PNEUMATICS

Pneumatic System Applications



Fig: Pneumatic auto drilling machine



Fig: Pneumatic sowing machine



Fig: Pneumatic operated door



Fig: Portable pneumatic punching machine

Application of Pneumatics

It is put to a wide variety of uses such as dentists drills, automatic doors, brakes on lorries and hammer drills used at roadwork's.

- Dentist drills
- Roadwork drills
- In Academic Projects
- Air nail gun
- Jackhammer
- Paint gun (sprayer)

In school projects





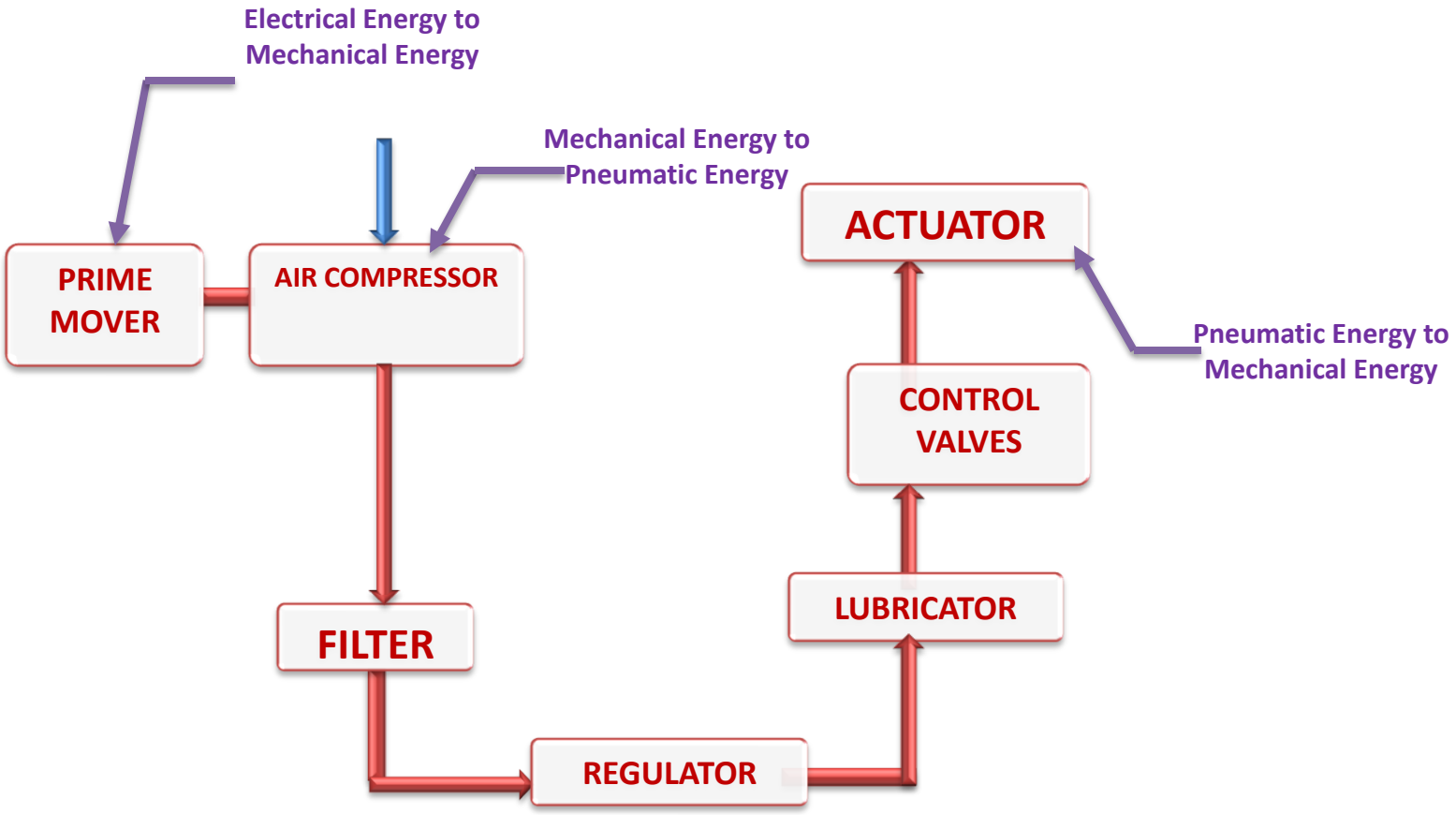
Roadwork drills



Dentist drills

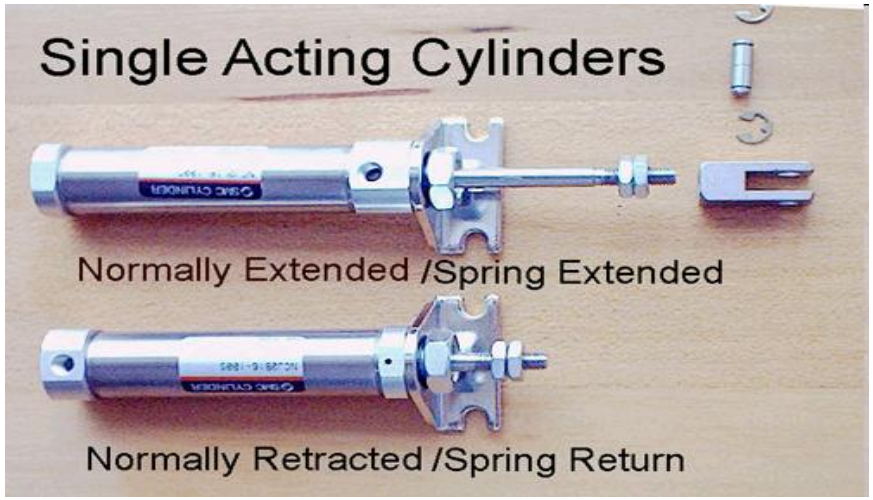


Pneumatic System



Actuators

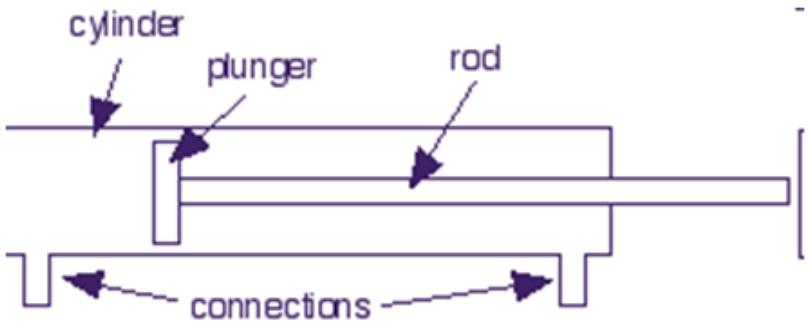
1. Single acting



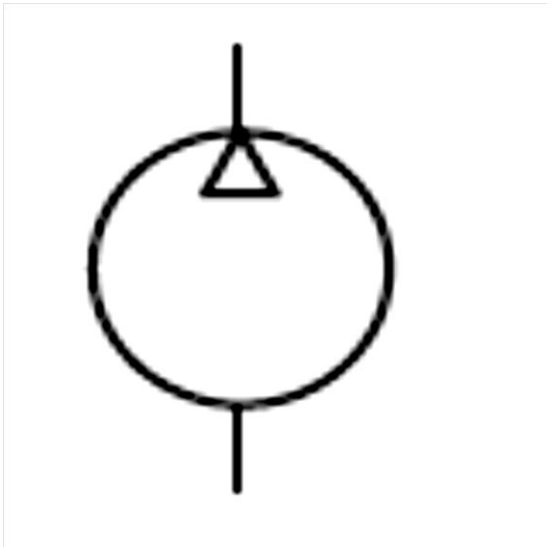


2. Double acting



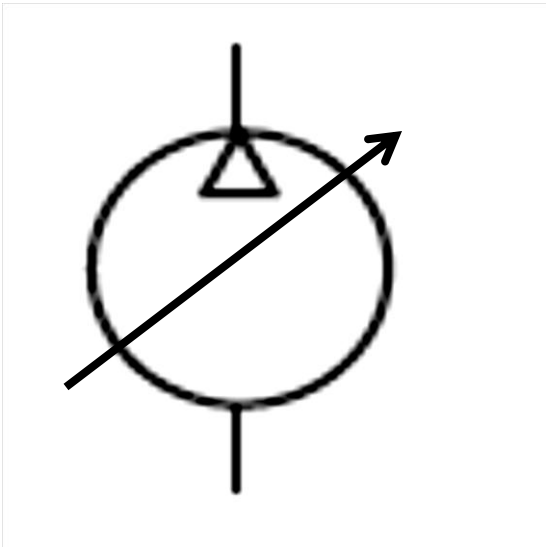






Compressors

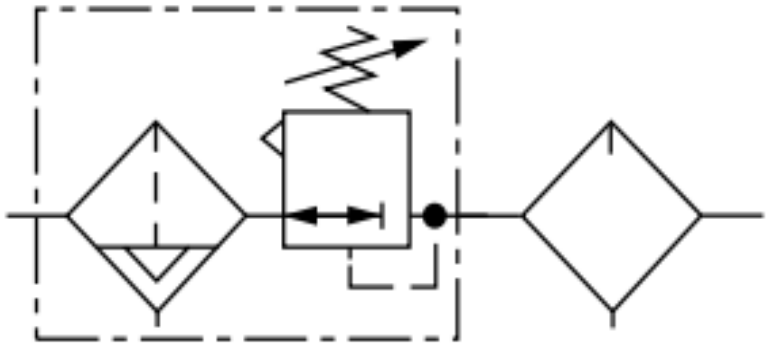


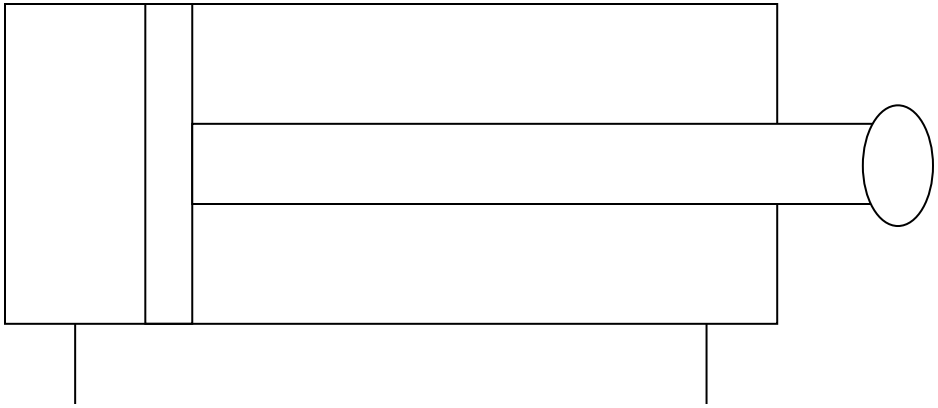




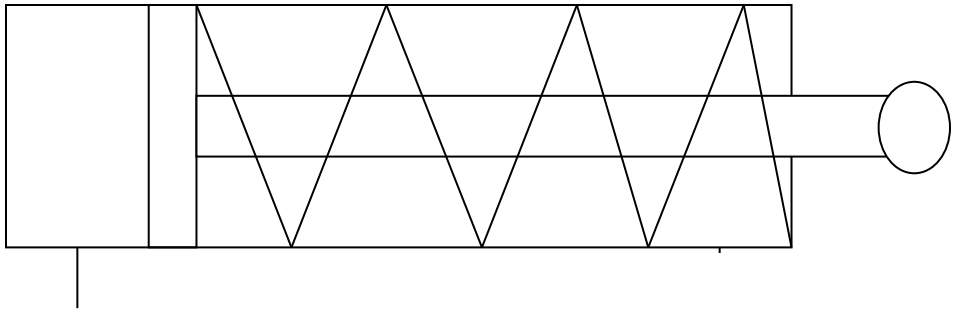


FLR Unit





Double Acting Cylinder



Single Acting Cylinder

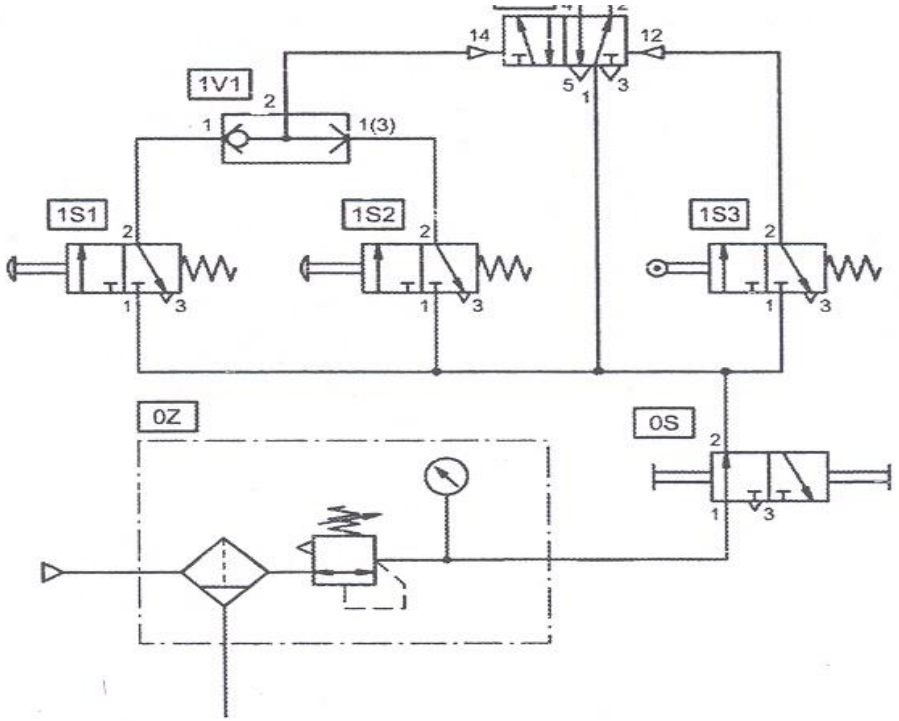
Signal Flow in Pneumatic System

Control element

Processing element

Input elements

Supply elements



Symbols in Pneumatics

Main Line



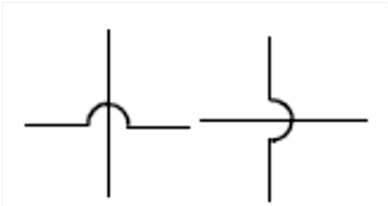
Pilot Line



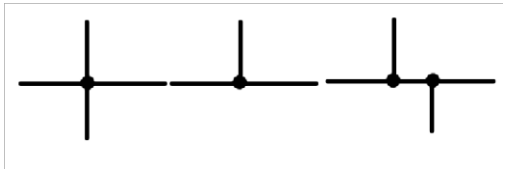
Drain Line



Lines Crossing



Lines Joining



Variable

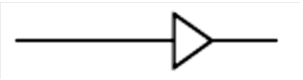




Temperature



Pneumatic



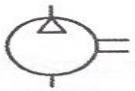
Hydraulic



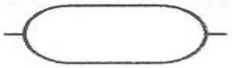
Symbols in Pneumatics

Supply

– Compressor with fixed capacity



– Air reservoir with T junction



– Pressure source



Service equipment

– Filter — Separation and filtration of particles



– Water separator, — Manually operated



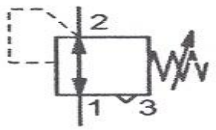
– Water separator, automatic



– Lubricator — Metered quantities of oil passed to the air stream

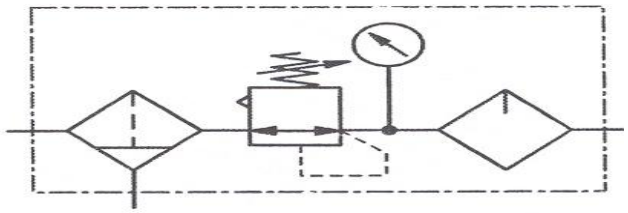


– Pressure regulator — Relieving type - vent hole for excess upstream pressure - adjustable

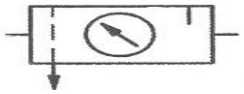


Combined symbols

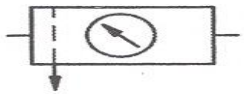
– Air service unit — Filter, Regulator, Gauge, Lubricator



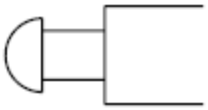
Simplified air service unit



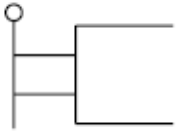
Simplified air service unit without lubricator



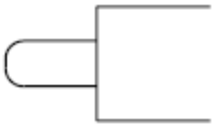
Method of Actuations



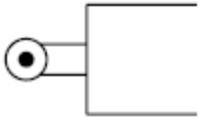
Manual control button



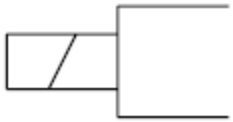
Manual control lever



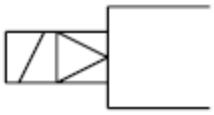
Manual control plunger



Manual control roller



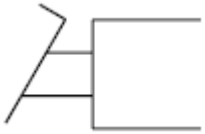
Solenoid with one effective winding



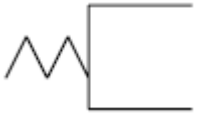
Combined control by solenoid & pilot



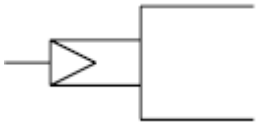
Pneumatic indicator



Manual control pedal



Manual control spring

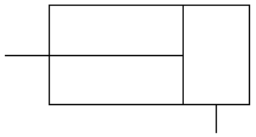


Pressure control

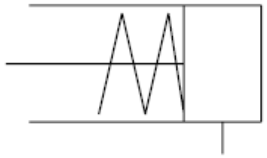


Silencer

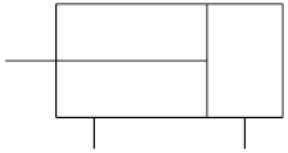
Actuators



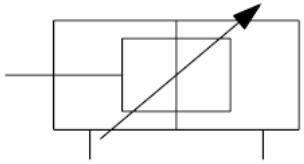
Single acting cylinder, return stroke by external force



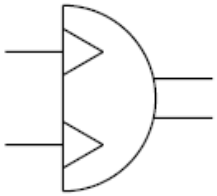
Single acting cylinder, spring return



Double acting cylinder



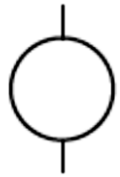
Double acting cylinder, cushioning adjustable at both ends



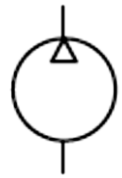
Semi rotary actuator, double acting



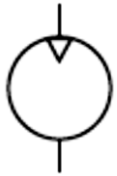
Rotary Devices



Rotary Device with ports



Air Compressor



Pneumatic Motor



Electric Motor

Control Valves

1. Non- return Valves (NRV)
2. Flow Control Valves (FCV)
3. Pressure Control Valves (PCV)
4. Directional Control Valves (DCV)

Non-return Valves

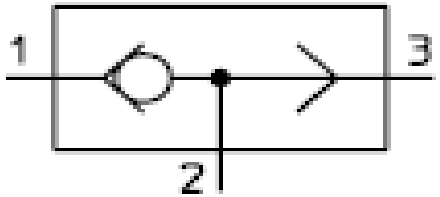
Check valve



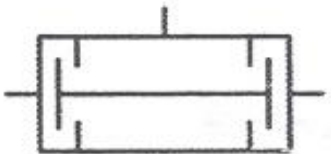
Spring-loaded check valve



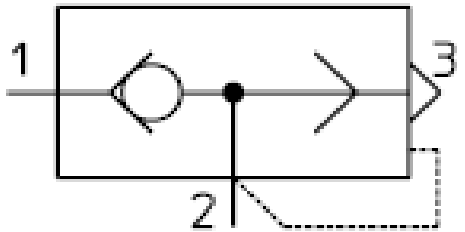
Shuttle valve



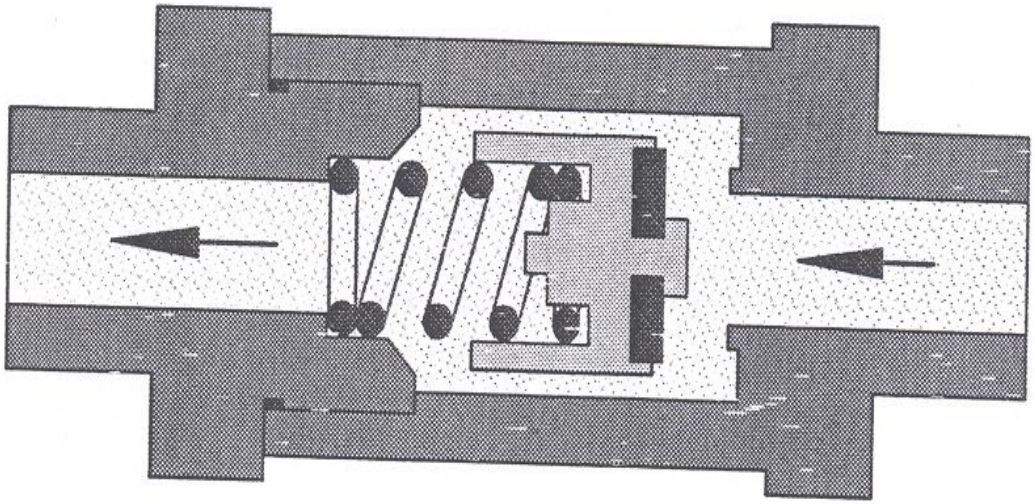
Dual-pressure valve

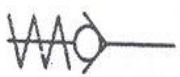


Quick exhaust valve

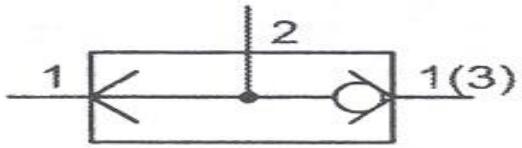


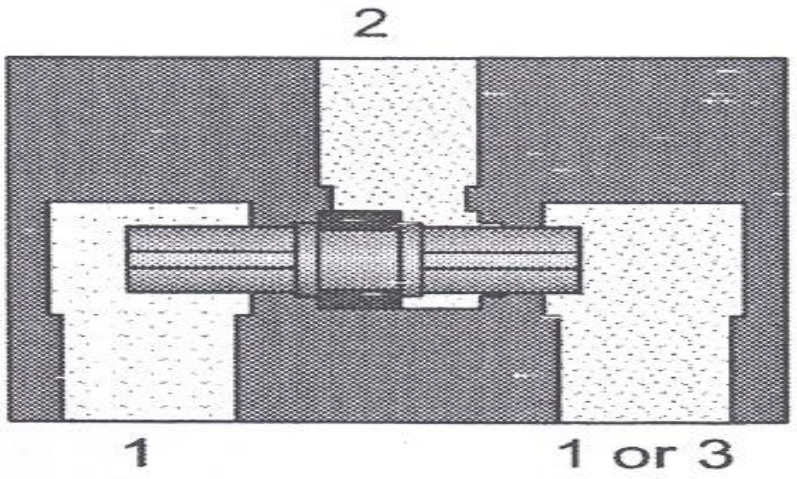
Check Valve

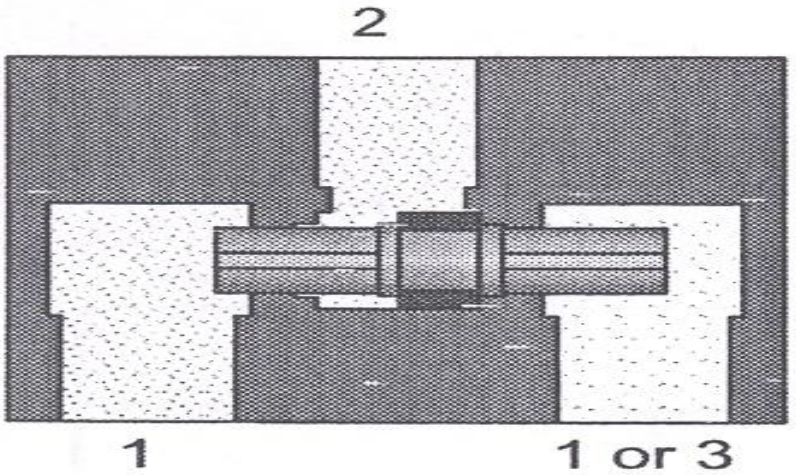




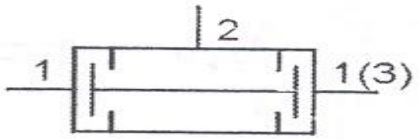
Shuttle Valve: Logic OR function

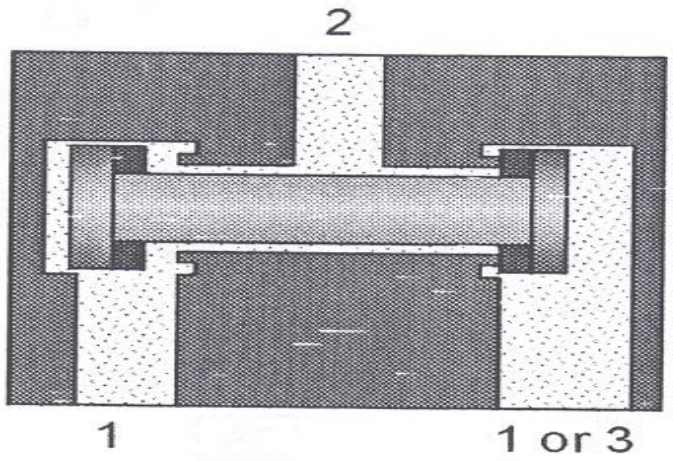


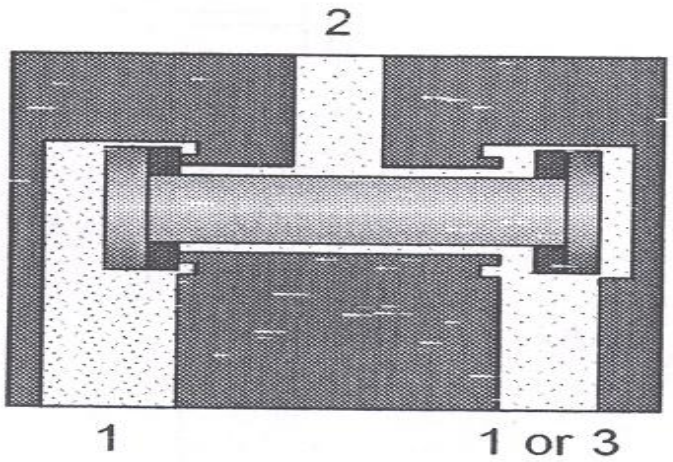




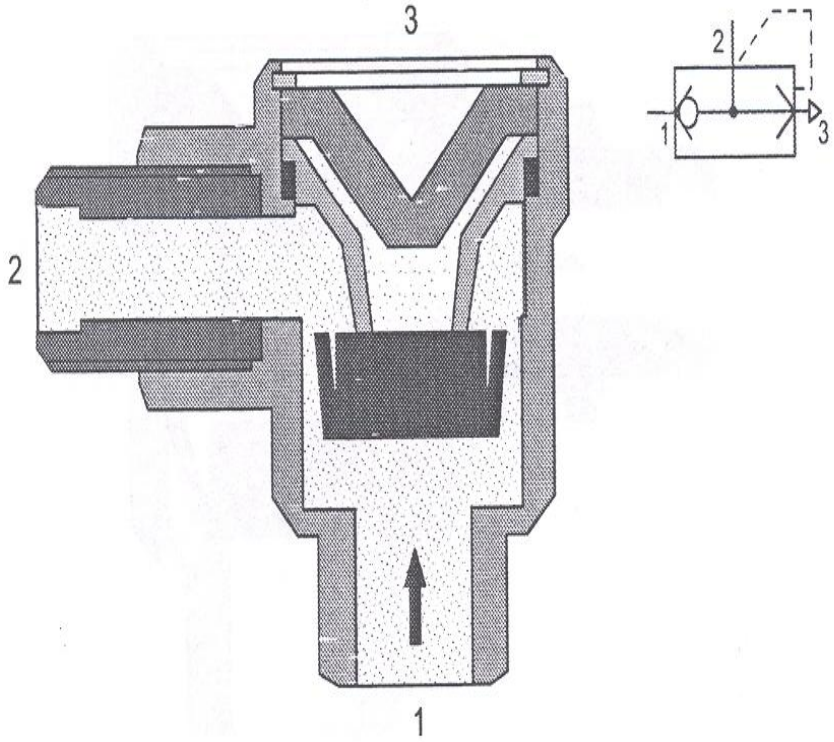
Dual Pressure Valve: logic AND function



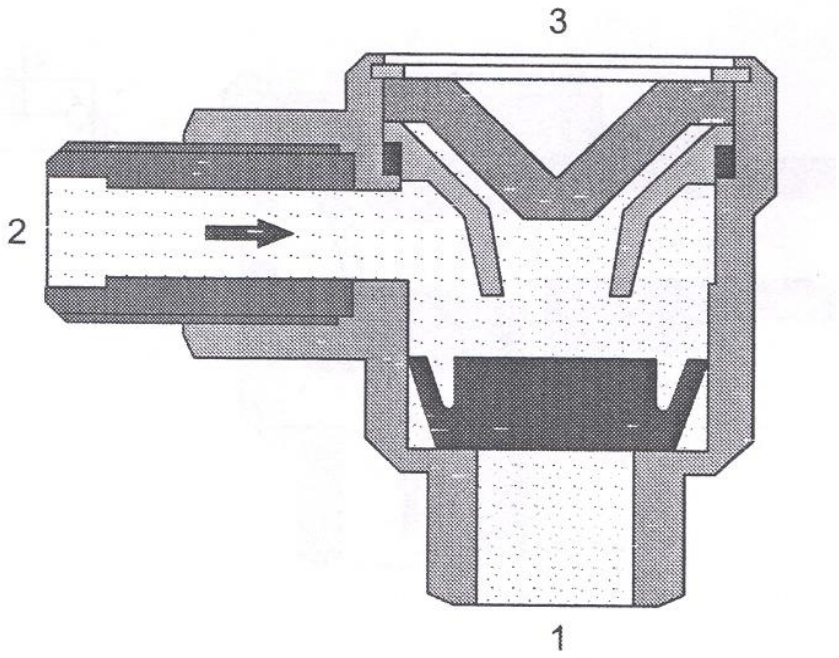




Quick exhaust Valve

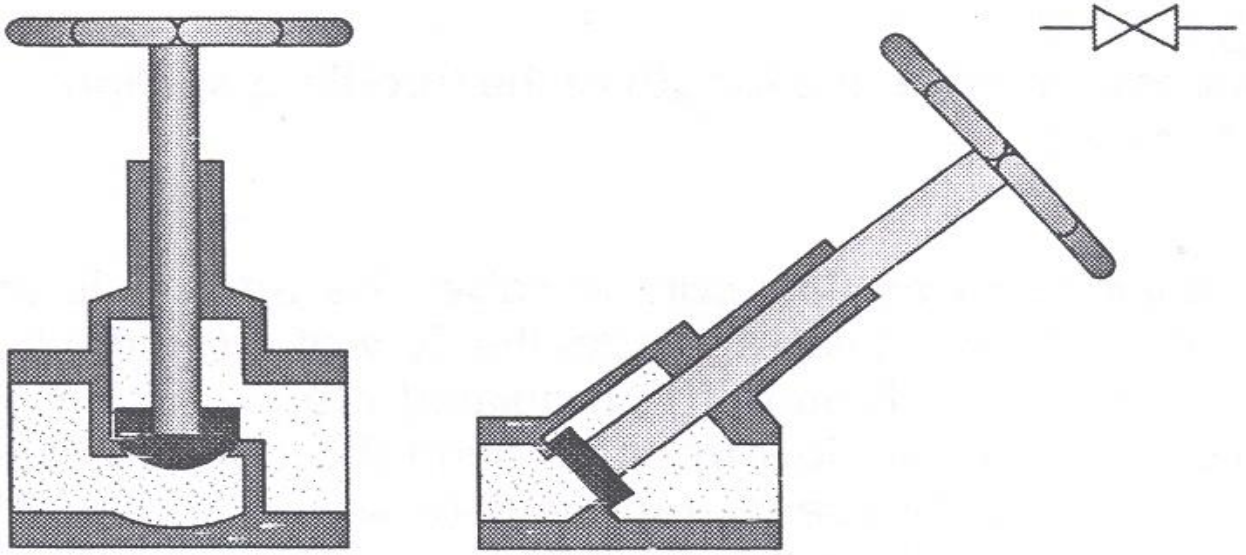


Flow from 1 to 2



Flow from 2 to 3

Stop Cock

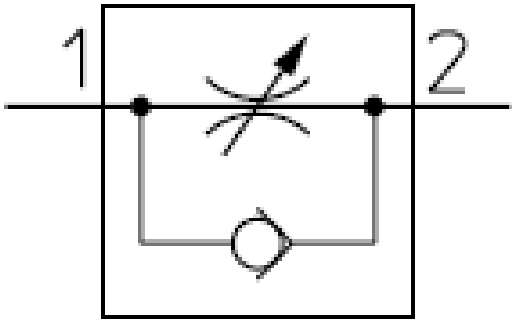


Flow Control Valves

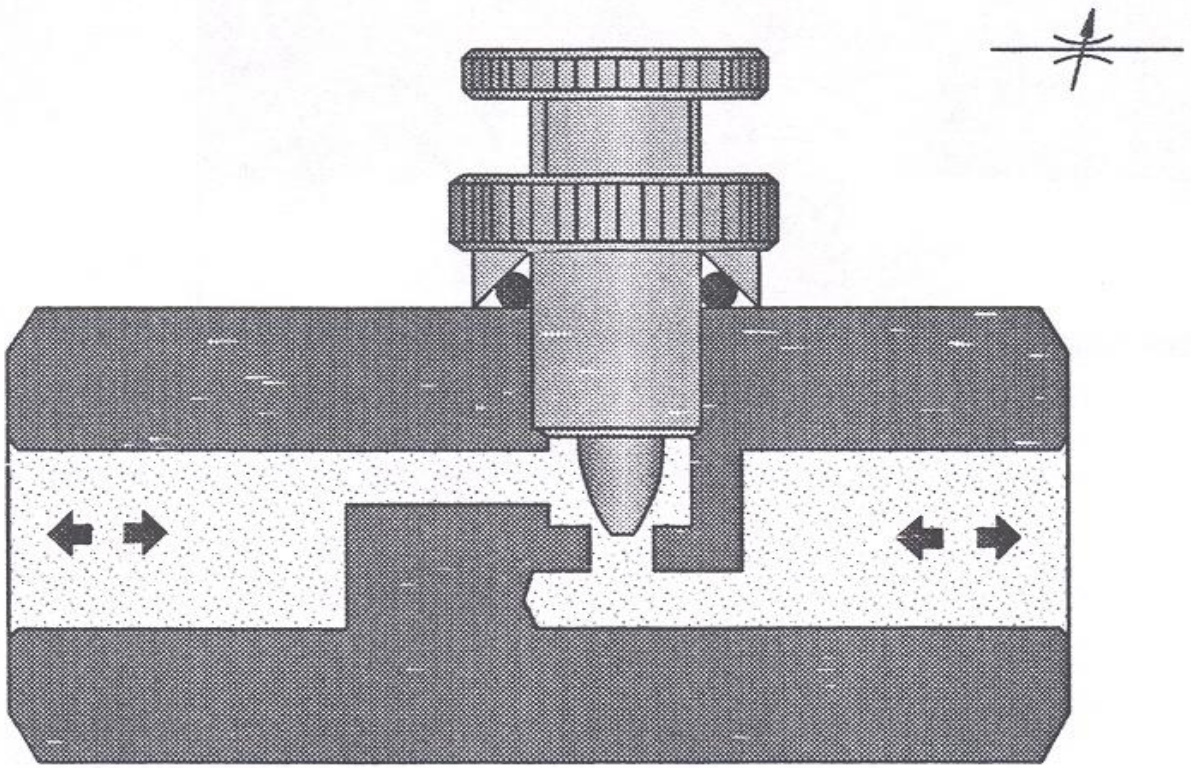
Flow control valve, adjustable



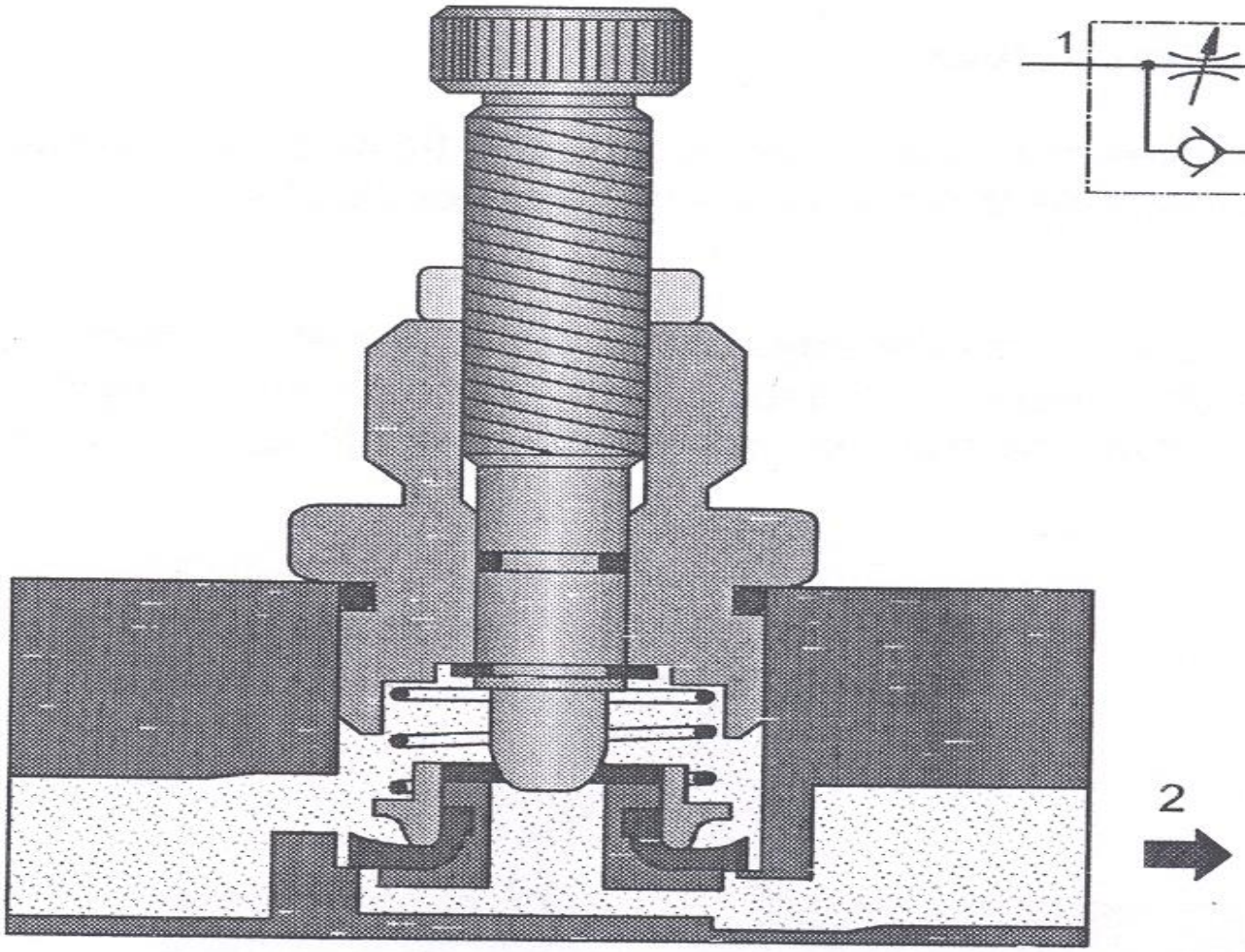
One-way flow control valve



Throttle Valve



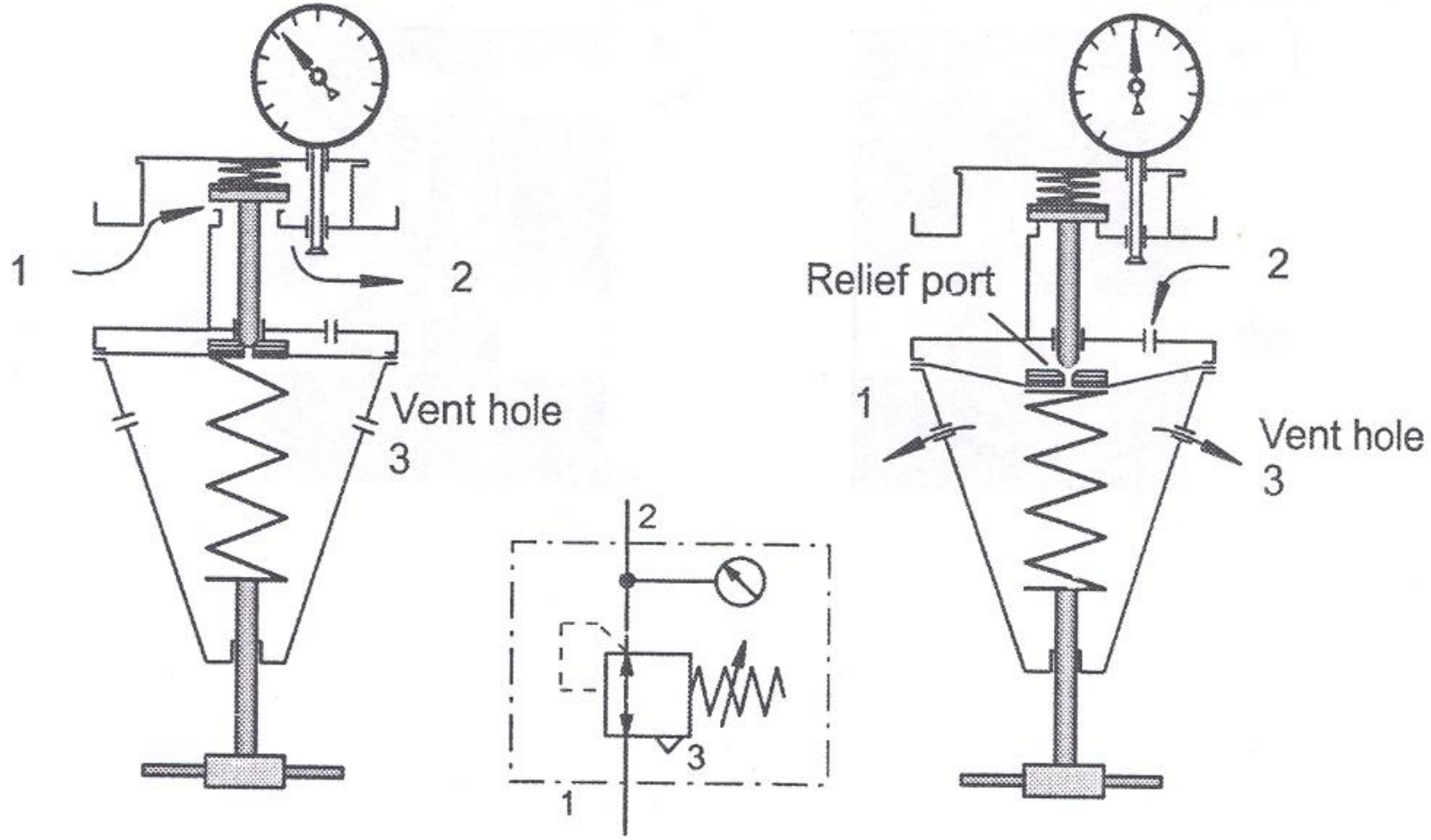
One-way Flow Control Valve



Pressure Control Valves (PCV)

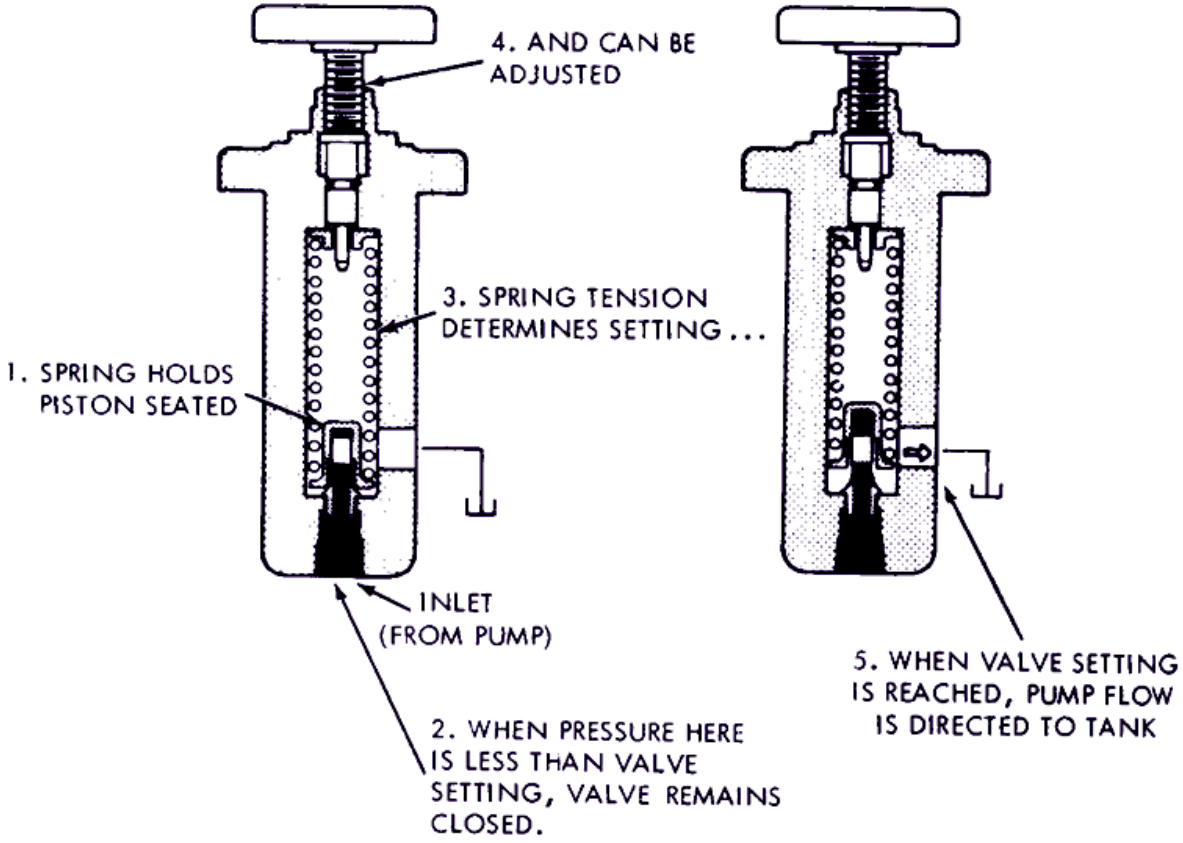
1. Pressure Regulating Valves
2. Pressure Limiting Valves (Relief Valve)
3. Pressure Sequencing Valves

Pressure Regulating Valve

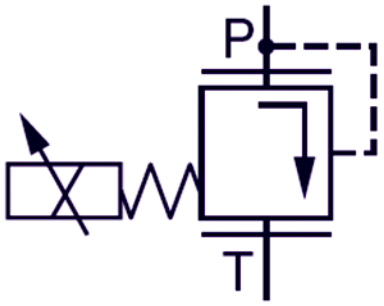


It is used on the up-stream side of the compressor to ensure the receiver pressure is limited for safety, so that the supply pressure to the system is set to the correct pressure.

Pressure relief valve

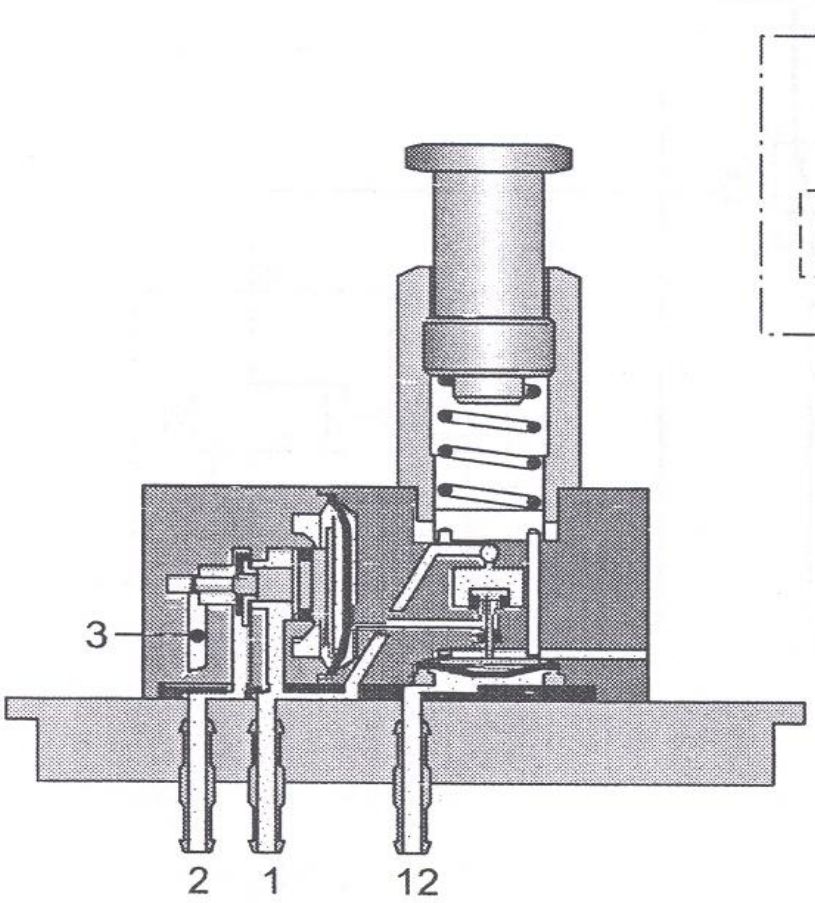


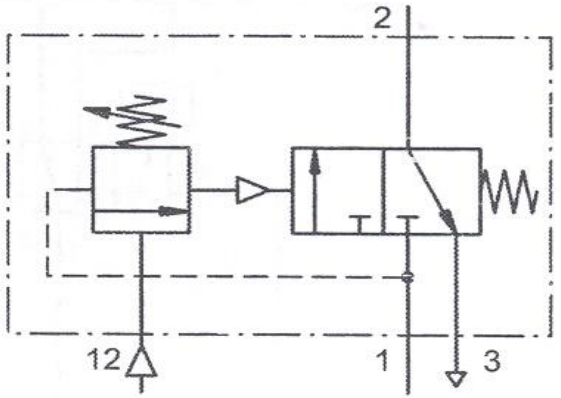
Symbol



- **It keeps the pressure constant irrespective of any pressure fluctuations in the system.**

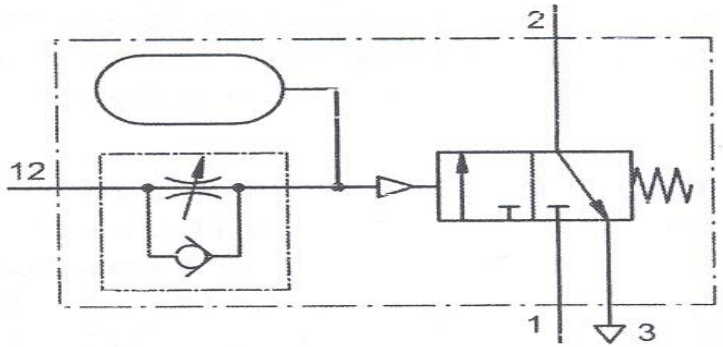
Pressure sequence Valve

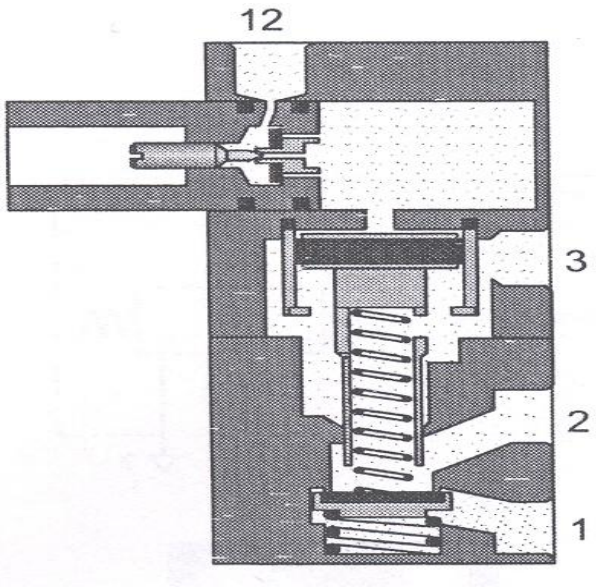


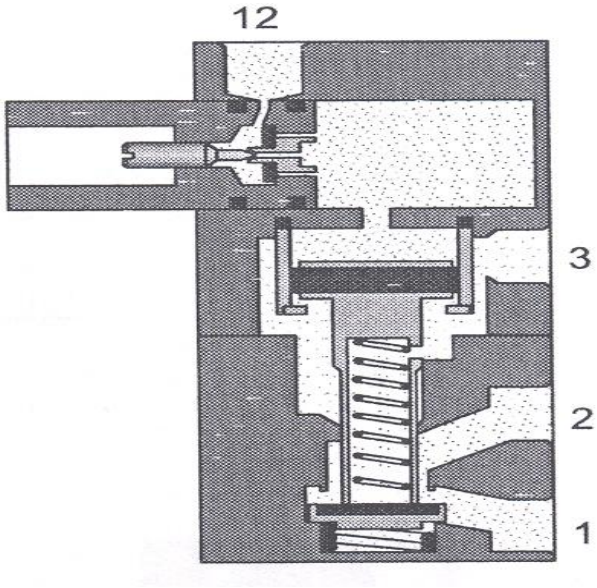


- This Valve is used if a pressure-dependent signal is required for the advancing of a control system.
- When the applied control signal reaches the set pressure, the DC valve incorporated at this point is actuated.
- Conversely, the valve reverses if the control signal falls below the set pressure.

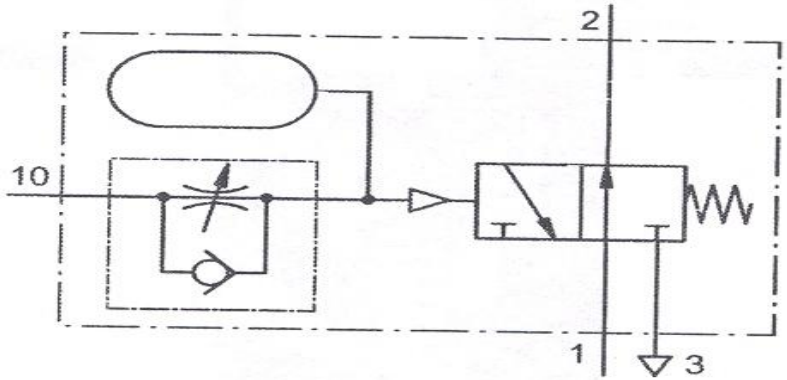
Time delay Valve (normally closed)
(ON Delay Timer)

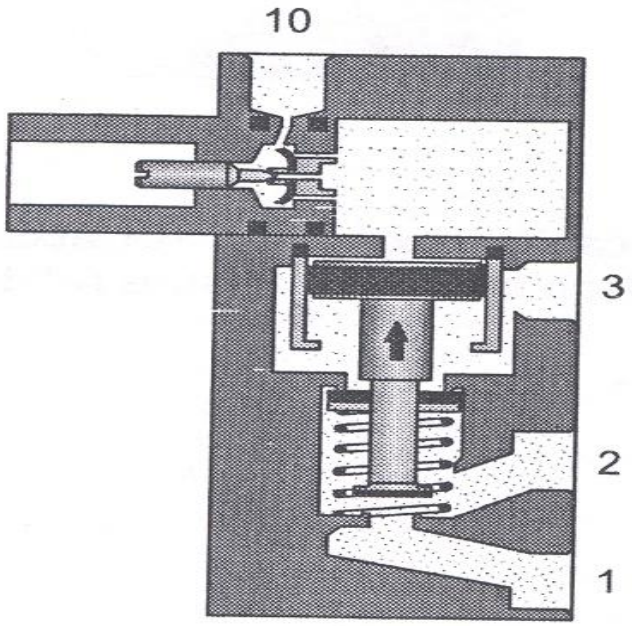


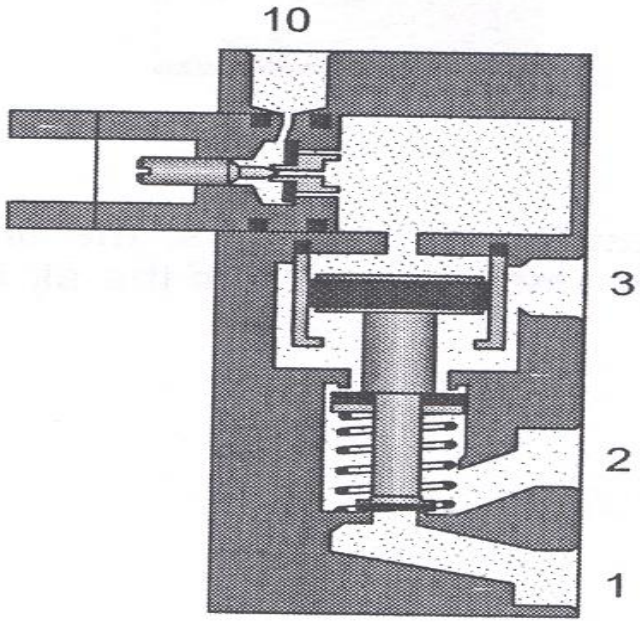




Time delay Valve: normally open
(OFF Delay Timer)



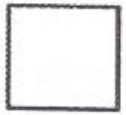




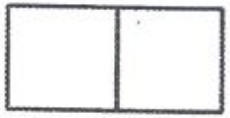
Directional Control Valves

Directional Control Valves Symbols

Valve switching positions
are represented as squares



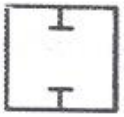
The number of squares shows how many
switching positions the valve has



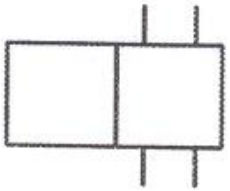
Lines indicate flow paths,
arrows shows the direction of flow



Shut off positions are identified in the boxes
by lines drawn at right angles

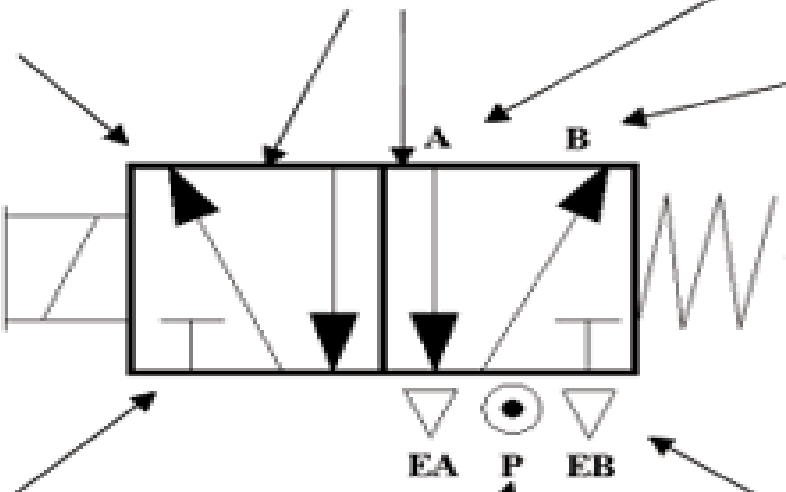


The connections (inlet and outlet ports) are shown
by lines on the outside of the box



Understanding Pneumatic Schematics

Symbols for Sliding Solenoid Valves



The Dark Rectangles indicate the possible positions or conditions of the valve. This valve has 5 ports and 2 possible positions or conditions, thus it is designated as a 5/2 valve.

Arrows indicate direction of gas flow through the valve and ports

In this position Port A Is being exhausted through exhaust port EA.

In this position Port B Is being pressurized through pressure supply port P

Actuator symbol indicates how the valve is controlled: Manual/Air Pilot or Electronic Solenoid Note: This is an electronic actuator symbol.

Return Spring indicates the Position of the solenoid valve at rest.

"T" Symbol indicates a closed (exhaust) valve.

The pressure or gas supply port is indicated by a circle and/or a P symbol.

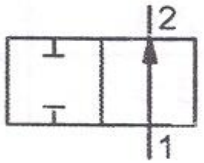
Triangle Symbols indicate output or exhaust port B

Directional Control Valves (Ports & Positions)

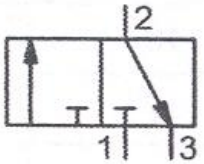
Number of ports

Number of positions

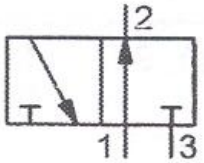
2/2 – Way directional control valve, normally open



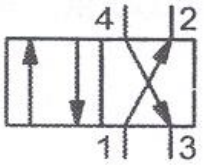
3/2 – Way directional control valve, normally closed



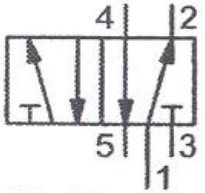
3/2 – Way directional control valve, normally open



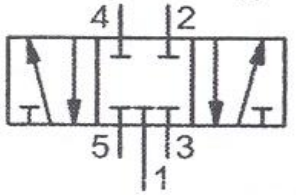
4/2 – Way directional control valve
Flow from 1 → 2 and from 4 → 3

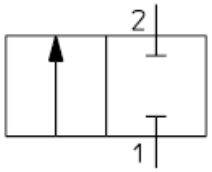


5/2 – Way directional control valve
Flow from 1 → 2 and von 4 → 5

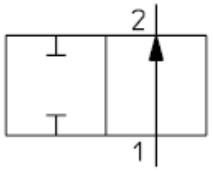


5/3 – Way directional control valve
Mid position closed

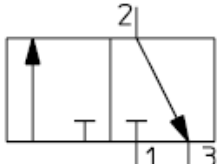




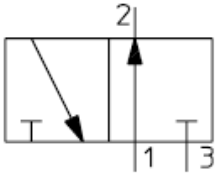
2/2 DCV,
Normally Closed



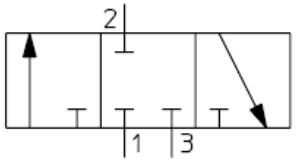
2/2 DCV,
Normally Open



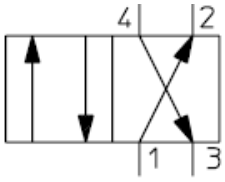
3/2 DCV,
Normally Closed



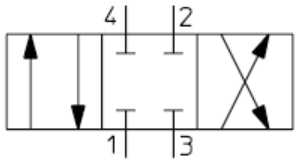
3/2 DCV,
Normally Open



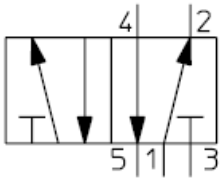
3/3 DCV, Closed
Neutral position



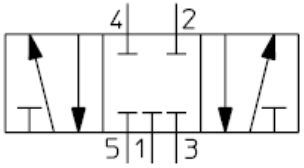
4/2 DCV,



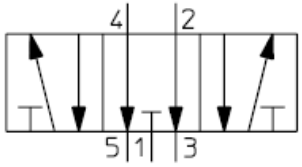
4/3 DCV, Closed
Neutral position



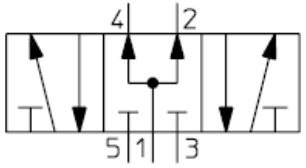
5/2 DCV,



5/3 DCV, Closed
Neutral position



5/3 DCV, Exhaust
Neutral position



5/3 DCV, Open
Neutral position

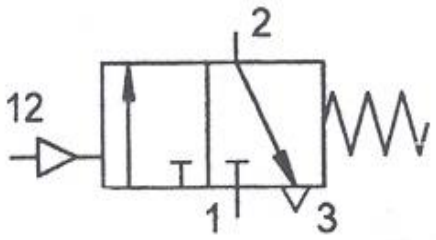
Working Lines

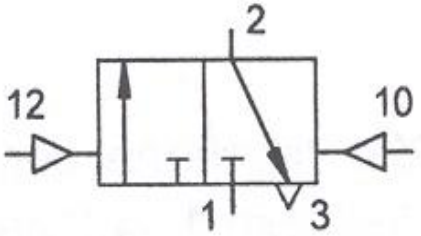
ISO 5599-3	Lettering System	Port or Connection
1	P	Pressure port
2, 4	A, B	Working lines
3, 5	R, S	Exhaust ports

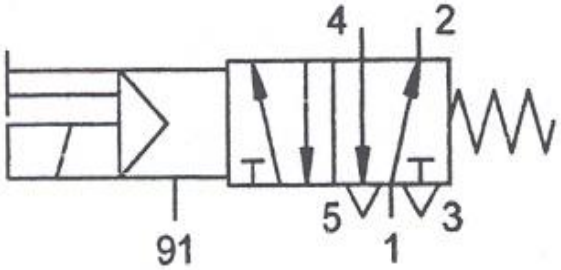
Pilot Lines

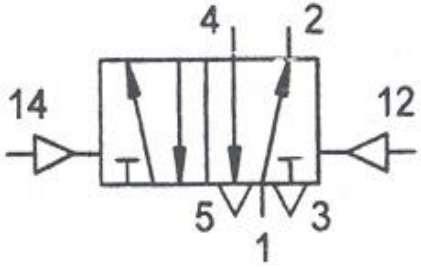
10	Z	Applied signal inhibits flow from port 1 to port 2
12	Y, Z	Applied signal connects port 1 to port 2
14	Z	Applied signal connects port 1 to port 4
81, 91	Pz	Auxiliary pilot air

Examples

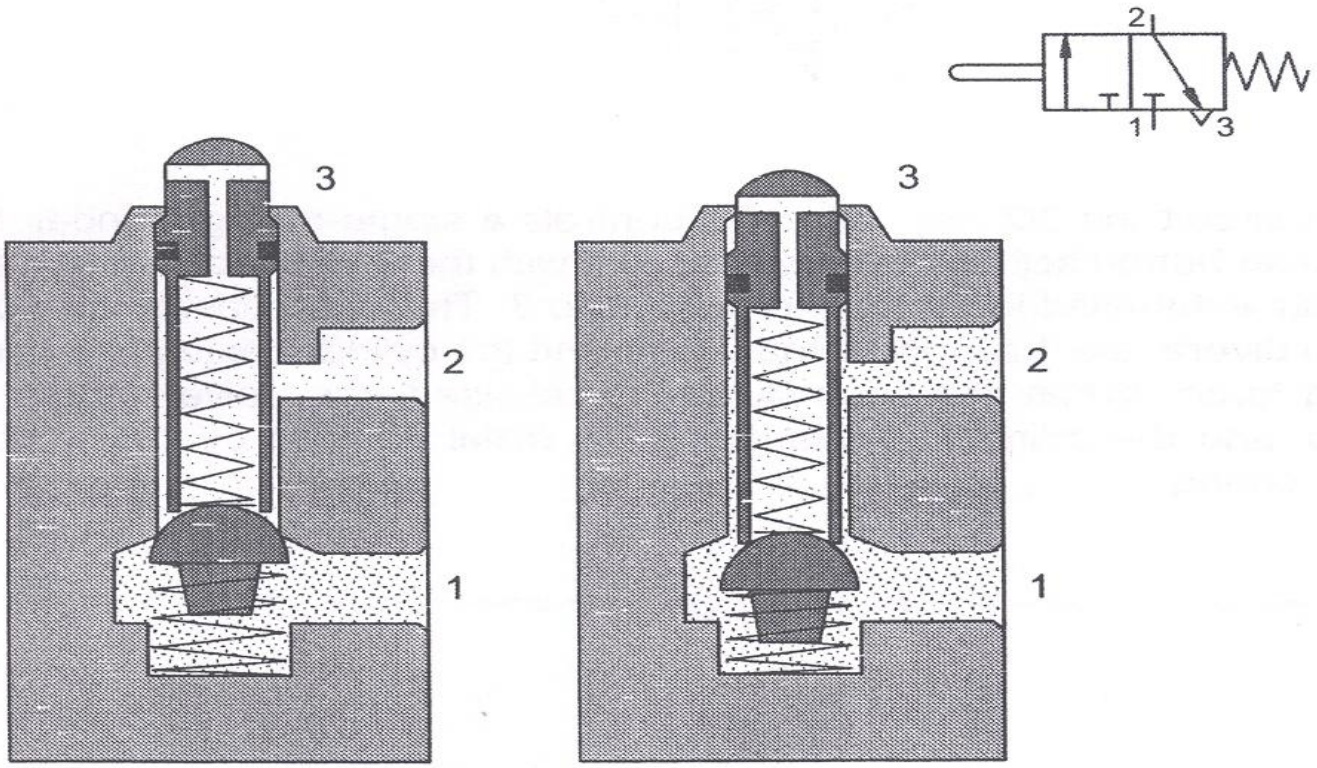




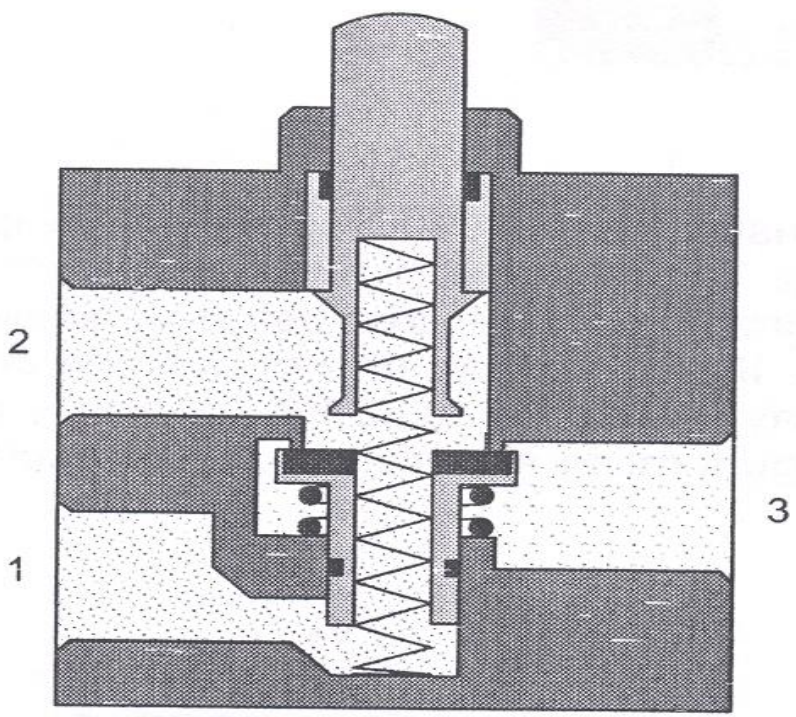


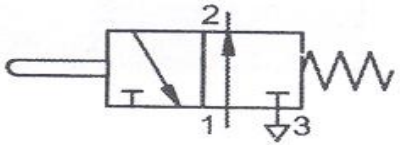


DIRECTIONAL CONTROL VALVES

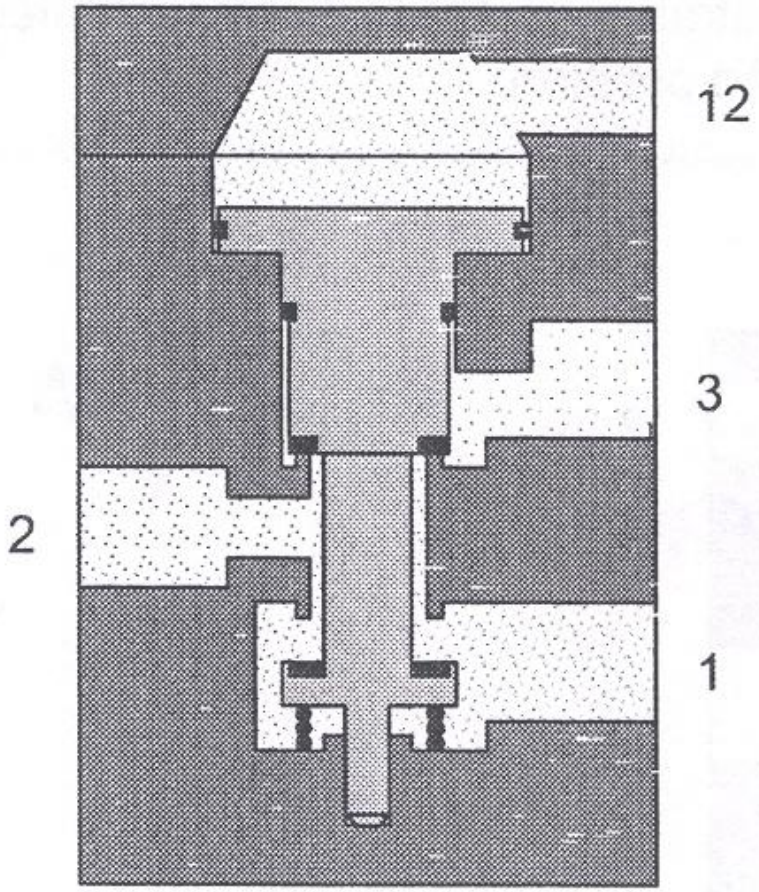


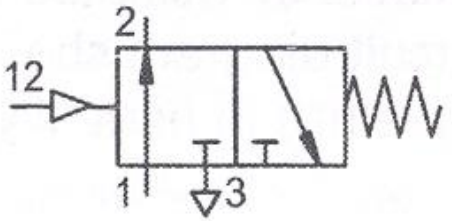
3/2 – WAY Valve, normally closed



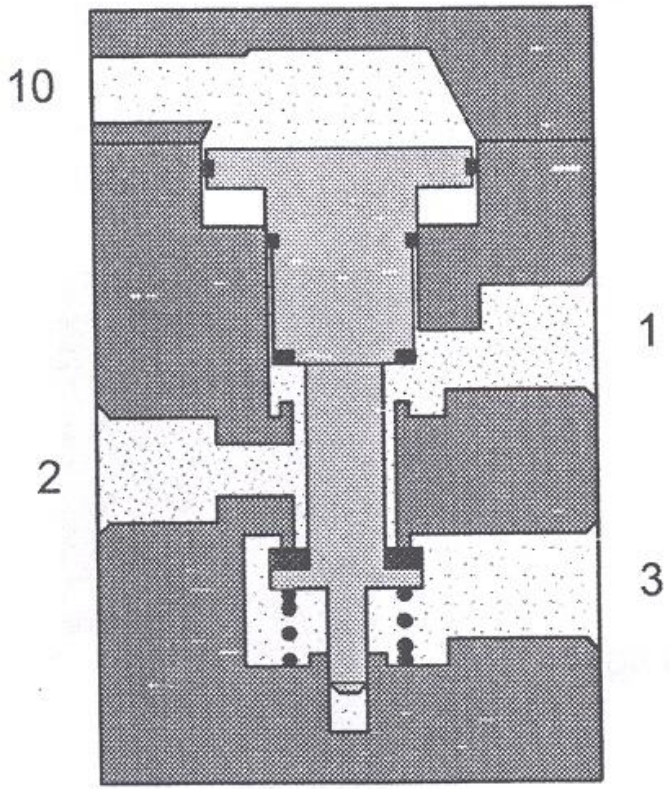


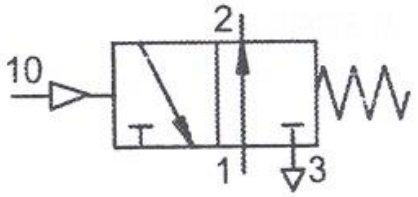
3/2-WAY Valve: Normally open unactuated



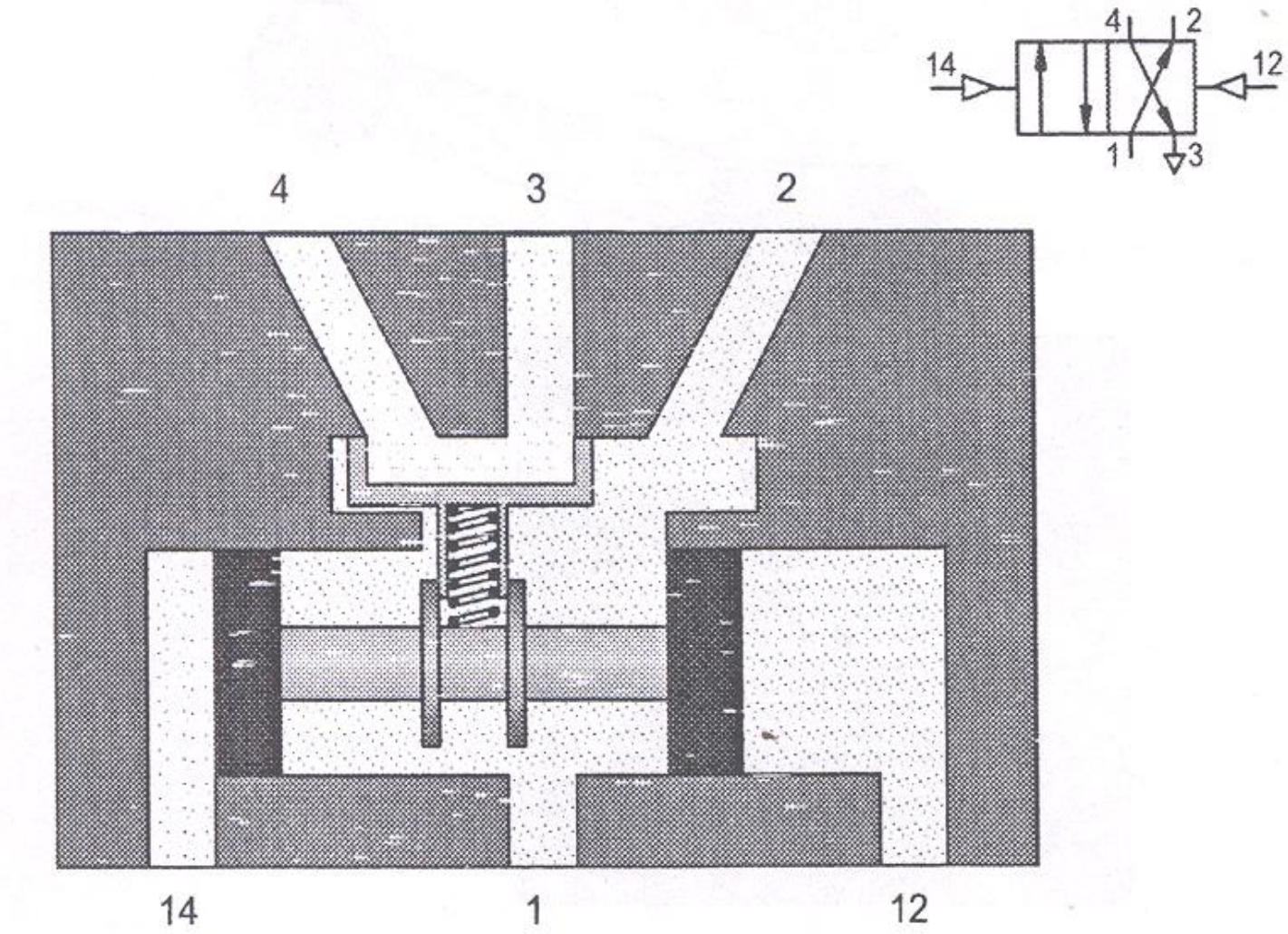


3/2-WAY Valve: Single pilot, Normally open with spring return , unactuated

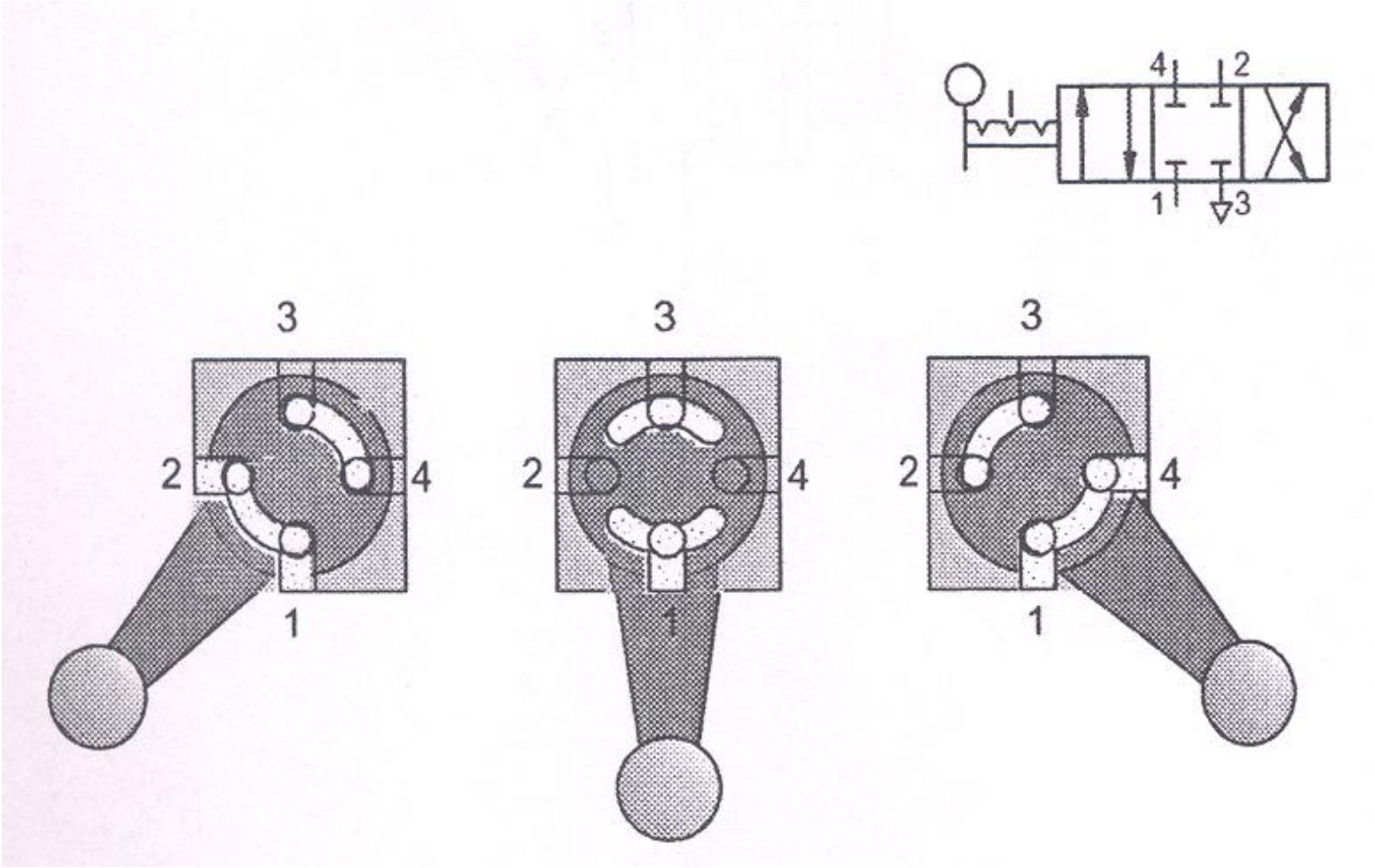




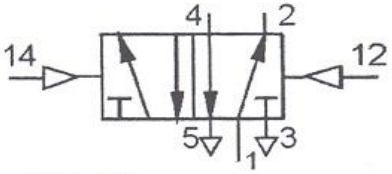
3/2-WAY Valve: Single pilot Normally open unactuated

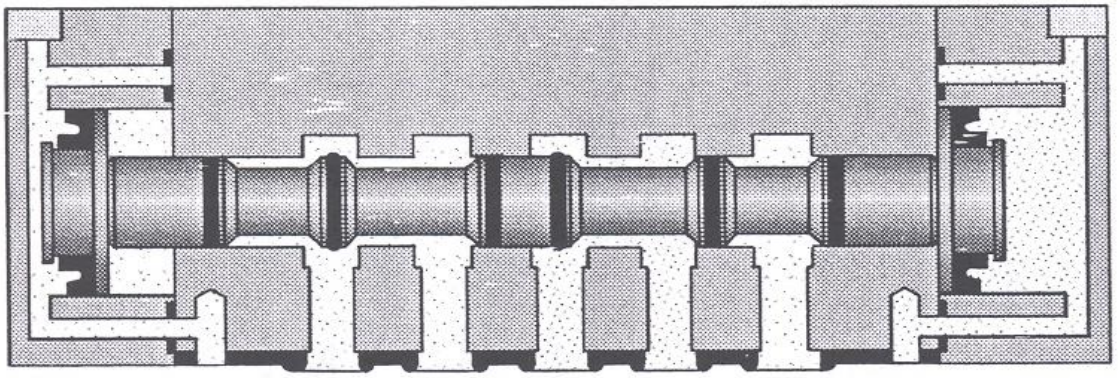


4/2 Way double pilot Valve

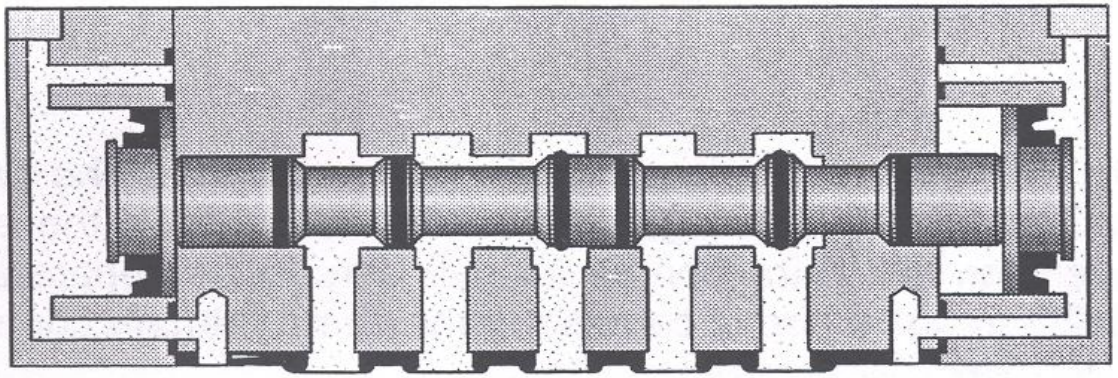


4/3 Way Valve – dented lever, mid position closed



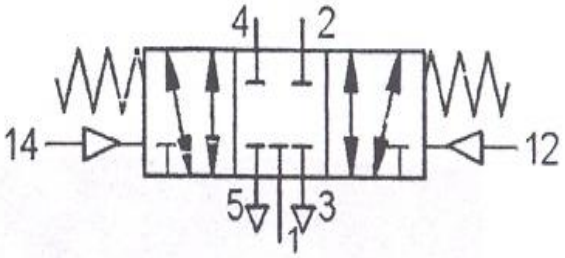


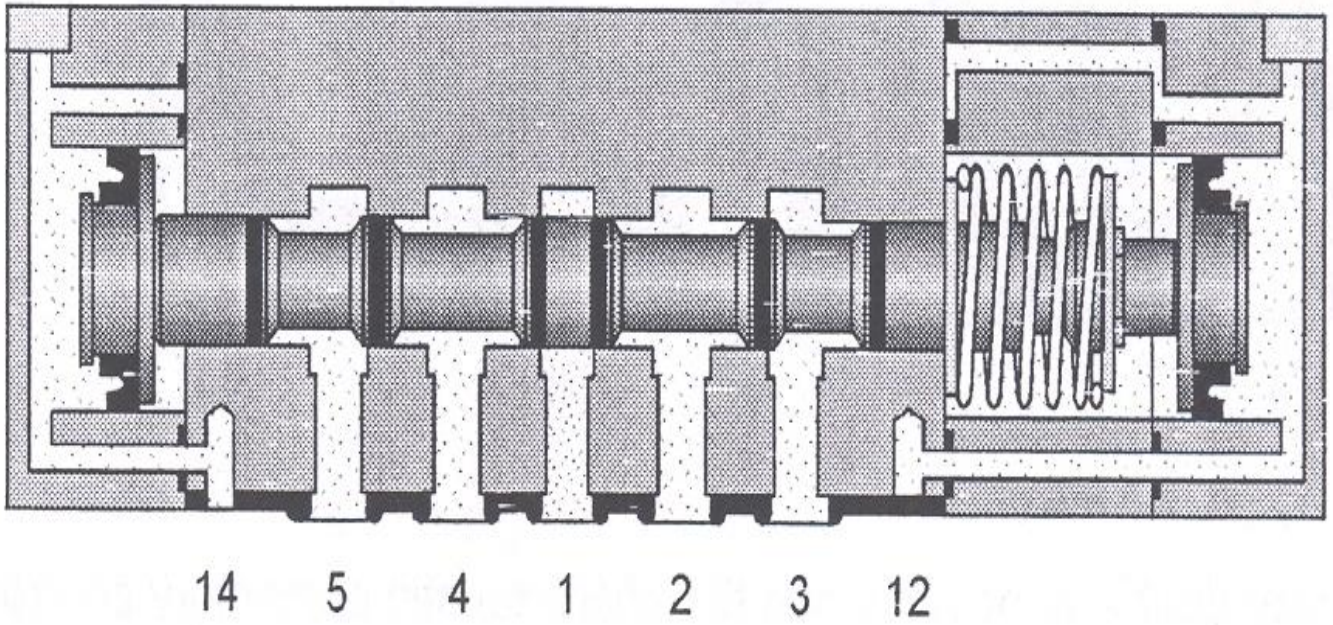
14 5 4 1 2 3 12



14 5 4 1 2 3 12

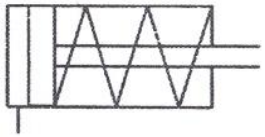
5/2-WAY Valve: Double pilot

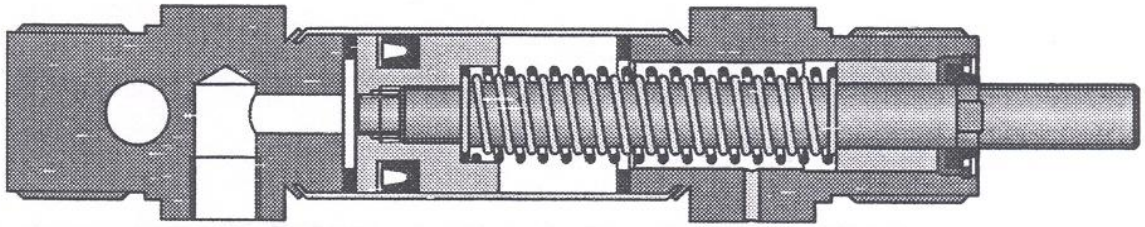




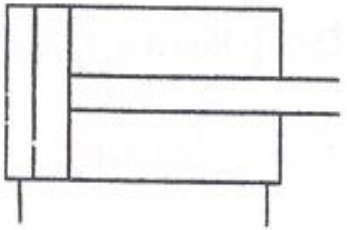
5/3-WAY, normally closed, double pilot Valve

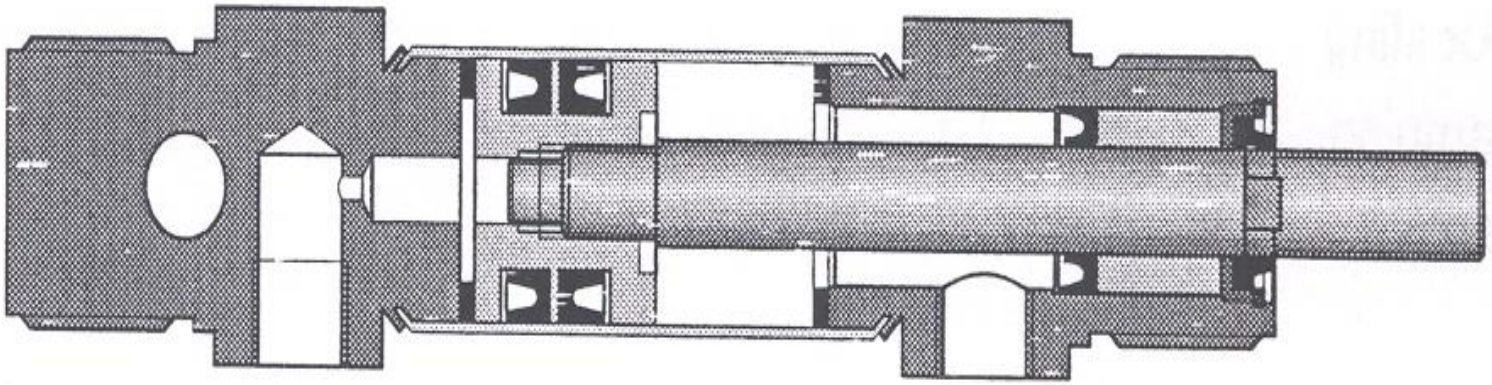
Single Acting Cylinder



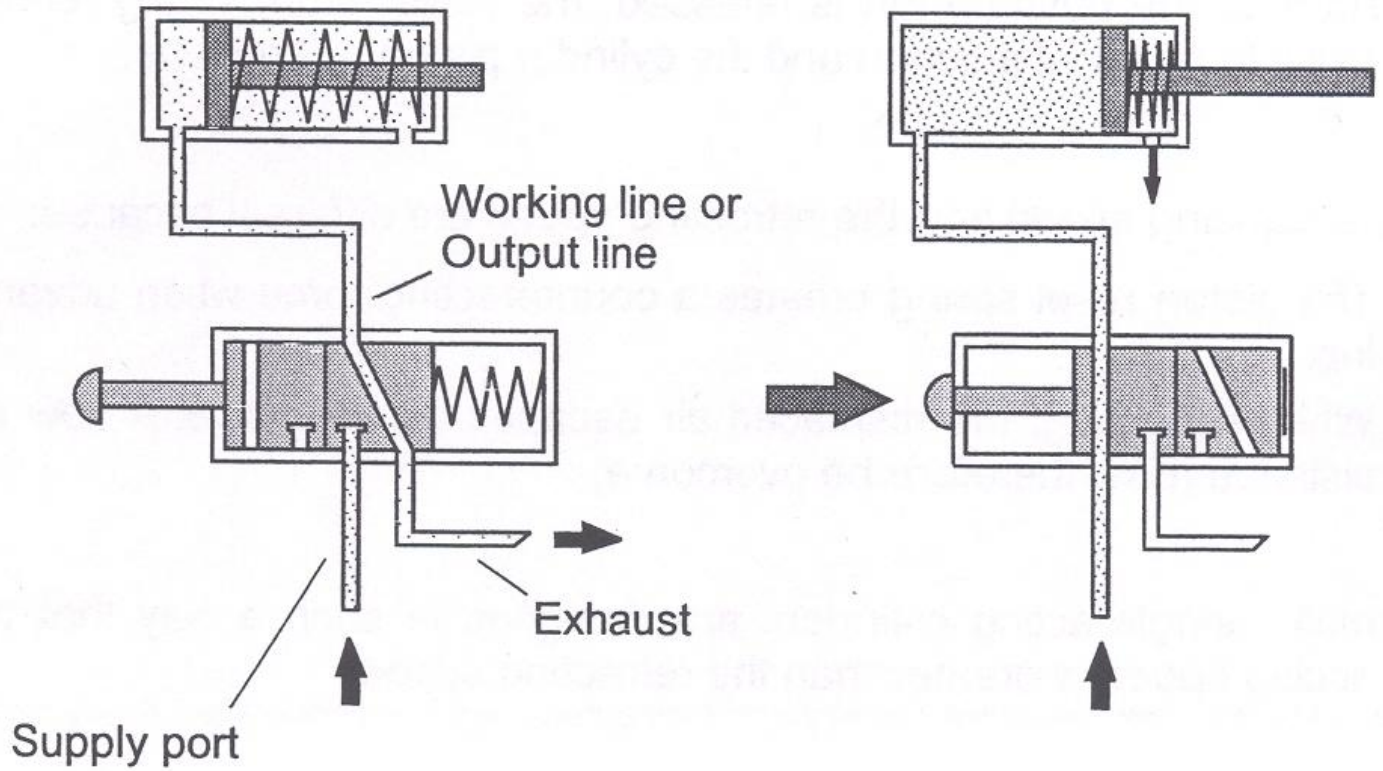


Double Acting Cylinder

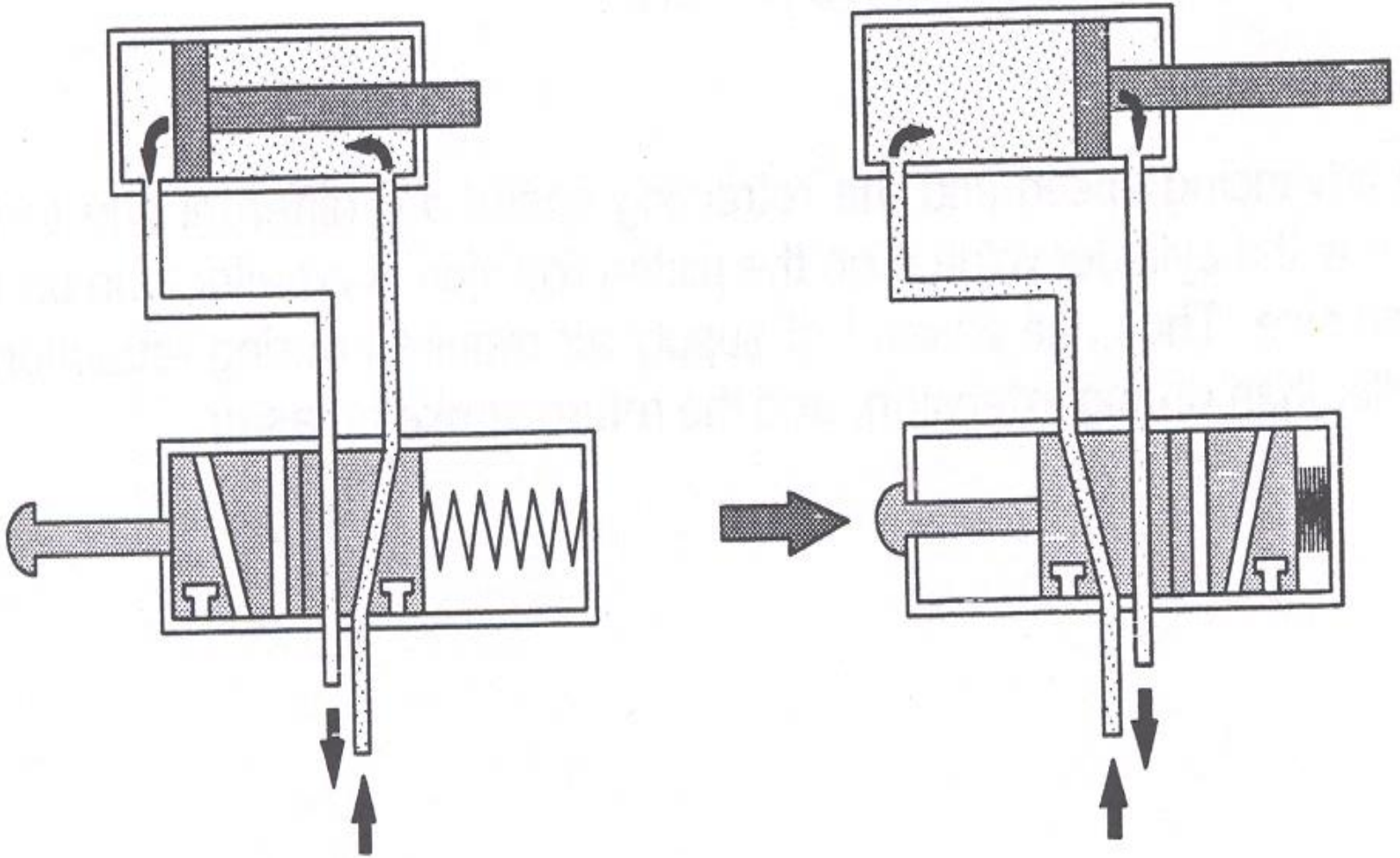




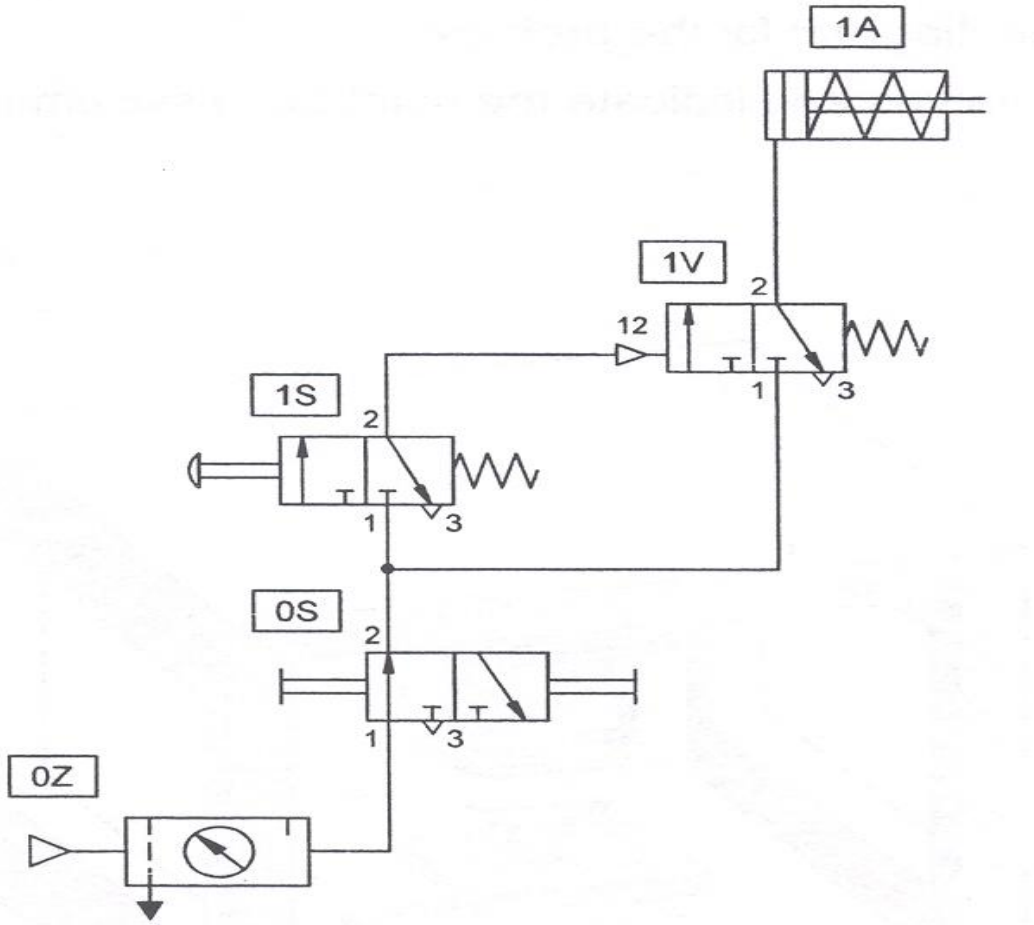
Actuation of Single Acting Cylinder



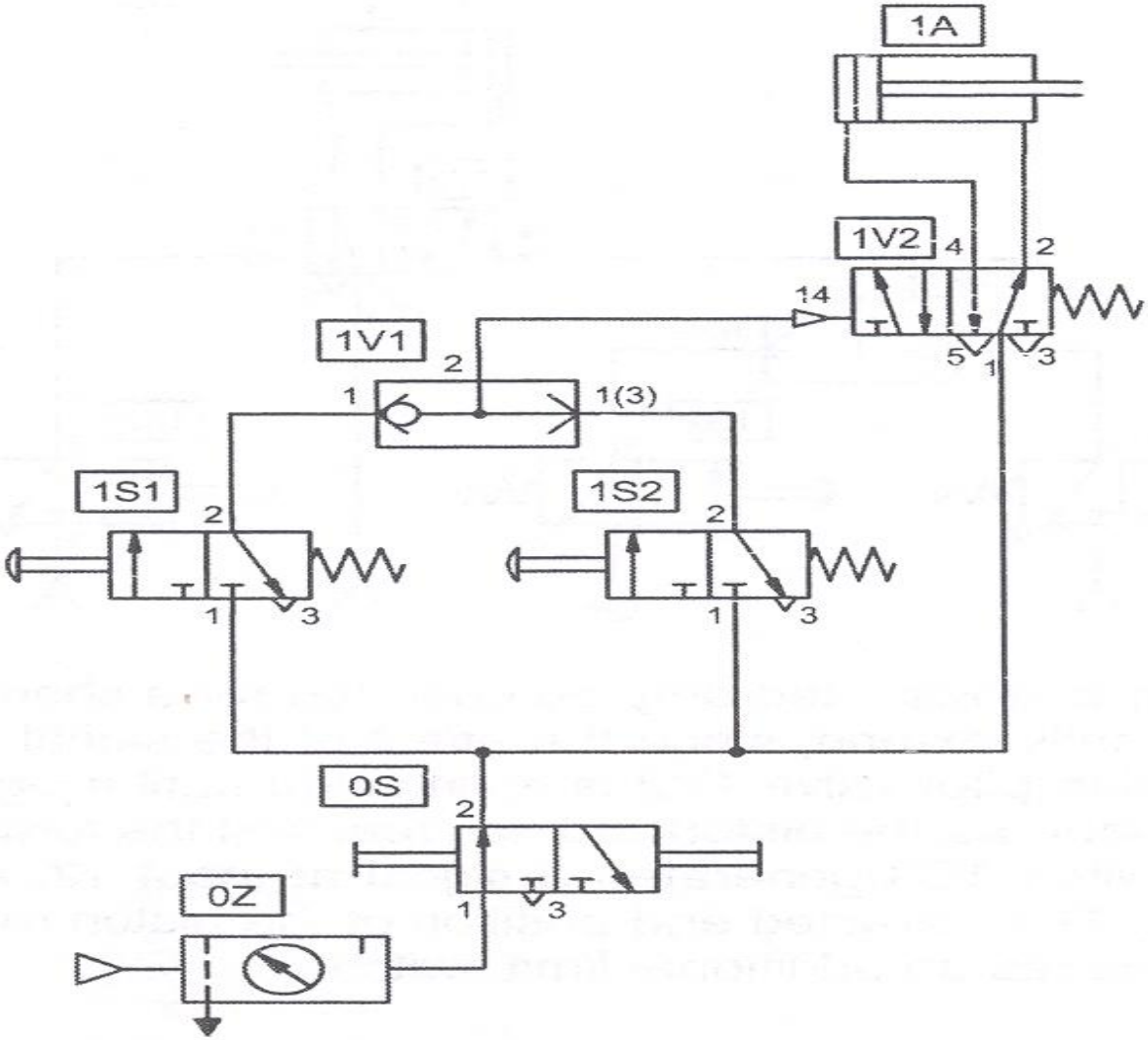
Actuation of a Double Acting Cylinder



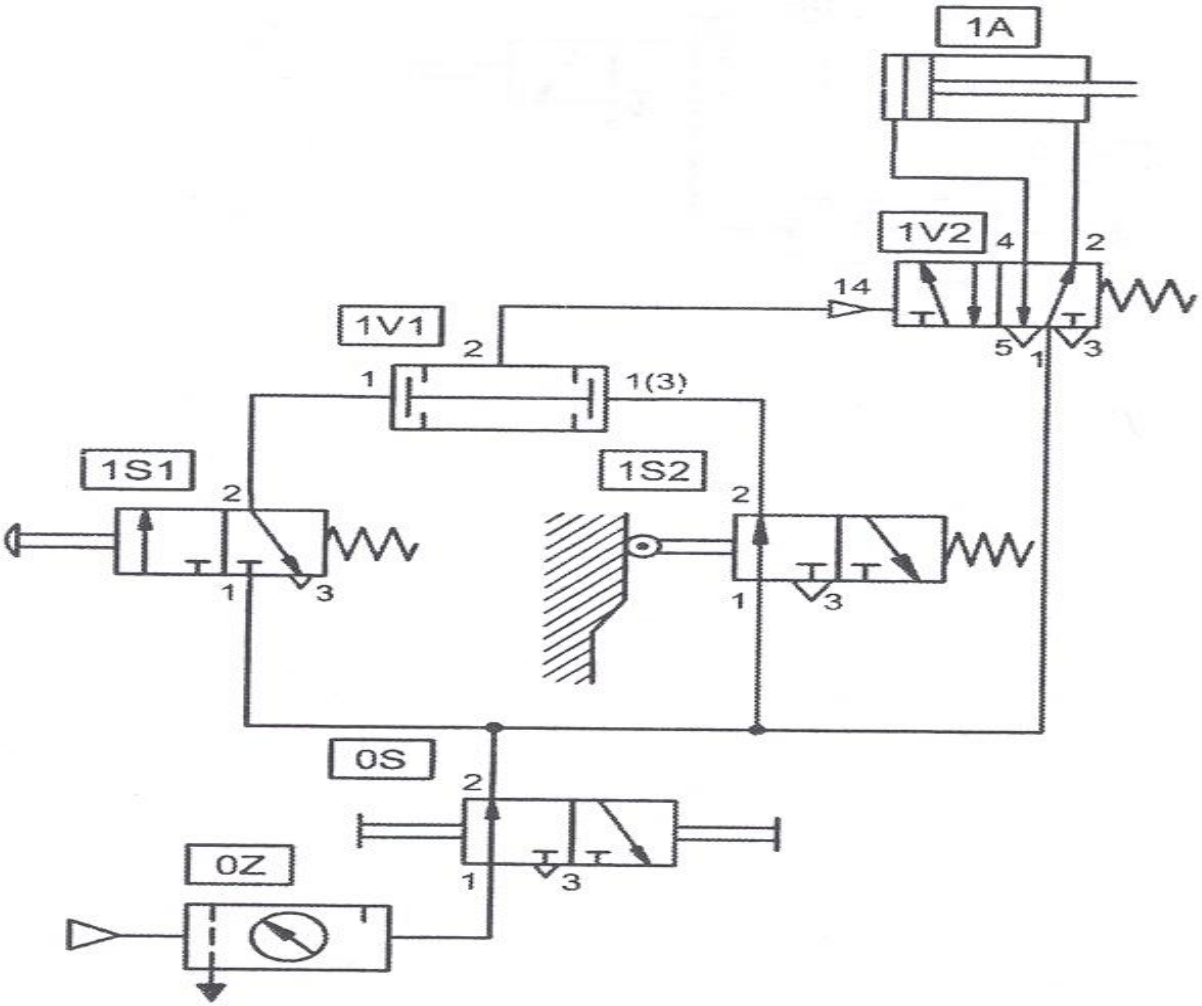
Actuation of a Single Acting Cylinder



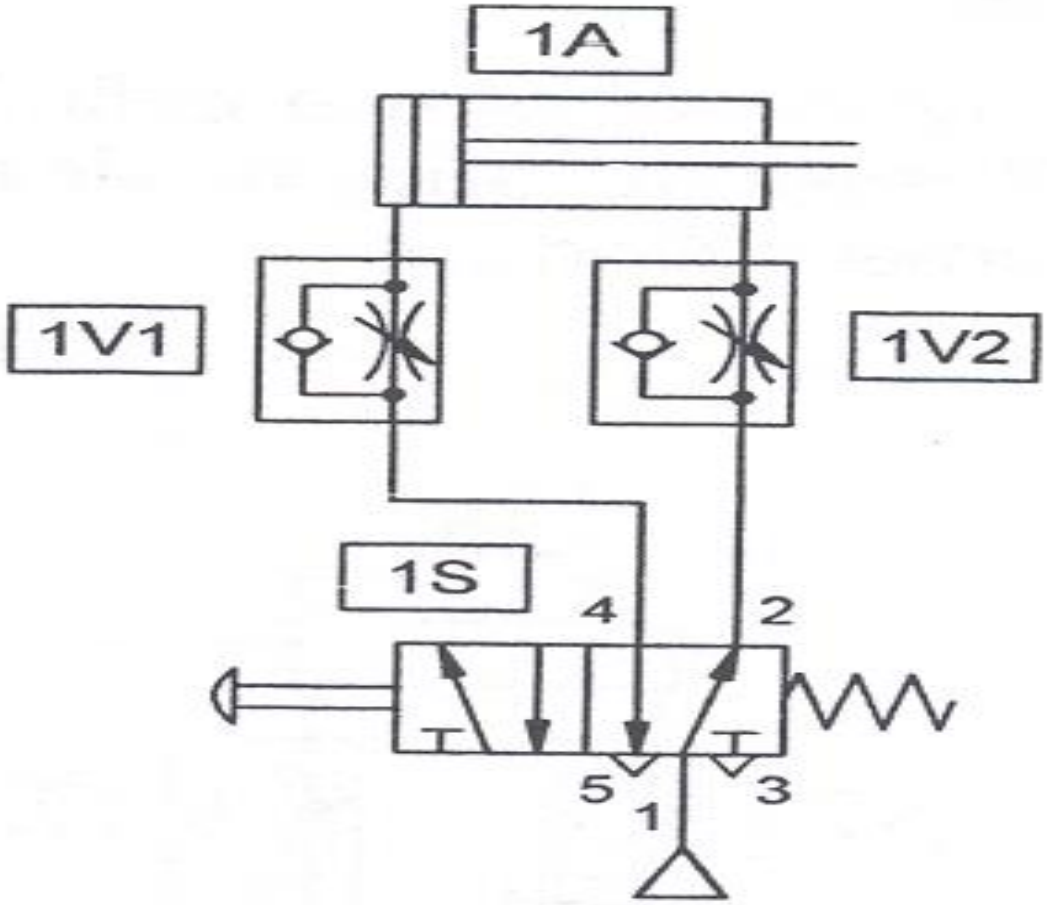
Actuation of a Double Acting Cylinder with OR Function



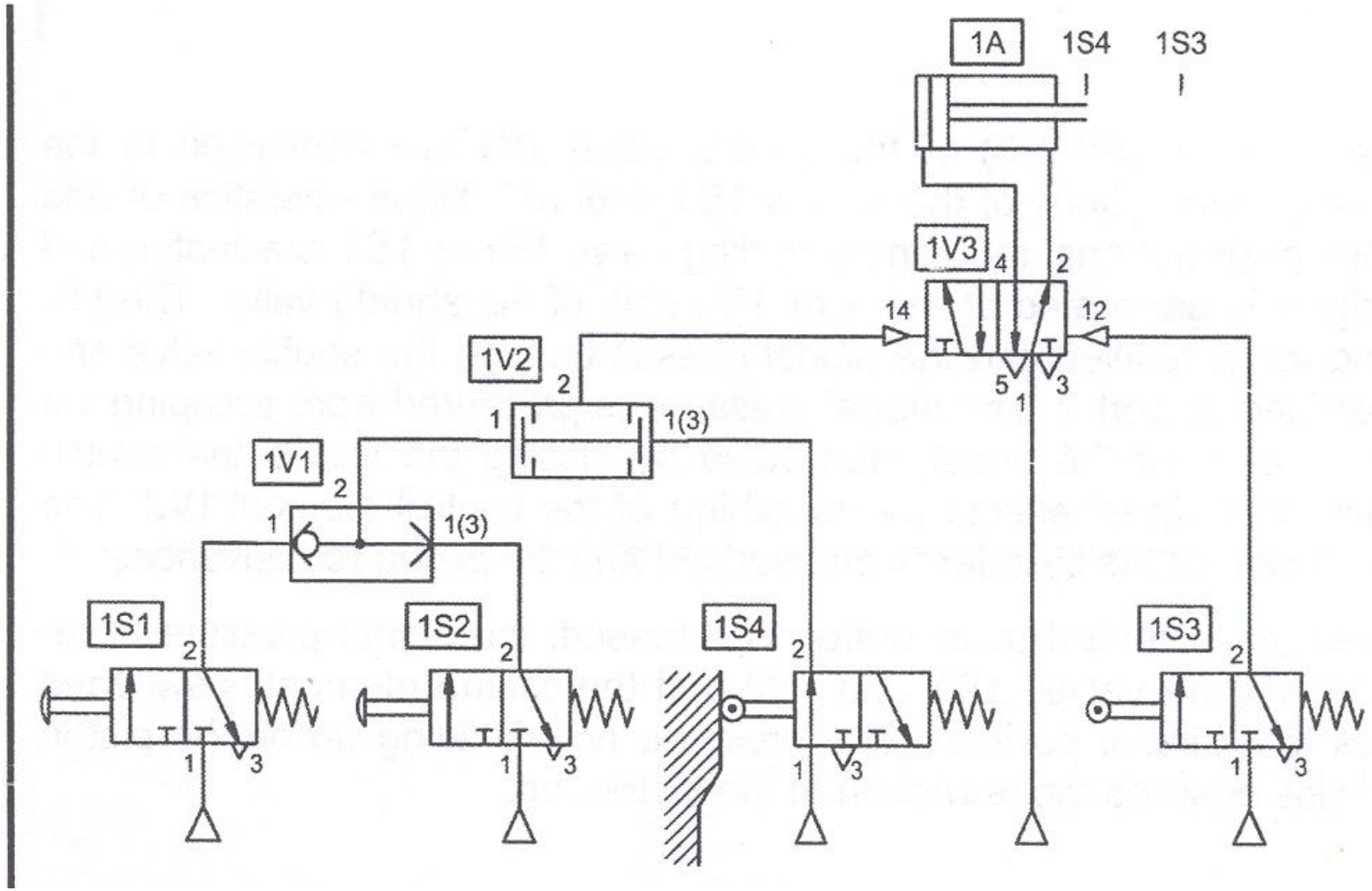
Actuation of a Double Acting Cylinder with AND function



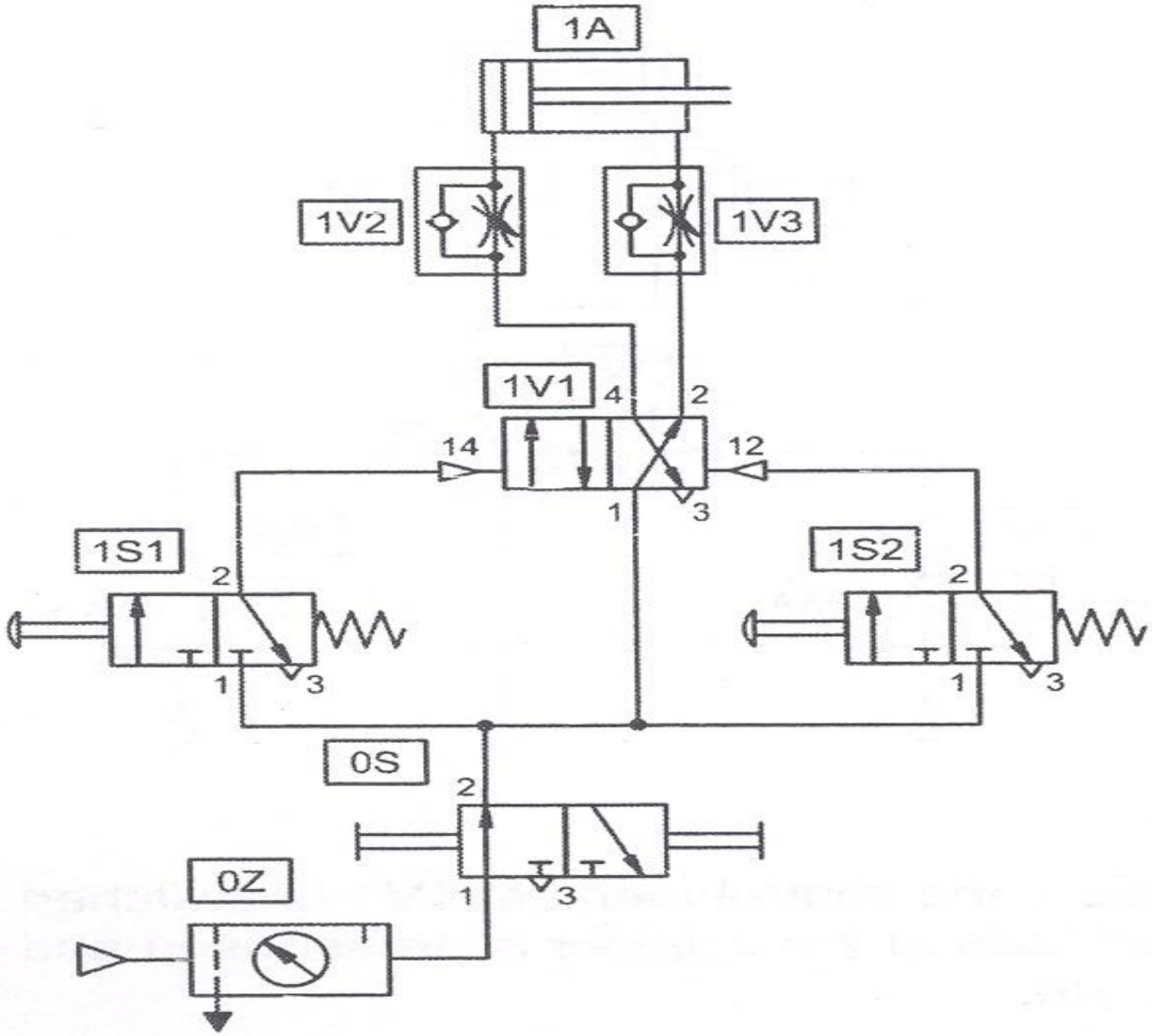
Speed control of Actuator



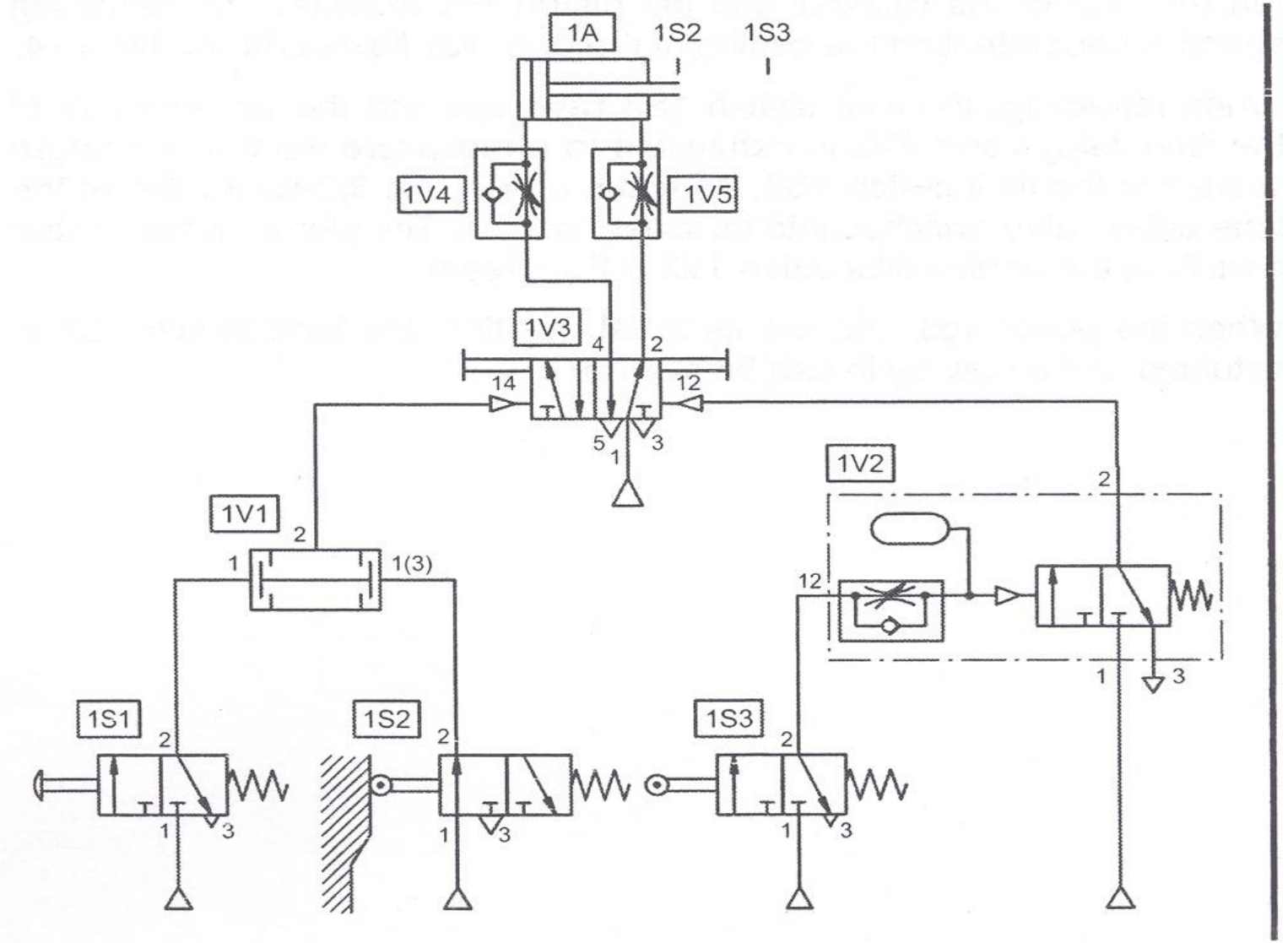
Combination of OR & AND function



Speed Control of Actuator



Time delay valve



Thank You