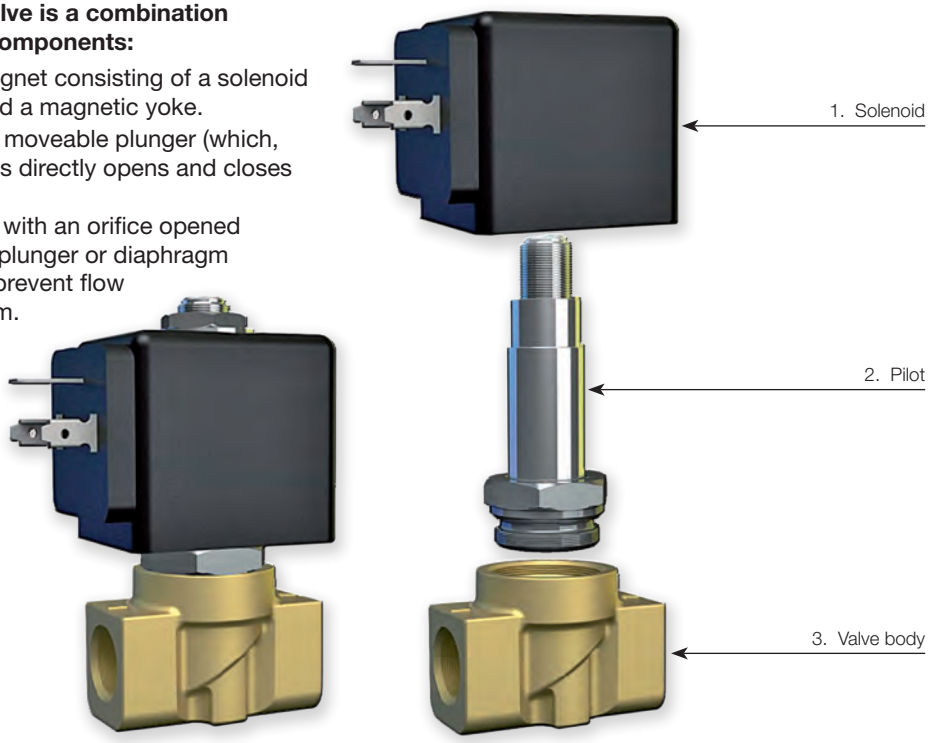
TECHNICAL INFORMATION ABOUT SOLENOID VALVES

General Information

Solenoid valves are electro-mechanical devices used for interrupting or diverting the flow of fluids by opening or closing one or more orifices.

The solenoid valve is a combination of three basic components:

1. An electromagnet consisting of a solenoid (windings) and a magnetic yoke.
2. A pilot with a moveable plunger (which, in some cases directly opens and closes the valve).
3. A valve body with an orifice opened or closed by plunger or diaphragm to enable or prevent flow of the medium.



Operating principles

The term solenoid refers to operator and coil, also known as pilot or magnetic actuator.

The coil consists of copper wire wound on a support reel. When electric current is applied into the coil, magnetic flow lines are generated which are stronger in the coil center.

This magnetic flow raises the moveable plunger in the coil until it brings it into contact with the pole piece. The valve body has an orifice through which the fluid flows when the valve is open.

The moveable plunger has an integral seat which when the solenoid coil is energised, moves off the valve (direct operated) orifice or diaphragm (pilot operated) orifice opening the valve.

When the coil is de-energised, a return spring brings the plunger back to the original closing position, thus cutting off the flow of the fluid.

BASIC COMPONENTS OF A SOLENOID VALVE

Valve body: Main part of the solenoid valve including ports, seat and orifices.

Solenoid tube assembly: Cylinder, in stainless steel, hermetically sealed and closed at one extremity. It is the guide channel of the moveable plunger which is moved magnetically. The solenoid coil is fitted on the external side of the enclosing tube.

Moveable plunger: Made by ferritic stainless steel, it is attracted by the solenoid magnetic field and slides inside the tube.

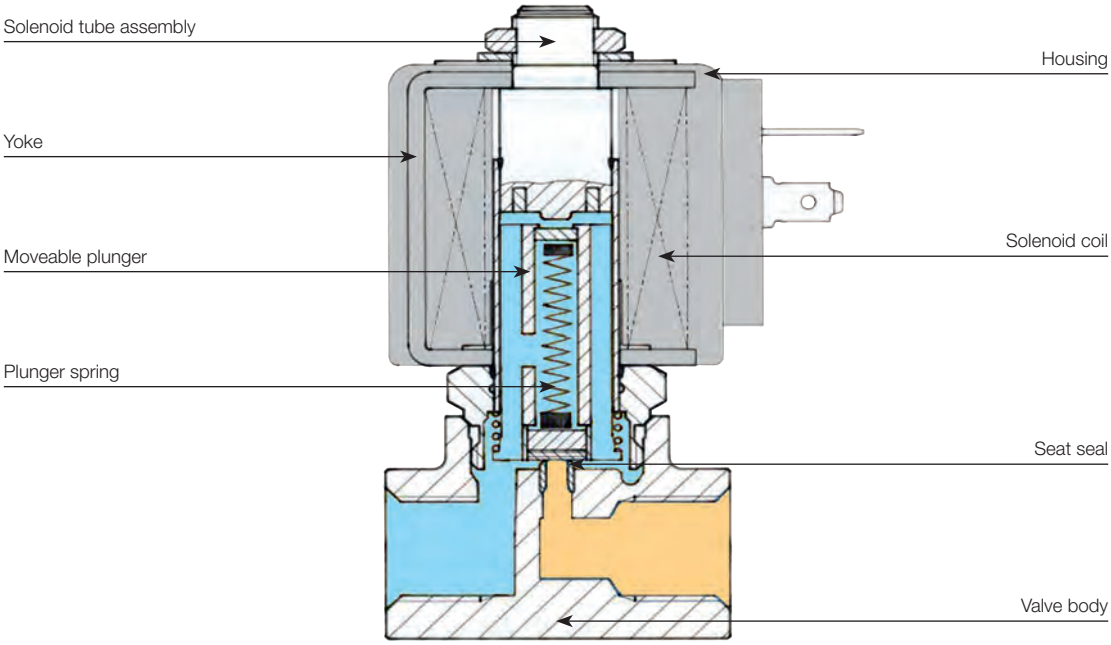
Plunger spring (or return spring): Used to hold the moveable plunger in position and to return it when de-energized.

Seat seal: Part of the moveable plunger, it is used to close a valves main orifice or pilot orifice.

Electromagnet (or solenoid coil): Electrical part consisting of a copper windings (solenoid) along, with a magnetic yoke (armature), when electric current flows through, it generates a magnetic field atracting the moveable plunger.

Housing: Part that contains and protects the coil.

Yoke: Metalic case surrounding the coil and concentring electro-magnetic force on the moveable plunger.



TECHNICAL VOCABULARY USED IN TABLES

Actuation	Body	Function	Port Size	Orifice (mm)	Flow Factor Kv(l/min)	MOPD (bar)	Max Fluid Temp. (°C)

NORMALLY CLOSED

Port size	Orifice Ø	Flow factors			Operating Pressure Differential			Fluid Temp.		Seat Seal	Parker Valves			Power		Coil Group	Dwg. No.
					Min	Max(MOPD)		Min	Max		Valve Ref.	Housing Ref.	Coil Ref.				
BSP	mm	Kv l/min	KV m^3/h	Qn l/min	bar	AC bar	DC bar	°C	°C					AC W	DC W		

The basic technical features of each solenoid valve are indicated in the tables, the terminology used is shown and explained below. Please notice that in certain sections you will have the choice between two product ranges: Parker valves, within blue tables and the Parker valves, within orange tables.

Actuation: The mechanical method used to control the flow.

Body: Main part of the solenoid valve with the ports, seats and orifice needed.

Function: The way the valve operates when de-energised.

Port Size: Fitting dimensions are defined as threaded in inches (G), in BSP or Sub-base, when a flat interface for ports is adopted.

Orifice (mm): Main orifice diameter in millimetres (nominal diameter).

Flow Factors: Define the quantity of water which flows through the solenoid valve with a pressure drop of 1 bar during one minute. Expressed in l/min and m^3/h.

Max Fluid Temperature: Maximum fluid temperature the valve can withstand.

Max Ambient Temperature: Maximum ambient temperature the valve can withstand typical value for pressure vessel is 50°C.

Minimum Operating Pressure Differential: The lowest differential pressure required for operation (bar).

Maximum Operating Pressure Differential (MOPD): The highest working differential pressure with 90% of the rated voltage (-10% Vn) applied to the solenoid coil (for AC) and 95% of the rated voltage (-5% Vn)(for DC).

TECHNICAL INFORMATION

Solenoid valves are highly engineered products that can be used in many diverse applications.

In addition to operational functionality, media compatibility and suitability for the operating environement when selecting the best product for a given application.

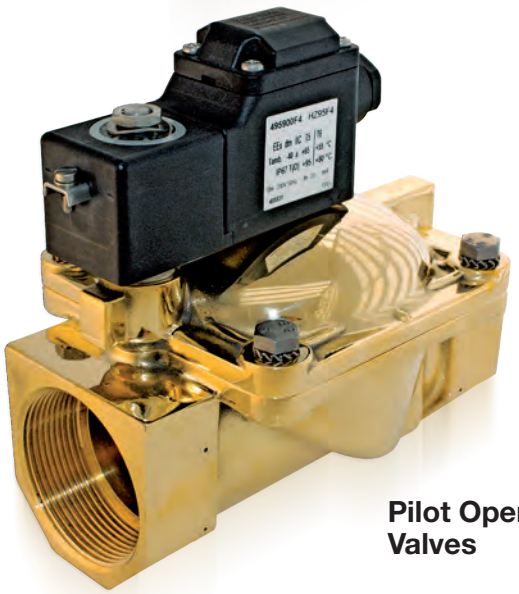
This section provides a brief overview of the components, actuation and function modes of solenoid valves avaible from Parker Hanninfin - FCSE.

Different Technologies:

Solenoid valves are electrically operated devices used to control flow.
The most common types of solenoid valve are:

Direct Operated Valves

Magnalift Valves



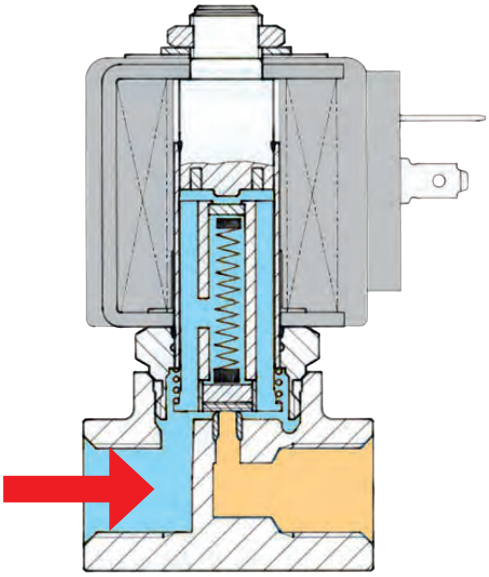
Pilot Operated Valves

DIRECT OPERATED VALVE

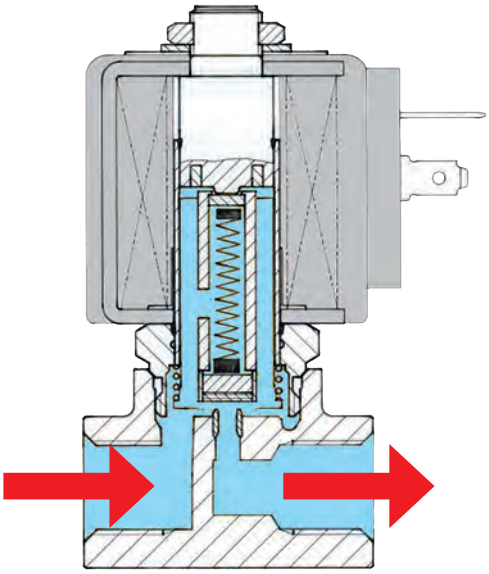
Magnetic force is used directly to open or close the plunger which controls the passage of the fluid. Performances are limited by the coil, the pressure, and the valve orifice size. For direct operated valves, the minimum working pressure is 0 bar and the maximum pressure relies on the combination (valve/coil) chosen.

Direct Operated Valve

De-energised

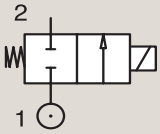


Energised



Example:

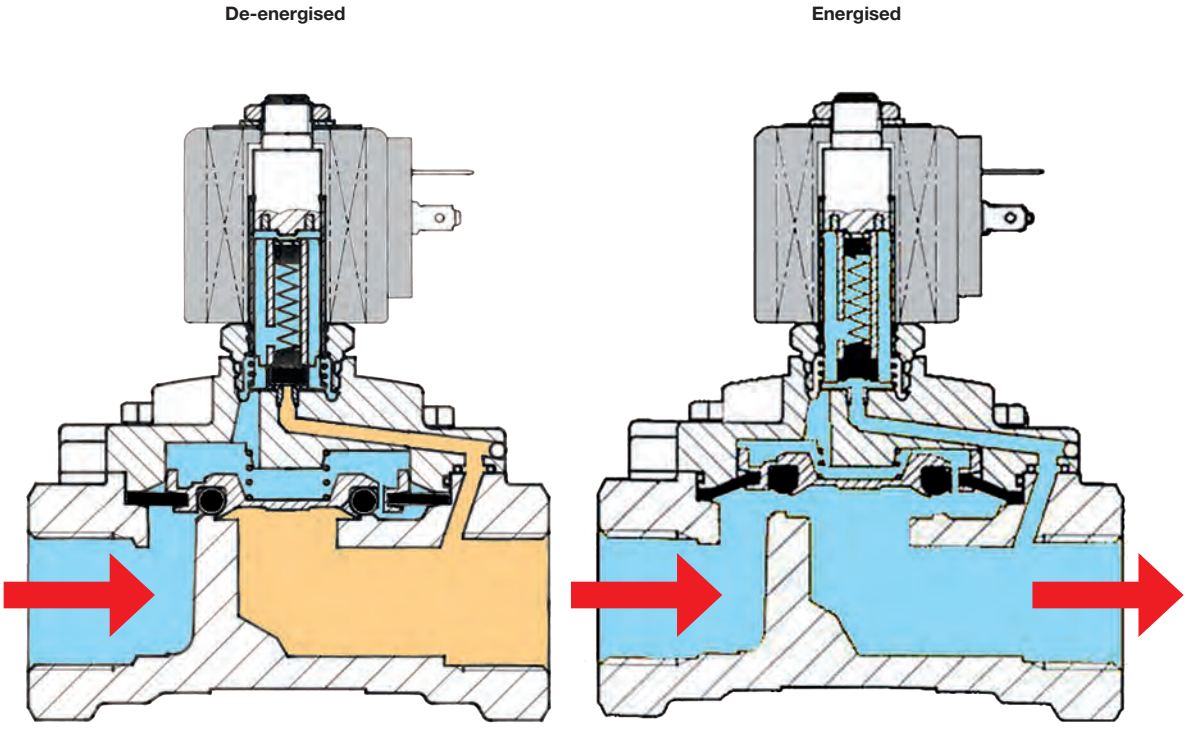
- 121 Series



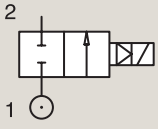
PILOT OPERATED VALVE

To control a higher flow, it is necessary to use pilot operated valves. The supply pressure enters the direct operated "pilot stage" which directs the flow to a "pilot chamber" which,in turn, applies the pilot pressure over a large area (generally a diaphragm or piston). Therefore, a large force is generated to move the main sealing elements against higher pressure or over a large orifice.
One condition of operation is to have a minimum pressure available to shift the valve (indicated in the catalogue). In most applications, this presents no particular problems (refer to magnalift valve section). The pressure rating of the valve starts between 0.1 to 0.5 bar (depending on the valve).
(NB. Pilote Operated Valves are also called Servo Operated Valves).

Pilot Operated Valve



Example:
- 321 Series
- 7321B Series

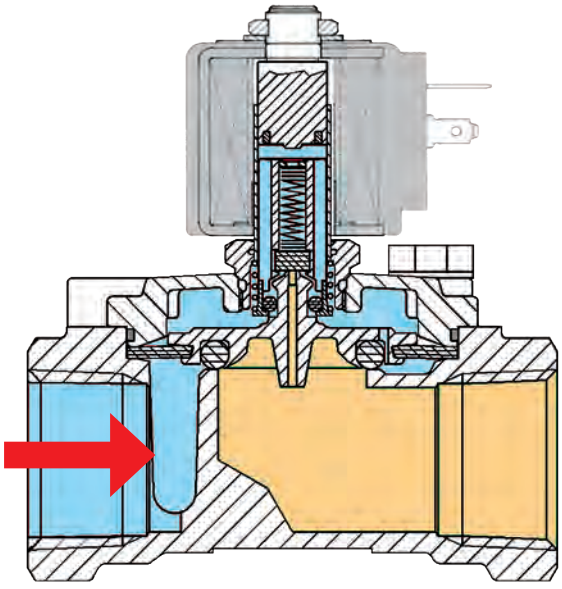


MAGNALIFT VALVE

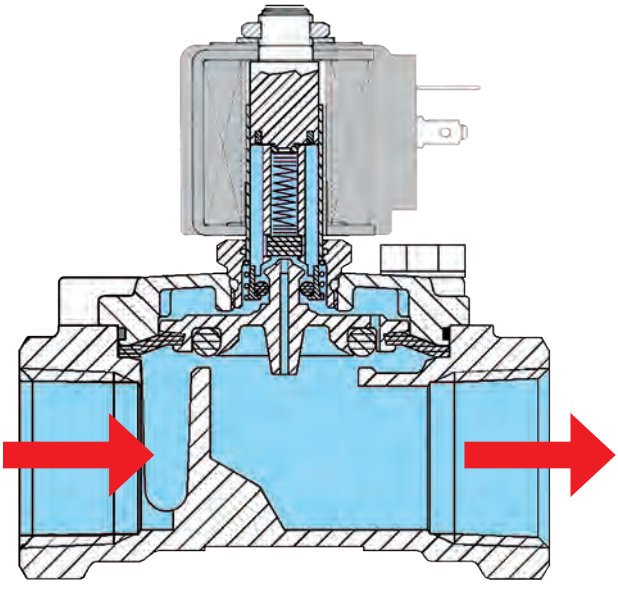
The magnalift valves combine the features of the direct operated and pilot operated valves. A mechanical link between the plunger and diaphragm retainer allows the valve to operate as a direct operated valve at low pressures and as a pilot operated valve at higher pressures. Magnalift valves are specially designed for applications where 0 pressure is needed to operate the valve, as well as bigger flow than a direct operated valve.

Magnalift Operated Valve

De-energised

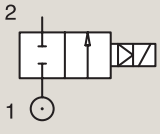


Energised



Example:

- 221 Series



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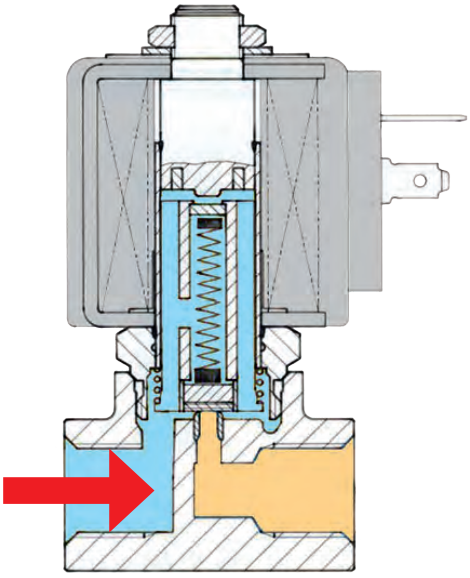
Fluid Control Solutions Europe
General Catalogue FCSE/0112/UK V2.1 03/2021

NORMALLY CLOSED VALVE

Most of our valves are available in normally closed and normally open configuration when not energized. In certain applications, you may require a normally open valve (open function in case of current failure). The differentiating factor of design of this technology, is based upon the design of the seat seal, which is reversed in comparaison to a normally closed valve.

Normally Closed Valve

De-energised



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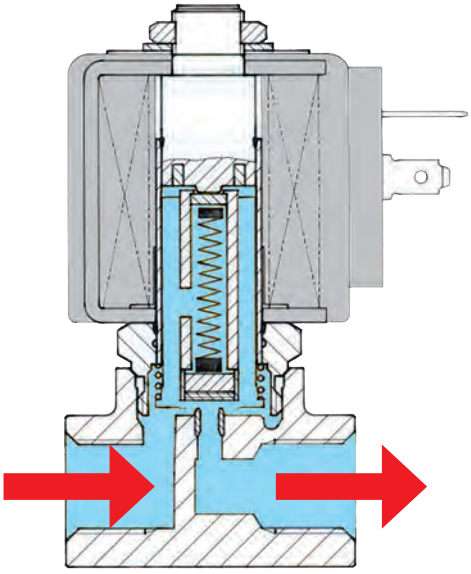
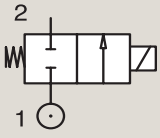


Example:

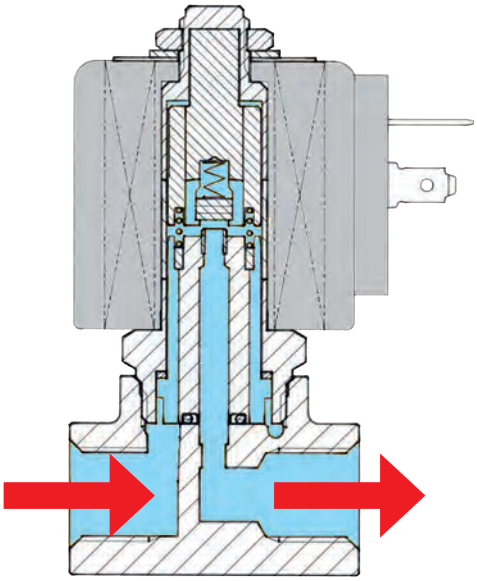
- 121 Series



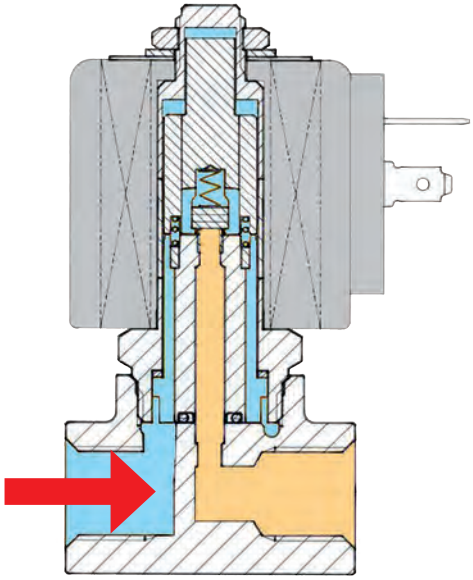
NORMALLY OPEN VALVE

Normally Open Valve

De-energised



Energised



Example:

- 122 Series