SOLENOID VALVES
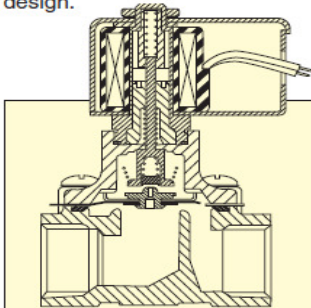## FOR PROCESS APPLICATIONS

1 YEAR WARRANTY · UL

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 C_v'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.

The SV-100/200 valves are modularly constructed from 3 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, valve material, and O-ring. The standard electric coils are all rated as "continuous duty" to eliminate overheating. Each coil is in a protective encapsulated material that resists moisture, fungus, and extreme environmental conditions. The standard electrical enclosures meet NEMA 4 (IP65) 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 uses the energy stored in the pressurized fluid to actuate the valving mechanism. A direct-acting solenoid valve is an integral part of the pilot-operated valve and is used to affect the balance of pressure above and below a diaphragm or piston.
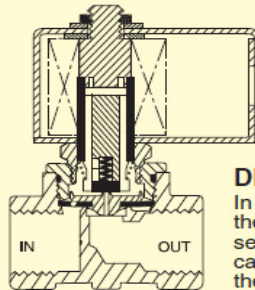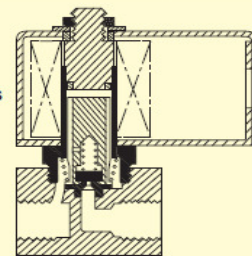
DIRECT LIFT

Direct-lift valves combine the features of a direct-acting valve with those of a pilot-operated valve. Because of 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 high 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 these valves are limited by the power of the solenoid.

SELECTING A SOLENOID VALVE
TO YOUR SYSTEM SPECIFICATIONS

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 that relate to all operating conditions is done by determining the flow factor (C_V) of the valve. The C_V value is the number of U.S. gallons of 60°F water per minute that, when flowing through the valve, causes a pressure drop of 1 psi. This measure of capacity is stated for each model in this handbook.

There are 5 main parameters to consider when selecting a valve: C_V, 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:
C_V = Flow factor of valve
Q = Flow expressed in U.S. gallons per minute (GPM)
ΔP = 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 60°F)

These factors relate as shown in the following 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) at a rate of 2 GPM. The pressure available is 10 psi; downstream pressure is 0 psi.

Solution:
$\Delta P = P_1 - P_2 = 10 - 0 = 10$ PSI

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

Therefore, a valve is needed with a C_V of at least 0.67, and a maximum operating pressure differential of at least 10 psid. Referring to the general purpose valves starting on page L-28, the SV105 with a $C_V = 0.75$ is acceptable. Check temperature, media compatibility, and end fittings to ensure a correct valve choice.

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

GAS APPLICATIONS

When compressible media such as air or gases are used, the sizing of the valve must include additional factors that affect performance:

C_V = Flow factor
Q = Flow expressed in standard cubic feet per hour (SCFH)
ΔP = 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 + (14.7 psia)
t = Gas temperature (°F)
G = Specific gravity of gas
(G = 1 for air at 55°F)

These factors relate as shown in the following equations:

If $(0.53) P_1 < P_2$
$$C_V = \frac{Q}{1349} \sqrt{\frac{(460 + t) \times G}{\Delta P \times P_2}}$$

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. Also known: Q = 500 SCFH G = 0.7 t = 60°F.
P_1 = 35 psia or (20 psig + 14.7)
P_2 = 30 psia or (15 psig + 14.7)
Solution:
$\Delta P = 35 - 30 = 5$ psid
$P_1(0.53) = 35 (0.53) = 18.55 < P_2$

Therefore, use the formula
$$C_V = \frac{Q}{1349} \sqrt{\frac{(460 + t) \times G}{\Delta P \times P_2}} =$$
$C_V = 0.58$

Therefore, a valve is needed with a $C_V \geq 0.58$ and a maximum operating pressure differential ≥ 5 psid.

Again, the general purpose stainless steel SV105 with a $C_V = 0.75$ 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 in/s at 56 psig to obtain 2" stroke of a 6" diameter cylinder in 2 s
P_1 = 115 psia or (100 psig + 14.7)
P_2 = 71 psia or (56 psig + 14.7) (for a 1600 lb force)
G = 1 for air, t = 90°F
ΔP = 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:

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

= 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

Converting this to SCFH:

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

= 265 SCFH

Select the C_V formula using:
$P_1 (0.53) = 115 (0.53) = 60.95 < P_2$

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

Therefore, valve SV241, which has a $C_V = 0.18$, max MODP = 150 psid, and max temp = 165°F, will work.