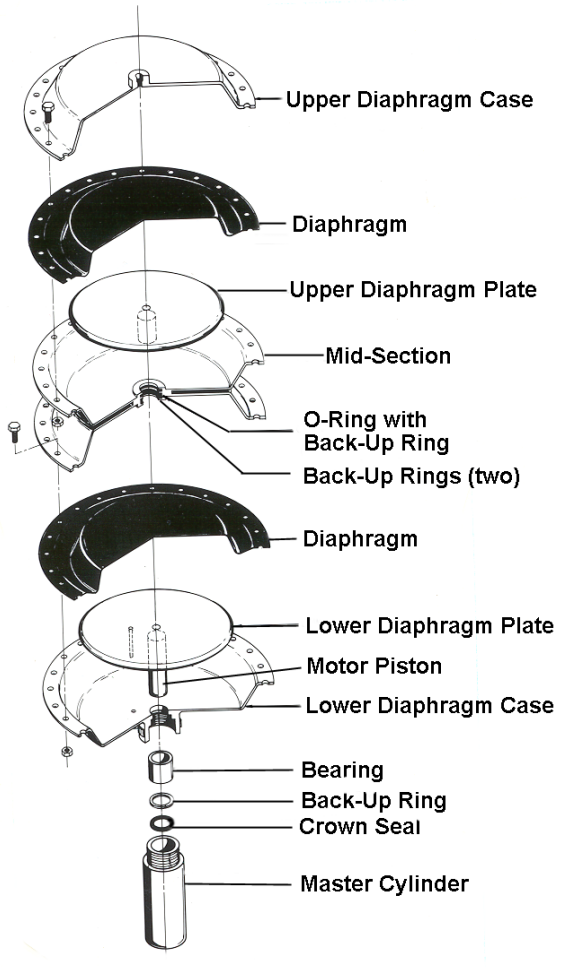


Figure 15
(Tandem Motor Master System)

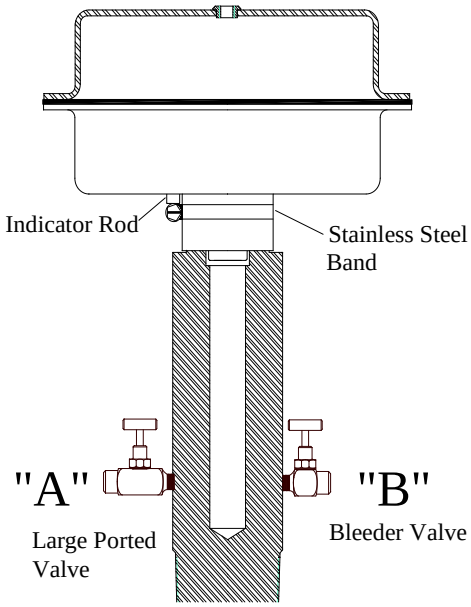


Figure 16
(Master Cylinder)

Reassembly

1. Loosen the stainless steel band or lock collar (Figure 16) and move it to the side of the indicator rod. This will allow the motor piston to drop and to be exposed. Inspect the motor piston for wear and roughness. Use 600-grit sandpaper to polish the rough areas and leave piston clean.

2. Lubricate the piston with a film of silicone grease and push motor piston back into diaphragm motor. Reposition the stainless steel band or lock collar under the indicator rod and tighten it.

3. Slowly replace motor. If at any time during replacement there is any resistance, stop and release hydraulic pressure through valve "B". Continue to tighten the diaphragm motor assembly to the master cylinder. Once diaphragm motor is assembled to master cylinder, loosen stainless steel band or lock collar (Figure 12, page 23) and turn band or lock collar on master cylinder body so the raised part of the band or lock collar is not under the indicator rod but is adjacent to it. This will allow the band to be used as a reference point indicating full open position of the Control Valve. Slightly open valve "B" to allow excess oil pressure to escape. This pressure will escape immediately when the valve is opened. **Do not allow indicator rod to lower itself from diaphragm case as this would mean you have not only purged excess oil pressure but have also lost necessary hydraulic oil. Make sure pressure on hydraulic system does not exceed 10 to 20 psig (.7 bar to 1.4 bar).**

Note: When **replacing** diaphragm motor, do not build too great a pressure on the master cylinder (10 to 20 psig, .7 bar to 1.4 bar) is acceptable and pressure can be checked by placing a gauge in valve "B").

4. Reconnect the instrument air supply to the top of the diaphragm motor.

5. Open valve "A" (Figure 8, page 17) between the master system and the slave system.

6. The inspection and reassembly procedure is now complete. If air was inadvertently introduced to the hydraulic system, refill the hydraulic system with fluid and purge the system of air. Refer back to "Filling the Hydraulic System" (pages 3-12).

Placing the *Welker Jet* Top Entry Control Valve in Service

The procedure for placing the Control Valve in service involves interruption of the gas flow and fluctuation of downstream pressure. All necessary precautions should be taken before starting.

Downstream piping should be protected against over-pressuring by placement of proper relief mechanisms. The downstream relief should be properly chosen and adjusted before the system is brought into service with the *Welker Jet* Top Entry Control Valve in place or monitor Control Valve could be utilized.

The door on the pneumatic controller will be open while adjustments are being made. If using gas as the supply pressure, be aware that the controller vents gas into the enclosure. **DO NOT SMOKE! KEEP OPEN FLAMES, SPARKS, AND ALL SOURCES OF IGNITION AWAY FROM WORKING AREA.**

Before the system can be placed in service, all sense lines and hydraulic lines must be hooked up. Pressure-sensing points should be located well downstream of the Control Valve and away from reducers, tees, elbows, and other sources of turbulence. The hydraulic system should be properly filled as noted on pages 3-12.

Welker would like to thank you for using the Welker Jet. Welker offers both in-house and field training on maintenance and operation of the *Welker Jet* Control Valve; please call for information at 1-800-776-7267 and for International at 1-281-491-2331.