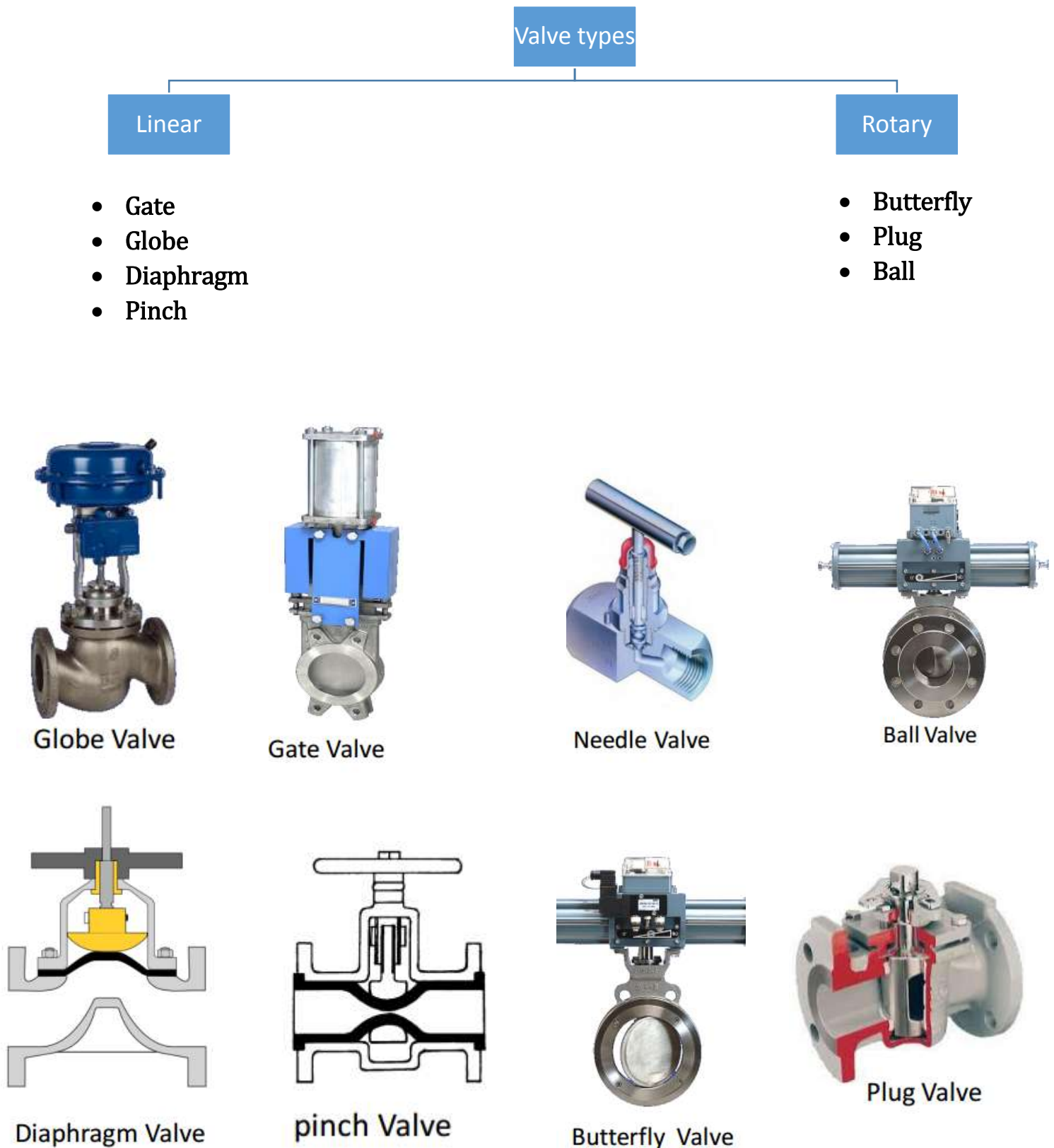


⑦ Control Valves

control valve is simply a variable orifice that is used to regulate the flow of a process fluid according to the requirements of the process.



Control Valve Accessories

Actuator

- Manual
- Diaphragm
- Electro-Hydraulic
- Motorized
- Piston

Positioner

Pneumatic

Electro pneumatic

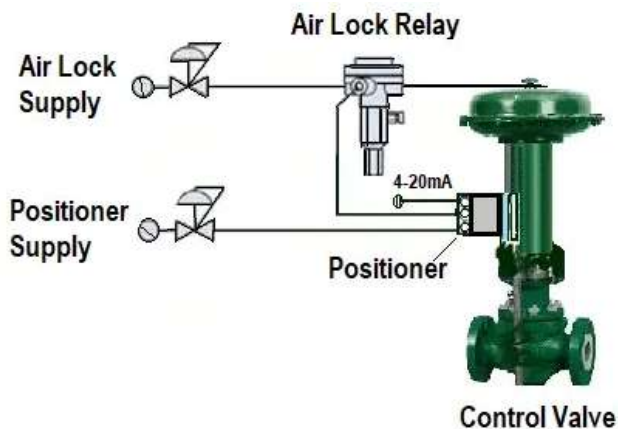
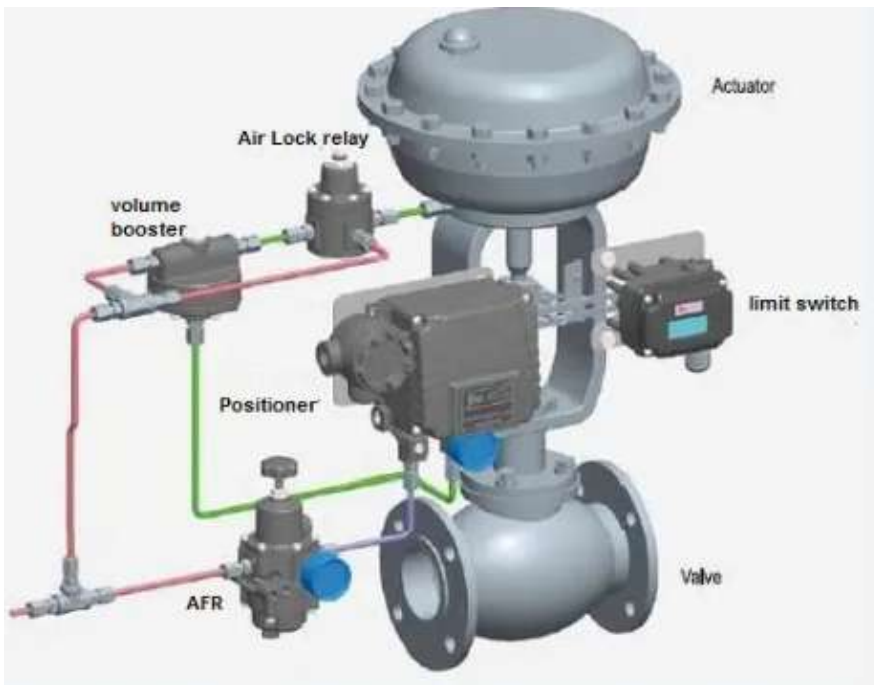
Digital valve controller

Regulator

Solenoid Valve

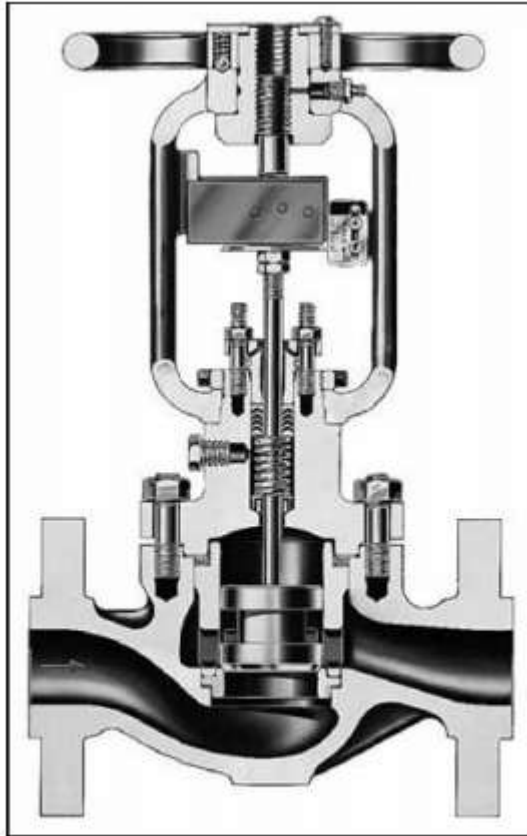
- Direct acting
- Manual reset
- Pilot operated

- With Diaphragm Actuator
- With Piston Actuator
- With Rotary Actuator



Manual Actuators :

- Useful where automatic control is not required.
- For manual control of the process during maintenance or shutdown of the automatic system.
- Much less expensive.
- Are available in various sizes for both globe-style valves and rotary-shaft valves.



FOR SLIDING-STEM VALVES



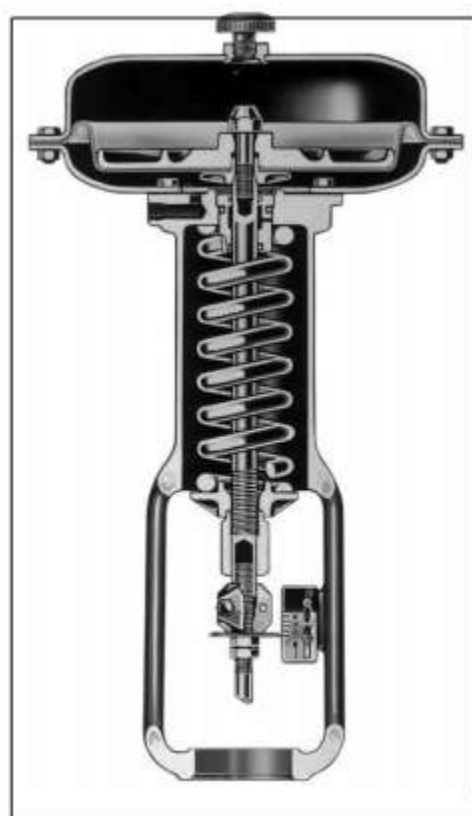
FOR ROTARY-SHAFT VALVES

Diaphragm Actuators:

- Uses input signal from the I/P converter , Positioner or other source like Manual Loader.
- Advantages :
 - Dependable
 - Simple
 - Economical
- Types :
 - Direct Acting
 - Reverse Acting



DIRECT-ACTING



REVERSE-ACTING

Electro-Hydraulic Actuators:

- Disadvantages:

- More complex.
- More expensive than pneumatic Actuators.

Offers Advantages where :

- No air supply source is available.
- Low ambient temperature could freeze the condensed water in pneumatic supply.
- Large stem forces are needed.



Piston Actuators:

- Uses high pressure plant air up to 150 psig.
- Provides fast stroking speeds.

- Types :

- single acting

- Double acting

- Can produce work in only one direction.
- Uses Built-in spring.

- Limitation :

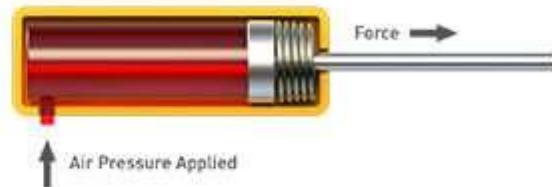
- Stroke length is limited.

- Applications :

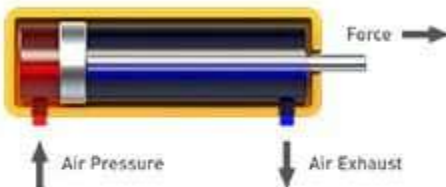
- Fail open or fail closed operation.

- No return spring.
- Able to work in both directions.
- Same two ports are used for supply and exhaust ports.
- Applications :
 - mostly used where max. force is required in both directions.

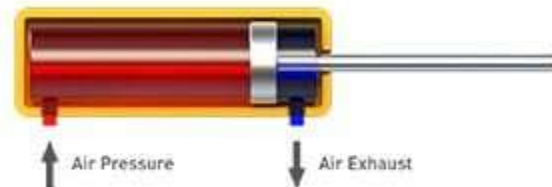
Single Acting Cylinder
Push Type



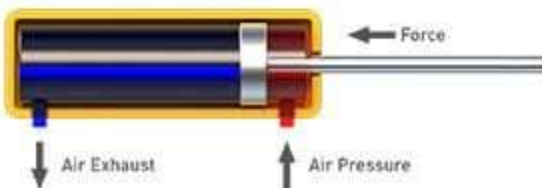
Double Acting Cylinder
Position 1



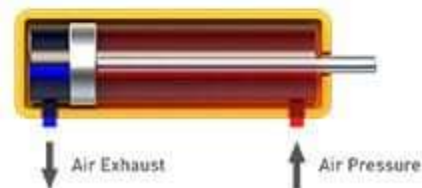
Position 2



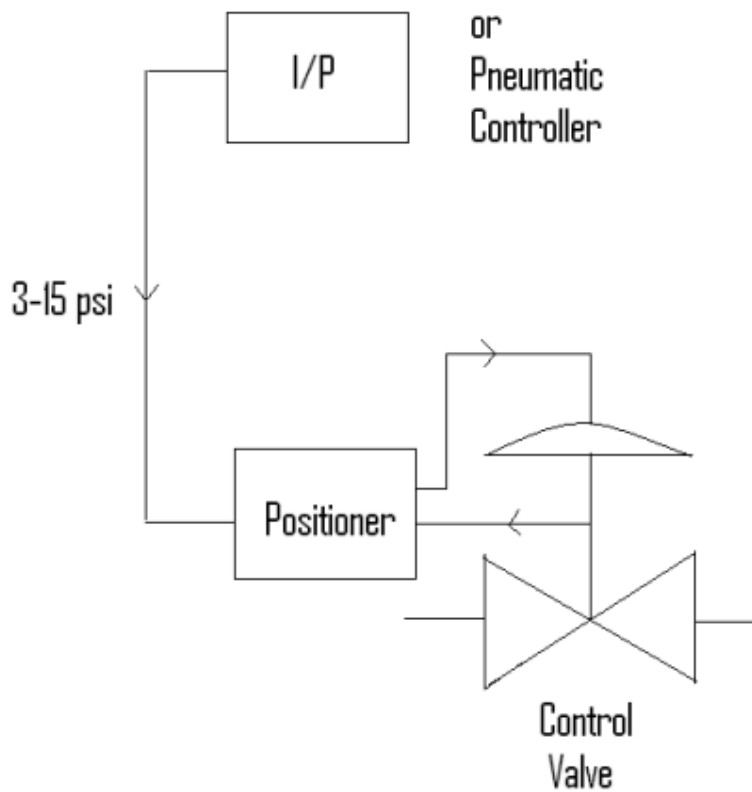
Position 3



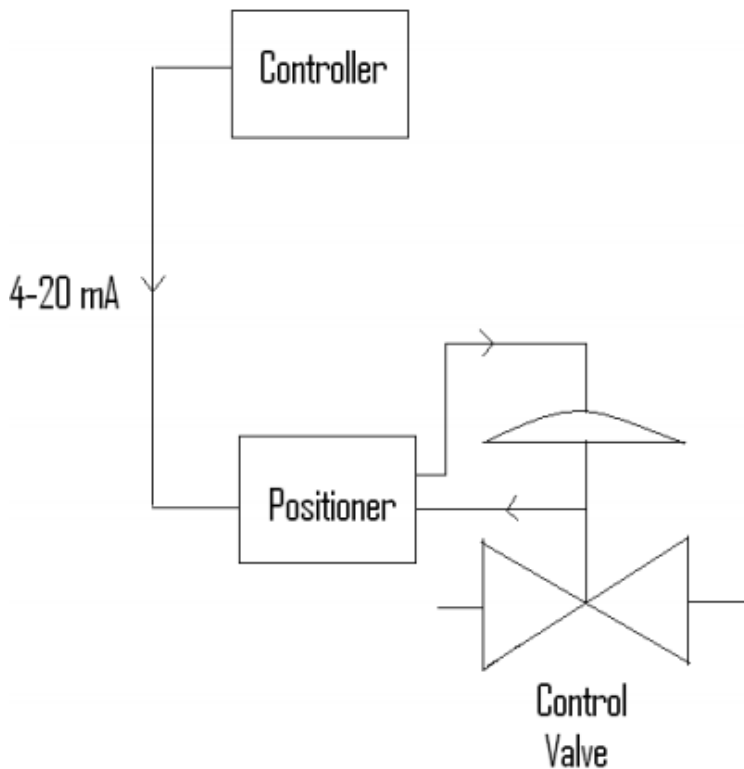
Position 4



Pneumatic Positioners :



Electro pneumatic Positioner:



Digital Valve controllers :

- Communicating (HART, Field-Bus) , Microprocessor based current-to-pneumatic instruments.
 - Features :
 - Easy access to information which is critical to process operation.
 - Avoids high cost of running separate power and signal wiring.



Digital valve controller mounted on Diaphragm Actuator



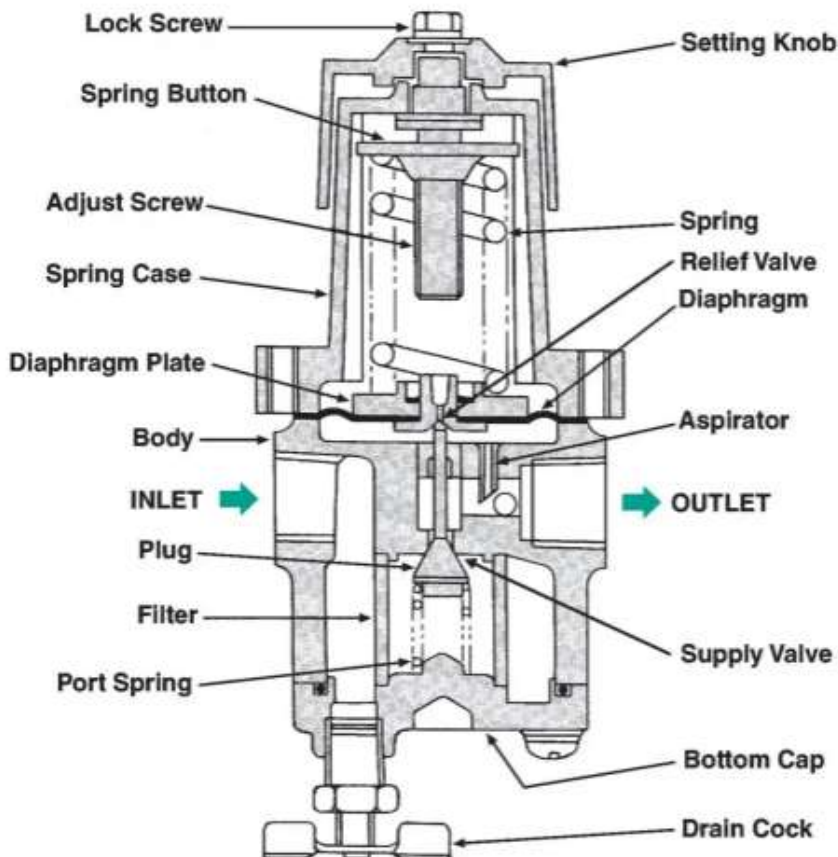
Digital valve controller mounted on Piston Actuator



Digital valve controller with Rotary Actuator

Air Filter Regulator:

A pressure regulator is an adjustable valve that is designed to automatically control the pressure downstream of the regulator.



Solenoid Valves:

- A solenoid valve is a combination of two basic functional units:
 1. Solenoid (electro-magnet) with its core (plunger).
 2. A valve containing an orifice in which a disc or plug is positioned to stop or allow flow.
- The valve is opened or closed by movement of the magnetic core which is drawn into a solenoid when the coil is energized.
- **Direct operated valve :**

In a direct operated valve the solenoid core is mechanically connected to the valve disc and directly opens / closes the orifice, dependent upon energization and de-energization of the solenoid.

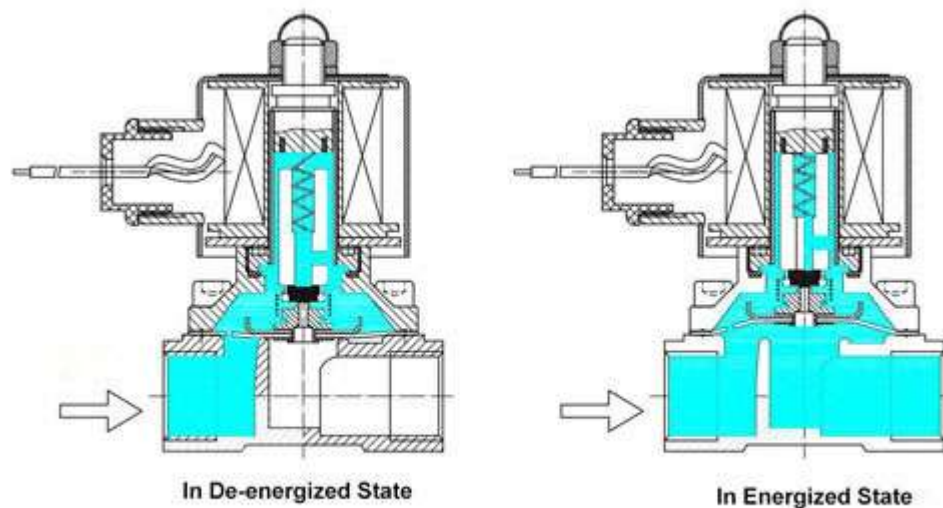


Figure - Direct Acting Solenoid Valve

- **Pilot operated valve :**

The pilot-operated solenoid valve is usually used in big diameter and high pressure occasions. As the valve is open, the minimum pressure of the solenoid valve is not allowed to be lower than 0.05MPa. So, the pilot pressure is required, otherwise it cannot be opened. In addition, the flow capability of the pilot-operated solenoid valve is bigger than that of the direct acting solenoid valve. It has a relatively higher requirement to the purity of the compressed air. Instead, the directly operated solenoid valve has no such high requirement.

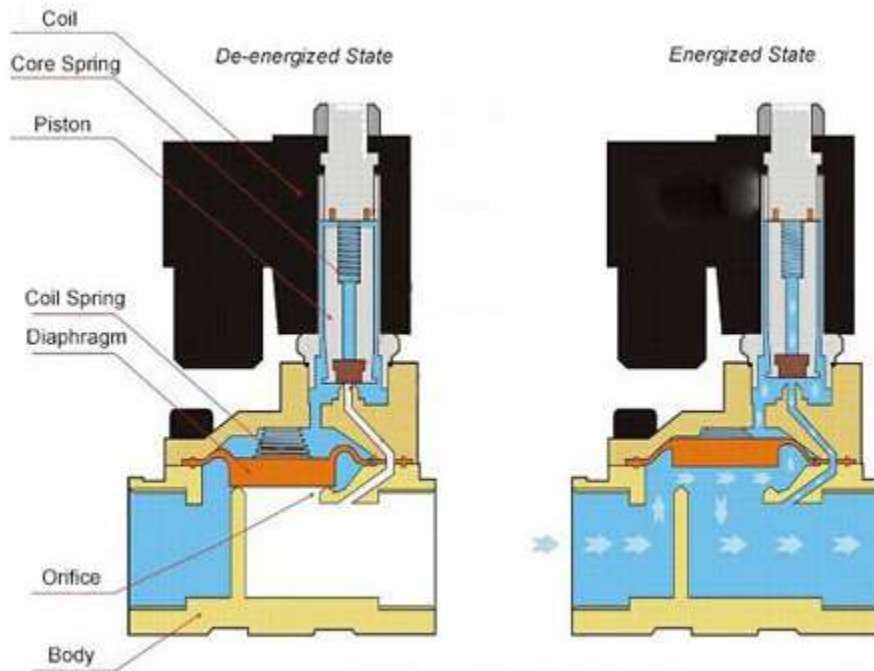


Figure - Pilot Operated Solenoid Valve

Differences between pilot-operated and direct acting solenoid valve:

- **Pressure tolerance**
The pilot-operated solenoid valve has a higher tolerance of liquid pressure than the direct acting solenoid valve.
- **Response time**
The starting speed of the direct acting solenoid valve is quicker than that of the directly operated type. It is mostly used for the occasion of fast connection and disconnection. Because the small valve opens in the first and the main valve opens later when the pilot-operated solenoid valve is supplied with power. Instead, the directly operated solenoid valve is opened with its main valve directly. When the pilot-operated solenoid valve is energized, the small valve opens at the first and the main valve opens later. However, as to the direct acting solenoid valve, the main solenoid opens directly.
- **Flow capacity**
The flow capacity of the pilot-operated solenoid valve is bigger than that of the directly operated type. Generally, the CV value can reach 3 or above. However, the directly operated solenoid valve usually has the CV value of below 1.
- **Power and consumption**
The power and consumption of the directly operated solenoid valve are higher than that of the pilot-operated type.
- **Purity of the medium**
The pilot-operated solenoid valve has a relatively high requirement to the purity of the flowing medium. However, the direct acting type has no such strict requirement.

Types of Valves :

2/2 (2-Way Valves)

- It has one inlet and one outlet pipe connection.

- **Normally Closed:**

Valve is closed when deenergized and open when energized.

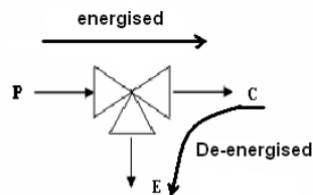
- **Normally Open :**

Valve is closed when energized and open when de-energized.

3/2 (3-WayValves)

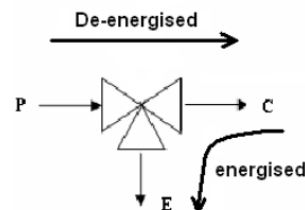
- Three pipe connections and two orifices Used to alternately apply pressure to and exhaust from diaphragm.

- **Normally closed**



Normally closed

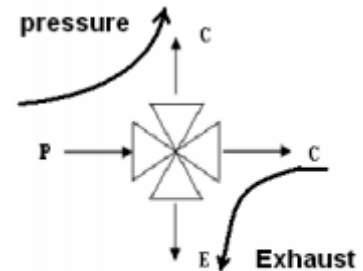
- **Normally Open**



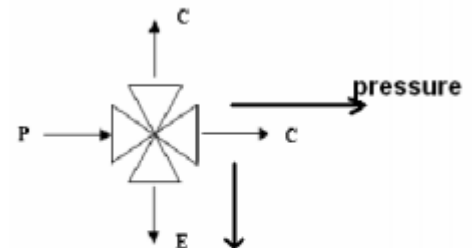
Normally open

4/2 and 5/2 (4-Way Valves)

- Four or five pipe connections one pressure, two cylinder and one or two exhausts.

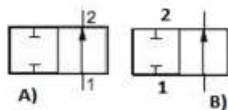


Energised



Exhaust

De-energised



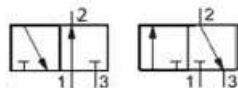
Number of Ports

Number of Positions

2/2 – Way directional control valve

A) Normally Open

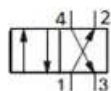
B) Normally Closed



3/2 – Way directional control valve

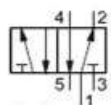
A) Normally Open

B) Normally Closed



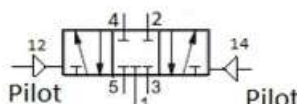
4/2 – Way directional control valve

Flow from 1 → 2 and from 4 → 3



5/2 – Way directional control valve

Flow from 1 → 2 and von 4 → 5



5/3 – Way directional control valve

Pilot Operated

Pressure Supply	1	P
Working Ports	2, 4	A, B
Exhaust Ports	5, 3	R, S
Ports Pilot Ports	12, 13	X, Y

Air Lock Relay :

Air Lock valve is used to hold the operating air inside actuator chamber to not make any disturbance in valve opening when any Pneumatic air supply or source failure occurs in the air operated process control line.

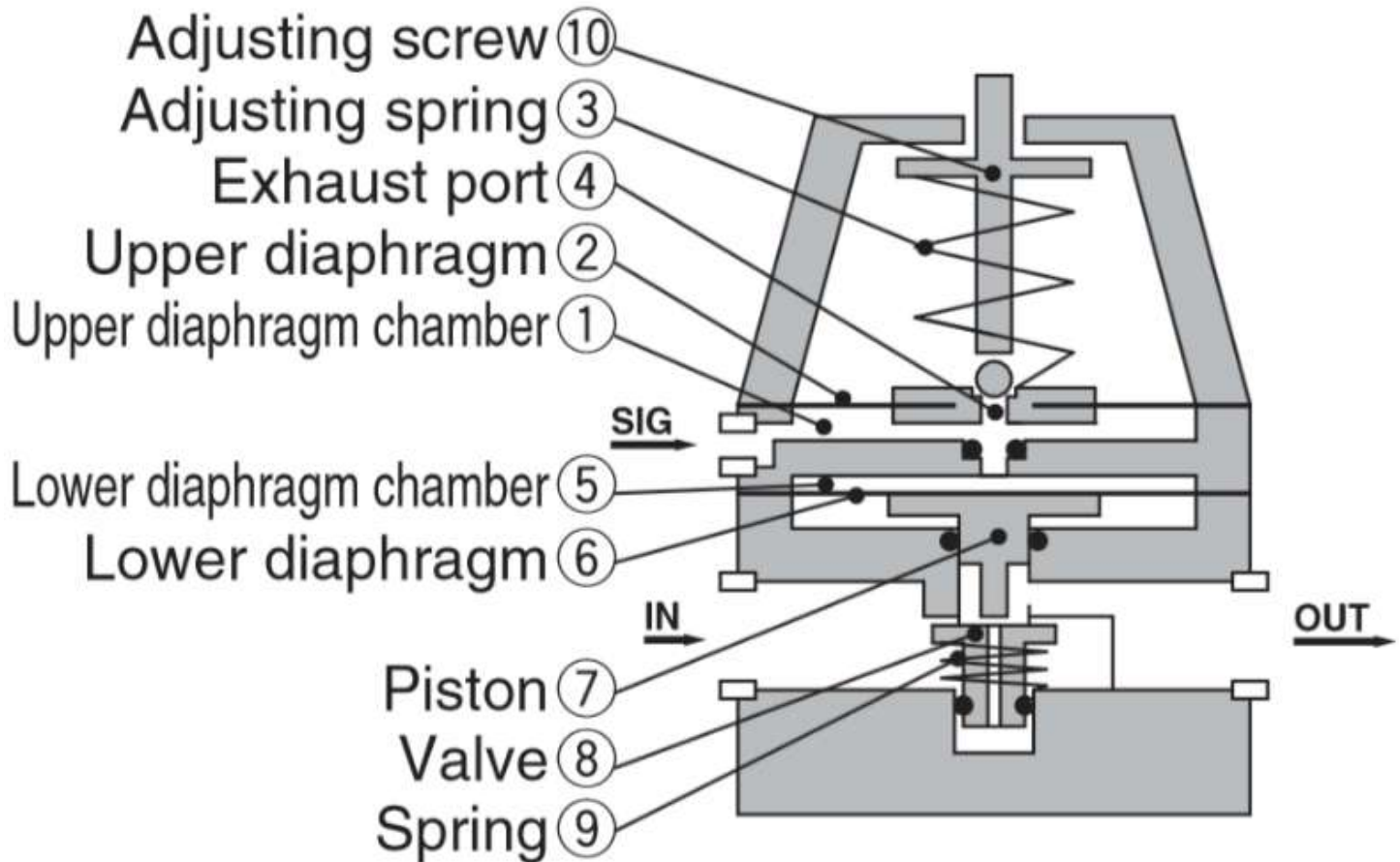


Figure- Air Lock Relay/ Valve Inside View

