# Pneumatics

# advantages and disadvantages of compressed air

| Advantages of compressed air | Disadvantages of compressed air |
|---|---|
| Air is available in unlimited quantities | Compressive air is relatively expensive means of conveying energy<br>The higher costs are, however. Largely compensated by the cheaper elements. Simpler and more compact equipment |
| Compressed air is easily conveyed in pipelines even over longer distances | |
| Compressed air can be stored | Compressed air requires good conditioning. No dirt or moisture residues may be contained in it. Dirt and dust leads to wear on tools and equipment |
| Compressed air need not be returned. It can be vented to atmosphere after it has performed work | It is not possible to achieve uniform and constant piston speeds( air is compressible) |
| Compressed air is insensitive to temperature fluctuation. This ensures reliable operation even in extreme temperature conditions | Compressed air is economical ony up to certain force expenditure. Owing to the commonly used pressure of 7 bar and limit is about 20 to 50 kN, depending on the travel and the speed. If the force which is required exceeds this level, hydraulics is preferred |
| Compressed air is clean. This is especially important in food, pharmaceutical, textile, beverage industries | The exhaust is loud. As the result of intensive development work on materials for silencing purposes, this problems has however now largely been solved |
| Operating elements for compressed air operation are of simple and inexpensive construction. | The oil mist mixed with the air for lubricating the equipment escapes with the exhaust to atmosphere. |
| Compressed air is fast. Thus, high operational speed can be attained. | Air due to its low conductivity , cannot dissipate heat as much as hydraulic fluid |
| Speeds and forces of the pneumatics elements can be infinitely adjusted | Air cannot seal the fine gaps between the moving parts unlike hydraulic system |
| Tools and operating elements are overload proof. Straight line movement can be produced directly | Air is not a good lubricating medium unlike hydraulic fluid. |

**Differences between hydraulic and pneumatic systems.**

One of the main differences between the two systems is that in pneumatics, air is compressible. In hydraulics, liquids are not. Other two distinct differences are given below.

**Pneumatic Systems**

These systems have two main features:

- Pneumatic systems use compressed gas such as air or nitrogen to perform work processes.
- Pneumatic systems are open systems, exhausting the compressed air to atmosphere after use.

**Hydraulic Systems**

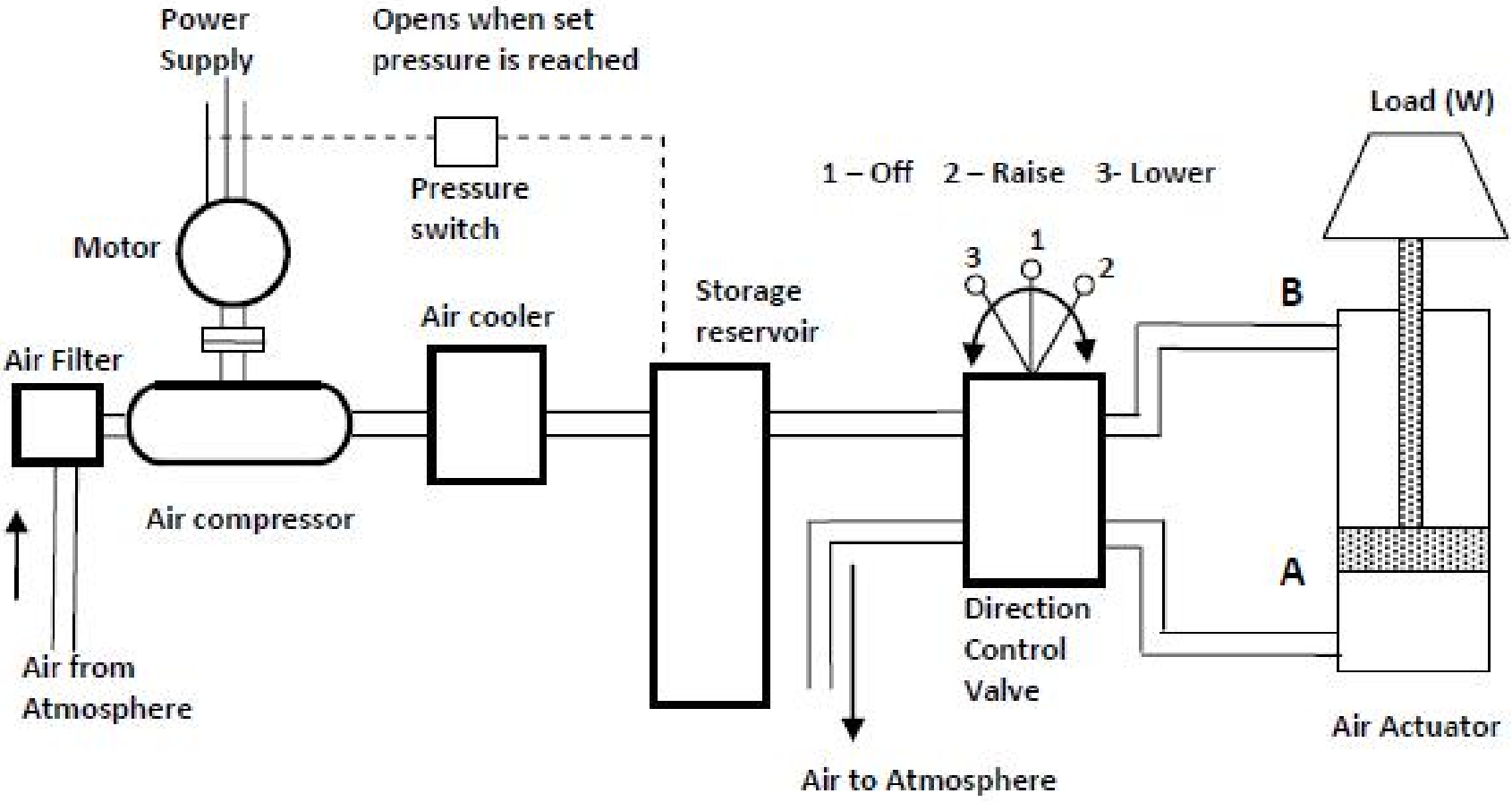
These systems also have two main features:

a) Hydraulic systems use liquids such as oil and water to perform work processes.
b) Hydraulic systems are closed systems, recirculating the oil or water after use.

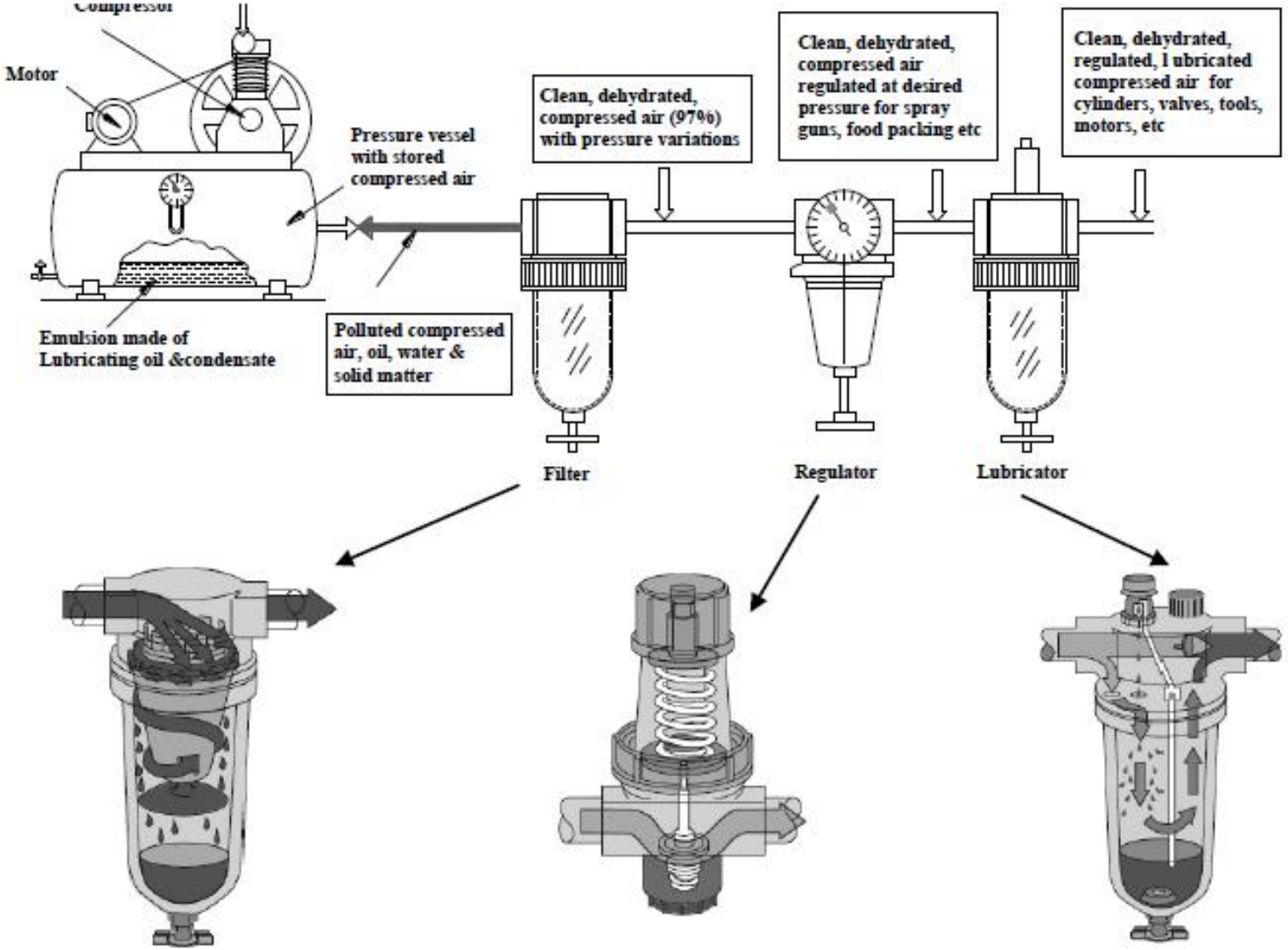
# APPLICATIONS OF PNEUMATICS

| Material Handling | Manufacturing | Other applications |
|---|---|---|
| Clamping | Drilling | Aircraft |
| Shifting | Turning | Cement plants |
| positioning | Milling | chemical plants |
| Orienting | Sawing | Coal mines |
| Feeding | Finishing | Cotton mills |
| Ejection | Forming | Dairies |
| Braking | Quality Control | Forge shops |
| Bonding | Stamping | Machine tools |
| Locking | Embossing | Door or chute control |
| Packaging | Filling | Turning and inverting parts |
| Feeding | | |
| Sorting | | |
| stacking | | |

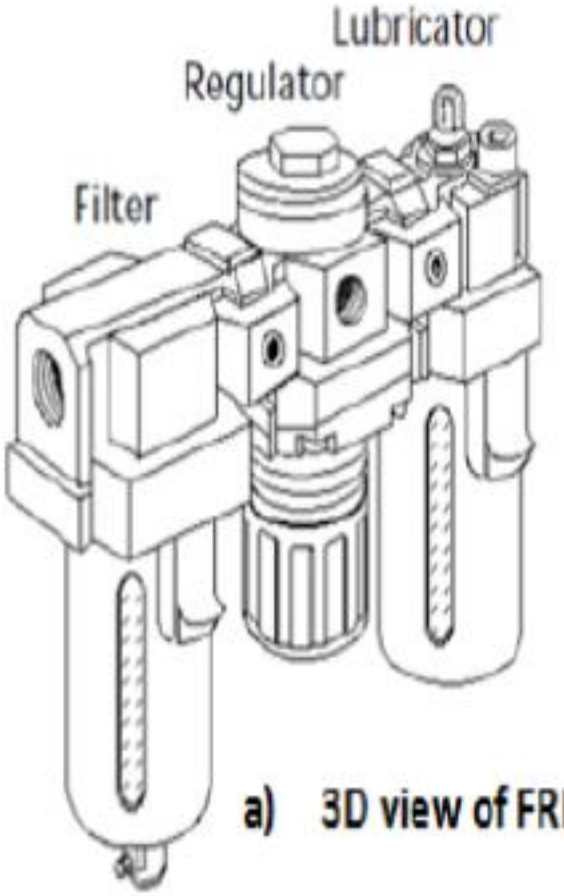
# BASIC COMPONENTS OF PNEUMATIC SYSTEMS



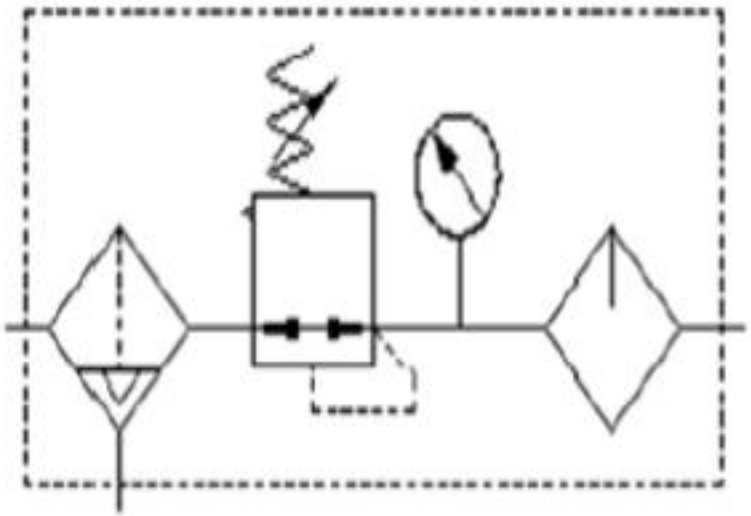
# FRL


Compressor
Motor
Pressure vessel with stored compressed air
Emulsion made of Lubricating oil &condensate
Polluted compressed air, oil, water & solid matter
Clean, dehydrated, compressed air (97%) with pressure variations
Clean, dehydrated, compressed air regulated at desired pressure for spray guns, food packing etc
Clean, dehydrated, regulated, l ubricated compressed air for cylinders, valves, tools, motors, etc
Filter
Regulator
Lubricator

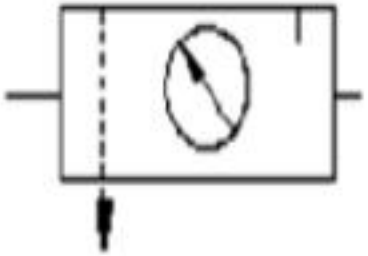
# FRL




a) 3D view of FRL unit

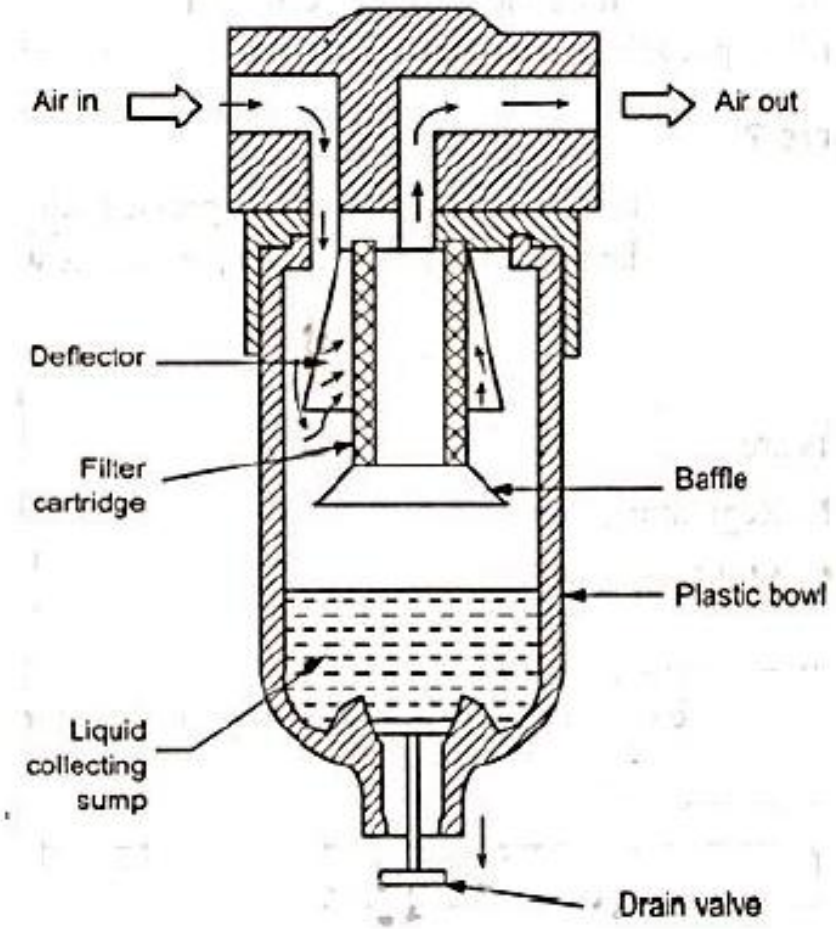


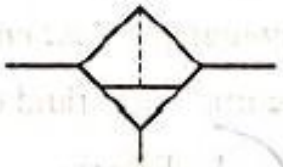
b) Symbol for FRL unit



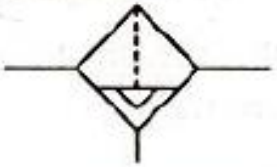
c) Simplified

# Construction of a Air filter



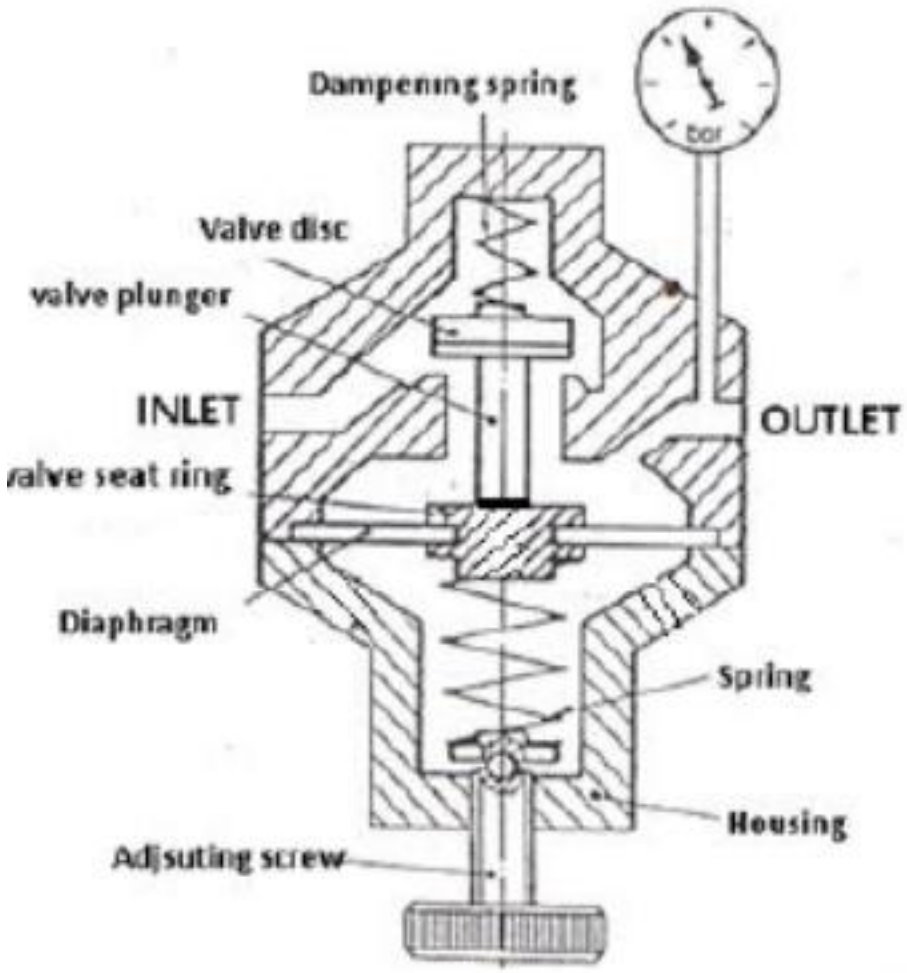
*Filter-separator manual drain*



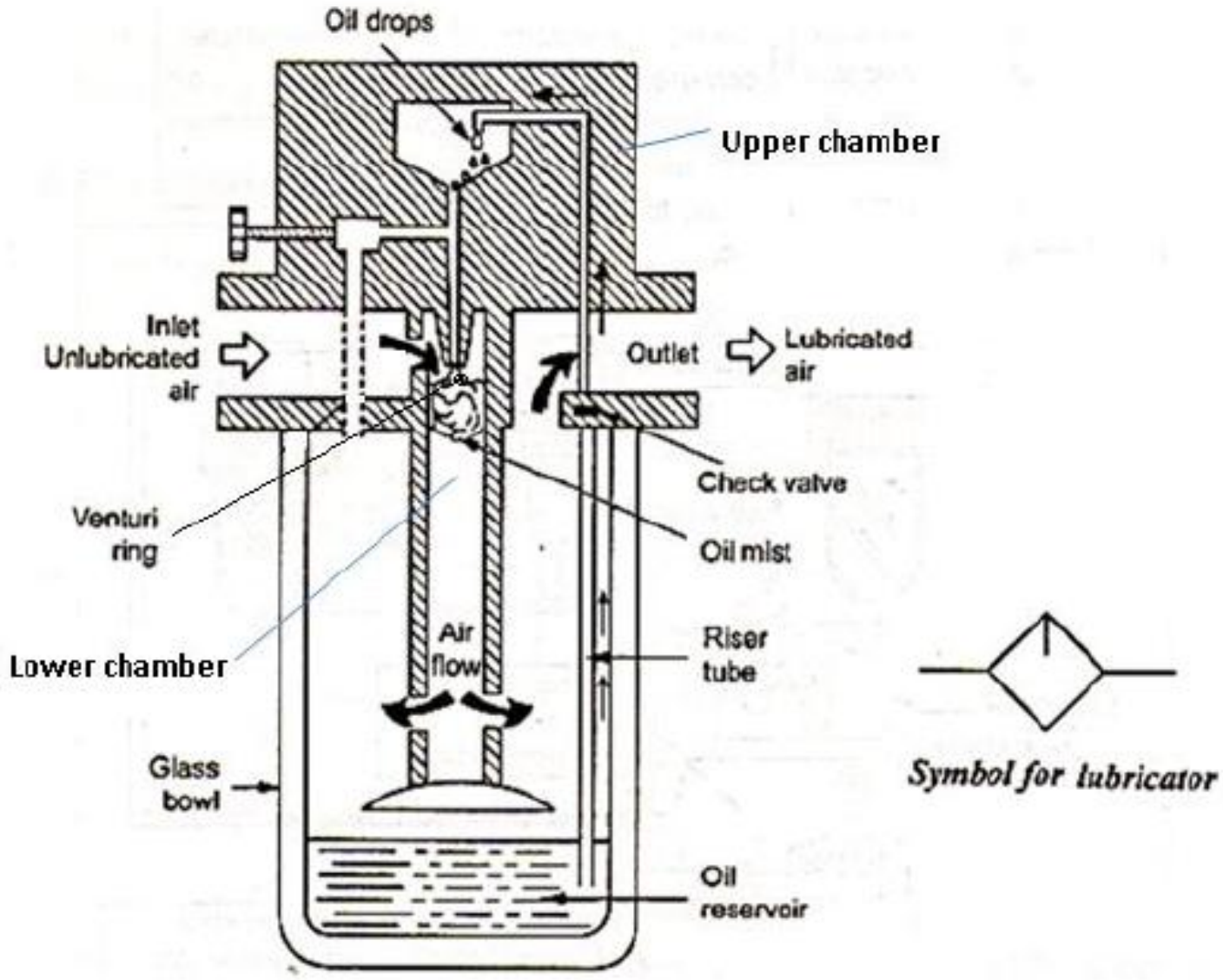
*Filter-separator automatic drain*

*Graphic symbol*

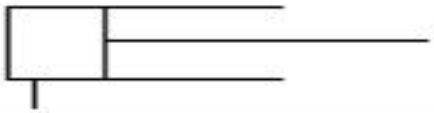
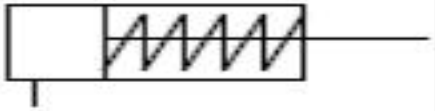
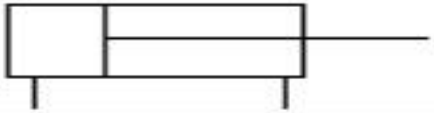
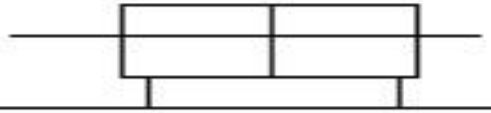
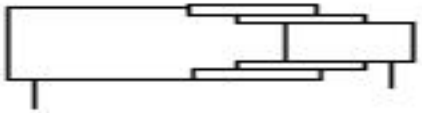
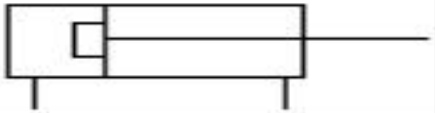
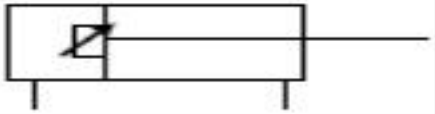
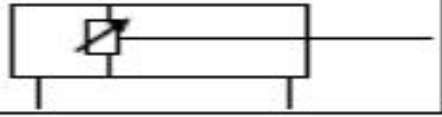
# AIR REGULATOR



# AIR LUBRICATOR

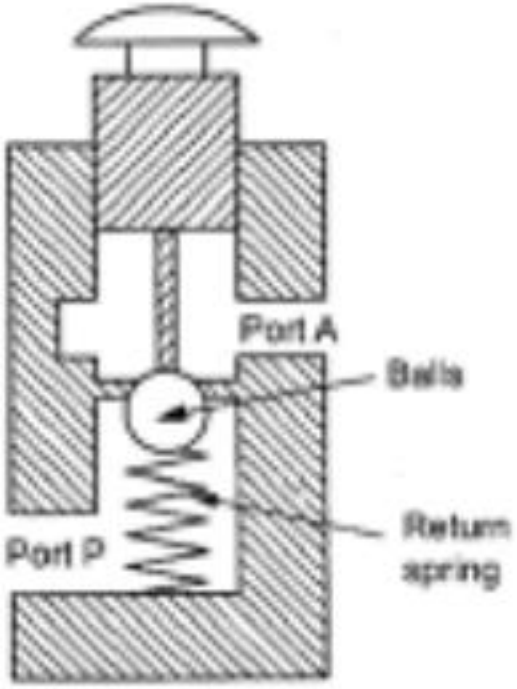


# Pneumatic Actuators

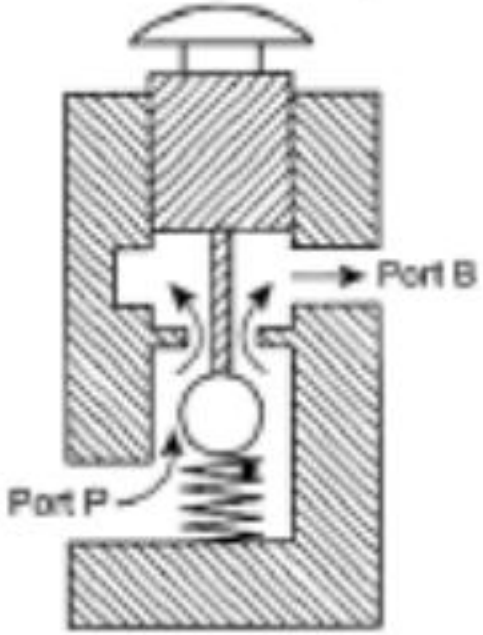
| Sl No | Graphical Symbols | Explanation |
|---|---|---|
| 1 |  | **Single acting cylinder with unspecified return**: Air pushes the piston in one direction and the piston is return is unspecified. External dock or lever may push |
| 2 |  | **Single acting cylinder with spring return.** Air pushes the piston in one direction and piston returns by spring on rod side |
| 3 |  | **Double acting cylinder –single piston rod**: the force exerted by compressed air moves the piston in both direction. |
| 4. |  | **Double acting cylinder –double piston rod**It has piston rods extending from both ends of the cylinder. It produces equal force and speed on both sides of the cylinder |
| 1. |  | **Telescopic cylinder –double acting** is used where space is constraint. It is used for long stroke application like in pneumatic cranes, dump trucks, lift fork trucks, dipper wagon |
| 7. |  | **Double acting cylinder** – fixed cushion on one side, Cushioning is used in the end position to prevent sudden impact which otherwise may damage parts. |
| 8 |  | **Double acting cylinder – variable cushion on one side**– fixed cushion on one side, cushioning is variable in one direction by adjusting the orifice opening. |
| 9 |  | **Double acting cylinder – variable cushion on both sides**– fixed cushion on one side, cushioning is variablein both direction. |

# Pneumatics Control Valves

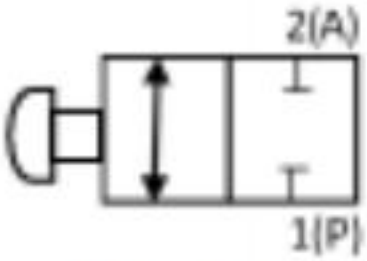
# POPPET DIRECTION CONTROL VALVES




*(a) Poppet position 1*

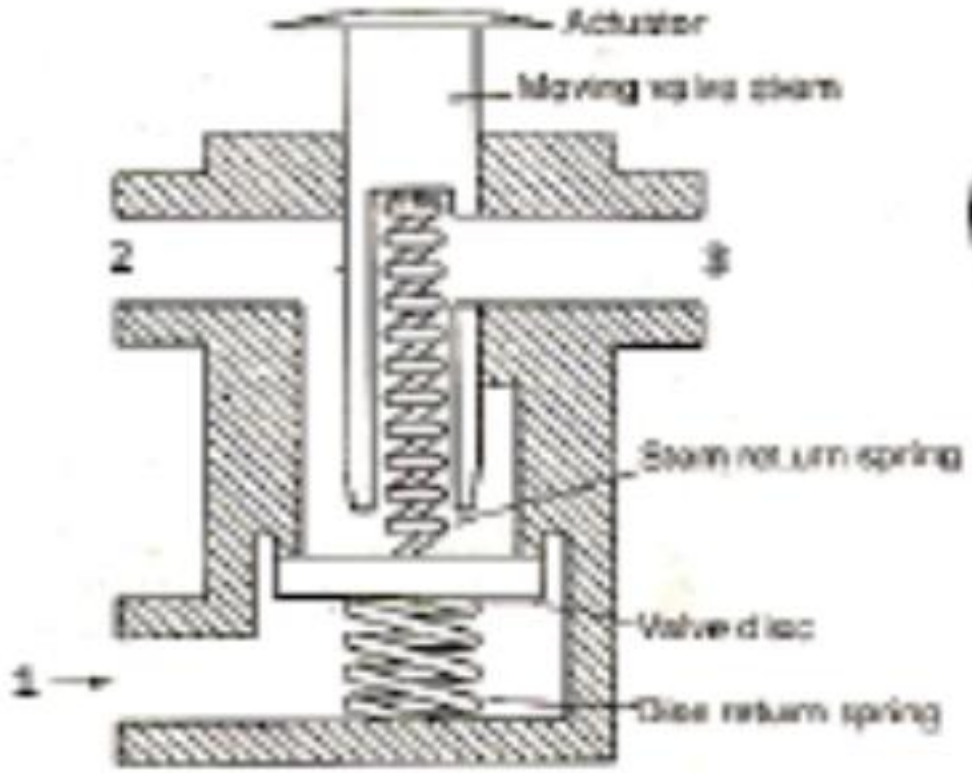


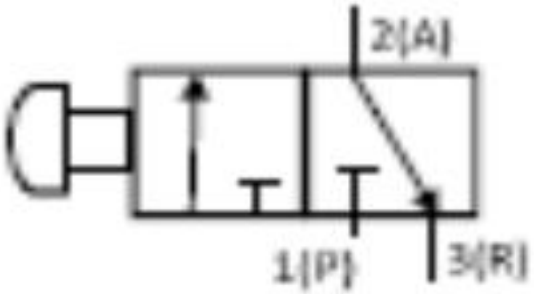

*(b) Poppet position 2*




(c) Symbol

# Disc seat poppet valve



# SPOOL DIRECTION CONTROL VALVES

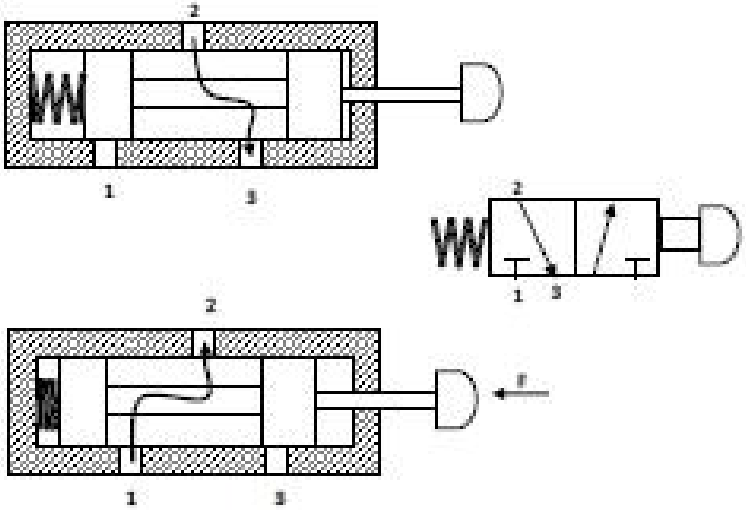



Figure 1.5 3/2 Directional control valve (Normally closed)

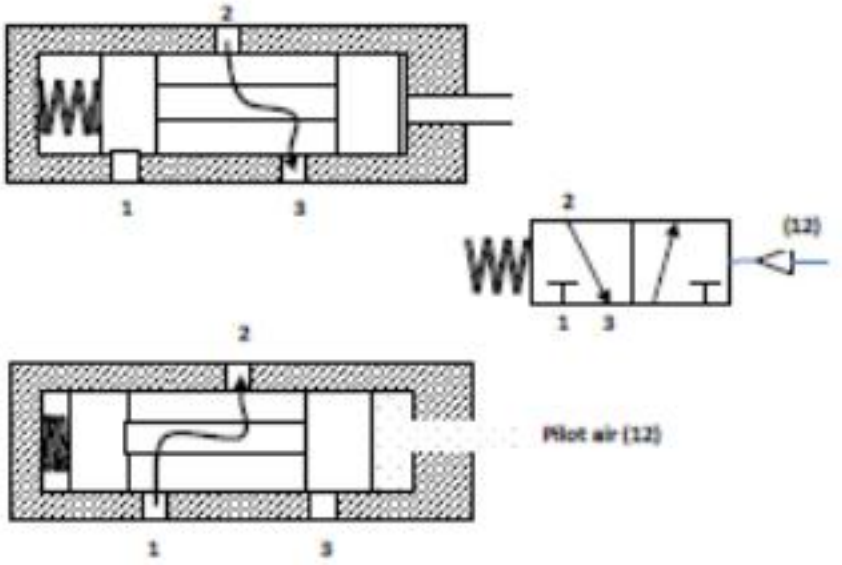
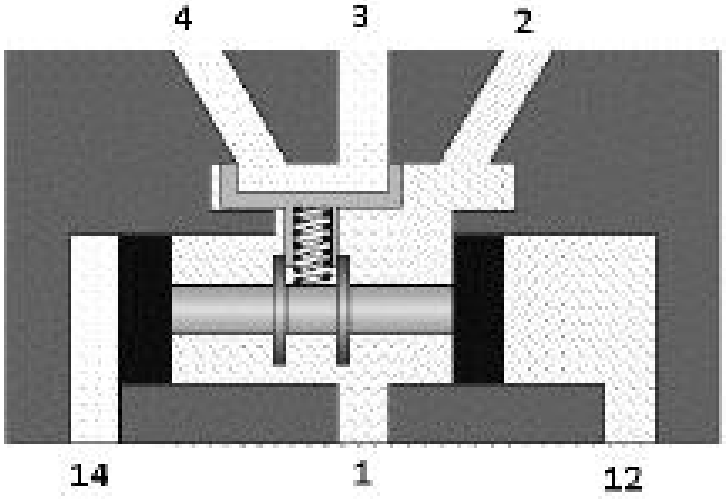
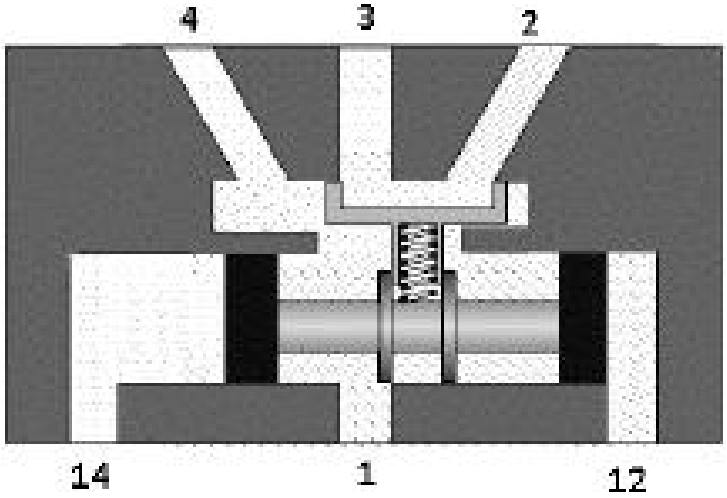
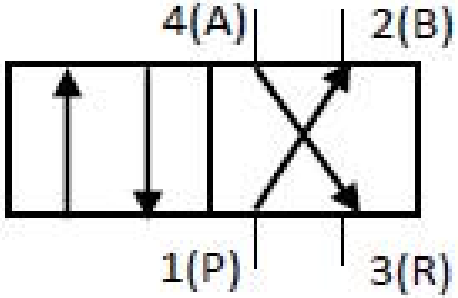


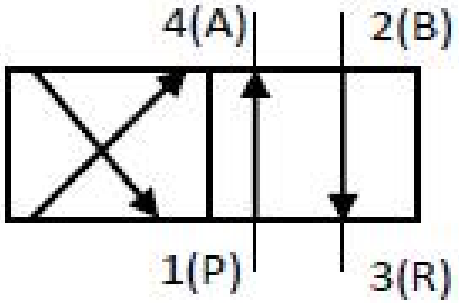

Figure 1.7 3/2 Directional control valve (pneumatically operated)

# Pneumatically actuated 4/2 DCV

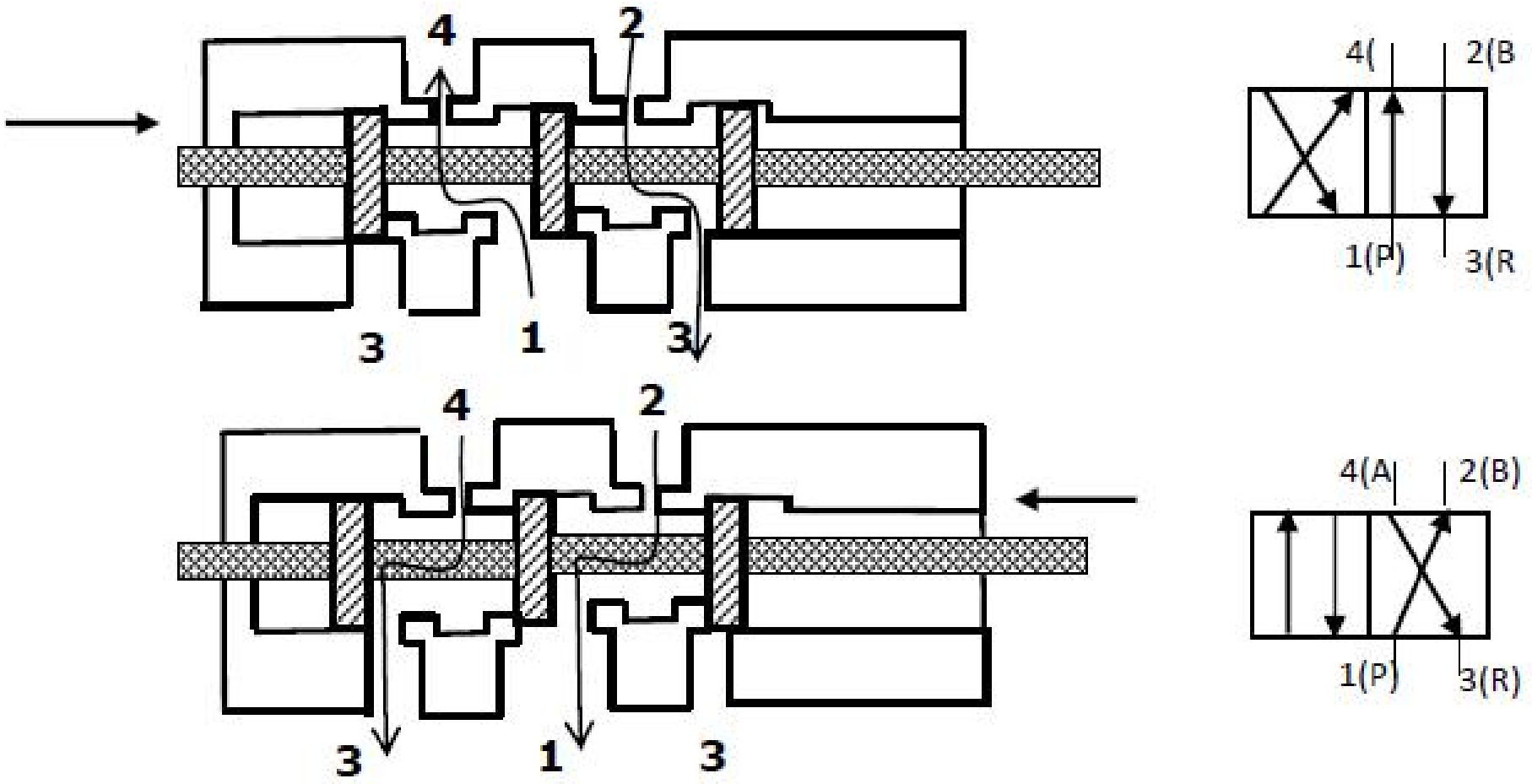


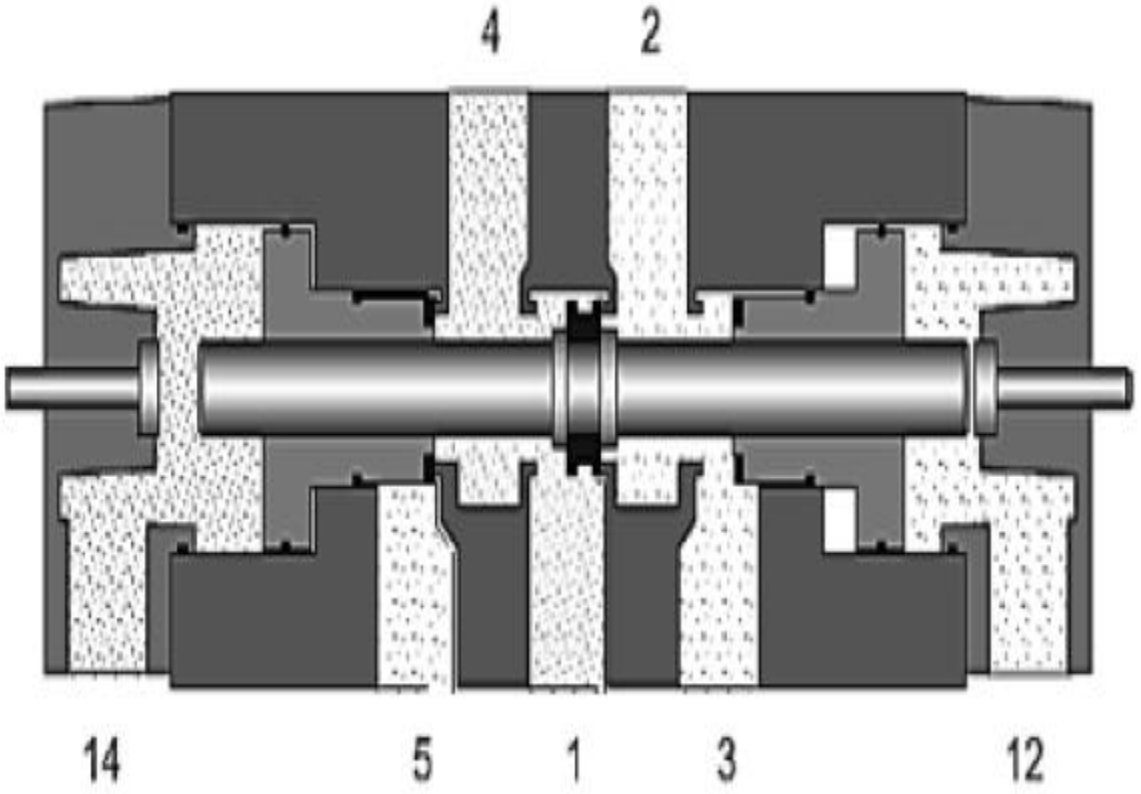



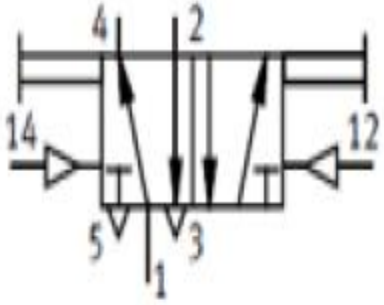



# Suspended Disc Direction Control Valves

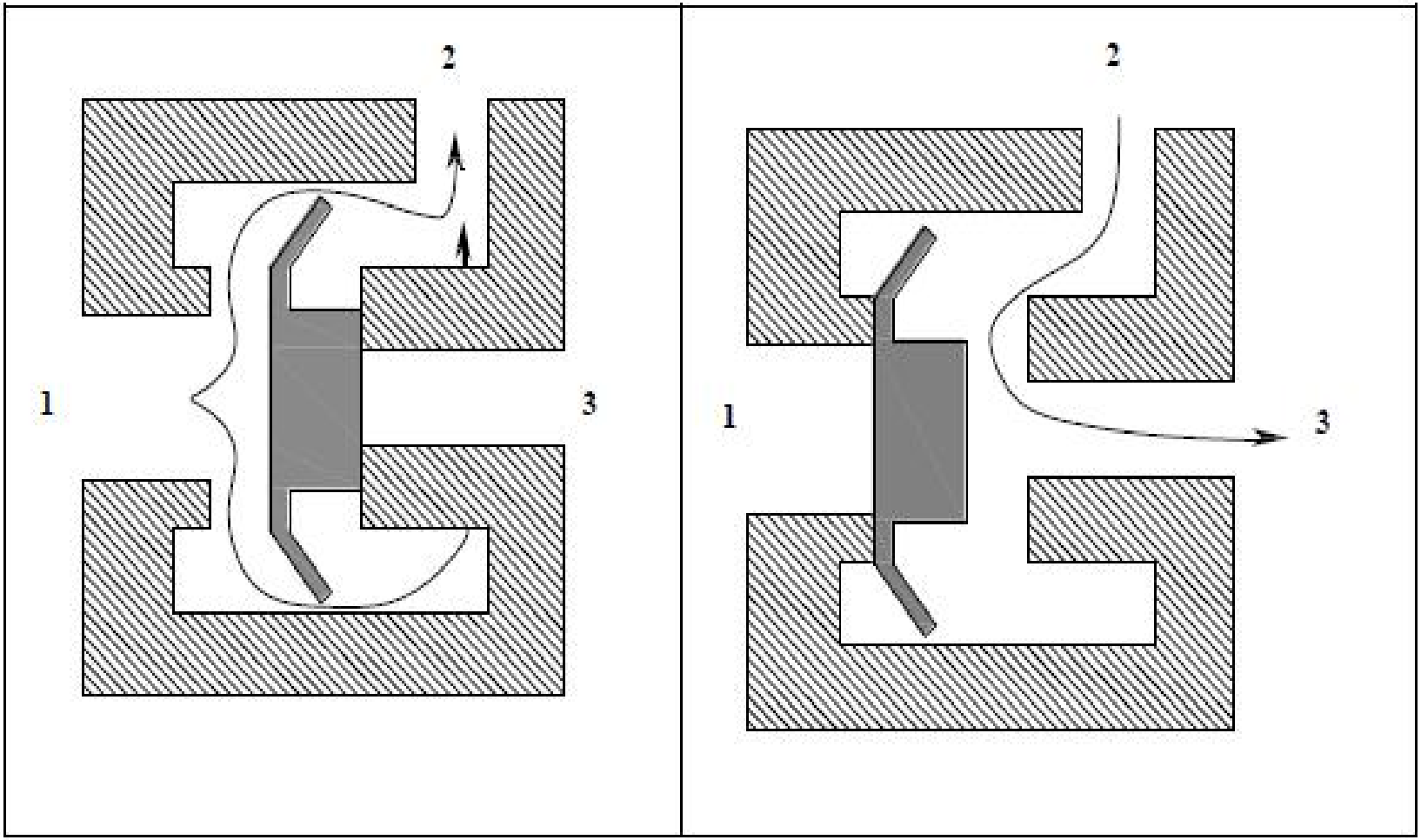


# 5/2 Directional control valve (suspended disc type)



# Quick Exhaust Valves



# Two Pressure Valve (AND Valve)