

# **TROUBLE SHOOTING VIKING DELUGE VALVES**

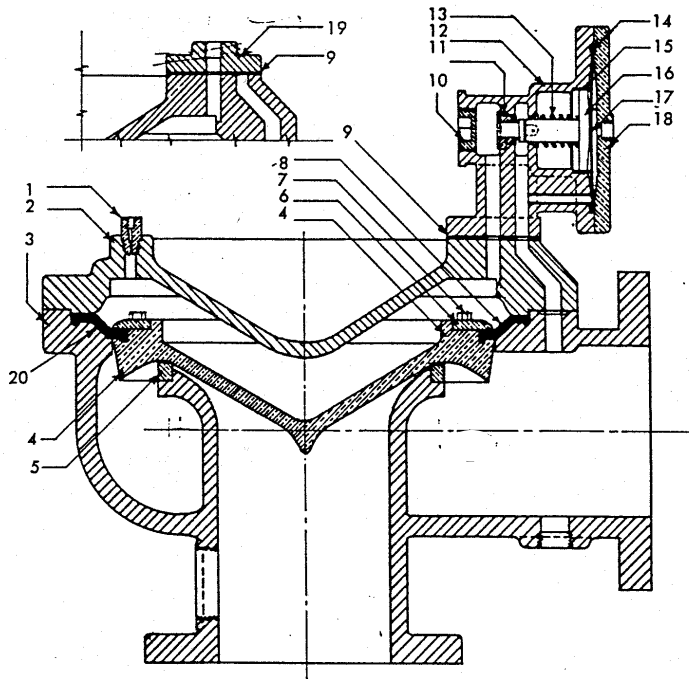
# TROUBLESHOOTING THE VIKING MODEL D, D-2, D-4 AND D-5 DELUGE VALVES

The Viking Model D, D-2, D-4 and D-5 deluge valves are very similar in operation, therefore they will all be covered as being in one section of the troubleshooting guide. The “D” series of Viking Deluge valves all have a priming chamber on top of the valve, an outlet chamber (the bowl of the valve), and an inlet chamber from the inlet flange to the underside of the clapper. They all use water pressure in the priming chamber to hold the valve closed, and the area above the clapper is twice the area of the waterway under the clapper. This means that if the water pressure is the same above the clapper as it is below the clapper, then there is a 2:1 mechanical ratio holding the clapper closed.

Therefore, in order to trip a Viking deluge valve, the priming chamber must be vented more quickly than the priming water can be replaced, in order to destroy the 2:1 differential of the priming chamber. The priming chamber can be vented pneumatically (by means of a Pneumatic Actuator), hydraulically (by means of a wet pilot line), or electrically, (by means of a solenoid valve and release control panel). Any one of these methods will allow the priming chamber to be vented by opening a drain port that is larger than the restricted orifice that is located in the priming line which feeds priming water into the priming chamber.

The valve bodies for the “D” series of Viking Deluge valves were made of cast iron, and are rated at 175 psi maximum working pressure. This series of valves had some kind of pressure relieving device for the electric or pneumatic release, that latched the valve open, once the valve had tripped, by continuously venting the priming chamber of water pressure.

## MODEL D CONTROL VALVE DIFFERENTIAL TYPE



Diaphragm bypass valve has standard 1/2" pipe tap in cover plate for release line.

Differential of diaphragm bypass valve is 5:1.

CONTROL VALVE DIFFERENTIAL  
2....Approx. 4:1  
3....Approx. 3:1  
4....Approx. 3:1  
6....Approx. 2:1

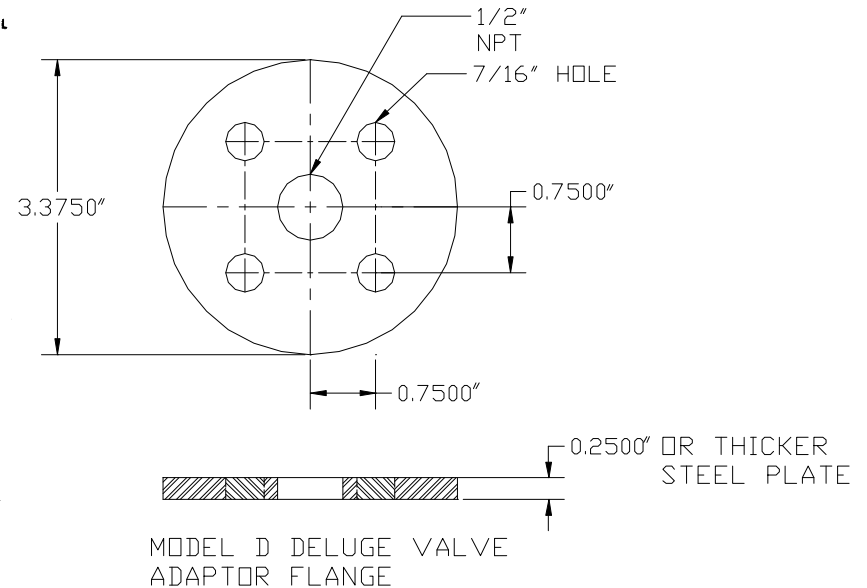
### GENERAL ASSEMBLY OF VIKING MODEL D CONTROL VALVE WITH DIAPHRAGM BYPASS VALVE

- |  |   |
|--|---|
| 1 — 1/4 x 1/8 Restricted Orifice.....Brass | 11 — Seat .....Brass                    |
| 2 — Top .....C.I.                          | 12 — Bypass Valve Body.....C.I.         |
| 3 — Body .....C.I.                         | 13 — Spring .....Bronze                 |
| 4 — Clapper .....Bronze                    | 14 — Diaphragm Gaskets ....Rubber       |
| 5 — Water Seat .....Bronze                 | 15 — Plunger Guide .....Brass           |
| 6 — Clamp Ring .....Bronze                 | 16 — Plunger .....Brass                 |
| 7 — Clamp Ring Bolts .....Bronze           | 17 — Diaphragm .....Bronze              |
| 8 — Rubber Diaphragm .....Rubber           | 18 — Cover .....Bronze                  |
| 9 — Bypass Valve Gasket.....Rubber         | 19 — Adaptor Plate .....C.I.            |
| 10 — 1 1/4" Plug .....Bronze               | 20 — Copper Screen Separator.....Copper |

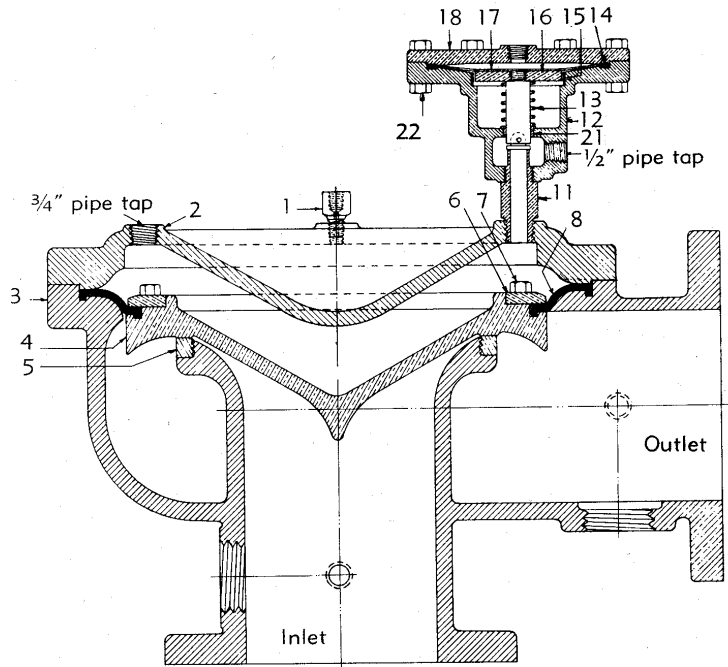
NOTE: Arrangement of parts same for all sizes.  
For hydraulic and electric release systems, use adapter plate No. 19.  
For pneumatic release systems, use diaphragm bypass valve, parts No. 10 to 18 inclusive.

# VIKING MODEL D DELUGE VALVE WITH DIAPHRAGM BYPASS VALVE

WHEN REMOVING THE OLD DIAPHRAGM BYPASS VALVE, AN ADAPTOR FLANGE MUST BE FABRICATED IN ORDER TO ADAPT A PNEUMATIC ACTUATOR TO THE VALVE TRIM. SEE BELOW FOR DETAIL OF ADAPTOR FLANGE. MAKE THE GASKET FROM SHEET RUBBER STOCK.



## MODEL D-2 CONTROL VALVE DIFFERENTIAL TYPE



Diaphragm bypass valve has standard 1/2" pipe tap in cover plate for release line.

Differential of diaphragm bypass valve is 5:1.

CONTROL VALVE DIFFERENTIAL  
 2....Approx. 4:1  
 3....Approx. 3:1  
 4....Approx. 3:1  
 6....Approx. 2:1

# VIKING MODEL D-2 DELUGE VALVE WITH DIAPHRAGM BYPASS

THE DIAPHRAGM BYPASS IS NO LONGER AVAILABLE. THE TRIM PIPING MUST BE MODIFIED BY REMOVING THE DIAPHRAGM BYPASS AND INSTALLING A MODEL H-1 PNEUMATIC ACTUATOR AND THE NECESSARY NIPPLES AND FITTINGS IN ITS PLACE. A PORV MUST ALSO BE ADDED INTO THE TRIM.

### GENERAL ASSEMBLY OF VIKING MODEL D2 CONTROL VALVE WITH MODEL D2 DIAPHRAGM BYPASS VALVE

1 — 1/4 x 1/8 Restricted Orifice.....Brass	12 — Bypass Valve Body.....C.I.
2 — Top .....C.I.	13 — Spring .....Bronze
3 — Body .....C.I.	14 — Diaphragm Gaskets .....Rubber
4 — Clapper .....Bronze	15 — Plunger Guide .....Brass
5 — Water Seat .....Bronze	16 — Plunger and Shaft.....Brass
6 — Clamp Ring .....Bronze	17 — Diaphragm .....Bronze
7 — Clamp Ring Bolts .....Bronze	18 — Cover .....Bronze
8 — Diaphragm .....Rubber	19 —
9 —	20 —
10 —	21 — Sleeve .....Brass
11 — Seat .....Brass	22 — Bypass Cover Bolts.....Steel

NOTE: Arrangement of parts same for all valves  
 For PNEUMATIC release systems always use a diaphragm bypass valve.  
 For HYDRAULIC release systems do not use a diaphragm bypass valve, but connect release line directly into top of cover.  
 For ELECTRIC release systems always use a magnetic bypass valve.

# VIKING MODEL D & D-2 DELUGE (CONTROL) VALVES

- There are not many replacement parts available for the Viking model D and D-2 deluge valves. It is necessary to do a few tests on the valve to see if it still is operating in a proper manner. The first test is to see if the upper diaphragm is operating properly.
- 1) Notify the alarm company that you will be turning off the valve. Close the control valve, and open the ¼” priming line. Check the water pressure in the priming chamber and make sure it at least “matches” the supply pressure. Turn off the priming water supply ball valve and watch the priming pressure gauge. If it drops in pressure, then there is a leak in the priming line, or the upper diaphragm. Reopen the priming line and then check if any water leaks out from the ball drip (drip check). If it does, then there is a tear in the upper diaphragm, and it needs to be replaced.
- 2) Check the clapper seating to the valve seat. These valves have no clapper rubber, it is a metal to metal seat. This is done by completing step 1 above, and leaving the priming valve open. Open the auxiliary drain, and begin opening the water supply valve. When water starts to flow from the auxiliary drain, close it and continue opening the water supply valve. When it is fully open, then check the ball drip for any signs of water flow. If water flows out the ball drip valve at this time, the clapper is not seating, or debris is caught between the clapper and the seat. Remove the cover of the valve, mark the body and the clapper together, before removing the clapper and check for damage. If it is damaged, you will need to lap the clapper.
- **NOTE: If the older style Deluge Valves such as a D or D-2 currently has a replaceable clapper rubber, then the older Model Valve clapper assembly has been replaced with a D-5 Clapper Assembly!**

# VIKING MODEL D & D-2 DELUGE (CONTROL) VALVES (CONTINUED)

Lapping the clapper is accomplished by doing the following:

- 1) Mark the clapper and body of the valve with a punch, etc, before the clapper is removed or turned. (This is done in order to keep the orientation of the clapper and seat as close to the original position as possible.)
- 2) Use either jeweler's rouge or a light rubbing compound (from an automobile parts store), remove the clapper, and apply a light coating on the valve seat.
- 3) Reinstall the clapper in its previously marked position, and begin to turn the clapper clockwise for about a ¼ turn or so, then do the same in the counterclockwise position. Repeat this process in order to "match" both surfaces as closely as possible.
- 4) Once this process has been repeated for several minutes, remove the clapper, and wipe off the excess compound from the clapper and seat.
- 5) Reinstall the clapper in its previously oriented position, and reinstall the cover and trim.
- 6) Follow the previous procedure for checking for leaks at the clapper seat.

**NOTE:** If lapping the clapper does not work, then the only alternative is to replace the clapper assembly with a D-5 unit.

# VIKING MODEL D & D-2 DELUGE (CONTROL) VALVES (CONTINUED)

THESE ARE ONLY RUBBER REPLACEMENT PARTS AVAILABLE FOR THE MODEL D AND D-2 DELUGE CONTROL VALVES. THE PART NUMBERS FOR THESE RUBBER PARTS IS NOTED BELOW FOR REFERENCE.

DIAPHRAGM RUBBER	SIZE	PART NUMBER
	2"	03284A
	3"	03285A
	4"	03286A
	6"	03287A

**NOTE: If the older style Deluge Valves such as a D or D-2 currently has a replaceable clapper rubber, then the older Deluge Valve clapper assembly has already been replaced with a D-5 Clapper Assembly! However, the valve must be disassembled in order to check the clapper.**

IF THE CLAPPER ASSEMBLY NEEDS TO BE REPLACED WITH A D-5 UNIT, HERE ARE THE PART NUMBERS FOR THOSE PARTS.

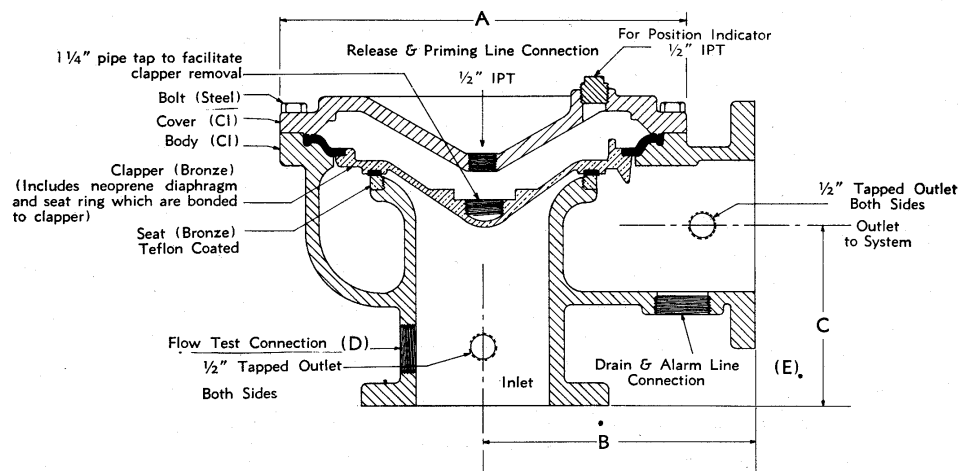
CLAPPER ASSEMBLY	SIZE	PART NUMBER
	2"	N/A
	3"	02491B
	4"	02376B
	6"	R8402315b

**VIKING DELUGE VALVE MODEL D-4**

Manufactured 1966—

UL Listed Guide No. 2245.3 F.M. Approved
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The Model D-4 Valve has a rubber to metal seat which is a vast improvement over the D-2 and D-3. One 1/2" tap is provided in the center of the cover for the release and priming line connections. The bronze seat is replaceable on this model.



NOTE: 2" Valve has standard female pipe threads on inlet and outlet. Other sizes have standard flanges.

VALVE SIZE	A	B	C	D	E	APPROX. DIFF.	RECOMMENDED FLOW (GPM)
2"	8 1/4	*4 1/6	*3 3/6	3/4	3/4	2:1	0-250
3"	10 1/2	7	5	1 1/2	3/4	2:1	125-500
4"	13	8 1/2	6 1/2	2	1	2:1	250-1000
6"	18 1/4	12	8	2	1	2:1	750-3000

\*Center to End of Pipe (Standard Theoretical Makeup Subtracted)

OPERATION: In set position equal pressure is maintained above and below the clapper through an orificed connection. Operation of release (manual or automatic) vents the pressure in the release line and the area above the valve. The pressure on the inlet side then forces the clapper up allowing water to enter the system.

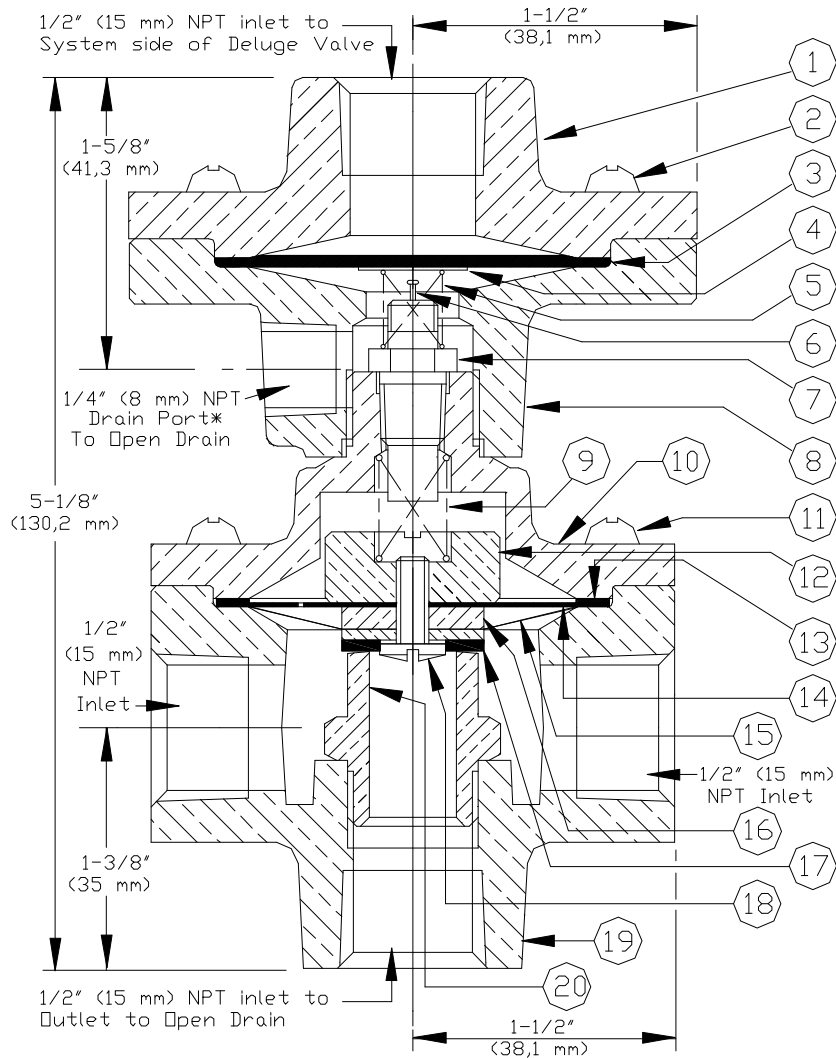
RATING: 175 PSI working water pressure. Each valve factory tested at 350 PSI.



# VIKING MODEL D- 4 DELUGE VALVES

- The Viking model D-4 deluge valve was the first Viking Deluge Valve to have a rubber to metal seal at the clapper seat. It began being manufactured in 1972 and was produced up to 1985, depending upon the size of the valve. It used a bonded rubber for the clapper seal to the clapper seat. Should the clapper rubber need to be replaced, it needs to be replaced with a D-5 Deluge Valve clapper assembly. This way, for future clapper rubber replacement, the clapper rubber is field replaceable with a D-5 unit.
- **NOTE: If the older style Deluge Valves such as a D-4 currently has a replaceable clapper rubber, then the clapper assembly has already been replaced with a D-5 Clapper Assembly! However, the valve must be disassembled in order to check out the clapper.**
- The clapper assembly is fairly simple to access, enough of the trim has to be removed so that the cover can be easily removed. Once the cover is removed, there is direct access to the clapper assembly. It can be removed by prying the rubber diaphragm up and out of the groove in the top of the body of the valve, all the way around the valve, and then lifting the clapper assembly out of the valve. Replace the removed clapper assembly with a D-5 clapper assembly. This is also a good time to check the clapper seat inside the valve to make sure it is not damaged in any way. If there are very slight scratches, or similar minor damage to the valve seat, Emory cloth can be used to smooth out the damaged area(s). If the seat is damaged to a point where it is too deep to allow for a consistent seating of the valve clapper, and light use of Emory cloth will not work in this case, then the valve needs to be replaced, because the valve seat is not replaceable.

# VIKING MODEL C-1 P.O.R.V.



\* Orientation of 1/4" outlet axis may vary relative to axis of 1/2" inlet ports.



SCHRADER CORE TOOL PART NUMBER 01715A

ACTUAL TOOL MAY VARY FROM PICTURE

ITEM NO.	PART NUMBER	DESCRIPTION	MATERIAL	NO. REQ'D.
1	01937B	Cover	Brass	1
2	04505A	R.H. Screws #10-24 UNC x 5/8" lg.	Stainless Steel	6
3	*	Diaphragm	Neoprene	1
4	*	Diaphragm Disc	Stainless Steel	1
5	04137A	Spring	Stainless Steel	1
6	*	Schrader Core	Brass, Nickel Plated	1
7	*	Schrader Body		1
8	01938B	Base	Brass	1
9	06177A	Spring	Stainless Steel	1
10	06426B	Cover	Brass	1
11	04505A	R.H. Screws #10-24 UNC x 5/8" lg.	Stainless Steel	6
12	*	Spring Retainer	Brass	1
13	*	Seal Ring	Neoprene	1
14	*	Diaphragm	Nylon Reinforced Neoprene	1
15	*	Clamp Plate	Brass	1
16	*	Screen	Monel	1
17	*	Clapper	Brass with Bonded Neoprene	1
18	*	Screw	Brass	1
19	*	Body	Brass	1
20	-	Seat	Brass	1

-Indicates replacement part not available

\*Indicates replacement part is only available in Sub-Assembly listed below

### Sub-Assembly

3,4	01792A	Diaphragm Assembly
6, 7	06418A	Schrader Valve
12-18	01828A	Diaphragm Assembly Repair Kit
19, 20	03709B	Body Assembly

# VIKING MODEL C-1 P.O.R.V.

The Viking Model C-1 P.O.R.V. is a field serviceable part that is made up of various components as indicated on the previous page. This device is essentially a hydraulic latch which holds the valve open, even when using resettable detection devices. It has been manufactured since 1966.

## **SYMPTOM:**

- 1) THE PORV WILL NOT RESET AFTER THE VALVE WATER SUPPLY IS SHUT OFF, AND THE SYSTEM IS DRAINED.**

## **REMEDY:**

- a) There is water pressure still being applied to the sensing end of the PORV. Break the union in the sensing line to see where the water is coming from, and correct the problem. There should be no water pressure in the sensing line once the system is shut down and drained.
- b) There are metal shavings, mud or silt caught under the clapper of the PORV. Remove the drain line from the discharge end of the PORV, then Slightly open the priming line valve. With the eraser end of a pencil, push on the clapper and let some water flow out the discharge end of the PORV. This may wash the metal shavings, mud, etc, away from the underside of the clapper. If it does not clear the obstructions, then the PORV must be removed, disassembled, cleaned, reassembled and installed.
- c) There is mud or silt, etc, inside the PORV at the sensing end, keeping pressure on the diaphragm and Schrader Core valve. This is very common where river water or non-potable water is being used. The PORV must be disassembled, cleaned, then reassembled.
- d) The valve stem of the Schrader Core valve is bent, or the diaphragm at the sensing end is distorted. With the Priming valve closed and the system still shut down, remove the six screws at the sensing end of the PORV, inspect the diaphragm for distortion, and check the Schrader Core valve to inspect the stem. If the diaphragm is distorted or the Schrader Core valve stem is bent, replace with new.
- e) The hole through the diaphragm at the discharge end of the PORV is plugged. The PORV must be disassembled and the diaphragm checked for obstructions in the diaphragm hole, by bending the diaphragm back and fourth at the location of the hole. This will break loose any obstructions. .

# VIKING MODEL C-1 P.O.R.V. (Continued)

## SYMPTOM:

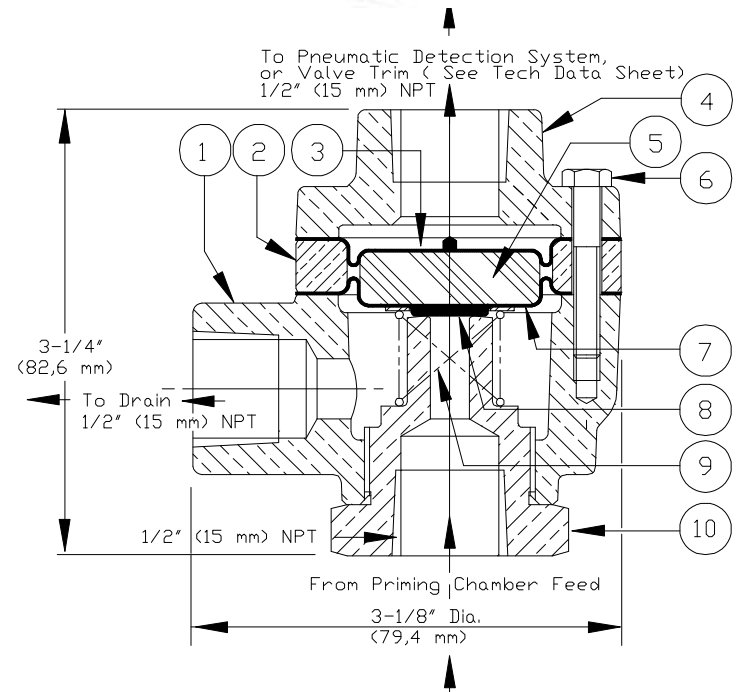
- 1) **THE PORV DOES NOT OPERATE WHEN THE VALVE TRIPS, AND IT DOES NOT VENT THE PRIMING CHAMBER. (No water flows out of the ¼” drain after the valve trips.)**

## REMEDY:

- a) The diaphragm at the discharge end of the PORV is split, and is allowing water to enter the chamber behind the clapper faster than it can be vented through the Schrader Core valve. The PORV must be disassembled and the diaphragm checked for tears, etc.
- b) The ¼” drain from the Schrader Valve is plugged, and is not venting the water from the chamber behind the clapper. Check the ¼” drain line to see if it is properly piped, and not obstructed. Sometimes, these outlets are plugged. Remove the plug and use ¼” steel piping to run the drain to the drip cup.
- c) The hole through the diaphragm at the discharge end of the PORV is plugged. The PORV must be disassembled and the diaphragm checked for obstructions in the diaphragm hole, by bending the diaphragm back and fourth at the location of the hole. This will break loose any obstructions.
- d) Some drain piping installations from the ¼” connection of the PORV were run in copper tubing instead of ¼” steel pipe. Check the tubing for dings or bends because the tubing may be “pinched.” If the ¼” drain from the Schrader Valve is plugged or “pinched” off, the PORV will not function properly.

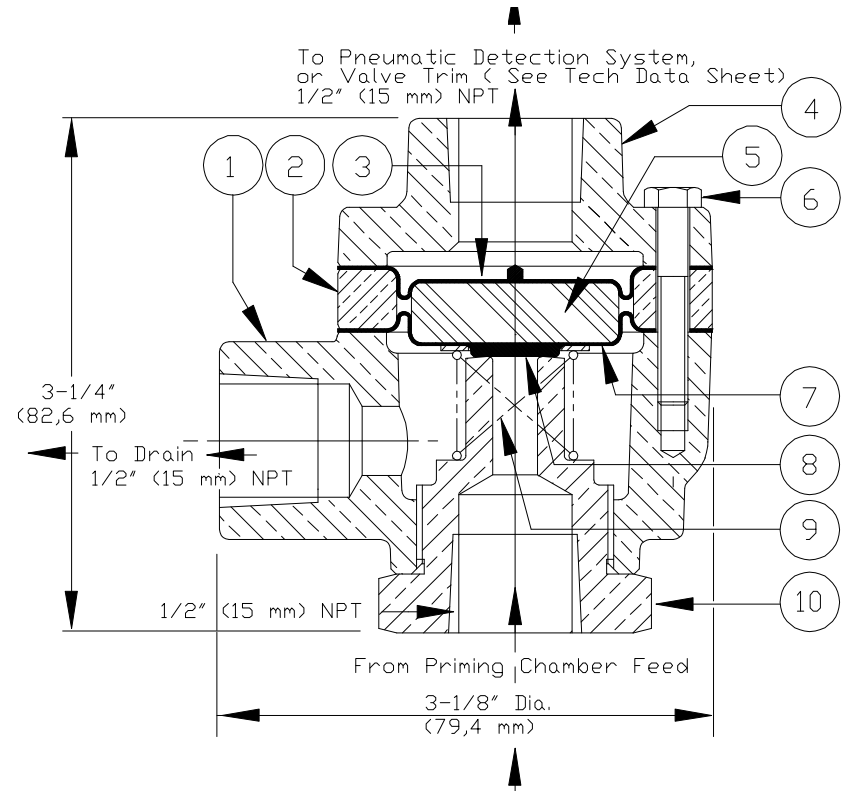
# VIKING MODEL H-1 PNEUMATIC ACTUATOR

Item No	Part No	Description
1	None	Body
2	None	Spacer
3	04735A	Upper Diaphragm
4	None	Cover
5	04736A	Piston
6	04732A	H.H.S. #10-24 x 1 1/4"
7	04861A	Lower Diaphragm
8	04739A	Spring Pad
9	04741A	Spring
10	06464B	Seat



# VIKING MODEL R-1 PNEUMATIC ACTUATOR (CORROSION RESISTANT MODEL)

Item No	Part No	Description
1	None	Body
2	None	Spacer
3	04735A	Upper Diaphragm
4	None	Cover
5	04736A	Piston
6	06228A	H.H.S. #10-24 x 1 ¼"
7	04861A	Lower Diaphragm
8	06227A	Spring Pad
9	06224A	Spring
10	06464BJ	Seat



# VIKING MODEL H-1 & R-1 PNEUMATIC ACTUATOR

The Viking H-1 and R-1 (corrosion resistant model) are both spring loaded to open, rolling diaphragm, piston operated valves. They are used wherever a separation is required between the detection and operating systems.

This H-1 has been manufactured since 1986, and the R-1 has been manufactured since 1996. There is a factory drilled weep hole drilled into the spacer (item 2 in the sections of both the H-1 and the R-1). The weep hole is there to identify either an air leak or water leak in the device.

**NOTE: THERE ARE SEVERAL VIKING DEVICES THAT LOOK SIMILAR TO THE VIKING H-1 PNEUMATIC ACTUATOR SUCH AS THE PSOV, AND THE ANTI-FLOOD DEVICE. DO NOT REPLACE ONE DEVICE WITH A SIMILAR LOOKING DEVICE. ALWAYS REPLACE THE DEVICE WITH AN EXACT REPLACEMENT PART.**

**SYMPTOM: THERE IS AIR COMING OUT OF THE WEEP HOLE IN THE PNEUMATIC ACTUATOR**

**REMEDY:**

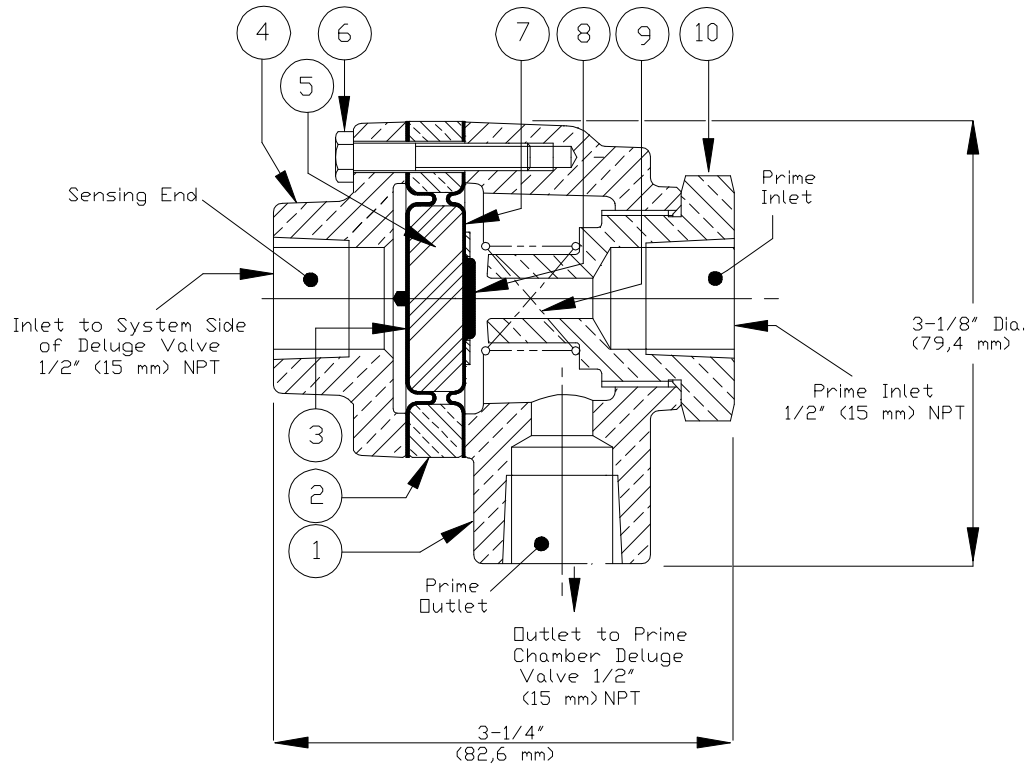
The Upper Diaphragm is torn, scuffed, or cut, and is leaking air out through the diaphragm. With the system shut down, remove the air piping from the top of the Pneumatic Actuator. Unscrew the 3 #10 x 24 x 1 ¼" HHS from the cover, and remove the cover and the Upper Diaphragm. Inspect the device inside, and make sure there are no burrs, etc that could cut the diaphragm. Replace the diaphragm, and reassemble the device. Place the device back into the valve trim, and repressurize the system with air. Check for leaks, then return the system to service as described in the current applicable Technical Data Pages.

**SYMPTOM: THERE IS WATER COMING OUT OF THE WEEP HOLE IN THE PNEUMATIC ACTUATOR**

**REMEDY:**

The lower Diaphragm is torn, scuffed, or cut, and is leaking water out through the diaphragm. With the system shut down, remove the Pneumatic Actuator from the trim piping. Unscrew the 3 #10 x 24 x 1 ¼" HHS from the cover, and remove the cover, the Upper Diaphragm, the Spacer and the Lower Diaphragm. Inspect the device inside to make sure there are no burrs, metal chips, etc, inside that could cut the diaphragm. Reassemble the device, and repressurize the system with air. Check for leaks, then return the system to service as described in the current applicable Technical Data Pages.

# VIKING MODEL A-1 PRIMING SHUT OFF VALVE



ITEM NO.	PART NUMBER		DESCRIPTION	MATERIAL		QTY REQ'D
	10723	10724		Model A-1	Model A-2	
1	--	--	Body	Brass, UNS-C84400	Brass*, UNS-C84400	1
2	--	--	Spacer	Brass, UNS-C84400	Brass*, UNS-C84400	1
3	04735A	04735A	Upper Diaphragm	EPDM/Polyester Fabric	EPDM/Polyester Fabric	1
4	--	--	Cover	Brass, UNS-C84400	Brass*, UNS-C84400	1
5	04736A	04736A	Piston	Polycarbonate	Polycarbonate	1
6	04732A	06228A	Hex Head Screw, #10-24 x 1-1/4" Lg.	Steel, Zinc Coated	Stainless Steel, UNS-S31600	3
7	04861A	04861A	Lower Diaphragm	EPDM/Polyester Fabric	EPDM/Polyester Fabric	1
8	04739A	06227A	Spring Pad	Stainless Steel UNS-S30200/UNS-S30400	Monel #400	1
9	04741A	06224A	Spring	Stainless Steel UNS-S30200	Inconel #600	1
10	06464B	06464BJ	Seat	Brass, UNS-C36000	Brass**, UNS-C36000	1

\* Electroless Nickel plated, Model A-2 only, Specification No. SPF02-J01.  
 \*\*Electroless Nickel and tin plated, Model A-2 only, Specification No. SPF-02-J07.  
 -- Indicates part is not available.

Table 1

**WARNING: NEVER USE RESETTABLE DETECTION SUCH AS C-1 THERMOSTATIC RELEASES WITH EZ TRIM AND A PSOV. OTHERWISE, THE VALVE MAY RESET AND CLOSE PREMATURELY.**



# VIKING MODEL A-1 PRIME SHUT OFF VALVE

The Viking A-1 and A-2 (corrosion resistant model) PSOV's are both spring loaded to open, rolling diaphragm, piston operated valves. They are a main component of EZ trim, and are used to positively shut off the priming water to a deluge valve upon valve operation.

The A-1 has been manufactured since 1999, and the A-2 has been manufactured since 1999. There is a factory drilled weep hole drilled into the spacer (item 2 in the sections of both the A-1 and the A-2). The weep hole is there to identify a water leak in the device.

**NOTE: THERE ARE SEVERAL VIKING DEVICES THAT LOOK SIMILAR TO THE VIKING A-1 PRESSURE OPERATED SHUT OFF VALVE (PSOV) SUCH AS THE PNEUMATIC ACUTATOR, AND THE ANTI-FLOOD DEVICE. DO NOT REPLACE ONE DEVICE WITH A SIMILAR LOOKING DEVICE. ALWAYS REPLACE THE DEVICE WITH AN EXACT REPLACEMENT PART.**

**SYMPTOM: THERE IS WATER COMING OUT OF THE WEEP HOLE IN THE PNEUMATIC ACTUATOR, AND THE PRIMING PRESSURE IS DROPPING SLIGHTLY.**

## **REMEDY:**

The Lower Diaphragm is torn, scuffed, or cut, and is leaking water out through the diaphragm. With the system shut down, remove the inlet piping from the sensing end of the PSOV. Unscrew the 3 #10 x 24 x 1 ¼" HHS from the cover, and remove the cover and the Upper Diaphragm. Inspect the device inside, and make sure there are no burrs, etc that could cut the diaphragm. Replace the diaphragm, and reassemble the device. Place the device back into the valve trim, and open the priming valve. Check for leaks, then return the system to service as described in the current applicable Technical Data Pages.

**SYMPTOM: THERE IS WATER COMING OUT OF THE WEEP HOLE IN THE PNEUMATIC ACTUATOR AFTER THE VALVE HAS TRIPPED.**

## **REMEDY:**

The Upper Diaphragm is torn, scuffed, or cut, and is leaking water out through the diaphragm. With the system shut down, remove the PSOV from the trim piping. Unscrew the 3 #10 x 24 x 1 ¼" HHS from the cover, and remove the cover, the Upper Diaphragm, the Spacer and the Lower Diaphragm. Inspect the device inside to make sure there are no burrs, metal chips, etc, inside that could cut the diaphragm. Replace the lower diaphragm, and reassemble the device. Place the device back into the trim, and open the priming valve<sup>15</sup>. Check for leaks, then return the system to service as described in the current applicable Technical Data Pages.

**END OF DELUGE VALVE SECTION**