V43 Pressure Actuated Water Regulating Valve

The V43 Pressure Actuated Water Regulating Valves are designed to regulate water flow for water-cooled refrigeration condensers requiring a large flow capacity (100 to 1000 gallons per minute). These pilot operated valves open on pressure increase and provide modulating operation.

Figure 1: V43 Pressure Actuated

Features and Benefits	
❑ **Built-in Pilot Valve**	Allows for more precise throttling
❑ **Easy Adjustment**	May be serviced and adjusted without breaking line connections
❑ **Drain Plug**	Allows water to be drained during shutdown to reduce the possibility of freeze-up
❑ **Mesh Monel Screen**	Protects pilot valve from dirt, scale, etc. and is easily removed for cleaning and servicing without breaking any line connections

Water Regulating Valve

Part No. 24-7664-699, Rev. —
Code No. LIT-125683

Application Overview

The V43 water regulating valves are pilot operated, provide for modulating operation, and are available for commercial and maritime applications. They are typically used to regulate water flow for condensers requiring a large flow capacity. The V43 valves automatically open when the refrigerant pressure increases and modulate the flow of cooling water through the condenser (based on refrigeration pressure).

V43 valves are available for non-corrosive refrigerants such as R-22, R-12, R-134A, R-404A, R-502, R-507, etc. Specially designed V43 valves are also available for ammonia service.

Commercial V43 valves are constructed with a cast iron body and brass internal parts. The seat material is bronze.

In order to resist the corrosive action of sea water, the V43 maritime and navy models are constructed with a red brass body, bronze and monel interior parts, and monel seat material.

IMPORTANT:	All V43 water regulating valves are designed for use only as operating devices. Where valve failure can result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (pressure relief or safety shutoff valves) or systems (alarm, supervisory) that protect against or warn of device failure.

Operation Description

The V43 valves are self-contained units, requiring only the inlet and outlet water line connections and the head pressure connection at the top of the bellows.

A built-in pilot valve, driven by refrigeration pressure, operates the main valve with water.

The main valve seat disc assembly is suspended on a heavy duty rubber diaphragm, eliminating all closely-fitted and sliding parts. This reduces friction within the valve, allows for more precise control, and reduces the chances of the valve stem sticking (to an O-Ring or other sealing components) in dirty water conditions.

Determining Valve Size

To select the correct valve size, first complete Steps 1 through 3. These steps will determine the following variables:

- Maximum Water Flow Required
- Refrigerant Head Pressure Rise Above the Valve Opening Point
- Water Pressure Available (WPA)

As instructed in Step 4, use these three variables to locate a point on one of the flow capacity charts (Figure 4) which slightly exceeds the maximum water flow required. The flow capacity chart containing this point represents the proper valve size.

Step 1: Determine the Maximum Water Flow Required.

Use the table provided by the manufacturer of the condensing unit to determine the maximum water flow required. If this information is not available, calculate the maximum water flow required by using the following formula:

$$\text{Maximum Water Flow Required (GPM)} = \frac{\text{Tons of Refrigeration} \times 30}{\text{Outlet Temperature - Inlet Temperature}}$$

Note: If the outlet water temperature is not known, assume it to be 10F° below the condensing temperature.

Example: If a 100 ton capacity system has an inlet water temperature of 85°F and an outlet water temperature of 95°F, the maximum water flow required is:

$$\text{Maximum Water Flow Required} = \frac{100 \times 30}{95 - 85}$$

$$\text{Maximum Water Flow Required} = 300 \text{ GPM}$$

Step 2: Determine the Refrigerant Head Pressure Rise Above the Valve Opening Point.

The *refrigerant head pressure rise above the valve opening point* is the valve's throttling range. This cannot be adjusted and must be determined by sizing the valve properly. Use the following formula to calculate the refrigerant head pressure rise above the valve opening point:

Refrigerant Head Pressure Rise = Refrigerant Pressure at the Desired Condensing Temperature – (Valve Closing Point + 7 psig)

The *valve closing point* (to assure closure under all conditions) must be the refrigerant pressure equivalent to the highest ambient air temperature that the equipment will be subjected to in the off cycle. Determine this variable in psig from a *saturated vapor table* for the refrigerant selected.

From the saturated vapor table, find the *refrigerant pressure at the desired condensing temperature* corresponding to the system condensing temperature at the outlet side of condenser.

Step 3: Determine the Water Pressure Available (WPA).

Use the following formula to calculate the *water pressure available*. WPA is the water pressure available to force water through the valve.

WPA = Supply Pressure* – (Pressure Drop through Condenser + Estimated Drop through all Piping to and from V43)

* *Supply pressure* is the supply water pressure from a cooling tower, the pump on a system, or from a city water main.

Step 4: Select the Proper Valve Size.

A properly sized valve meets the requirements of the maximum water flow required, refrigerant head pressure rise above the valve opening point, and the water pressure available. These variables are represented on a flow capacity chart (Figure 4).

Select the correct flow capacity chart (representing the proper valve size) by performing the following:

a. On the flow capacity chart (Figure 2) locate Point A, at the intersection of the following:
   - the refrigerant head pressure rise above the valve opening point (as determined in Step 2) on the Y axis and
   - the WPA curve representing the water pressure available (resulting from the WPA value determined in Step 3). If the actual WPA curve is not represented on the chart, draw a new curve (parallel to the existing WPA curve of the nearest value).

b. Draw a line from Point A (determined in Step a) down to the *Maximum Water Flow Required* axis (Point B, Figure 2). This point represents the *maximum water flow available*.

c. The *maximum water flow available* value (Point B) must be slightly greater than the *maximum water flow required* value (Point C) determined in Step 1. The flow capacity chart meeting this requirement represents the proper valve size.

d. After determining the correct valve size, select the correct valve model from Table 3 and, if applicable, an optional flange and gasket kit.

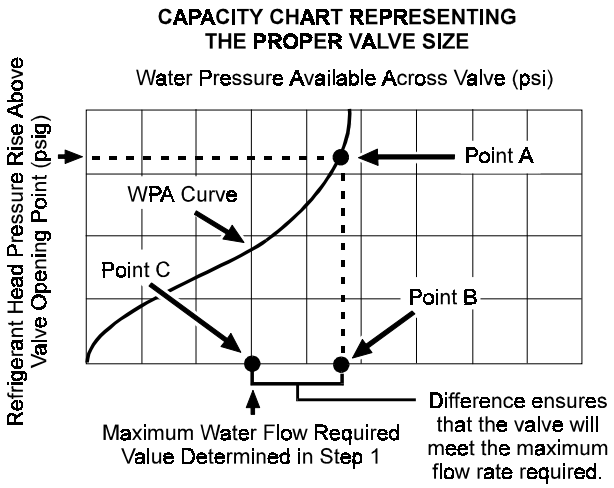


Figure 2: Selecting the Proper Valve Size

Example:

In this example, the required flow for a R-22 system is 300 GPM. The desired system condensing temperature is 105°F. The refrigerant pressure at the outlet side of condenser is 211 psig. The maximum ambient temperature the equipment will be subjected to in the off cycle is estimated at 91°F. The city water pressure is 40 psig and the condenser manufacturer's table gives a pressure drop through the condenser, accompanying piping, and valves of 15 psi. The pressure drop through the installed piping is approximately 4 psi.

Step 1: ***Maximum Water Flow Required* = 300 GPM**

Step 2: Valve closing point is the pressure of the refrigerant (R-22) corresponding to the maximum ambient temperature of 91°F = 171 psig.

Valve Closing Point = 171 psig

Refrigerant (R22) Pressure at Desired Condensing Temperature (105°F) = 211 psig

Refrigerant Head Pressure Rise = 211 - (171 + 7)

Refrigerant Head Pressure Rise **= 33 psig**

Step 3: *Water Pressure Available* = 40 - (15 + 4)

Water Pressure Available **= 21 psi**

Step 4: Select Proper Valve Size

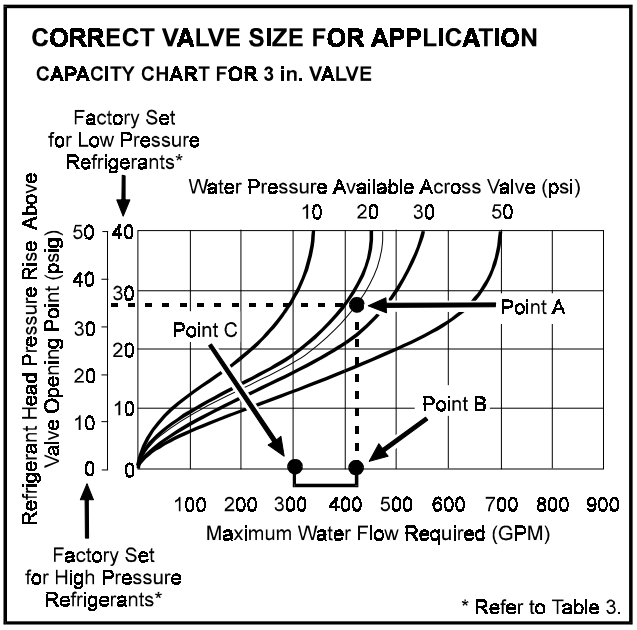
Plot the variables listed above--first on a chart representing a small size valve, then continue to larger valves. The flow capacity chart represents the proper valve size if the *maximum water flow available* value (Point B) is slightly greater than the *maximum water flow required* value (Point C).

Result: As indicated in Figure 3, the correct valve size for this application is 3 in. The maximum water flow available for the 3 in. valve is slightly greater than the maximum water flow required (300 GPM) . Select valve type from Table 3.

Maximum Water Flow Required = 300 GPM } Point C

Refrigerant Head Pressure Rise = 33 psig
Water Pressure Available (WPA) = 21 psi } Point A

Maximum Water Flow Available = 470 GPM } Point B



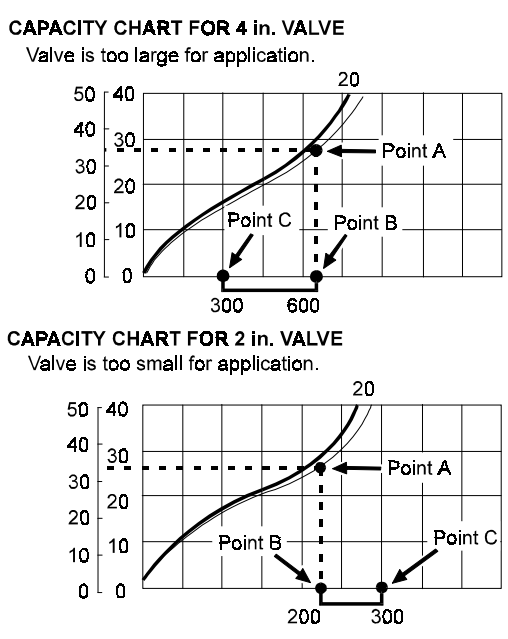


Figure 3: Example, Flow Capacity Chart

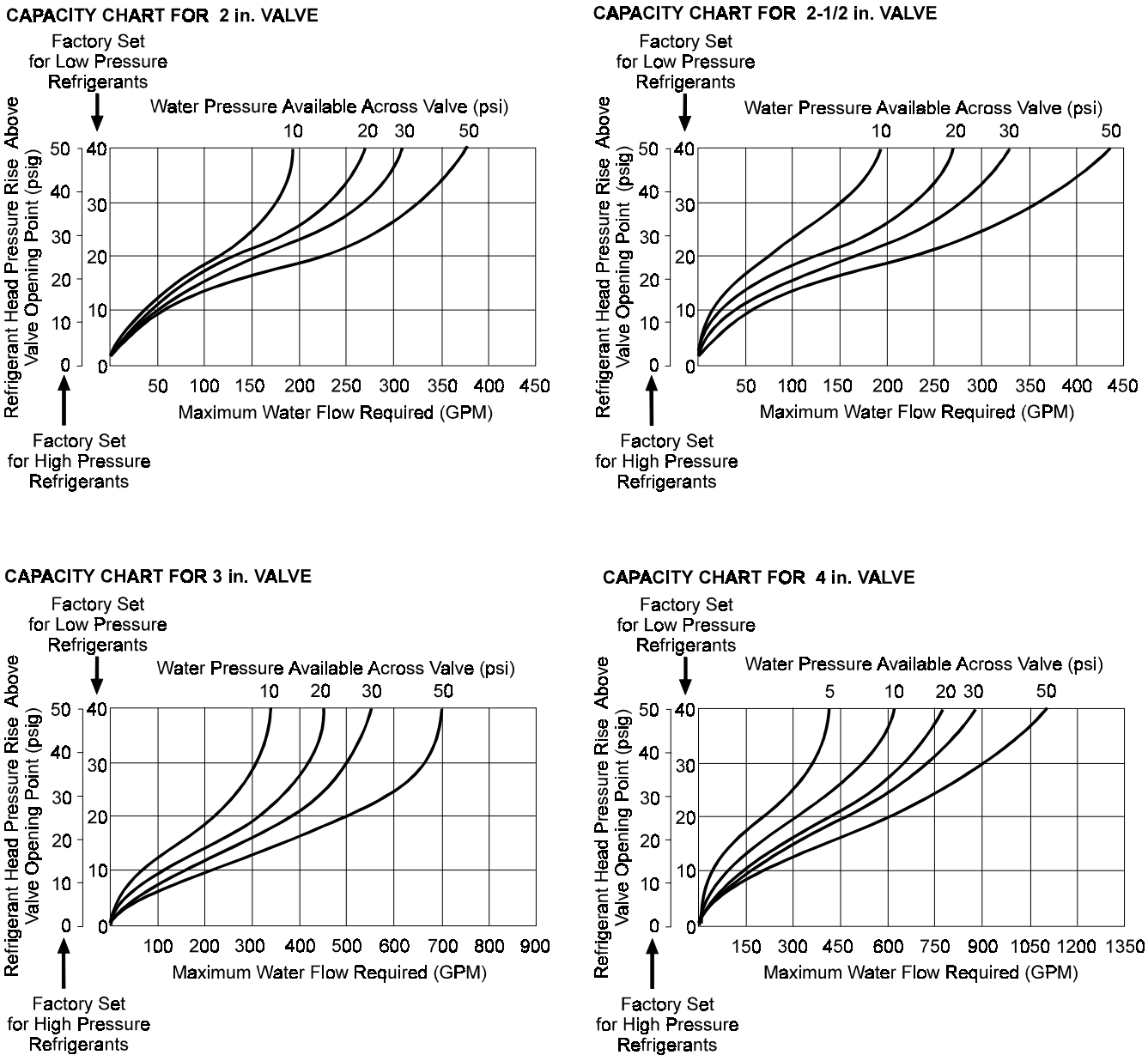


Figure 4: V43 Flow Capacity Charts

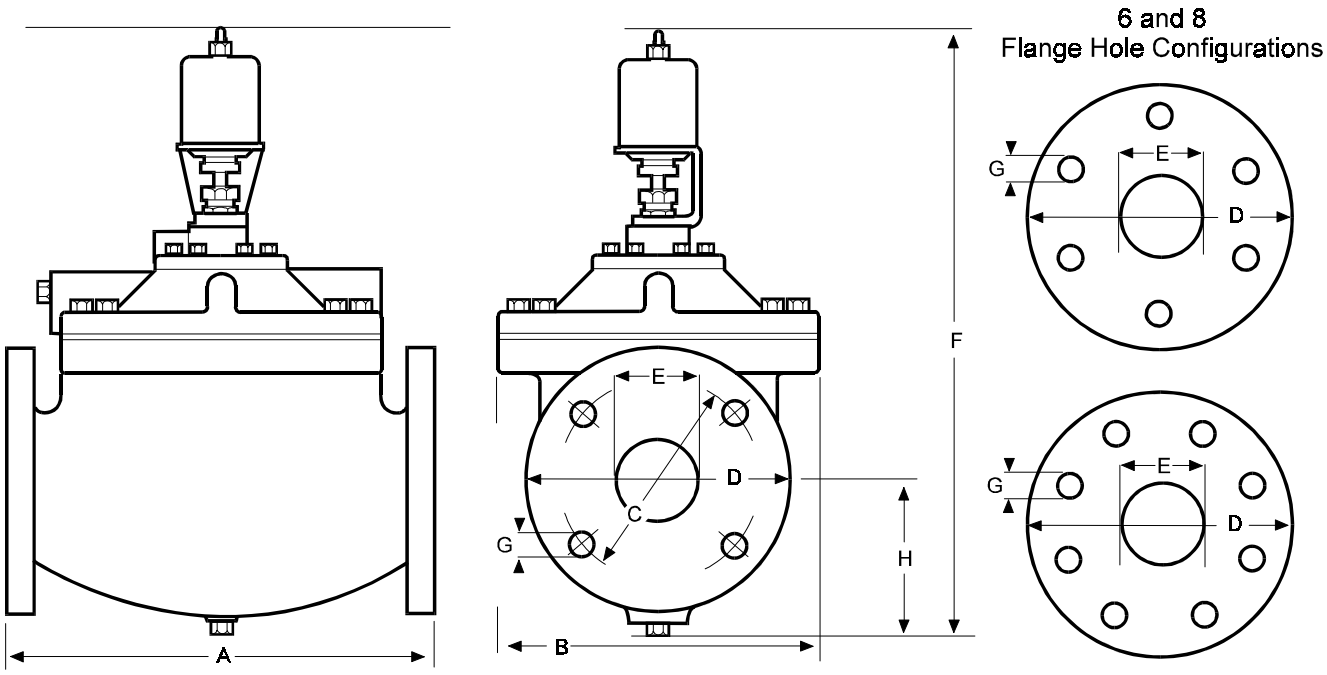


Figure 5: Dimensions

Table 1: Dimensions

Reference Letter	2 in. Valve in. (mm)	2-1/2 in. Valve in. (mm)	3 in. Valve in. (mm)	4 in. Valve in. (mm)
A	9-1/2 (241)	10-3/4 (273)	11-3/4 (298)	14 (356)
B	7-1/2 (191)	8 (203)	9 (229)	10-3/4 (273)
C	4-3/4 (121)	5-1/2 (140)	6 (152)	7-1/2 (191)
D	6 (152)	7 (178)	7-1/2 (191)	9 (229)
E	2-1/8 (54)	2-5/8 (67)	3-1/8 (80)	4-1/8 (105)
F	15-1/4 (387)	15-9/16 (395)	16-9/16 (421)	18-1/5 (462)
G	3/4 (19)	3/4 (19)	3/4 (19)	3/4 (19)
H	3-5/8 (92)	3-15/16 (100)	4-1/4 (108)	5 (127)

Installation and Initial Adjustment

Note: If available, follow the mounting instructions of the equipment onto which the V43 will be installed. For new installation, a companion flange and gasket kit (refer to Table 3) is required to mount the V43 to the water lines.

1. Flush the lines to remove any foreign matter before connecting the lines to the valve. Refer to the *Servicing* section.
2. Screw each companion flange and gasket onto the inlet and outlet water lines as indicated in Figure 6. The inside of the companion flange is threaded. (Refer to Table 3 for flange and gasket kit information.)
3. Mount the V43 so that the water flow follows in the direction indicated by the arrow on the V43 casting.

   The V43 is not position sensitive for operation. However, if the V43 is to be drained during shutdown, mount the V43 onto a horizontal water line, with the bellows up.
4. Secure the inlet and outlet water lines (with companion flange and gasket) to the inlet and outlet flange connections on the V43 with a hex bolt and nut.

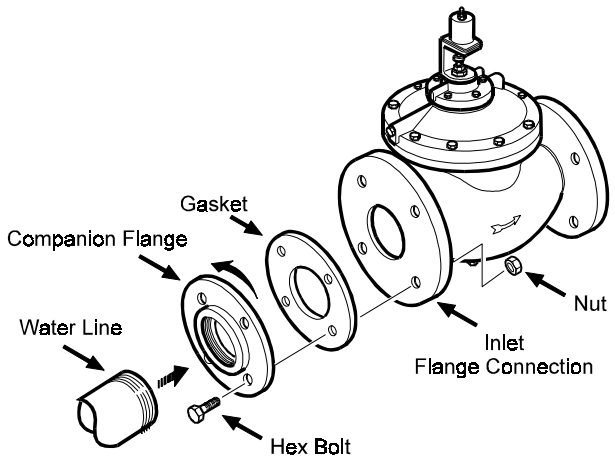


Figure 6: V43, Gasket, and Flange Connections (V43AV Shown)

5. Connect a 1/4 in. copper (or Ecosafe®) tube from the bellows of the V43 to the refrigerant line as indicated in Figure 7. If possible, make the connection on the inlet side of the condenser.
6. Manually flush the valve to remove debris. (Refer to *Servicing* section.)
7. Put the system into operation under normal operating conditions.
8. Determine the correct refrigerant operating head pressure for the system. Observe the refrigerant pressure indicated at the high side pressure service gauge.
9. If necessary, adjust the operating head pressure as instructed in the *Valve Adjustment* section.

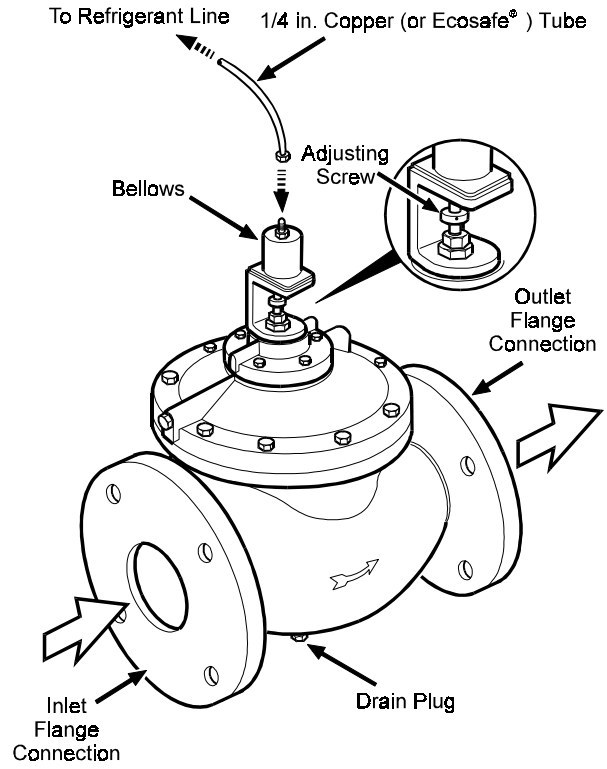


Figure 7: V43 Connections and Adjustments (V43AV Shown)

Checkout Procedure

Note: Before operating equipment, always manually flush the valve. Refer to the *Servicing* section.

Before leaving the installation site, observe at least three complete operating cycles (bellows open and close) to verify that all components are functioning properly. The V43 should be regulating the water flow at the correct pressure. To adjust the operating head pressure and water flow, refer to the *Valve Adjustment* section.

Valve Adjustment

Make adjustments gradually. Adjust by 1/2 revolution and wait for the system to stabilize after each adjustment change. The differential is not adjustable.

- **To increase the operating head pressure and decrease the water flow:** Turn the adjusting screw (Figure 8, inset) down, toward main valve body (clockwise when viewed from the top).
- **To decrease the operating head pressure and increase the water flow:** Turn the adjusting screw up, away from main valve body (counter-clockwise).

Servicing

The V43 valve can be disassembled, cleaned, and reassembled without breaking the line connections.

To Access Internal Parts

1. Shut off water flow to the V43.
2. Remove the hex bolts (Figure 8) from the top of the bellows flange.
3. Remove the bellows flange.

Note: For internal parts replacement instructions, refer to the respective replacement parts instruction sheet.

Manual Flushing

Before starting equipment, manually flush the valve to remove any foreign material from the valve. Flushing before operation will prolong equipment life and enhance valve performance.

1. Turn the adjusting screw (Figure 8, inset) counterclockwise (when viewed from top), raising the adjusting screw as far up as possible.
2. Insert a standard screwdriver tip between the adjusting screw and the push pin.
3. Pry the push pin down with the screwdriver to open the valve as indicated.
4. Hold the push pin down to hold the valve open. Flush the valve for several minutes, removing all foreign matter from the V43.
5. After flushing the V43, remove the screwdriver and set the adjusting screw to the desired operating pressure. (Refer to the *Valve Adjustment* section.)

Cleaning the Monel Screen

The pilot valve is protected from dirt, scales, etc. by a fine mesh monel screen. To clean the screen, shut off flow, unscrew hex bolt (Figure 8), remove monel screen, brush, and rinse clean.

Draining the V43 During Shutdown

To reduce the possibility of freeze-up, drain the V43 during shutdown. To drain, unscrew the drain plug at the base of the V43. Refer to Figure 8.

Note: In order to drain, the V43 must be mounted in a horizontal water line with the bellows up and the drain plug down.

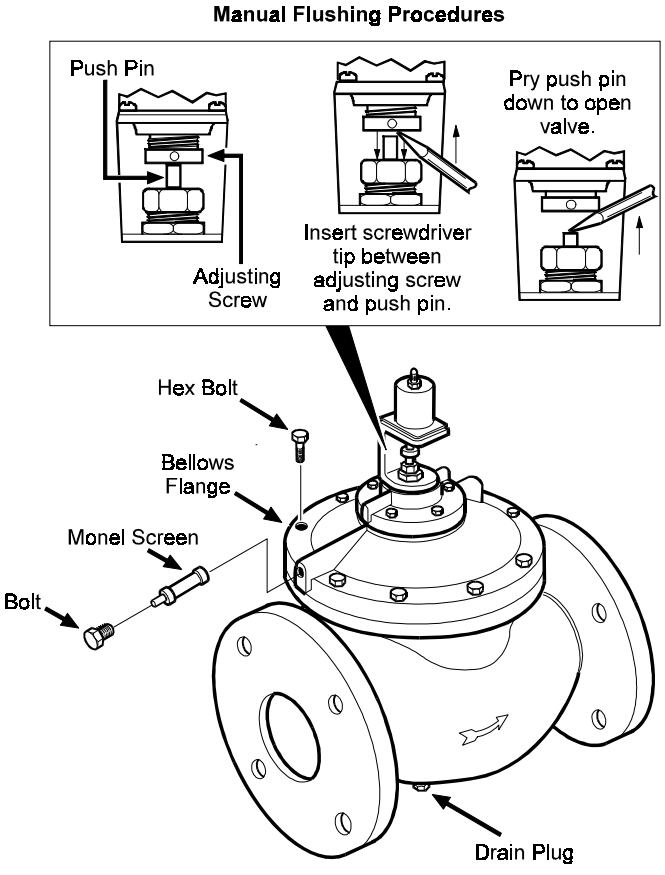


Figure 8: Monel Screen, Drain Plug, and Manual Flushing Procedures (V43AV Shown)

Repairs and Replacement

The sensing element, internal parts, and rubber diaphragms are replaceable. Refer to the *Servicing* section for instructions. To obtain replacement parts, contact the nearest Johnson Controls distributor. Replacement parts are listed in *V43 Series Repair Parts Kits* (LIT-121690).

Ordering Information

When ordering the V43, specify the following:

1. Product number (Refer to Tables 2 and 3.)
2. Optional companion flange and gasket kit

   For new installation of commercial valves, a companion flange and gasket kit is required to mount the water lines to the V43. Refer to Table 4 for kit ordering information.

Table 2: Type Number Selection Matrix

V43	A	Commercial service with iron body, open on pressure increase
	B	Maritime service with brass body, open on pressure increase
	C	Navy service with brass body, open on pressure increase
	S	2 in. flange
	T	2-1/2 in. flange
	V	3 in. flange
	W	4 in. flange

Table 3: Product Number

Valve Size and Pipe Connection	R-12, R-134A 70 to 150 psig (483 to 1034 kPa) *Low Pressure* Opening Point Range	R-22, R404A, R502, R-507 160 to 260 psig (1103 to 1793 kPa) *High Pressure* Opening Point Range	Ammonia (R-717) 160 to 260 psig (1103 to 1793 kPa) *High Pressure* Opening Point Range
Commercial Service			
2 in. IPS Flanged	V43AS-1	V43AS-2	V43AS-5
2-1/2 in. IPS Flanged	V43AT-1	V43AT-2	V43AT-5
3 in. IPS Flanged	V43AV-1	V43AV-2	V43AV-5
4 in. IPS Flanged	V43AW-1	V43AW-2	V43AW-5
Maritime Service			
2 in. IPS Flanged	V43BS-1	V43BS-2	--
2-1/2 in. IPS Flanged	V43BT-1	V43BT-2	--
3 in. IPS Flanged	V43BV-1	V43BV-2	--
4 in. IPS Flanged	V43BW-1	V43BW-2	--
Navy Service			
2 in. IPS Flanged	V43CS-1	V43CS-7	--
2-1/2 in. IPS Flanged	V43CT-1	V43CT-3	--
3 in. IPS Flanged	V43CV-2	V43CV-4	--

Table 4: Optional Flange and Gasket Kits*

Kit Number	Water Valve Size	Shipping Weight lb. (kg)
KIT14A-613	2 in.	11.8 (5.4)
KIT14A-614	2-1/2 in.	16.5 (7.5)
FLG15A-600	3 in.	20 (9.1)
FLG15A-601	4 in.	34 (15.4)

* A companion flange and gasket kit is required to mount the water lines to commercial type V43 water regulating valves.

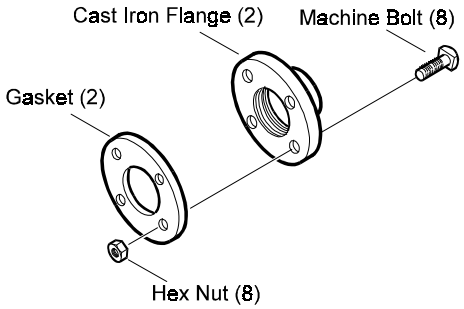


Figure 9: Flange and Gasket Kit

Notes

Specifications

Product	V43 Pressure Actuated Water Valve	
Body Material	Commercial:	Cast Iron
	Maritime:	Red Brass
Internal Parts Materials	Commercial:	Brass
	Maritime:	Bronze, Monel
Seat Material	Pilot Seat::	Monel
	Main Valve Seat:	Bronze (Commercial) Monel (Maritime)
Seat Disc Material	Buna N™	
Packing--Bellows Assembly	Brass Stem, Stainless Steel Spring, Synthetic Rubber Boot	
Head Pressure Range (Opening Points)	Low Pressure Refrigerants such as R-134A:	70 to 150 psig (482 to 1034 kPa)
	High Pressure Refrigerants such as R-22, R-502, R404A:	160 to 260 psig (1103 to 1793 kPa)
	Ammonia:	160 to 260 psig (1103 to 1793 kPa)
Factory Setting (Opening Point)	Low Pressure Refrigerants such as R-134A:	90 psig (620 kPa)
	High Pressure Refrigerants such as R-22, R-502, R404A:	180 psig (1240 kPa)
	Ammonia:	180 psig (1240 kPa)
Water Supply Pressure	150 psig (1034 kPa) Maximum	
Water Supply Temperature	160°F (71°C) Maximum	
Maximum Permissible Head Pressure	300 psig (2068 kPa)	
Pressure Bellows Connection	Non-corrosive	1/4 in. SAE Male Flare
	Ammonia	1/4 in. NPT

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

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