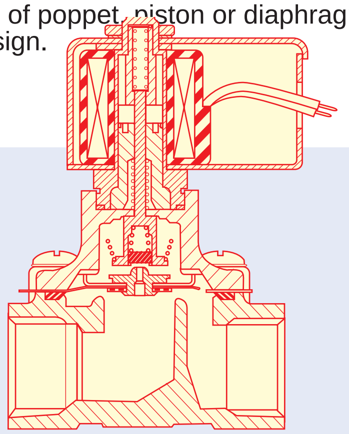
SOLENOID VALVES
For Process Applications

For Use with Liquids, Steam, Gases and Hot Water

The OMEGA® SV-100 and SV-200 series solenoid valves for liquids and gases cover most industrial and laboratory applications. The valves are available in sizes ranging from ¼" to 2" NPT, with Cv's as high as 38. OMEGA also offers general-purpose 2-, 3-, and 4-way valves made of brass or stainless steel, and specialty valves for hot water and steam applications.

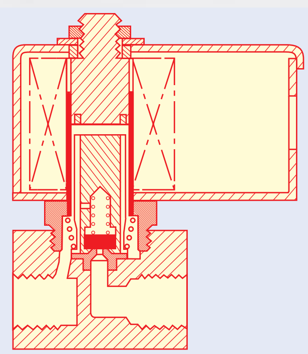
SV-100/200 valves are modularly constructed in three basic parts: the valve body, the electrical coil, and the coil enclosure. The valve bodies are normally stainless steel or brass for greatest media compatibility, while the wetted parts consist of the shading ring, the valve material, and an O-ring. The standard electric coils are all rated as "continuous duty" to eliminate overheating. Each coil is encased in a protective encapsulated material that resists moisture, fungus, and extreme environmental conditions. The standard electrical enclosures meet NEMA-4 ratings and have a ½" conduit port.

OMEGA's SV-100/200 Series valves are of poppet, piston or diaphragm design.



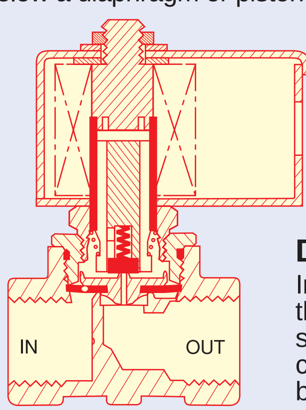
PILOT-OPERATED

A pilot-operated solenoid valve utilizes the energy stored in the pressurized fluid to actuate the valving mechanism. A direct acting solenoid valve is an integral part of any pilot-operated valve, and is used to affect the balance of pressure above and below a diaphragm or piston.



DIRECT LIFT

Direct lift valves combine the features of a direct acting valve with those of a pilot-operated valve. Because it has a flexible link between the solenoid plunger and the diaphragm, the valve functions as a direct acting valve at low pressures and as a pilot-operated valve at higher pressures. It is sometimes referred to as a Zero Delta P (Pressure) valve or a "hung diaphragm" valve.



DIRECT ACTING

In this construction, the magnetic force of the solenoid acts directly on the valve's sealing mechanism. The pressure and flow capabilities of this type of valve are limited by the power of the solenoid.

SELECTING A SOLENOID VALVE
To Your System Specifications

SV251, $145, shown larger than actual size, see page J-35.

SELECTION GUIDELINES

General purpose solenoid valves are used with a wide variety of liquids and gases in a broad spectrum of applications. Rating the valve capacity in terms which apply to all operating conditions is accomplished by determining the "flow factor" (Cv) of the valve. The Cv value is the number of U.S. gallons of water at 16°C (60°F) per minute that, when flowing through the valve, causes a pressure drop of 1 psi. This measure of capacity is stated for every model in this catalog.

There are five main parameters to consider when selecting a valve: Cv, media compatibility, pressure, temperature, and process fitting. For each of these parameters, maximum values are listed for each valve. To choose the correct valve, compare each parameter and check that it is less than the maximum value listed.

LIQUID APPLICATIONS

For most applications, liquids are considered incompressible, and only the following factors need be considered in sizing a valve:

Cv = Flow factor of valve
Q = Flow expressed in U.S. gallons per minute (GPM)
P = Pressure drop across the valve ($= P_1 - P_2$)
P_1 = Inlet Pressure (psig)
P_2 = Outlet Pressure (psig)
G = Specific Gravity of the fluid
(G = 1.0 for water at 16°C (60°F)

These factors are related according to the equation:

$$C_V = Q\sqrt{\frac{G}{\Delta P}}$$

Sample Problem: A 2-way normally closed valve is needed to control the transfer of a liquid (G = 1.1), flowing at a rate of 2 GPM. The pressure available is 10 psi; downstream pressure is 0 psi.

Solution:

$$P = P_1 - P_2 = 10 - 0 = 10 \text{ psi}$$

$$C_V = Q\sqrt{\frac{G}{\Delta P}} = 2\sqrt{\frac{1.1}{10}} = 0.66$$

Therefore, a valve is needed with a Cv of at least 0.66, and a max operating pressure differential of at least 10 psid. Referring to the general purpose valves on page J-18, the SV6001 with a Cv = 1.5 is O.K. Check temperature, media compatibility and end fittings, to insure a correct valve choice.

Note: *The Cv values given in this catalog are applicable to liquids with viscosities up to 100 SSU (22 centistokes).*

GAS APPLICATIONS

When compressible media such as air or gases are used, the sizing of the valve must take account of additional factors which affect performance.

Cv = Flow factor
Q = Flow expressed in Standard Cubic Feet per Hour (SCFH)
P = Pressure drop across the valve (inlet to outlet) in psid
P_1 and P_2 = Inlet and outlet absolute pressures respectively (psia)
psia = Gage Pressure (psig) + 14.7 psia
t = Gas temperature (°F)
G = Specific gravity of gas (= 1 for air at 13°C (55°F))

These factors relate as follows:
If $P_1 \times 0.53 < P_2$:

$$C_V = \frac{Q}{1349}\sqrt{\frac{(460 + t) \times G}{\Delta P \times P_2}} =$$

If $(0.53)\, P_1 \geq P_2$

$$C_V = \frac{Q\sqrt{(460 + t) \times G}}{704 \times P_1}$$

Sample Problem: A normally closed 2-way valve is needed to control gas entering a furnace. Known are:

Q = 500 SCFH G = .7 t = 60°F
P_1 = 35 psia or (20 psig + 14.7)
P_2 = 30 psia or (15 psig + 14.7)

Solution:
P = 35-30 = 5 psid
$P_1 \times 0.53 = 35 \times 0.53 = 18.55 < P_2$ (30 psia)

Therefore, use the formula:

$$C_V = \frac{Q}{1349}\sqrt{\frac{(460 + t) \times G}{\Delta P \times P_2}} =$$

Cv = 0.58

Therefore, a valve is needed with a Cv ≥ 0.58 and a max. operating pressure differential ≥ 5 psid.

Again, the general purpose stainless steel SV6001 on page J-18 with a Cv = 1.5 is sufficient, and temperature and media compatibility are good.

Sample Problem: A 3-way normally closed valve is needed to control a single-acting spring-return cylinder. Known are:

Q_A = 28.3 cubic inches/sec at 56 psig to obtain 2" stroke of a 6" diameter cylinder in 2 sec.
P_1 = 115 psia (100 psig + 14.7)
P_2 = 71 psia (56 psig + 14.7) (for a 1600 lb. force)
G = 1 for Air, t = 90°F
P = 115-71 = 44 psid

Since the flow was determined at a pressure of 56 psig, it must be converted to its equivalent volume at standard pressure. Boyle's law for converting to standard conditions provides:

$$Q_S = Q_A\left(\frac{P_A}{P_S}\right)\left(\frac{515}{t + 460}\right)$$

= 127 Standard Cubic Inches per second

Where Q is Flow
P is Pressure in psia
A is for Actual Conditions
S is for Standard Conditions

$$= 127\ \frac{in^3}{s} \times \left(208\ \frac{s - ft^3}{in^3 - hr}\right)$$

Converting this to SCFH:

=265 SCFH

Select the appropriate Cv formula:
$P_1 \times 0.53 = 115 \times 0.53 = 60.95 < P_2$

Therefore, a valve such as the SV241, which has a Cv = 0.17, max.

$$C_V = \frac{265}{1349}\sqrt{\frac{550 \times 1}{44 \times (56 + 14.7)}} = 0.083$$

DP = 150 psid, and max. temp. = 240°F will work.

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