

DIA-FLO[®]

Handwheel Operated Diaphragm Valves Weir and Straightway Maintenance Manual

This manual provides installation and maintenance instructions for manually operated DIA-FLO diaphragm valves. If additional information is required, or if your valves have pneumatic, electric, or any other type of power actuation, contact:

Engineered Process Solutions Group
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Attention: Sales Department

WARNING

ITT INDUSTRIES VALVES AND VALVE ACTUATORS ARE DESIGNED AND MANUFACTURED USING GOOD WORKMANSHIP AND MATERIALS, AND THEY MEET ALL APPLICABLE INDUSTRY STANDARDS. THESE VALVES ARE AVAILABLE WITH COMPONENTS OF VARIOUS MATERIALS, AND THEY SHOULD BE USED ONLY IN SERVICES RECOMMENDED IN OUR PRODUCT CATALOG OR BY A COMPANY VALVE ENGINEER.

MISAPPLICATION OF THE PRODUCT MAY RESULT IN INJURIES OR PROPERTY DAMAGE. A SELECTION OF VALVE COMPONENTS OF THE PROPER MATERIAL CONSISTENT WITH THE PARTICULAR PERFORMANCE REQUIREMENT, IS IMPORTANT FOR PROPER APPLICATION.

EXAMPLES OF THE MISAPPLICATION OR MISUSE OF ITT INDUSTRIES VALVES INCLUDE USE IN AN APPLICATION IN WHICH THE PRESSURE/TEMPERATURE RATING IS EXCEEDED OR FAILURE TO MAINTAIN VALVES AS RECOMMENDED.

IF VALVE EXHIBITS ANY INDICATION OF LEAKAGE, DO NOT OPERATE. ISOLATE VALVE AND EITHER REPAIR OR REPLACE.

Notice: Bonnet fasteners should be adjusted prior to installation.

HANDWHEEL OPERATED

1.0 INSTALLATION

WARNING

Valves not supplied w/a factory designed and mounted chainwheel are not suitable for field mounting of a chainwheel operator. If a chainwheel is desired, please contact the factory to obtain the necessary conversion parts. Failure to use conversion parts may result in personal injury or death.

NOTE: WELD END VALVES

Weld end valves for schedule 10 and heavier pipe require bonnet and diaphragm removal prior to welding in line. See Section 3.4, steps 1-3, 6-9. Schedule 5 and lighter pipe and tubing may be welded with automatic equipment without removing the diaphragm. Manual welding requires diaphragm removal for all pipe schedules.

NOTE: GLASS LINED BODIES

Glass lined bodies have special installation instructions - see Section 1.3.

NOTE: SOLID PLASTIC VALVES

Solid Plastic Valves are not recommended for installation in plastic lined piping systems. Also note, threaded inserts are supplied in the base of the valve body and should be used for bracketing/supporting valves in accordance with cGMP's.

- 1.1 In vertical lines, Dia-Flo diaphragm valves may be installed in any position.

In horizontal lines, where drainability is critical, Dia-Flo valves should be installed with the drain dot or hash mark, located on the end connection close to the body-bonnet flange, at 12 o'clock. This angle is unique to each valve size. Contact the factory if a drain dot or hash mark is not present.

In horizontal lines, where drainability is a concern but not critical (typically processes other than pharmaceutical, bioprocessing, food or beverage), the

valve should be positioned with the stem at 90 degrees from vertical.

In all lines, the bonnet assembly should be positioned with the weep hole (a small hole in the side of the bonnet used as a diaphragm leak detection port) facing down.

- 1.2 Prior to pressurization (with the valve open), tighten the bonnet nuts in a crisscross pattern in accordance with Table 1. Retightening 24 hours after the system reaches operating temperature and pressure is recommended. If leakage occurs at the body/diaphragm seating area, immediately depressurize system and tighten bonnet nuts as noted above. If leakage continues, diaphragm replacement is required. See Section 3.4.
- 1.3 **INSTALLATION — GLASS LINED VALVE BODIES**
It is extremely important that all glass lined valves be installed with proper end flange gaskets and that proper torque be applied to the bolts in correct sequence. The use of PTFE plastic envelope gaskets with soft insert materials is recommended. See Figure 1 for proper bolt torque and sequence.
- 1.4 The travel stop (see Fig. 2), if so equipped, is factory set and should not require adjustment at time of installation. However, if adjustment is required, see Section 2.3.

2.0 OPERATION AND ADJUSTMENT

- 2.1 **STANDARD BONNET (Fig. 3)**
The standard bonnet will be equipped with either a position indicating or travel stop type spindle. The valve is closed with a clockwise rotation of the handwheel. See Table 2 for stroke length and number of turns information.
- 2.2 **SEALED BONNET (Fig. 2)**

WARNING

When the process fluid is a hazardous or corrosive material, extra precautions should be taken. The user should be prepared to control an external leak or spill of the process when using the V-notch vent plug (see description below). In addition, the bonnet internals and seals should be constructed of materials suitable for exposure to the process fluid or gas. If in doubt, contact ITT Industries for evaluation.

The sealed bonnet functions in the same manner as the standard bonnet. However, the sealed bonnet is equipped with o-ring seals which prevent external leakage in the event of a diaphragm failure.

The sealed bonnet is equipped with a special "v-notch" vent plug which permits safe inspection for diaphragm rupture. Simply loosen the v-notch vent plug 2-3 turns. Fluid weepage indicates a diaphragm failure has occurred. Replace diaphragm immediately. Failure to follow these instruction could result in serious personal injury or death and property damage.



ITT Industries
Engineered for Life

2.3 TRAVEL STOP

The purpose of the travel stop is to prevent overclosing of the valve, thus prolonging diaphragm life. The travel stop is set at the factory and should not require further adjustment; however, if adjustment is necessary, the following procedure should be followed:

WEIR (elastomer & PTFE diaphragms - see Fig. 2):

The first (and preferred) option is to install the valve in a test fixture (Figure 7). Supply air pressure equal to the system operating pressure to one side of the valve. Cap the other side of the valve and install a venting rubber or plastic tube. Hold the tube in a container of water. Air bubbles indicate leakage. Tighten the valve until the leakage stops. Adjust the travel stop nut tight against the spacer.

If a test fixture is not available, the following procedure may be used **FOR ELASTOMER DIAPHRAGMS ONLY**:

1. Remove pressure from the line containing the valve.
2. Remove bonnet bolts and nuts. Remove the bonnet and unscrew the diaphragm from the compressor.
3. Replace the bonnet on the valve body (without a diaphragm).
4. Replace two bonnet bolts and nuts on opposite sides of the bonnet, hand tight.
5. Turn the handwheel until the compressor touches the weir. The valve will not close further.
6. Screw the travel stop nut down until it seats on the spacer. The travel stop is now adjusted.
7. Remove the bonnet from the valve body. Screw a diaphragm into the compressor hand tight. Then back it off until the bolt holes in the diaphragm and bonnet flange register.
8. Rotate the handwheel counterclockwise just enough to permit flange area of diaphragm to rest flat against flange area of bonnet.
9. Replace the bonnet, which now includes the diaphragm, on the valve body. The bonnet should be opened one-half to one turn of the handwheel. Tighten the bonnet nuts in accordance with Section 1.2.

If a test fixture is not available for Weir Valves with PTFE diaphragms, use the following procedure:

1. Loosen lock nut.
2. Turn handwheel clockwise until the initial resistance of the diaphragm seating is felt. From this point, turn the handwheel another 5/8 turn.
3. Turn the lock nut down until it bottoms on the spacer.

STRAIGHTWAY (see Fig. 4):

The only available method is leak testing the valve in a fixture. See Weir procedure, above.

3.0 MAINTENANCE

WARNING

On 900 series plastic bonnet assemblies, the plastic handwheel is intended to fail prior to bonnet failure when over-tightened. The purpose of this mode of failure is to assure valve operator safety. Care should be taken to assure that only the correct plastic handwheel is used on a plastic bonnet assembly. *That is, the handwheel and bonnet materials must agree.* The bonnet material identification (PP or PAS) is printed on the bonnet. The handwheel material identification (PP or PAS) is embossed under the handwheel rim. Failure to follow these instructions could result in serious personal injury or death and property damage.

- 3.1 Periodically inspect condition of external valve parts. Replace all parts showing excessive wear or corrosion. On sealed bonnet valves, back off the v-notch vent plug 2 or 3 turns.

WARNING

When the process fluid is hazardous or corrosive, extra precautions should be taken. The user should employ appropriate safety devices and should be prepared to control a leak of the process fluid. Fluid weeping from the plug indicates a diaphragm failure. Replace diaphragm immediately. Failure to follow these instructions could result in serious personal injury or death and property damage.

- 3.2 If body-diaphragm seating area leaks, depressurize system and open valve slightly. Tighten bonnet nuts as described in Section 1.2. If leakage continues, diaphragm replacement is required.
- 3.3 If leakage is occurring around the handwheel, spindle, or through a bonnet weep hole, the diaphragm is ruptured and must be replaced.

3.4 DIAPHRAGM REPLACEMENT

WEIR (See Fig. 3):

1. Remove pressure from line containing valve. Rotate handwheel clockwise to just close valve.
2. Remove bonnet nuts.
3. Lift off bonnet and unscrew diaphragm from compressor by turning counterclockwise.
4. Replacement diaphragm should be identical size and grade as original diaphragm. See Figure 6 for location of size and grade marking. Thread new diaphragm into compressor handtight, then back off until bolt holes in diaphragm register with bolt holes in bonnet flange.

NOTE: For PTFE plastic diaphragms (Figure 2(A)), remove elastomer backing cushion with plastic diaphragm. Replace elastomer backing cushion with each new plastic diaphragm. PTFE diaphragms are molded in the closed position, but should be inverted to the open position prior to installation to ensure complete (correct) thread engagement. To invert, press with thumbs at center bottom of diaphragm while retaining with fingers at the diaphragm edge.

5. Rotate handwheel counterclockwise just enough to permit flange area of diaphragm to rest flat against flange area of bonnet.
6. Replace valve bonnet on body and tighten bonnet nuts handtight.
7. Close valve fully by rotating handwheel clockwise; then back off one-half to one full turn of handwheel. Tighten bonnet nuts evenly with a wrench (see Section 1.2).
8. Open valve and check bonnet nuts to ensure they are evenly tightened.
9. If diaphragm leaks at body/bonnet joint after reaching temperature and pressure, depressurize system and retighten nuts in accordance with Section 1.2.

STRAIGHTWAY:

Perform steps 1-6 as for weir valve.

7. Open valve 2 to 3 turns and tighten bonnet nuts evenly with a wrench (See Section 1.2).
8. If diaphragm leaks at body/bonnet joint after reaching temperature and pressure, depressurize system and retighten nuts in accordance with Section 1.2.

3.5 LUBRICATION

NOTE: Standard lubricants are as outlined below. Special lubricants may be required for oxygen or other unique services. Contact ITT Industries for evaluation of non-standard lubricants.

3.5.1 Bonnets with Transparent Caps.

These bonnets are not equipped with grease fittings and must be disassembled to be lubricated. Under normal operation, lubrication is not necessary.

3.5.2 Non-sealed bonnets, straightway and weir, without Transparent Caps. Flush type fittings are standard in valve sizes 1/2" through 1-1/4" (straightway 1/2" through 1-1/2"). Hydraulic type fittings are standard in valve sizes 1-1/2" and larger (straightway 2" and larger). One shot of grease every six months is sufficient.

3.5.3 Sealed bonnets, straightway and weir, with Transparent Caps. Sealed bonnets are not equipped with grease fittings and must be disassembled to be lubricated. Under normal operation, lubrication is not necessary.

3.5.4. Where valves are exposed to corrosive atmospheres or weather conditions, contacting surfaces of the handwheel and bonnet shell should be lubricated.

3.5.5. Standard lubricants—DIA-FLO: Mobil grease HTS or equivalent. PURE-FLO: Chevron FM #2 in valve. Dow Ill in v-notch vent plug (sealant).

3.6 O-RING REPLACEMENT (SEALED BONNETS, Fig. 2)

1. Remove bonnet nuts and lift off bonnet. Remove clear plastic cap and travel stop nut (if so equipped).
2. Loosen handwheel setscrew(s) and remove handwheel from bonnet.
3. Remove diaphragm/spindle/bushing assembly by withdrawing through bottom of bonnet.

Bonnets without Transparent Caps

4. Remove o-ring from groove in bonnet bore.
5. Unscrew diaphragm/spindle assembly from handwheel bushing.
6. Remove o-ring from groove inside of bushing.
7. Lubricate thrust bearing or washer in accordance with Section 3.5. Install on shoulder of bushing.
8. Select correct size for o-rings 1 and 2 (Figure 5). Lubricate new o-rings in accordance with Section 3.5 and insert into grooves in bonnet and bushing.

Bonnets with Transparent Caps

4. Remove o-ring from groove in bushing outside diameter.
5. Unscrew diaphragm/spindle assembly from handwheel bushing.
6. Remove o-ring from groove in spindle outside diameter.
7. Lubricate thrust bearing or washer in accordance with Section 3.5. Install on shoulder of bushing.
8. Cover stem threads with masking tape to protect o-ring during installation. After o-ring installation, be sure to completely remove tape. Select correct size for o-rings 1 and 2 (Figure 5). Lubricate new o-rings in accordance with Section 3.5 and insert into grooves in bushing and spindle.

All Bonnets:

9. Screw diaphragm/spindle assembly into bushing.
10. Install diaphragm/spindle/bushing assembly into bonnet.
11. Verify shim washer is installed. Install handwheel and tighten setscrew(s), ensuring end of setscrew(s) engages hole(s) in bushing. A thread locking compound is recommended (except for plastic handwheels).

Bonnets with Transparent Caps

12. Select correct size for o-ring 3. Install. Screw cap onto bushing handtight.

TABLE I
BONNET FASTENER TORQUES IN INCH-POUNDS.

| Bonnet | | Metal | | | | Plastic |
|-----------|-----|---|------|---------------------------------|------|---------|
| Body | | All Weir & Straightway (Except Glass Lined) | | Glass Lined, Weir & Straightway | | All |
| Diaphragm | | Elastomer | PTFE | Elastomer | PTFE | All |
| Size | | | | | | |
| IN | DN. | | | | | |
| 1/2 | 15 | 40 | 80 | 40 | 40 | 18 |
| 3/4* | 20 | 48 | 80 | 48 | 80 | 18 |
| 1 | 25 | 48 | 100 | 48 | 80 | 25 |
| 1 1/4 | 32 | 48 | 100 | 48 | 80 | — |
| 1 1/2 | 40 | 48 | 220 | 48 | 110 | 75 |
| 2 | 50 | 96 | 275 | 96 | 170 | 100 |
| 2 1/2 | 60 | 192 | 575 | 192 | 200 | — |
| 3 | 80 | 300 | 1000 | 300 | 300 | 420 |
| 4 | 100 | 192 | 575 | 192 | 360 | 180 |
| 6 | 150 | 480 | 1200 | 480 | 600 | — |
| 8 | 200 | 480 | 1200 | 480 | 600 | — |
| 10 | 250 | 480 | 1200 | 480 | — | — |
| 12 | 300 | 480 | 1200 | 480 | — | — |

NOTES:

- 1) Torque may be exceeded by up to 10%.
- 2) Bolt tension developed using torque wrenches can vary widely depending on fastener condition, wrench accuracy, degree of lubrication and technique. If fastener yielding or galling is apparent, reduce torque accordingly and replace fasteners.
- 3) Stainless steel studs/bolts with stainless steel nuts have Carbowax[®] 3350 applied at the factory. Stainless steel studs/bolts with bronze nuts have no lubricant. Subsequent field lubricant is not necessary.

* For 3/4" w/flanged ends, use 1" data except solid plastic.

TABLE 2
STEM TRAVEL AND NUMBER OF TURNS

| WEIR VALVES | | | | | | | | | | | | | |
|-------------------------|-----|------|------|---------|-------|-------|-------|-------|--------|--------|--------|----------|--------|
| Valve Size (in.) (DN) | 1/2 | 3/4‡ | 1 | 1 1/4*‡ | 1 1/2 | 2 | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 |
| Stem Travel (in.)* (mm) | 1/4 | 3/8 | 1/2 | 5/8 | 13/16 | 1 1/8 | 1 3/8 | 1 5/8 | 2 1/8 | 3 1/8 | 4 5/8 | 15 3/8 | 6 1/2 |
| | 6.4 | 9.5 | 12.7 | 15.9 | 20.6 | 28.6 | 34.9 | 41.3 | 54.0 | 79.4 | 117.5 | 142.9 | 165.1 |
| Turns* | 2 | 3 | 4 | 3 3/4 | 4 7/8 | 6 3/4 | 6 7/8 | 8 1/8 | 10 5/8 | 15 5/8 | 15 3/8 | 19 11/16 | 22 3/4 |

| STRAIGHTWAY VALVES | | | | | | | | | | | | | |
|-------------------------------|-------|-------|-------|--------|--------|--------|---------|--------|--------|--------|--------|--|--|
| Valve Size (in.) (DN) | 1/2 | 1 | 1 1/2 | 2 | 2 1/2 | 3 | 4 | 6 | 8 | 10 | 12 | | |
| Stem Travel (in.)* 15/32 (mm) | 15/32 | 15/16 | 1 1/4 | 1 7/8 | 2 | 2 5/16 | 2 13/16 | 4 1/4 | 6 1/4 | 7 1/2 | 7 1/2 | | |
| | 11.9 | 23.8 | 31.89 | 47.6 | 50.1 | 58.7 | 71.4 | 108.0 | 158.8 | 190.5 | 190.5 | | |
| Turns* | 4 | 5 3/4 | 7 3/4 | 11 1/2 | 10 1/4 | 11 3/4 | 14 1/4 | 21 1/2 | 22 1/4 | 26 1/2 | 26 1/2 | | |

*between open and closed positions (approximate) ‡ For 3/4" with flanged ends, use 1" data except solid plastic.
* Use 1 1/2" data for solid plastic and all valves having 1 1/2" diaphragms and bonnet assemblies.

FIGURE 1
INSTALLATION — GLASS LINED BODIES

Important
It is extremely important that all glass lined valves be installed with proper end flange gaskets and that proper torque be applied to the bolts in correct sequence. The use of PTFE plastic envelope gaskets with soft insert materials is recommended. See below for proper bolt torque and sequence.

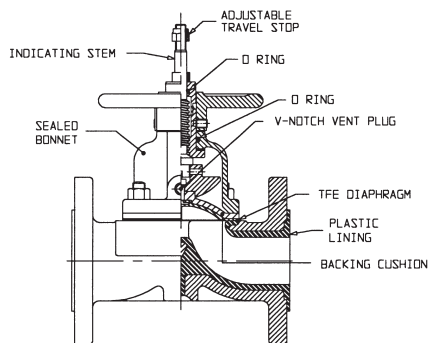
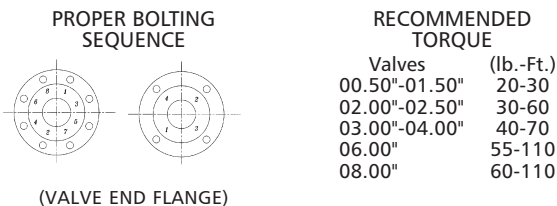


FIGURE 2 (A)

BONNET WITHOUT TRANSPARENT CAP

THIS BONNET SHOWS THE OPTIONAL "SEALED" FEATURE AND OPTIONAL "TRAVEL STOPS".

*IN OLDER BONNET ASSEMBLIES (ORDERED PRIOR TO 4-1-95), A FINGER PLATE MAY BE PRESENT BETWEEN THE BONNET AND THE DIAPHRAGM.

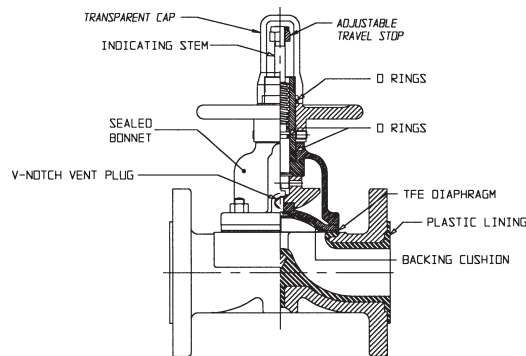


FIGURE 2 (B)

BONNET WITH TRANSPARENT CAP

THIS BONNET SHOWS THE OPTIONAL "SEALED" FEATURE (i.e. V-NOTCH VENT PLUG).

*IN OLDER BONNET ASSEMBLIES (ORDERED PRIOR TO 4-1-95), A FINGER PLATE MAY BE PRESENT BETWEEN THE BONNET AND THE DIAPHRAGM.

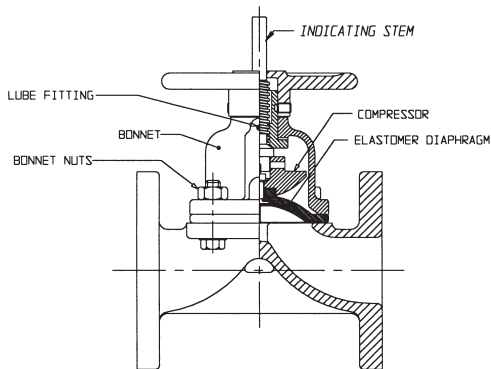


FIGURE 3
STANDARD BONNET WITHOUT TRANSPARENT CAP

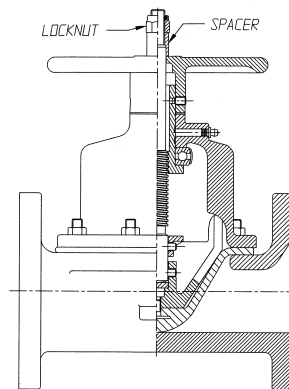


FIGURE 4
STRAIGHTWAY VALVE FEATURING STANDARD BONNET WITH OPTIONAL "TRAVEL STOP".

1/2"-4" WEIR VALVES
"O" RINGS FOR STANDARD AND SEALED BONNET

| VALVE SIZE | O-RING SIZE | | | |
|------------|-------------|------|-------|------|
| | 1 | 2 | 3 | 4 |
| 1/2 | .445x.063 | #107 | #118‡ | — |
| 3/4* | .571x.036 | #109 | #119 | — |
| 1 | .634x.063 | #110 | #121 | — |
| 1 1/4☆ | .728x.063 | #111 | #118 | — |
| 1 1/2 | #119 | #112 | #122 | — |
| 2 | #119 | #112 | #122 | — |
| 3 | #218 | #209 | #128 | #212 |
| 4 | #220 | #210 | #130 | #214 |

* For 3/4" with flanged ends, use o-rings for 1" size except solid plastic.

‡ Use #212 w/Polypropylene handwheel.

☆ Use 1 1/2" data for solid plastic and all valves with 1 1/2" diaphragms and bonnet assemblies.

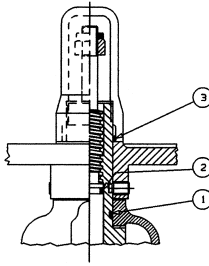


FIGURE 5 (B.1)
1/2"-2"

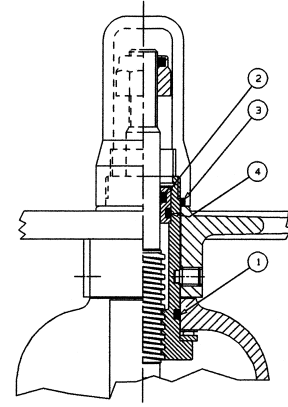


FIGURE 5 (B.2)
3" & 4"

6"-8" WEIR VALVES "O" RINGS FOR SEALED BONNET

| Valve Size | 1 | 2 |
|------------|------|------|
| 6" | #212 | #328 |
| 8" | #218 | #333 |

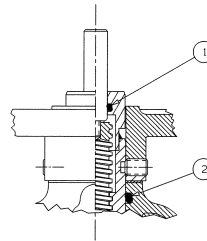


FIGURE 5 (A)

STRAIGHTWAY VALVES "O" RINGS FOR SEALED BONNET

| VALVE SIZE | 1 | 2 |
|------------|------|------|
| 1/2 | #011 | #115 |
| 1 | #012 | #212 |
| 1 1/2 | #111 | #216 |
| 2 | #111 | #216 |
| 2 1/2 | #115 | #222 |
| 3 | #115 | #222 |
| 4 | #116 | #326 |
| 6 | #212 | #328 |
| 8 | #218 | #333 |
| 10 | #218 | #333 |
| 12 | #218 | #333 |

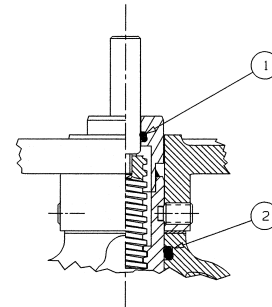
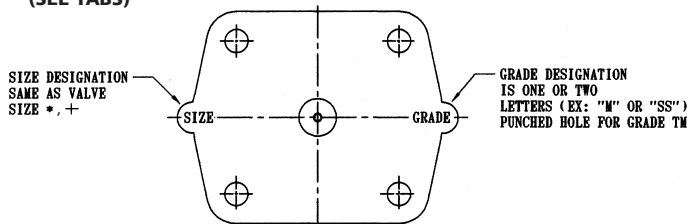


FIGURE 5 (C)

VALVE DIAPHRAGM IDENTIFICATION

ELASTOMER — 1 PIECE, MADE OF RUBBER, WITH MOLDED-IN STUD.
(SEE TABS)



R2, TM (PTFE)
THESE DIAPHRAGMS ARE TWO-PIECE, WHITE PLASTIC WITH A BLACK ELASTOMER BACKING.

* For 00.75 with flanged ends use 01.00 diaphragm except for solid plastic.

+ For 01.25 solid plastic uses 01.50 diaphragm.

FIGURE 6

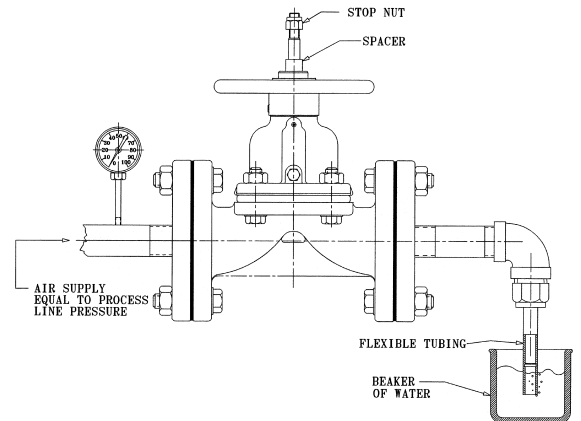


FIGURE 7