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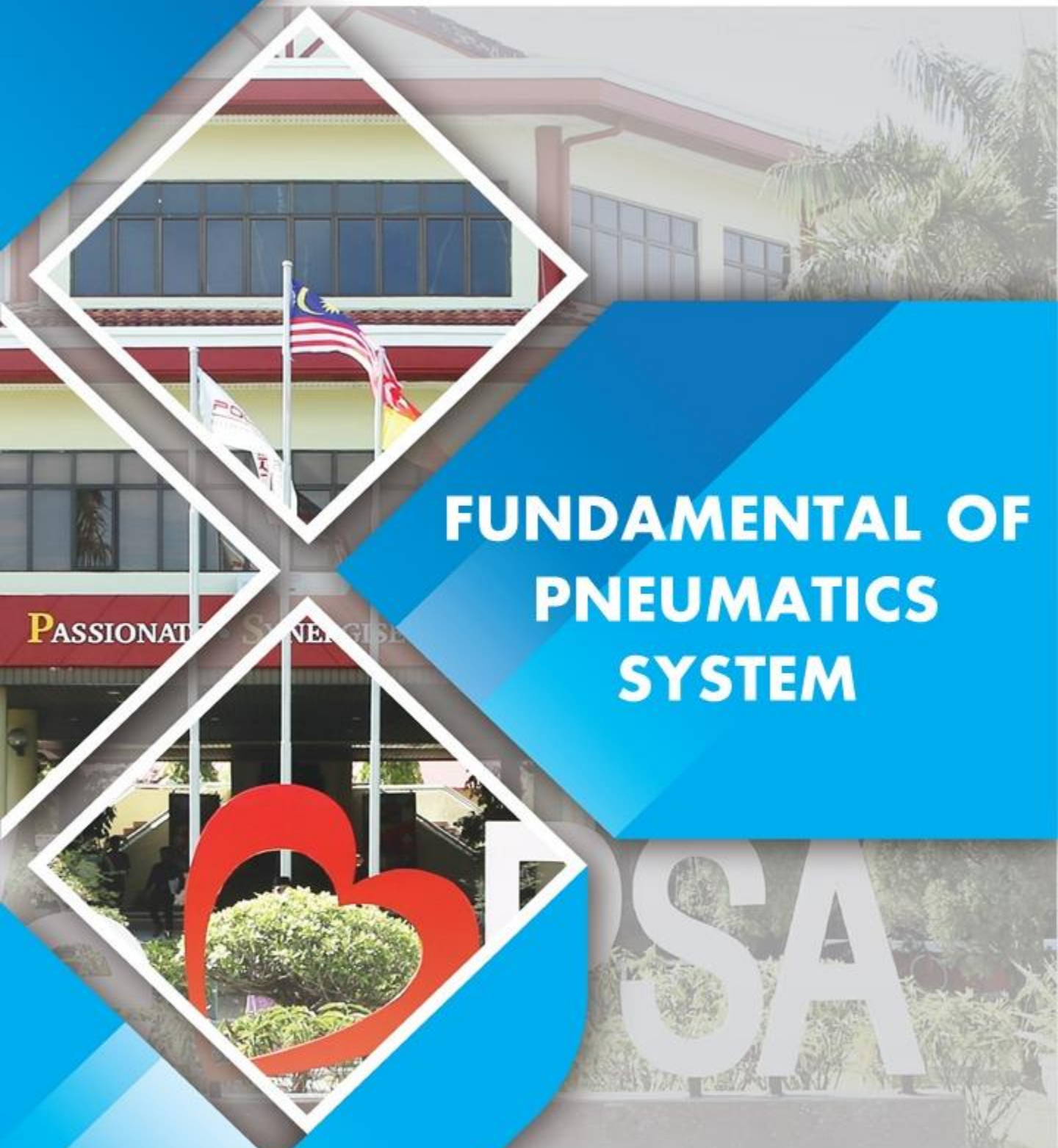

FUNDAMENTAL OF PNEUMATICS SYSTEM

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Fundamental of PNEUMATIC SYSTEM

First Edition

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PREFACE

The fundamental of the Pneumatics System is one of the important parts in the technology of automation system. In this book, the reader will be introduced to the system and its components. Standard Symbols Of The Pneumatic Component has also been introduced as beginner knowledge. The learning system is therefore broken down in this chapter focuses only on a fully pneumatic system as follows:

- Basic of pneumatic system
- The Standard Symbols Of The Pneumatic Component
- The components of the pneumatic

The learning system for pneumatic technology is continuously updated and expanded according to developments in the field of education and actual professional practice. This book deals with various pneumatic components and is very helpful for engineering students to explore the machine part.

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-COMBINATION VALVE

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-ROTARY ACTUATOR

5.0 STANDARD SYMBOLS OF THE PNEUMATIC COMPONENT

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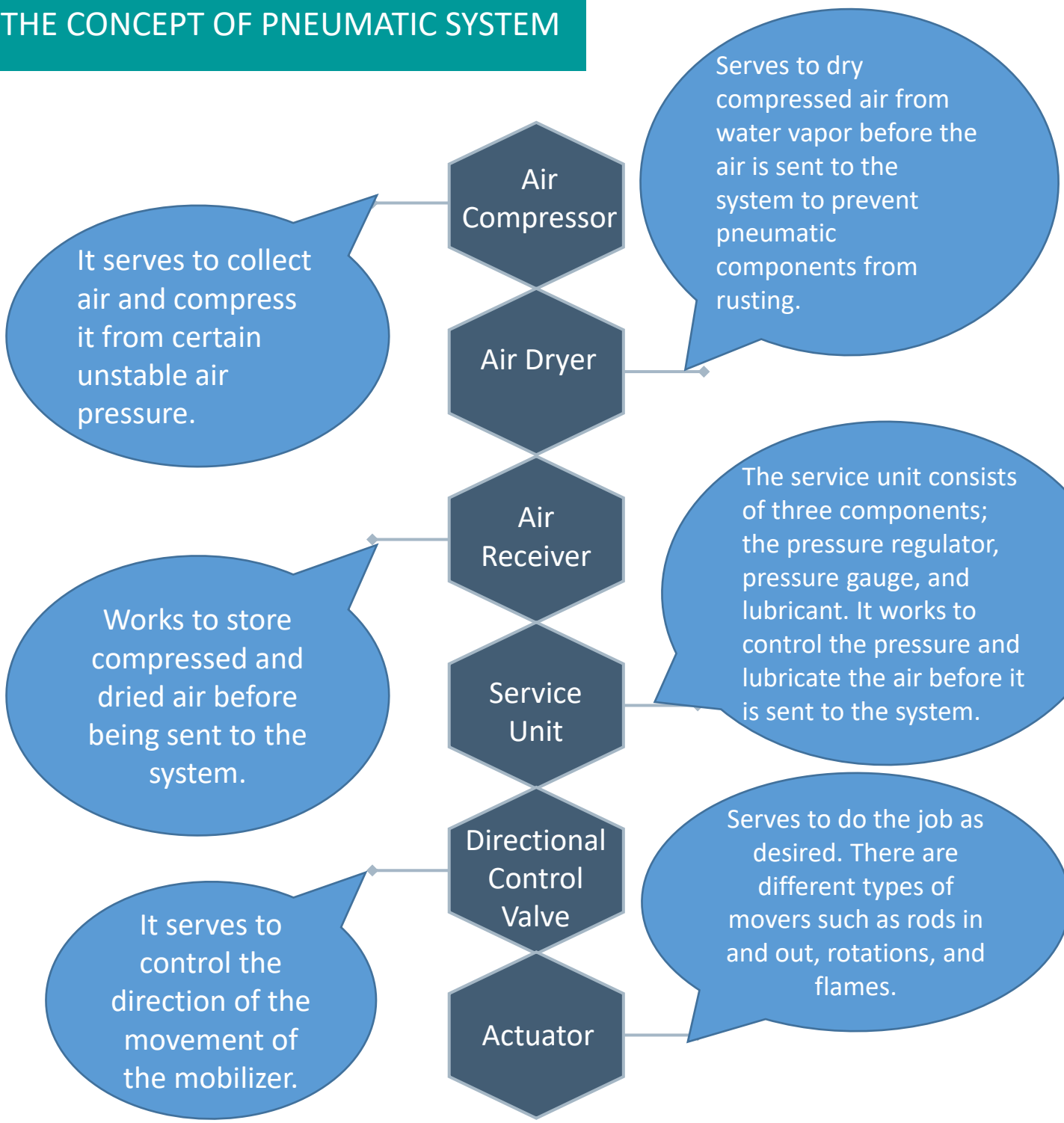
Introduction to Pneumatic System

Pneumatic systems are widely used in electronic components, food processing machines, and pneumatic devices such as drill machines, air motors. The pneumatic system is also used by buses on the automatic door system and the brake section.

Pneu is a Greek word that means wind, while *matik* refers to power. Therefore, a pneumatic system can be understood as a system powered by wind power. The pneumatic system uses compressed air as a power transfer media. Compressed air is surrounding air that has been compressed using an electric motor operated air compressor.

Usage Of Pneumatic Control In The Industry

THE CONCEPT OF PNEUMATIC SYSTEM



Benefits Of The Pneumatic System

Image Courtesy: rowse.co.uk

Among the benefits of the pneumatic system are as below :

a) Easy to channel for long distances and easy to store. That is, its availability is Unlimited.

b) The water is not subject to temperature and is not flammable.

c) Can provide an effective Way for multiplication, easy to adjust and no load load problem.

d) Water can can provide flexibility in machine control

e) Can provide a quick response to start and cessate control.

f) Water doesn't need a backflow.

g) The air is clean, the leak will not pollute the environment. The air volume is low, so it moves faster than hydraulic oil.

h) Components of a pneumatic system are easy to build when compared to other systems

Disadvantages Of Pneumatic Systems

The disadvantages of the pneumatic system are as below :-

a) Water Compressed requires careful system Setup .

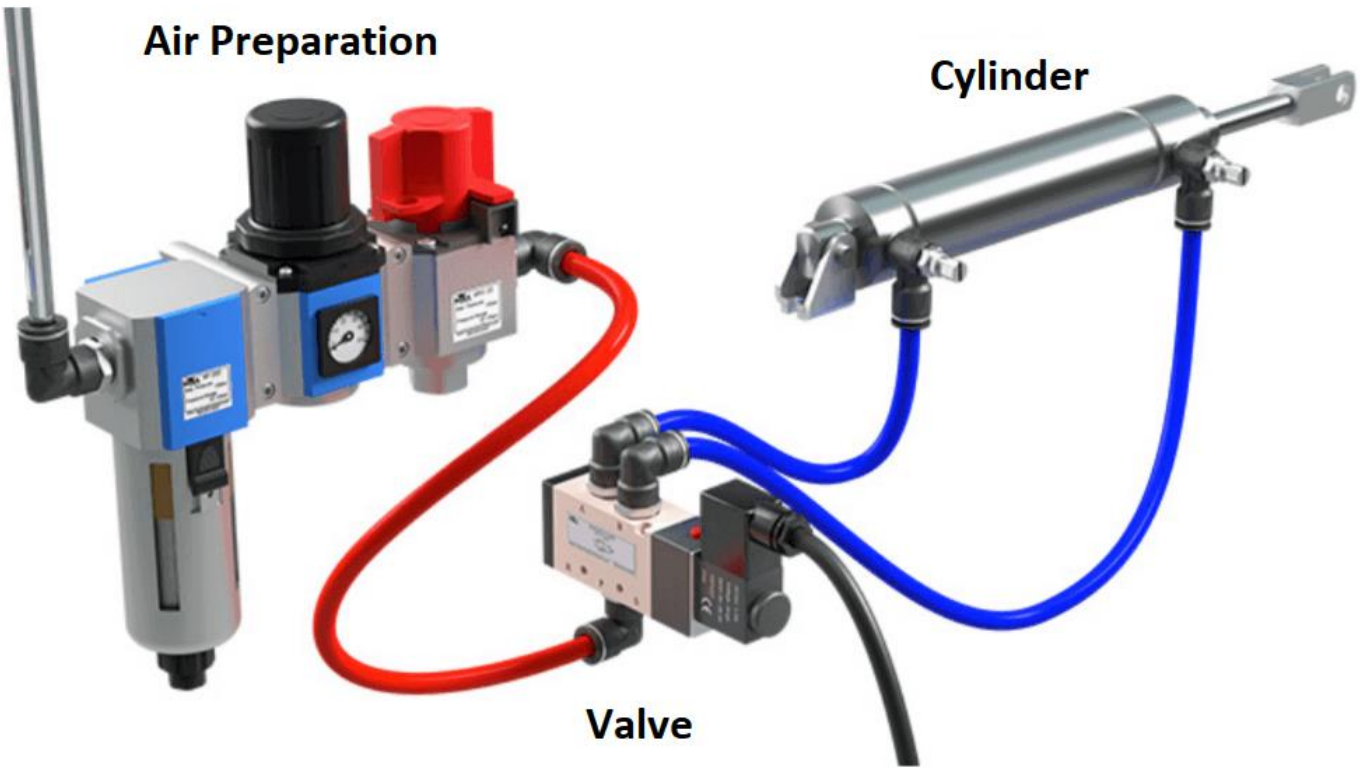
b) The air that comes out of the compression process emits a loud noise.

c) Although maintenance costs are low but the preparation cost is high (to dispose of contaminants).

d) Its power requirements are limited, only from 20 kN – 30 kN.

e) Compression cannot produce constant and uniform piston speeds.

f) To be a source of quake, compressed air is arguably expensive. It uses a lot of pipes.



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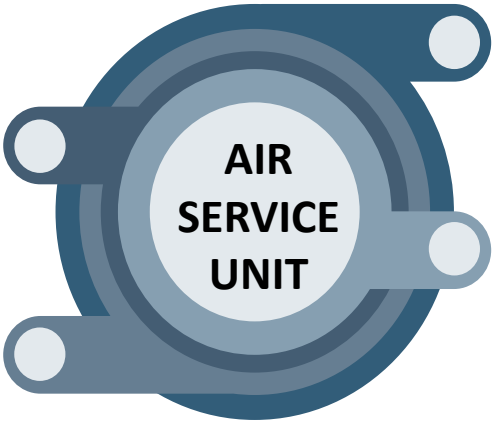
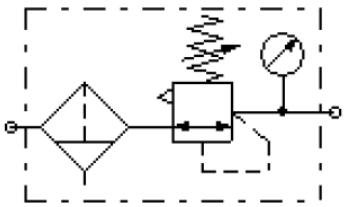
PNEUMATIC SYSTEM ELEMENTS

SUPPLY ELEMENTS





Consist of three main part:

1. Compressed Air filter:
   - to separate water and impurities from the compressed air

2. Compressed Air Regulator:
- To ensure the pressure is constant during the operations.

3. Compressed Air Lubricator:
- distributes oil mist into the air distribution system when required.

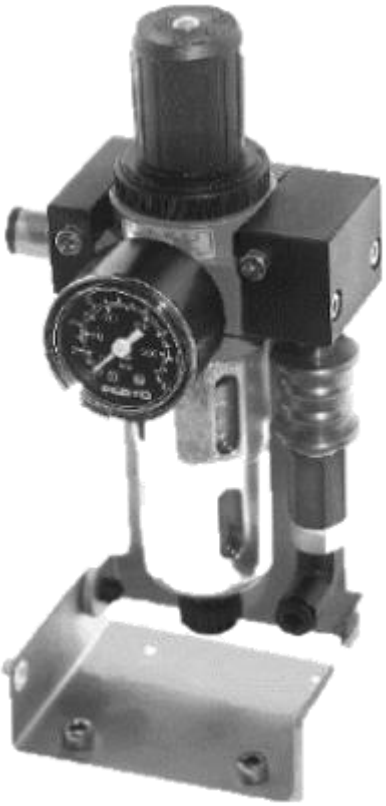
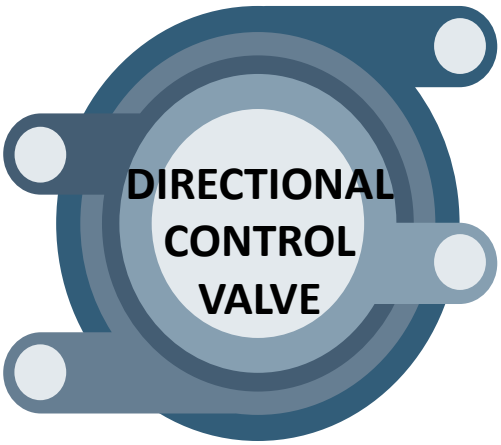


Fig. 1: Air service unit

PNEUMATIC SYSTEM ELEMENTS

VALVE



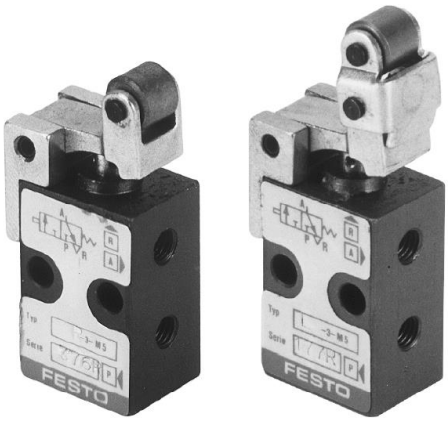
Function:
Controls the passage of air signals by:
- generating,
- cancelling or
- redirecting signals.

Way to describe valve:	
Description	**Example**
Ports	2-way, 3-way , 4-way
Positions	2 positions, 3 positions
Actuation Method	Manually, Mechanically, Pneumatically, Electrically
Return Actuation Method	Spring return, air return

Function of DCV	Example:
Signalling element	Roller lever detect the position rod piston cylinder
Processing element	Process depends on input signal
Control element	Control delivery required quantity of air

PNEUMATIC SYSTEM ELEMENTS

VALVE



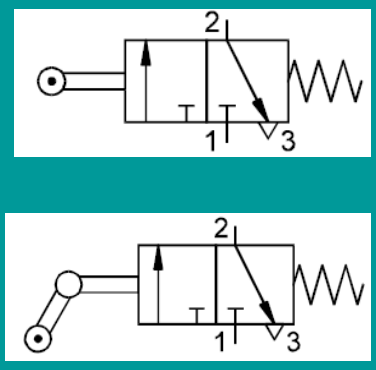
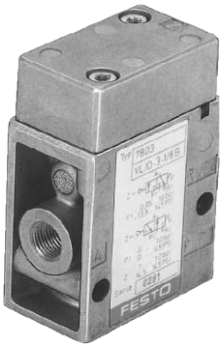


Fig. 2: 3/2 way roller lever valve (without and with idle return)



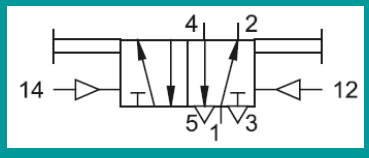
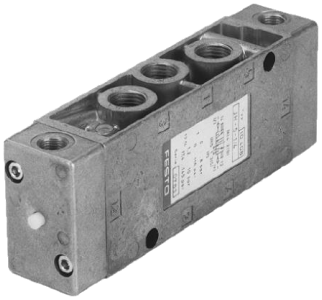


Fig. 3: 3/2 way air actuated valve: single pilot valve, with spring return



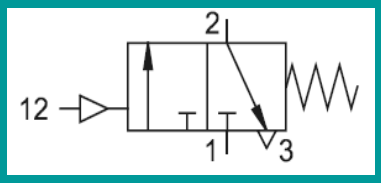
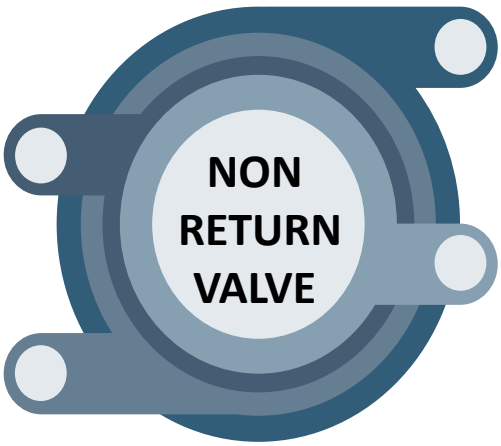


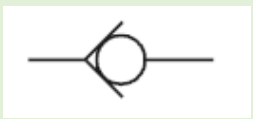
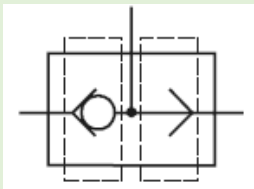
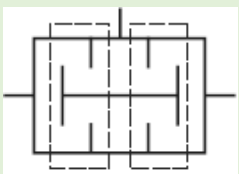
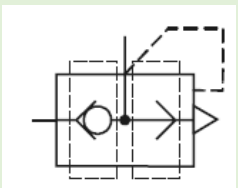
Fig. 4: 5/2 way valve for cylinder control: double pilot valve

PNEUMATIC SYSTEM ELEMENTS

VALVE

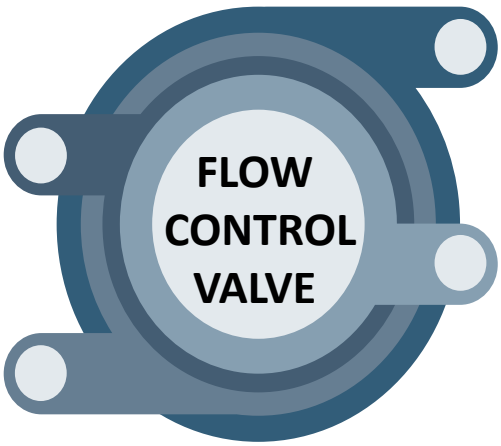


Function:
Controls allows a signal to flow through the device in one direction

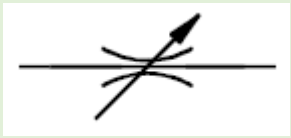
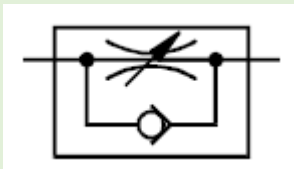
Types of Non Return Valve	Symbol
Check valve	
Shuttle valve	
Dual pressure valve	
Quick exhaust valve	

PNEUMATIC SYSTEM ELEMENTS

VALVE

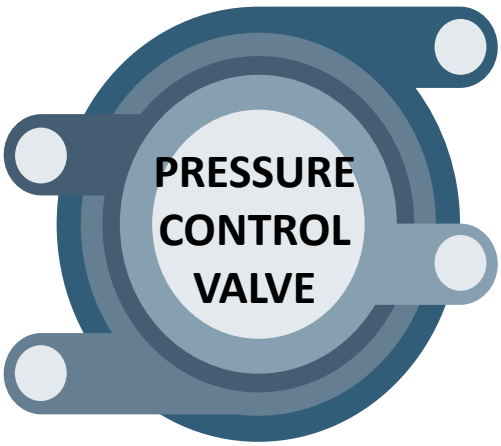


Function:
Control the air in a particular direction; to reduce the flow rate of the air and control the signal flow.

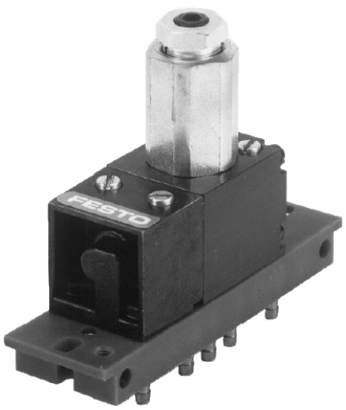
Types of Non Return Valve	Symbol
Flow control valve, adjustable	
One way flow control valve	

PNEUMATIC SYSTEM ELEMENTS

VALVE



Way to describe valve:	
Description	**Example**
Pressure limiting valve	Set the system to correct pressure
Pressure regulating valve	Ensure the constant pressure
Pressure sequence valve	Control system based on input signal



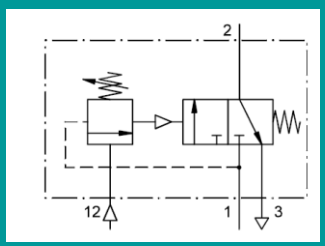
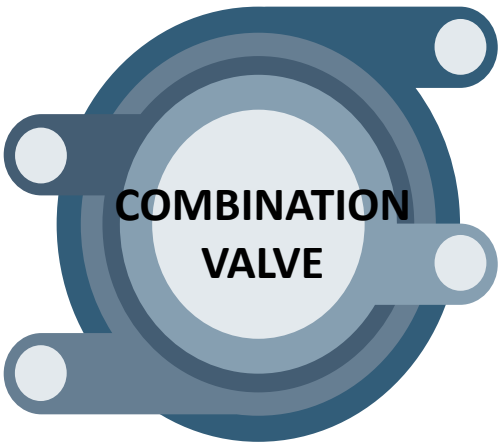


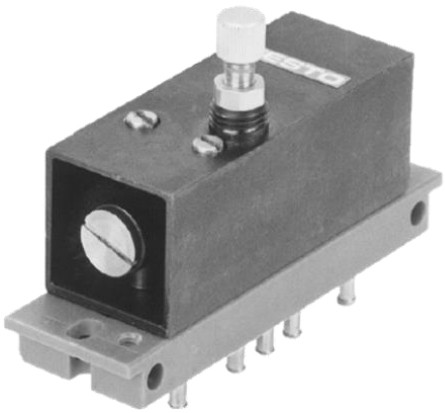
Fig. 5: Pressure sequence valve

PNEUMATIC SYSTEM ELEMENTS

VALVE



Function:
Produce a new function/task in the system



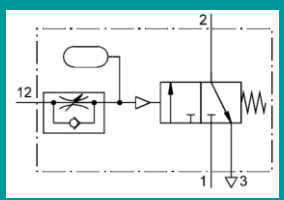
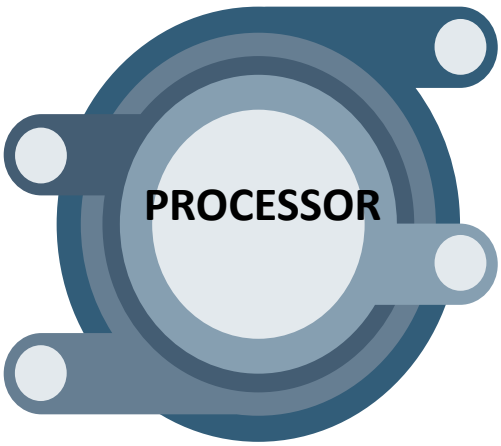


Fig. 6 Time delay valve

The combination valve consist parts:
Two-hand start unit
Pulse generator
Stepper modules
Memory modules

PNEUMATIC SYSTEM ELEMENTS

PROCESSING ELEMENT



Function:
Support DCV in the processing phase. 2 types:
-Dual pressure valve (AND function)
-Shuttle valve (OR function)

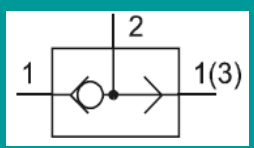
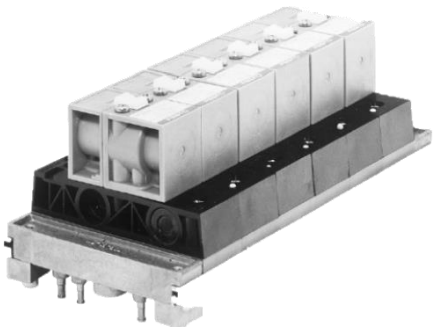


Fig. 7 Shuttle valve



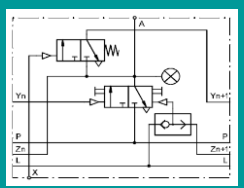
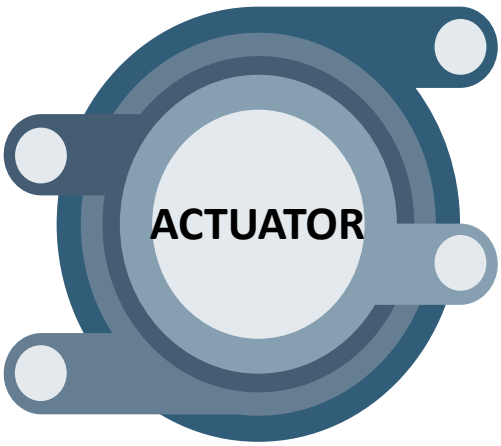


Fig. 8 Modular processing unit (stepper module)

PNEUMATIC SYSTEM ELEMENTS

POWER COMPONENTS



Function:
The actuators are added by the control elements, which assignment the required quantity of air to move the actuator.

Types of actuator
Linear actuator
Single-acting cylinder
Double-acting cylinder

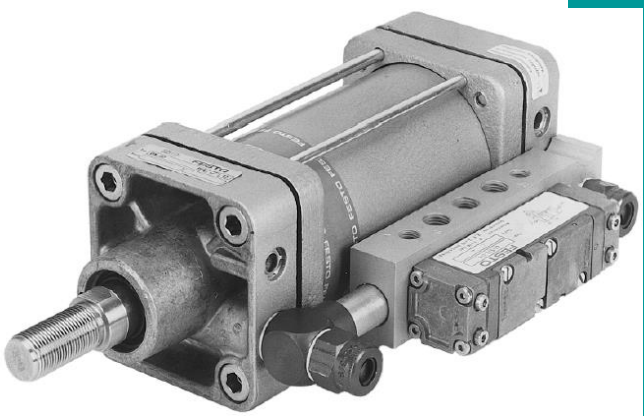


Fig. 9 Actuator with control element

PNEUMATIC SYSTEM ELEMENTS

POWER COMPONENTS

Rotary actuator
Air motors
Rotary actuators

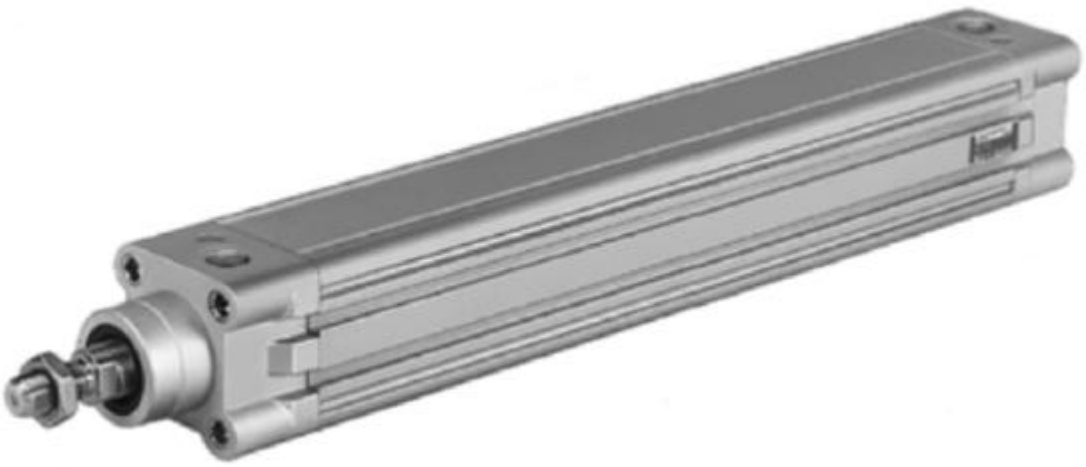
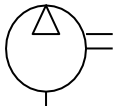
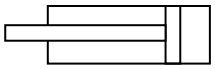
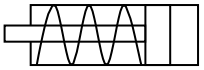
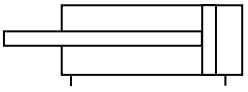
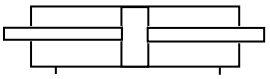
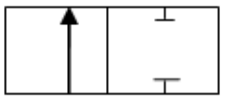
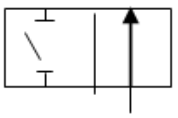
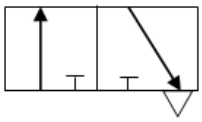
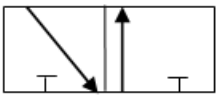
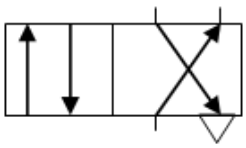
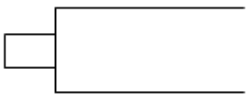


Fig. 10
Actuators, linear and rotary

STANDARD SYMBOLS OF THE PNEUMATIC COMPONENT

COMPONENTS	DESCRIPTION	SYMBOL
Pneumatic compressor	Fixed displacement	
Pneumatic cylinders	Double Acting	
	Single Acting	
Pneumatic cylinders two-way action	Single rod	
	Twin rods	
Valve 2/2	Two inlet	
	Two inlet open	

STANDARD SYMBOLS OF THE PNEUMATIC COMPONENT

COMPONENTS	DESCRIPTION	SYMBOL
Valve 3/2	Closed inflows	
	Open inflow liang	
Valve 4/2	Two-way streams (one exhaust)	
Humane movement	Am	
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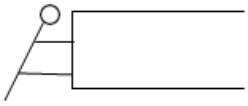
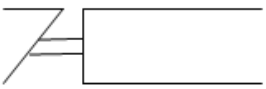
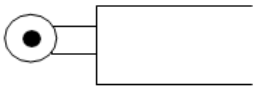
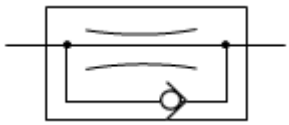
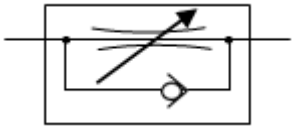
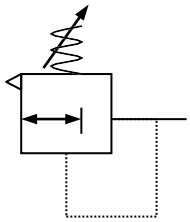
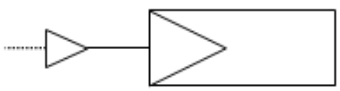
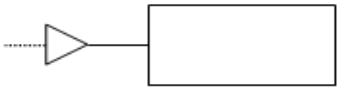
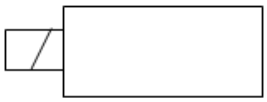
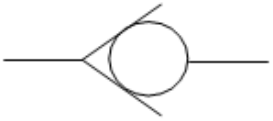
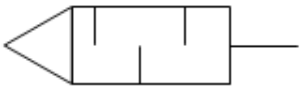
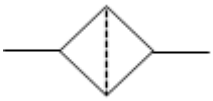
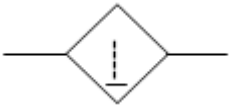
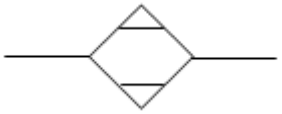
	Lever	
	Injak	
Mechanical motion	Roller	

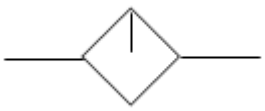
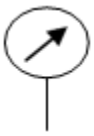
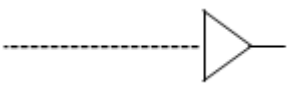
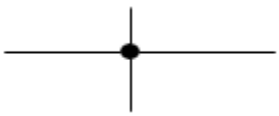
STANDARD SYMBOLS OF THE PNEUMATIC COMPONENT

COMPONENTS	DESCRIPTION	SYMBOL
Flow control valve	Transformable flow control	
	One-way flow control only	
	Transformable flow control in one direction only	
Pressure regulator	Convertibles	
Pneumatic movement	Pressure on solid valves	
	Direct pressure	

STANDARD SYMBOLS OF THE PNEUMATIC COMPONENT

COMPONENTS	DESCRIPTION	SYMBOL
Electrical motion with a single-loop solenoid	With a solenoid one coil	
One-way valve	Without spring	
	With spring	
Silencer		
Filter	Without water filtering	
	With a water filter	
Air dryer		

STANDARD SYMBOLS OF THE PNEUMATIC COMPONENT

COMPONENTS	SYMBOL
Lubricants	
Pressure gauge	
Air source from compressor	
Air ducts	
Pneumatic guide channel	
Channel connection	

QUESTIONS

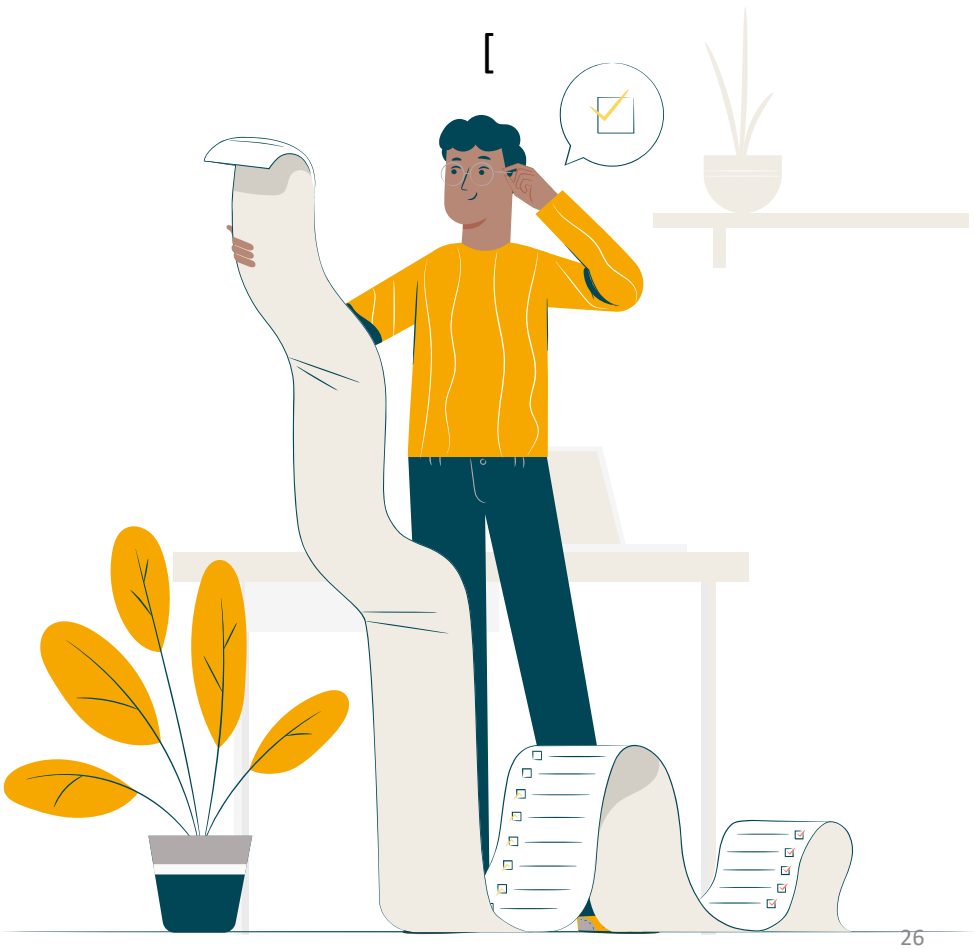
QUESTION 1

List FIVE (5) advantages of a pneumatic system.

QUESTIONS

QUESTION 2

1. List FIVE (5) basic equipments of a pneumatic system.



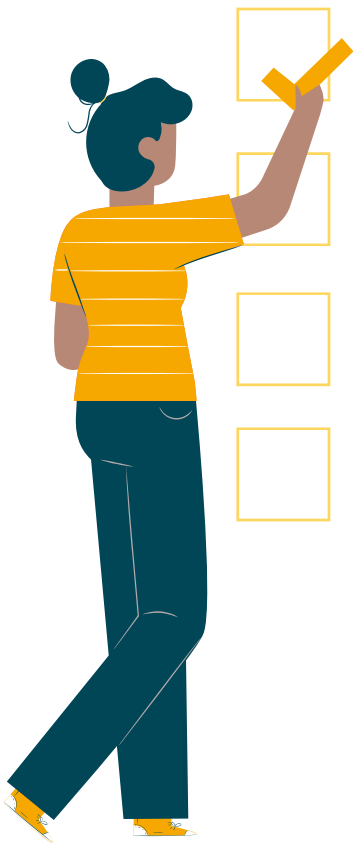
QUESTIONS

QUESTION 3

a. Define pneumatic.

b. List FOUR (4) advantages and disadvantages of a pneumatic system.

c. Sketch a block diagram for a pneumatic system. Give one example for each element of the block.



QUESTIONS

QUESTION 4

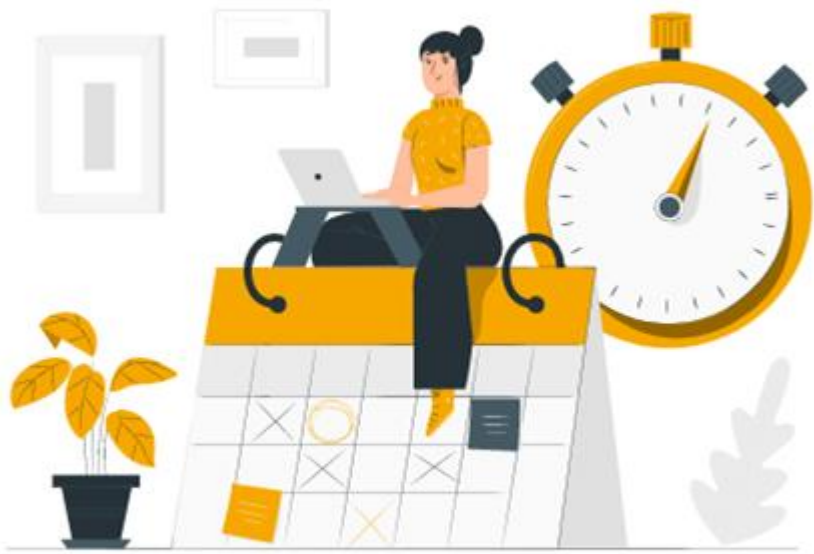
Differentiate between single stage piston compressor and double stage piston compressor.

QUESTIONS

QUESTION 5

Illustrate the standard ISO symbol for pneumatic components below:

i. 2/2 way DCV, normally closed
ii. Non return valve, without spring
iii. Filter
iv. Pressure gauge
v. Dryer



QUESTIONS

QUESTION 6

a. List FIVE (5) uses of a pneumatic system in the industry.

b. With an aid of illustration, describe the basic operating principle of a sliding vane compressor.

QUESTIONS

QUESTION 7

With an aid of sketching the standard symbol, differentiate between single acting and double acting cylinder.

QUESTIONS

QUESTION 8

a. List FIVE (5) uses of a pneumatic system in the industry.

b. With an aid of illustration, describe the basic operating principle of a sliding vane compressor.

c. With an aid of sketching the standard symbol, differentiate between single acting and double acting cylinder.

REFERENCES

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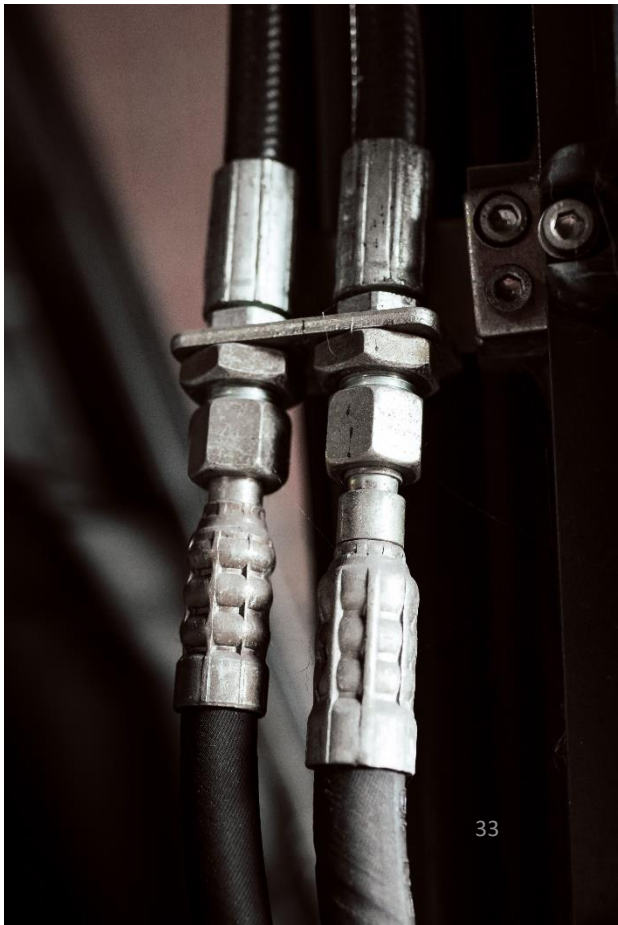

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