

Hydraulics & Pneumatics

Chapter 2: Pneumatics (Pneumatic in Review)

by

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Lesson Outcome

- By the end of this lecture, student should be able to:
 - Explain the characteristics, advantages, disadvantages and application of pneumatic systems.
 - Identify basic pneumatic components

Content

- Introduction to Pneumatics
- Air Distribution
- Pneumatic Valve
- Pneumatic Actuator

Pneumatics in Review

- Definition: The use of **compressed air** in order to **generate force** that can **produce mechanical movement**
- Pneumatics has been used for carrying out mechanical tasks for a long time
- Important applications:
 - Determine the status of processors (sensor)
 - Control the system by switching the actuator
 - Conduct the designed work (actuators)

Good VS Bad

- Advantages of pneumatics
 - Raw material freely available
 - Easily transportable and stored
 - Can be used in high temperatures
 - Clean
 - Fast
 - Explosion proof
 - Parts are easy to design & build
- Disadvantages
 - Preparation
 - Compression
 - Force limitations
 - Noise

Applications

- Drilling
- Milling
- Sawing
- Finishing
- Forming
- Stamping
- Embossing
- etc

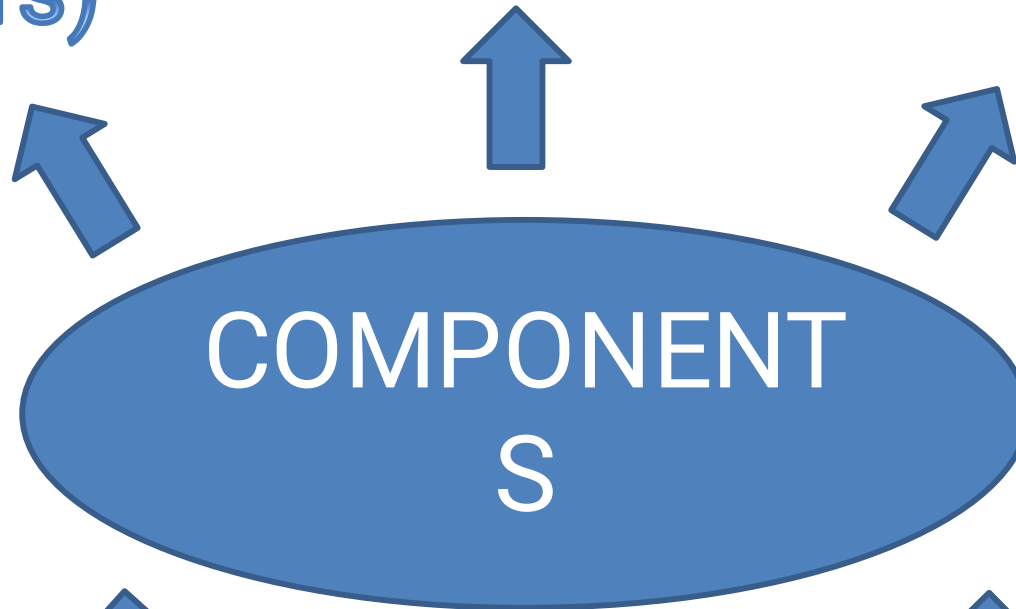
Pneumatics & control system development

- Factors in development of pneumatics control system:
 - Reliability and safety of operation
 - Ease of maintenance
 - Cost (economy, spare parts, etc)
 - Assembly and connection
 - Interchangeability and adaptability
 - Compact design
 - Operation efficiency

Power components
(Actuators)

Air
tank

Air generation
distribution (piping)



Compressor

Motor

Valves

Others: Receivers, filters, etc

1. Air generation and distribution

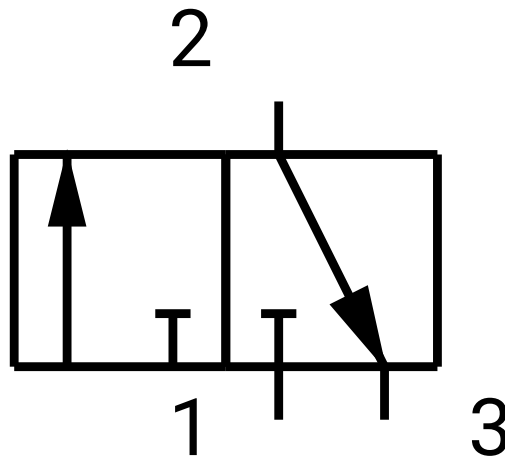
- Compressor fills the reservoir – as storage tank
- Pipeline is installed with a gradient of 1 to 2 %
- Condensate removal are installed under the main pipeline

2. Valves

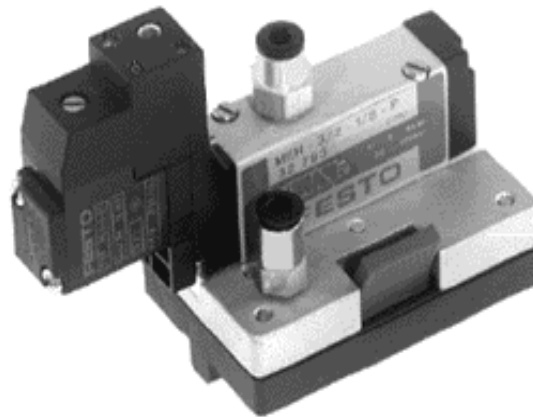
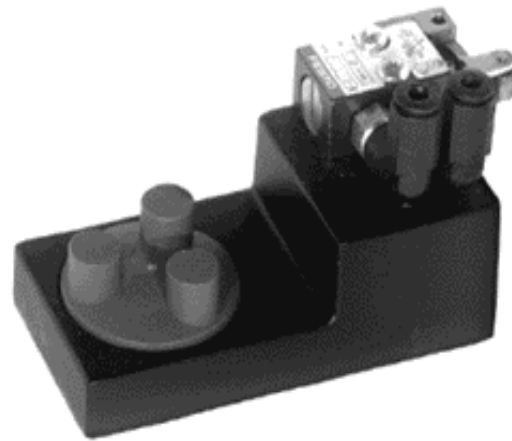
- Categories:
 - Directional control valves
 - Non-return valves
 - Flow control valves
 - Pressure control valves
 - Shut-off valves

Directional control valves 1

- **3/2 Way Valve** - 1 Input (supply), 1 Output (Working Line) and 1 Exhaust



3/2 Way Valve

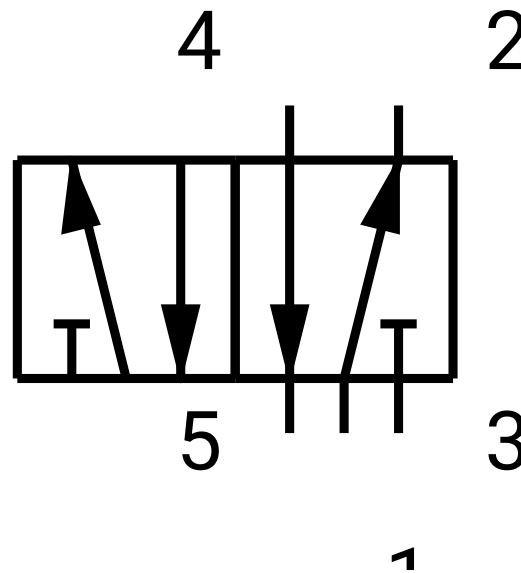


- Applications:
 - 1) As input signal (pushbutton, limit switch, emergency button)
 - 2) To control Single Acting Cylinder

Source: Croser and Ebel
(2000)

Directional control valves 2

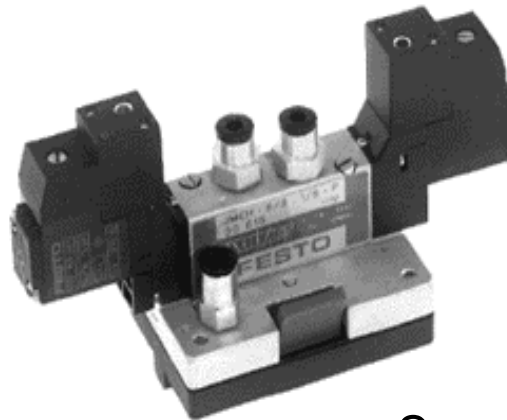
- **5/2 Way Valve** with 1 Input (supply), 2 Output (Working Line) and 2 Exhaust



5/2 Way Valve

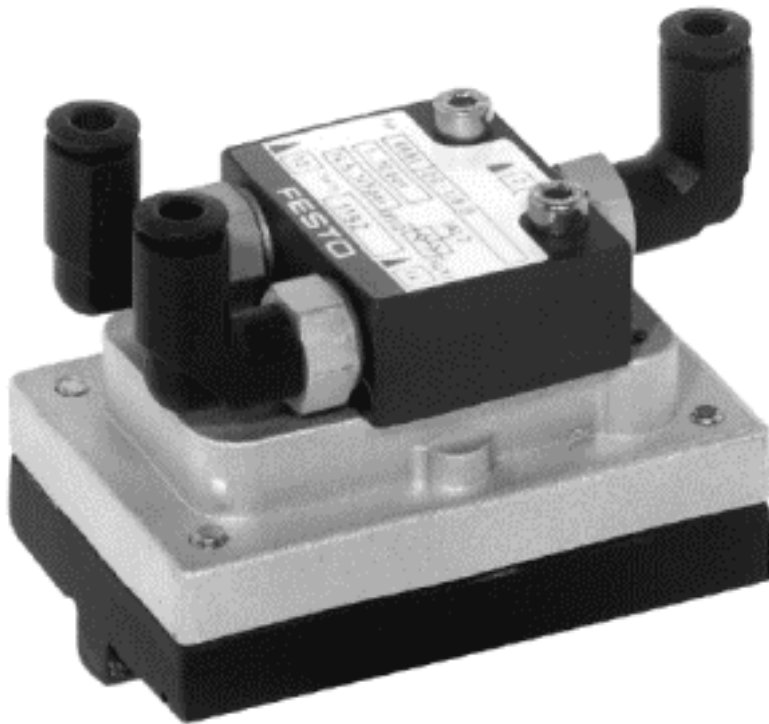
Application:

- Control movement of Double Acting Cylinder

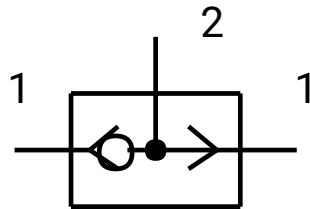


Source: Croser and Ebel
(2000)

Non-Return Valves (OR-Shuttle Valve)

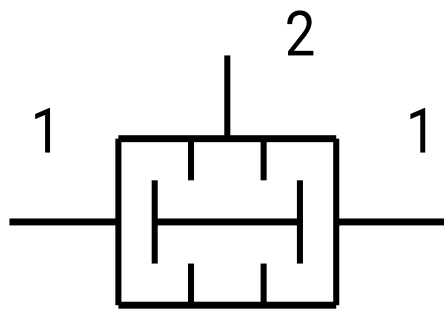


- 2 input and 1 output
- Allow a signal to flow in one direction
- Output is acquired if one (or both) of input supply pressure
- For circuit with more than 1 input signal



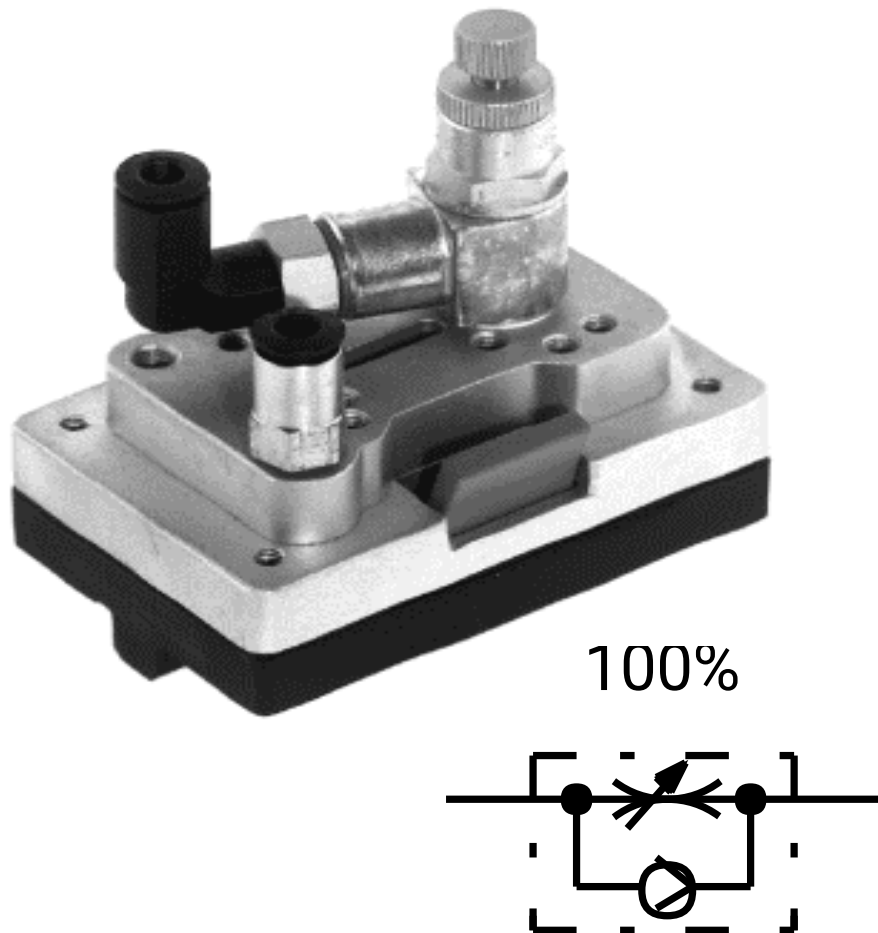
Source: Croser and Ebel
(2000)

Non-Return Valves - AND (Two Pressure Valve)



- 2 input and 1 output
- Output only acquired if both input supplied with pressure
- For circuit with more than 1 input signal

Flow Control Valve – One Way Flow Control



- ❑ 1 input and 1 output.
- ❑ To reduce speed of piston movement (adjustable)

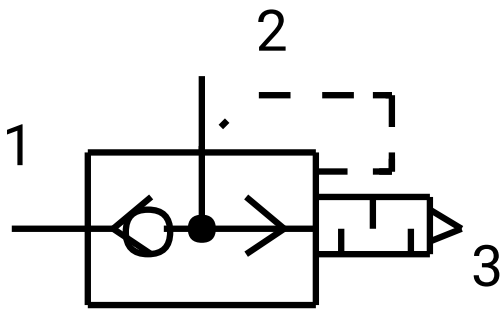
Source: Croser and Ebel
(2000)

Non-Return Valves - Quick Exhaust Valve



- 1 input, 1 output and 1 exhaust

- To increase speed of piston movement (but not adjustable)



Source: Croser and Ebel
(2000)

3. Power components

- Consists of control elements & actuators
- Linear actuator
 - Single acting cylinder
 - Double acting cylinder
- Rotary actuator
 - Air motors

Summary

We have learn:

- The characteristics, advantages, disadvantages and application of pneumatic systems.
- The basic pneumatic components

Reference

- Croser, P and Ebel, F (2000). Pneumatic: Basic Level Text Book. Festo Didactic GmbH & Co.