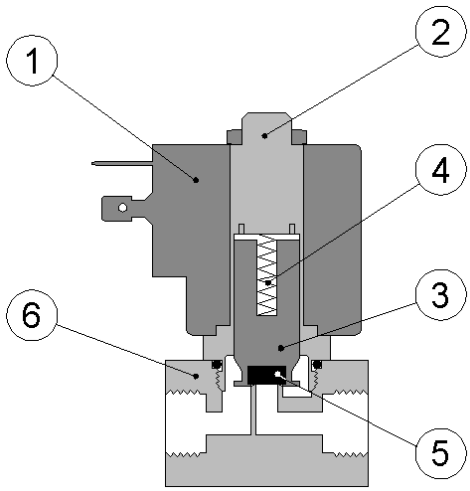
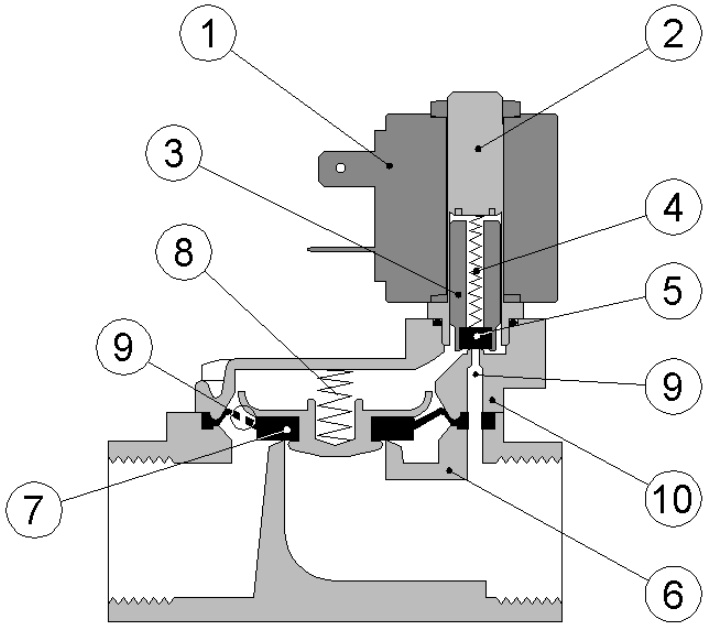
SOLENOID VALVE TERMINOLOGY

I. DIRECT ACTING VALVE

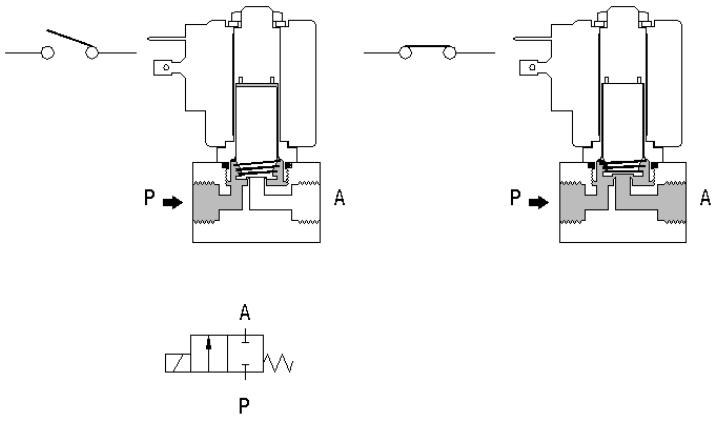


1. Coil
2. Solenoid base
3. Solenoid core
4. Core spring
5. Disc seal
6. Valve body

II. DIAPHRAGM OR PISTON VALVE

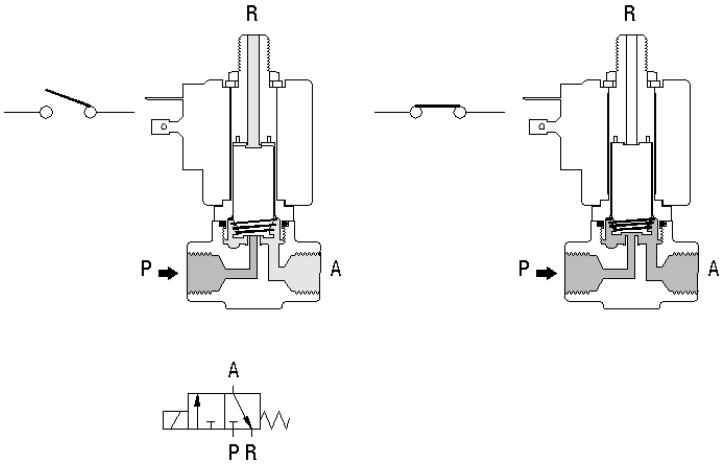


1. Coil
2. Solenoid base
3. Solenoid core
4. Core spring
5. Disc seal
6. Valve body
7. Diaphragm or piston
8. Diaphragm or piston spring
9. Pilot orifice (bleed orifice)
10. Valve bonnet



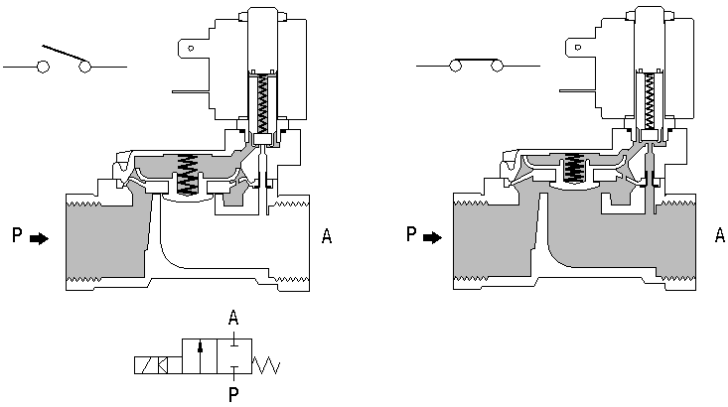
2/2 CLOSED WHEN DE-ENERGISED (NC) DIRECT ACTING

When the coil is energised the valve opens. The valve does not require minimum operating pressure differential. Maximum operating pressure depends on the orifice diameter and coil power. Due to the coil power limitations high flow rates cannot be achieved.



3/2 CLOSED WHEN DE-ENERGIZED (NC) DIRECT ACTING

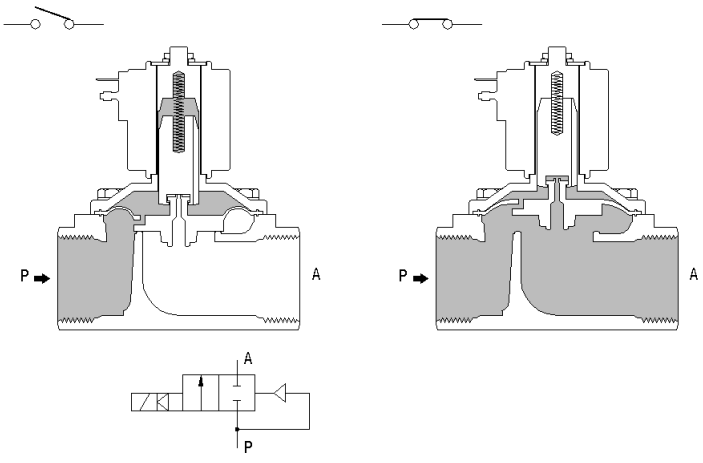
Valve function similar to 2/2 NC, only with 3 ports that allow 2 ways simultaneously: one open and the other closed. 3/2 valves are often used as cylinder activators.
The same valve also allows NO function when properly connected.



2/2 CLOSED WHEN DE-ENERGIZED (NC) PILOT-OPERATED

Valve orifice is closed by a diaphragm or a piston. A bypass connects the chamber above the diaphragm/piston and valve outlet. Bypass is closed by a solenoid core and opens when coil is energized. When this occurs, the pressure above the diaphragm/piston drops and the flow through the valve is established.

This principle of operation requires pressure difference between the valve inlet and outlet and is therefore not applicable at pressures near 0 bar.



2/2 CLOSED WHEN DE-ENERGIZED (NC) COMBINED OPERATION

Principle of operation combines direct acting and pilot operation. Valve diaphragm or piston is attached to the solenoid core and no pressure difference is required. This principle allows high flow rate at pressure near 0 bar.

ENGINEERING MATERIALS

The choice of materials used depends on the type of fluid to be controlled.

Bodies
are made of machined brass, bronze, thermoplasts, stainless steel or nickelized brass or bronze.

Seals – diaphragms
are chosen according to mechanical, thermal and chemical requirements.

NBR is the standard material for use with neutral chemically fluids at temperatures up to 90°C.
At higher temperatures, EPDM, FPM and PTFE can be used.

In some cases (high temperature and high cycling rate) stainless steel can also be used.

Characteristics of sealing materials

NBR
• high mechanical durability
• resistant to oil and grease
• tight shut-off
• temperature range: -10°C to +90°C
• fluids: water, fuel, mineral oil, air, argon, town gas, methane, propane, buthane

EPDM
• resistant to acids and lyes of medium concentration
• **non-resistant to oil**
• tight shut-off
• temperature range: -40°C to +130°C
• fluids: hot water, wet steam, ozone, ethylene and methylene alcohol, acids and lyes

FPM
• excellent chemical resistance
• mechanical durability lower than NBR or EPDM
• tight shut-off
• temperature range: -15°C to +200°C
• fluids: hot and oiled air, acids, lyes and other fluids that do not allow use of NBR or EPDM

PTFE
• resistant to almost all chemicals
• non-resilient, shut-off with slight leakage
• temperature range: -200°C to +250°C
• fluids: various chemicals, refrigerants, ammonia, dry steam

ELECTRICAL CHARACTERISTICS

All coils are designed for coninuous duty (ED100%). Exceptions are marked on individual coil or valve types.
Wire inulation is class F (155°C) or H (180 or 200°C).
Voltage tolerance is ±10% at AC and ±5% at DC.

Power consumption is stated in watts (W) and equals:
- the product of measured DC voltage and current
- the product of measured AC voltage and current multiplied by 0.6

Thermal conditions

When the coil has been energized for a period of time the temperature of the winding rises. Amount of heating is affected by ambient and fluid temperature.
In extreme cases the overheating causes damage to the wire insulation and the coil becomes defective.
Special coils for extreme thermal conditions are also available.

Electrical protection - IP rating

Apart from standard coils, original explosion- and waterproof coils are also available, thus allowing the use of solenoid valves in practically any environment.

Standard coils are encapsulated in special thermoplastic resin which prevents the intrusion of damp and protects the winding from mechanical damage.

Explosionproof coils are encapsulated in epoxy resin.

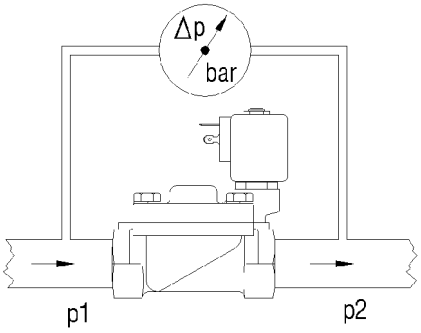
Basic IP rating for a coil is IP00, whereas IP65 can be achieved with properly fitted plug (to DIN 43650).
The TM35k type coil with IP67 rating is designed for extremely damp ambients (also water immersion).

FLOW RATE AND Kv VALUE

Flow rate of any given valve depends on valve size, type of fluid and the pressure which forces the fluid through the valve.
Kv value is given for each valve type in the table. With known parameters the flow rate can be calculated according to the following formula:

$$Q = Kv\sqrt{\frac{\Delta p}{\rho}}$$

$$\Delta p = p1 - p2$$



Q flow rate [l/min]
Kv value given in the table for each valve type
Δp difference between inlet and outlet pressure [bar]
p1 pressure measured at valve inlet [bar]
p2 pressure measured at valve outlet [bar]
ρ specific mass of fluid [kg/dm³]
(equals 1 for tap water)

Kv value is approximately the same for tap water and other fluids (e.g. oil) of viscosity not exceeding 21 mm²/s.
At higher viscosity a correction of Kv value is required.

PRESSURE RATING

a) Maximum operating pressure differential is the maximum difference between valve inlet and outlet pressures at which the valve will still reliably operate. Values in tables (with tolerance ±10%) are given at ambient and coil temperature 22°C.

b) Minimum operating pressure differential is the minimum difference between valve inlet and outlet pressures at which the valve will still reliably OPEN. If required pressure difference is not achieved the valve will not open when activated.

c) Maximum static pressure is the highest fluid pressure endured by valve body and internal parts without damage.

INSTALLATION AND RECOMMENDATIONS

Valves can be installed horizontally or vertically. Upright coil position is recommended to avoid accumulation of impurities in pilot which may result in faulty operation.

Before installation it is highly recommended to clean the pipeline to minimize the amount of impurities in fluid.
It is also recommended to install a strainer (40 micron mesh) in front of the valve.

AC coils should not be connected to the electrical circuit unless fitted properly on the stem as this will result in coil burning.
In very damp ambients the use of special coil sealing sets or TM35k type coil is necessary (available from your supplier).