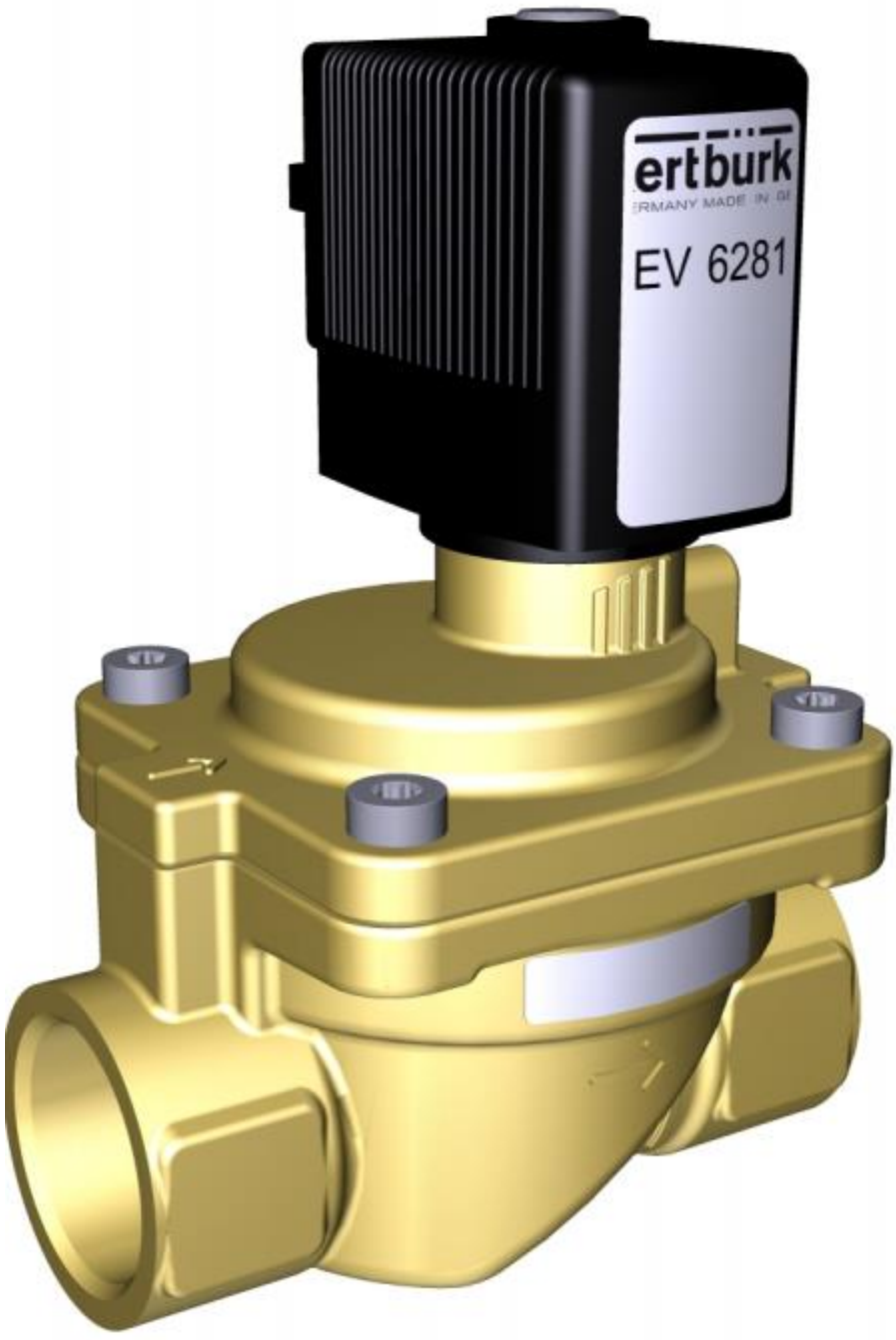
Valves ONLINE

THE KNOWLEDGE
SOLENOID VALVES



Direct-acting Valve Anatomy

Coil
The coil forms the drive system of the solenoid valve. Electrical energy is converted to a controlled magnetic force.

Plunger
The plunger is a precision turned part made of magnetic steel. It is moved by the magnetic field generated in the coil.

Closing spring
The closing spring presses the plunger onto the valve seat to close it.

Electrical connection
A broad spectrum of electrical connections is available. Many magnetic systems are designed for protection type IP 65.

Plunger guide tube
Precision machined tube made of non-magnetic steel, in which the plunger is guided.

Shading ring (AC only)
his is needed only for AC coils. The shading ring represents a coil with one winding, which during zero crossing of the AC voltage induces sufficient residual magnetism to keep the plunger from dropping.

Air gap and stopper
The stopper is part of the magnetic circuit and is firmly fastened to the plunger guide tube. The air gap is the distance between the stopper and the plunger. There should be no gap when the plunger is attracted, in order to generate an optimal magnetic force.

Encapsulation
The coil is cast in polyamide or epoxy to protect it against damage and moisture. The coil temperature and ambient influences determine the material used for encapsulation.

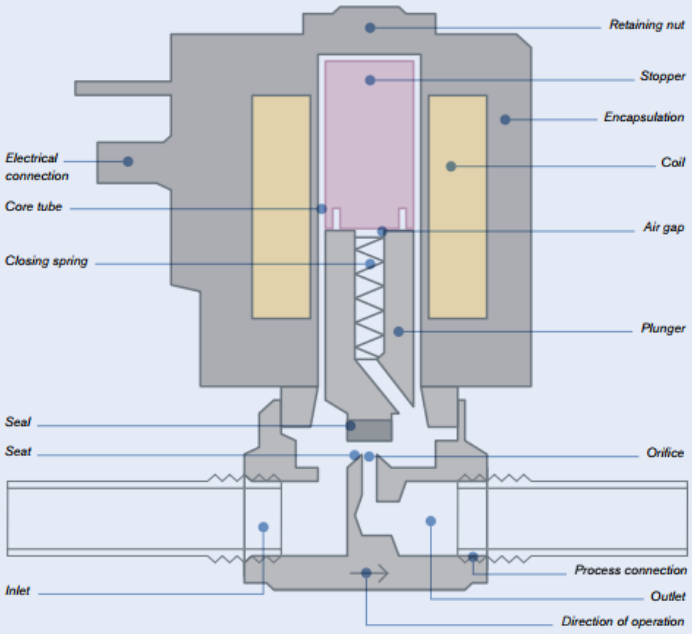
Diameter
The diameter refers to the inner diameter of the valve seat. It is relevant for the flow rate calculation.

Process connection
The process connection is used for the fluidic connection of the valve in the pipe system. Standard DIN and ANSI connections are available, as well as special versions.

Valve seat
The valve seat is the essential fluidic element. It is manufactured with high precision and formed according to the sealing principle.

Seal
The seat seal is the heart of the fluidic system. It is always adapted to the valve pressure, media temperature and chemical resistance.

The main difference between direct acting and pilot solenoids is that direct-acting solenoid valves have a direct connection with the opening and closing armature, whereas pilot-operated valves employ the use of the process fluid to assist in piloting the operation of the valve. Both types of solenoid valve have their particular merits.



Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids (liquids and gases). They are confronted with many different requirements in a plethora of application environments and must offer:

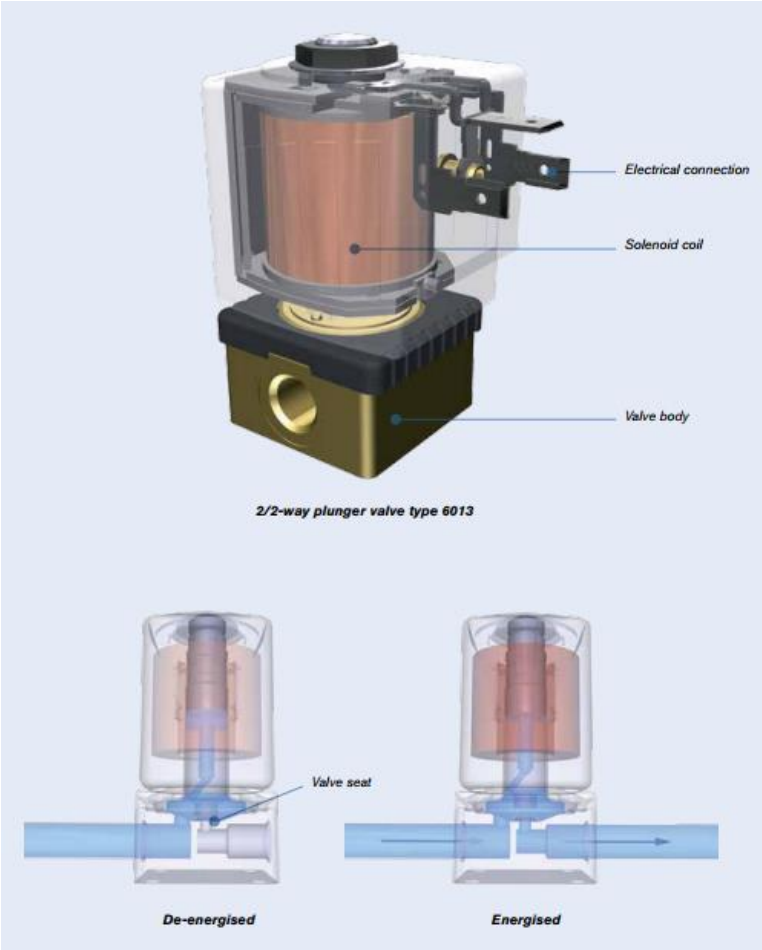
- *fast and safe switching*
- *high reliability*
- *long service life*
- *good medium compatibility of the materials used*
- *low control power*
- *compact design*

Direct-acting 2-way plunger valve

Function:
The main components of this valve type are a coil, a closing spring, a valve body cover and the valve body with the seat. Without current the path to the outlet is blocked (normally closed), since the closing spring, supported by the pressure of the medium, presses the plunger onto the valve seat. If current flows through the coil, the latter generates a starting force, which pulls the plunger and the seal against the spring force and draws the medium upward. The channel is opened for the medium.

Application:
This cost-effective valve type is used in universal applications for neutral and clean liquids, gases and vapours. Versions with special high-quality materials also allow their use in mildly acidic and alkaline solutions. The direct-acting 2-way plunger valves therefore can be used for diverse applications, such as shut-off, dosing, filling and ventilation.

Special features:
Due to a spring-damped seat seal, these valve types have a long service life. Especially noteworthy are the increased switching cycles and service life due to sliding ring bearings. These products are also suitable for high pressure and temperature ranges.



6011
0-21 Bar

6013
0-25 Bar

6027
0-250 Bar

Direct Acting Solenoid Valves

Direct acting solenoids adhere to simple working principles. They do not use a diaphragm – their seal is part of the moving core – and they will remain closed even when no pressure is being applied. This is in contrast to a pilot operated valve, which requires some pressure for the valve to stay closed. The main components of a direct-acting 2-way plunger valve, such as the Type 6013, are a coil, a closing spring, a valve body cover and the valve body with the seat.

In a normally closed direct acting solenoid valve, the path to the outlet port is blocked when no current is applied to the coil as the closing spring presses the plunger onto the valve seat. Current through the coil generates a starting force, which pulls the plunger and the seal against the spring force, and draws the medium upward. As such, the channel is opened for the medium to flow through the direct acting valve.

Cost-effective direct-acting 2-way plunger valves are used in universal applications for neutral and clean liquids, gases and vapours. Versions with special high-quality materials also allow for use in mildly acidic and alkaline solutions. They can therefore be used for a broad spectrum of applications, such as shut-off, dosing, filling and ventilation. Due to a spring-damped seat seal, these valve types have a long service life, as well as increased switching cycles and service life due to sliding ring bearings.

Benefits of direct acting solenoid valves

Suitable for negative pressure circuits.
Designed to cope with particle debris.
Available in very cost-effective compact sizes.
2/2 and 3/2 way normally open or normally closed versions.
Miniature versions available for very high pressures.

Pilot Operated Solenoid Valves

Pilot solenoid valves use the differential pressure of the medium over the valve ports to open and close. Also known as servo-assisted solenoids, these valves provide high flow rates and can operate at higher pressure and temperature ranges, with lower power consumption. A servo-assisted, diaphragm solenoid valve with pilot control employs the use of a small chamber directly above the diaphragm to assist in the operation of the valve. Process fluid is allowed to enter the chamber through a small orifice in the inlet port, and in a normally closed valve, compresses against the diaphragm and forces is against the seat to maintain the closing seal.

Once current is applied to the pilot solenoid, the diaphragm is pulled upwards against the spring pressure, and the pilot fluid in the chamber is forced back through the orifice in the inlet port where it re-joins the main flow through the valve body.

The main areas of application for pilot-controlled diaphragm solenoid valves are liquid or gaseous media (such as compressed air, water and hydraulic oils) within closed circuits in which little or no differential pressure is present for opening and closing. The Type 290 features a soft-kick function for a longer service life and all of the DC versions feature energy-saving power reduction. The Type 6213 EV, on the other hand, uses a spring as a coupling for 'diaphragm-friendly' opening of the main seat in frequent working cycles.

Benefits of Pilot solenoid valves

Excellent for very large flow.
Pressure assists valve operation.
Needs minimum pressure differential.
More economical for higher flow values
Lower electrical power level

Servo-assisted Valve Anatomy

Pilot Valve
All of the functional principles explained for direct-acting valves (plunger, pivoted armature, rocker and flipper valves) can be used for pilot valves.

Chamber (above diaphragm)
Pressure is equalized in the chamber and is the space into which the diaphragm or piston recedes to allow flow.

Pilot channels
Allow fluid to move out of the chamber and from the pilot to downstream to enable the fluid to assist in opening the main seal.

Equalization hole/channel
Ensures that the inlet pressure and the pressure in the chamber above the diaphragm or piston are slowly equalised in order to close the valve.

Above the seat flow
In all pilot-controlled valves the flow takes place above the valve seat.

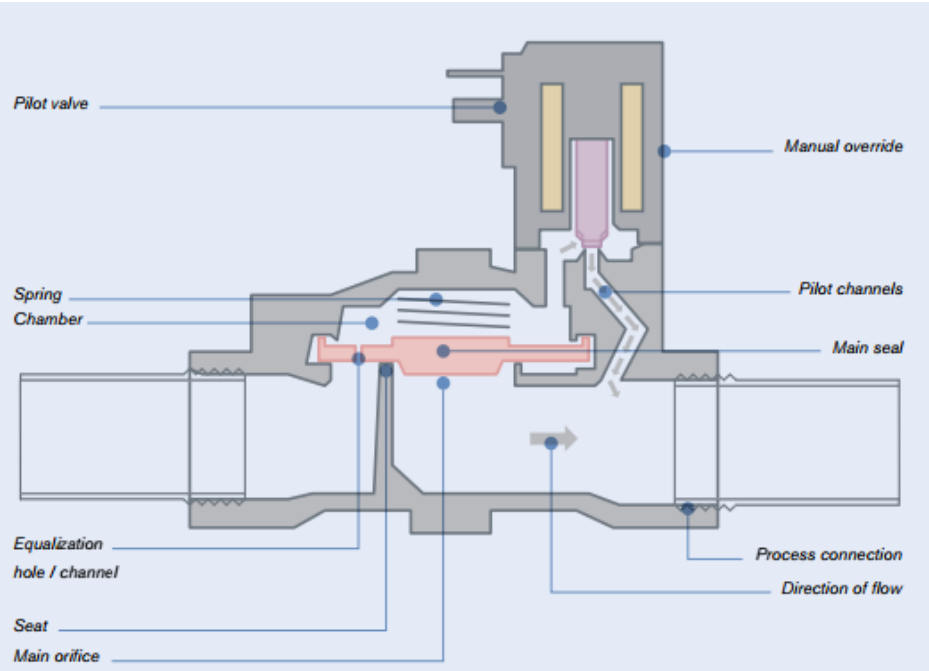
Spring
The spring in the chamber supports the media pressure during closing of the valve. In valves that are exposed to aggressive chemical fluids the spring is avoided. The media pressure alone then closes the valve.

Main Orifice
The area on which the media pressure will act and the gap through which the media will flow when the valve is energized. Along with the contours of the valve it governs the pressure drop and the flow rate of the valve.

Process connections
Many fluidic sizes and connections are available to meet local geographic or industry specific standards.

Seal
A soft material, either a diaphragm or a flat seal attached to the underside of a solid piston or a plunger which halts the flow of fluid from one side of the main orifice to the other.

Seat
A raised area at the diameter that concentrates the pressure of the seal. Press-fit seats made of VA are used in case of potential abrasion or cavitation.



Opening large orifices using the direct acting method would require enormous and expensive coils. Therefore servo assisted valves use the power of the fluid to open the flow channel by controlling a small pilot channel to alter the forces on a larger main seal.

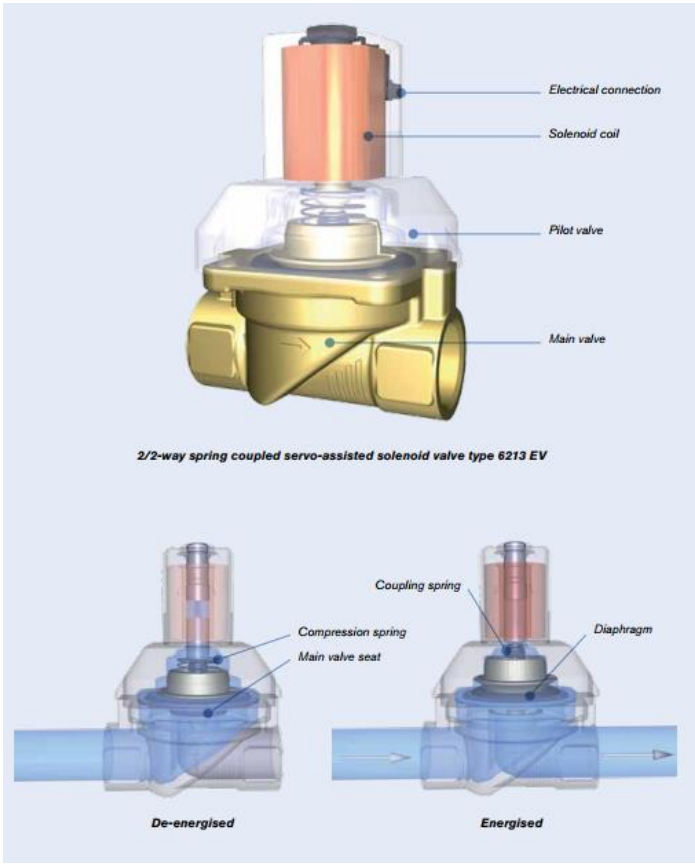
Servo-assisted:

Coupled diaphragm solenoid valve with plunger pilot control

Function:
This functioning principle uses a direct-acting plunger valve as the pilot valve and a flexible diaphragm as the main seal. As soon as the pilot valve opens, the fluid chamber above the diaphragm is emptied. The media pressure within the diaphragm raises the diaphragm and opens the valve so that the medium can flow. If the pilot valve is closed, the media pressure above the diaphragm builds up again through the small compensation opening and the closing process is supported additionally by the compression spring. This valve type can switch without differential pressure, since the diaphragm holder of the main valve is connected to the armature rigidly or by means of a spring. The pilot valve alone is capable of partially opening the main valve.

Application:
The main areas of application for pilot-controlled diaphragm solenoid valves are liquid or gaseous media such as compressed air, water and hydraulic oils in closed circuits in which little or no differential pressure is present for opening and closing.

Special features:
Type 290 features a soft-kick function for a longer service life. All of the DC versions feature energy-saving power reduction. Type 6213 EV uses a spring as a coupling for “diaphragm-friendly” opening of the main seat in frequent working cycles.



EV6213
0-10 Bar

0290
0-16 Bar

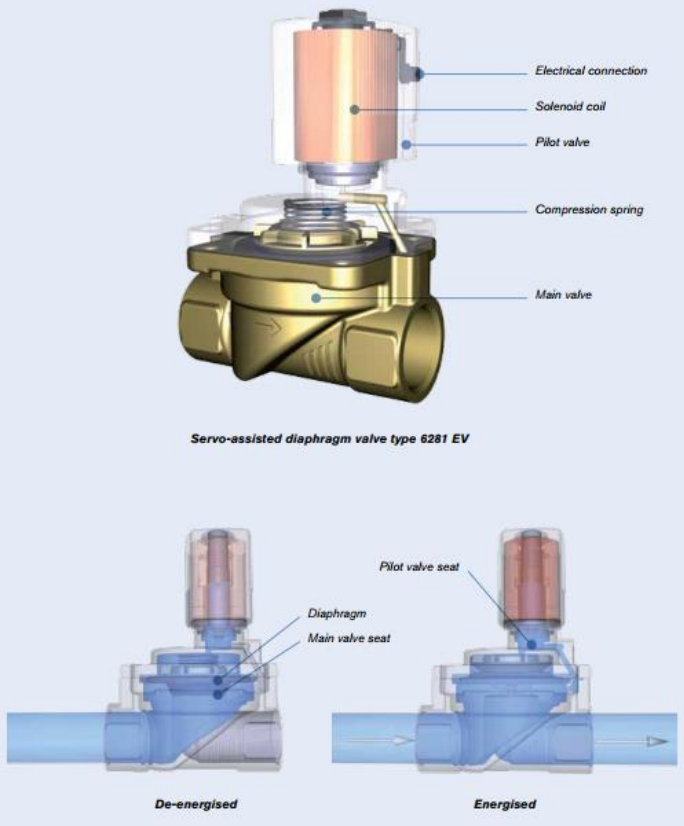
Servo-assisted:

Diaphragm valve with plunger pilot control

Function:
This functioning principle uses a direct-acting plunger valve as the pilot valve and a flexible diaphragm as the seal for the main seat. As soon as the pilot valve opens, the fluid chamber above the diaphragm is emptied. The media pressure within the diaphragm raises the diaphragm and opens the valve so that the medium can flow. If the pilot valve is closed, the media pressure above the diaphragm builds up again through the small compensation opening and the closing process is supported additionally by the compression spring. A minimal differential pressure between the inlet and outlet is necessary for complete opening and closing.

Application:
The main areas of application for this pilot-controlled solenoid diaphragm valve are clean liquid or gaseous media such as compressed air, water, hydraulic oils, etc. The small pilot valve makes them less expensive than direct-acting valves for use with higher pressures and larger diameters.

Special features:
Since pilot-controlled valves (also: servo-assisted valves) have only a small pressure equalisation hole in the diaphragm, they are susceptible to dirt particles and crystallising media, which can clog the hole. These solenoid valves are designed as soft stop valves. Ex or low power versions are virtually unproblematic compared with direct-acting valves, since the pilot control valve only has lower power consumption.



EV6281
0.2 – 16 Bar

EV6281
0.2 – 16 Bar

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Want More Information on our solenoid valves or do you have a project where we may be able to help then please contact us on +44 1822 855600, email sales@valvesonline.co.uk