JOHNSON CONTROLS

**Controls Group** 507 E. Michigan Street
P.O. Box 423, Milwaukee, WI 53202
Code No. LIT-1900163

V146 Series

# High Water Pressure Two-Way Pressure-Actuated Water-Regulating Valves

**V146 Series Valve**

## Description

The V146 Series 2-Way Pressure-Actuated Water-Regulating Valves are designed to regulate water flow and control refrigerant head pressure in systems with water-cooled condensers. The V146 valves are ideal for applications with system water pressures of up to 350 psi (2413 kPa), such as high-rise buildings.

V146 valves may be used with standard non-corrosive refrigerants. V146 valves have a monel (nickel-copper alloy) seat and disc holder.

## Features

- no close-fitting or sliding parts in water passages provides control in less-than-ideal water conditions
- high-pressure design allows use in systems with up to 350 psi (2413 kPa) water pressure
- pressure-balanced design resists changes to setpoint caused by gradual or sudden water pressure changes
- corrosion-resistant material for internal parts promotes long valve life
- accessible range spring allows easy manual flushing
- take-apart construction allows access to valve interior without removing valve from refrigeration system or pumping down

## Applications

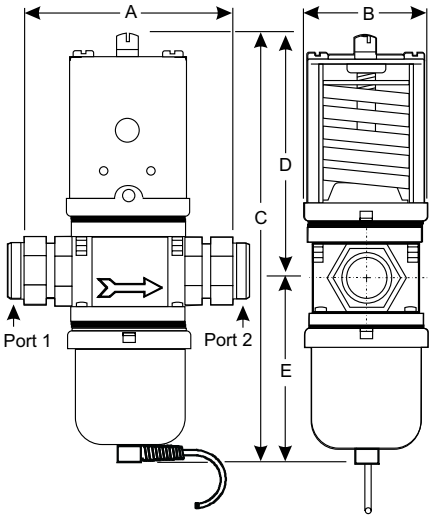
V146 valves are designed to regulate flow in systems with water pressures up to 350 psi (2413 kPa). The valves have an adjustable opening point in a refrigerant pressure in a range of 70-260 psi (483-1793 kPa). V146 valves may be used with standard non-corrosive refrigerants. Internal valve parts that come into contact with water are constructed of monel (nickel-copper alloy) and brass to resist corrosion.

## To Order

Specify the code number from the following selection chart. Also refer to *Finding the Valve Size Required* and *Valve Sizing Example* on the following page.

## Selection Chart

| Code Number | Nominal Valve Size | Inlet and Outlet Ports | Pressure Connection Style |
|---|---|---|---|
| **V146AL-1C** | 1 in. | Union (Sweat) | 46 |




Pressure connection and capillary as specified.

## Specifications

| V146 Series 2-Way Pressure-Actuated Water-Regulating Valves | | |
|---|---|---|
| **Nominal Valve Size** | | 1 in. |
| **Maximum Refrigerant Pressure at Bellows** | | 320 psig (2206 kPa) |
| **Opening Point Adjustment Range** | | 70-260 psig (483-1793 kPa) |
| **Factory-Set Opening Point** | | 165 psig (1138 kPa) |
| **Maximum Water Pressure** | | 350 psi (2413 kPa) |
| **Temperature** | **Maximum** | 170°F (77°C) |
| | **Minimum** | 40°F (4°C) |
| **Material** | **Body** | 1 in. - Cast Iron with Corrosion-resistant Finish |
| | **Disc Stud, Valve Stem** | Brass |
| | **Disc Cup, Valve Seat** | Monel (Nickel-Copper Alloy) |
| | **Valve Disc** | Buna-N |
| | **Sensing Element** | Brass and Phosphor Bronze Bellow in Brass Cup |
| | **Diaphragm** | Nylon Reinforced Buna-N |

## V146 Valve Dimensions, inches (millimeters) and Shipping Weight, pounds (kilograms)

| Valve Code Number | Nominal Valve Size | Callout | | | | | Shipping Weight |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | |
| V146AL-1C | 1 in. | 4-3/4 (121) | 2-3/4 (71) | 10 (254) | 5-5/16 (151) | 4-1/16 (103) | 9.3 (4.0) |

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# *V146 Series High Water Pressure Two-Way Pressure-Actuated Water-Regulating Valves (Continued)*

## Finding the Valve Size Required

Each application is unique and will require specific engineering data to properly size and design a system to fulfill the appropriate requirements. Typically, a valve will be replaced with another valve of the same size in a properly-sized and engineered system. Contact Johnson Controls/Penn Refrigeration Application Engineering at (800) 275-5676 to obtain specific engineering data. To make a rough field estimate of the size of valve for an application, find the valve size by locating a point on a flow chart (see Flow Chart, 1 in. V146 Valve diagram) that satisfies these requirements:

### Maximum Water Flow

**Maximum water flow (Flow)** required by the condenser should be taken from information provided by the manufacturer. If the manufacturer's information is unavailable, maximum water flow in gallons per minute (gpm) can be roughly approximated with the following information:

- System Capacity (**Tons of Refrigeration**)
- Outlet Water Temperature (**Temp. $_{Outlet}$**)
- Inlet Water Temperature (**Temp. $_{Inlet}$**)

If the outlet temperature is unknown, assume it to be 10°F (5.5°C) above the inlet temperature.

### Refrigerant Head Pressure Rise

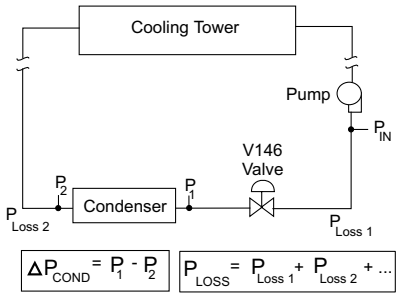
**Refrigerant Head Pressure Rise Above Valve Opening Point ($P_H$)** can be roughly approximated with the following information:

- **Refrigerant Condensing Pressure ($P_{COND}$)** is the manufacturer's recommended condensing pressure.
- **Valve Closing Pressure ($P_{VC}$)** is equal to the refrigerant pressure at the highest ambient temperature the refrigeration equipment will be subjected to in the Off cycle. Use a Pressure-Temperature Chart to find this pressure.

### Maximum Available Water Pressure Drop

The maximum available water pressure drop through the valve is the water pressure actually available to force water through the valve.

- **Minimum Inlet Pressure** is the water pressure from city water mains, pumps or other sources.
- **Pressure Drop Through Condenser** is the difference in water pressure between the condenser inlet and the condenser outlet. Obtain this information from the condenser manufacturer.
- **Pressure Drop Through All Associated Piping** is an estimated or calculated value.




**Maximum Available Water Pressure Drop**

### Equations

Maximum Water Flow $\quad Flow = \dfrac{\text{Tons of Refrigeration} \times 30}{(Temp._{Outlet} - Temp._{Inlet})}$

Refrigerant Head Pressure Rise $\quad P_H = P_{COND} - (P_{VC} + 7\ psi)$

Maximum Available Water Pressure Drop $\quad P_{AVAIL} = P_{IN} - \Delta P_{COND} - P_{LOSS}$

### Metric conversions

Use these equations to convert between U.S. and S.I. units.
1 $dm^3/s$ = 3.6 $m^3/h$ = 15.8 U.S. gal. /min. = 13.2 U.K. gal. /min.
1 bar = 100 kPa = 0.1 MPa ≈ 1.02 $kp/cm^2$ = 1.02 atm at ≈14.5 psi

## Valve Sizing Example

### *Maximum Water Flow*

- According to the manufacturer's information, the maximum required water flow for the system is 35 GPM.

Maximum water flow is 35 GPM.

### *Refrigerant Head Pressure Rise*

- The system uses refrigerant R-22.
- Maximum ambient temperature during the Off cycle is estimated at 95°F, which gives a refrigerant pressure of 180 psi. (**$P_{VC}$** = 180)
- The manufacturer's recommended condensing temperature is 110°F, so the Condensing Pressure is 226 psi. (**$P_{COND}$** = 226)
- **$P_H = P_{COND} - (P_{VC} + 7\ psi)$** = 226 – (180 + 7) = 39 psi

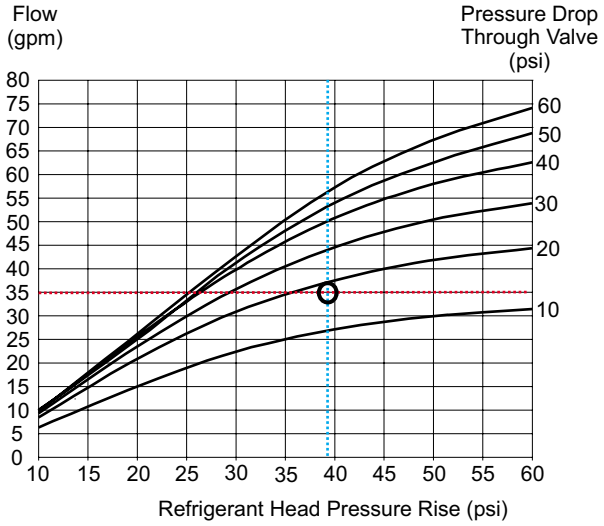
Refrigerant Head Pressure Rise is 39 psi.

### *Maximum Available Water Pressure Drop*

City water pressure (minimum inlet pressure) is 40 psi. (**$P_{IN}$** = 40 psi)
The manufacturer's table gives a pressure drop through the condenser and the accompanying piping and valves at 15 psi. (**$\Delta P_{COND}$** = 15 psi)
Water pressure drop through the installed piping is approximately 5 psi. (**$\Delta P_{LOSS}$** = 5 psi)
**$P_{AVAIL} = P_{IN} - \Delta P_{COND} - \Delta P_{LOSS}$** = 40 - 15 – 5 = 20 psi

Maximum Available Water Pressure Drop is 20 psi.

Using a flow of 35 GPM, a head pressure rise of 39 psi, and a pressure drop across the valve of 20 psi, the 1 in. valve meets these criteria. See the 1 in. V146 Valve flow chart.




**Flow Chart, 1 in. V146 Valve**

**Note: The maximum differential water pressure across a valve is 60 psi (414 kPa).**