ثانوية التكنولوجيا التطبيقية
Applied Technology High School

Basic Pneumatics

Module 4

One way flow control valve & Quick exhaust valve

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IAT Curriculum Unit

January 2011

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One way flow control valve & Quick exhaust valve

Module Objectives

Upon the completion of this module the student will be able to:

1. Control the speed of single acting cylinder by using one way flow control valve
2. Draw a pneumatic circuit diagram containing one way flow and quick exhaust valve.
3. Construct a pneumatic circuit according to the requirements.
4. Simulate pneumatic circuit using Fluid SIM software.

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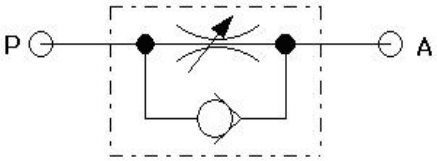
1. One way flow control valve

1.1 Function:

Controls the flow in one direction only

Figure (4.1.a) shows the picture of the one way flow control valve and figure (4.1.b) shows its ISO symbol

(a) one way flow control valve



(b) ISO symbol of one way flow control valve

1.2 Construction of the one way flow control valve

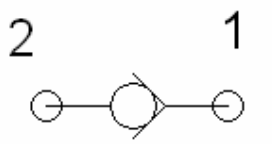
One way valve consists of:

1- Check valve

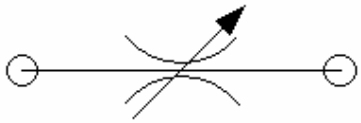
2- Throttle valve.

If the flow from (P) to (A), the check valve (figure 4.1.c) stops the flow passing in this direction and the flow then passes through the throttle valve (figure 4.1.d). The cross-section of the throttle is adjustable via a regulator screw.

If the flow in the opposite direction from (A) to (P), the check valve permits freely the flow from (1) to (2)



(c) Check valve



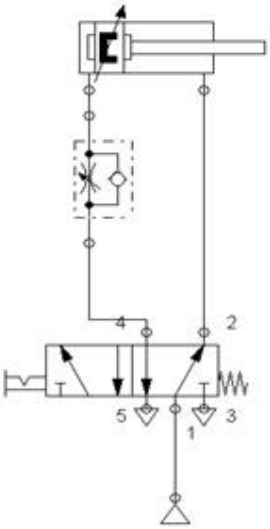
(d) Throttle valve

Fig 4.1

1.3 Types of flow control used with double-acting cylinders.

1.3.1 Supply air Throttling

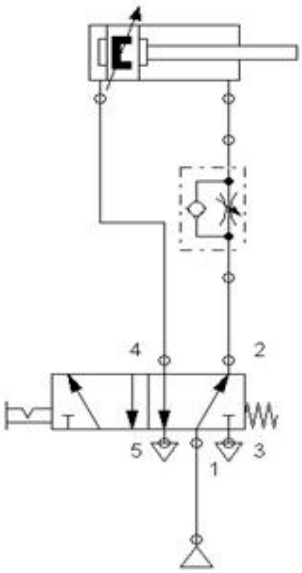
In the case of supply air throttling (figure4.2.a), the one-way flow control valves are installed such that air being fed to the cylinder is restricted. Exhaust air can escape freely via the non-return valve. Supply air throttling is used for single acting cylinders and small volume cylinders



(a) Supply air throttling

1.3.1 Exhaust air flow control

In the case of exhaust air throttling (figure4.2.b), supply air flows freely to the cylinder and the flow control in the exhaust line resists the escaping air. The piston is held between two air cushions. Exhaust air throttling should always be used for large double acting cylinders with long strokes.



(b) Exhaust air throttling

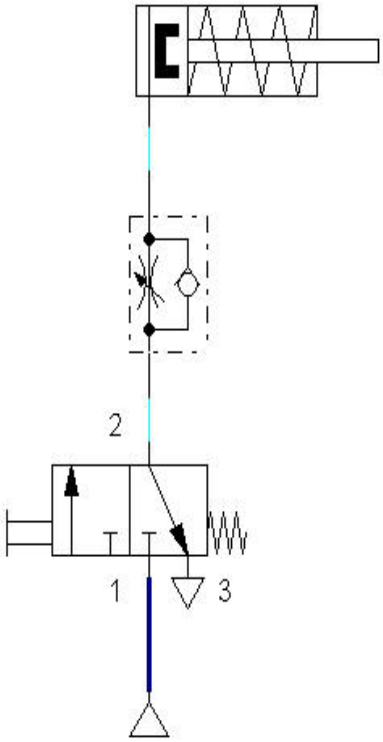
Figure 4.2

2 Practical Task 1: Controlling the speed of a single acting cylinder:

Required components: The following items are required to complete this task:

- Single acting cylinder
- 3/2 way valve N/C
- One way flow control valve
- Pressure supply

The pneumatic circuit diagram is shown in Fig.4.3.



Pneumatic circuit diagram

Fig.4.3

2.1. Procedures

1- Prepare the components according to components list.

2- Mount all components according to Pneumatic circuit.

3- Connect pneumatic tubes according to the pneumatic circuit.

4- Check all parts are connected properly with each other.

5- Switch on the service unit.

6- Start the circuit and check the operation

7- Turn off the service unit

8- Dismantle and tidy up.

3 Quick Exhaust valve

3.1 Function:

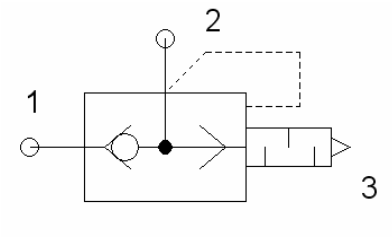
In many applications especially with single acting cylinders, it is a common practice to increase the piston speed during retraction of the cylinder to save the cycle time. This is carried out by incorporating a Quick exhaust valve figure (4.4.a). The Quick exhaust valve has essentially three ports: supply port 1, is connected to the out put of the final control element (Directional control valve). The Output port 2 of this valve is directly fitted on to the working port of cylinder. The exhaust port 3 is left open to the atmosphere

The I.S.O. symbol for Quick exhaust valve is shown in the figure (4.4.b).

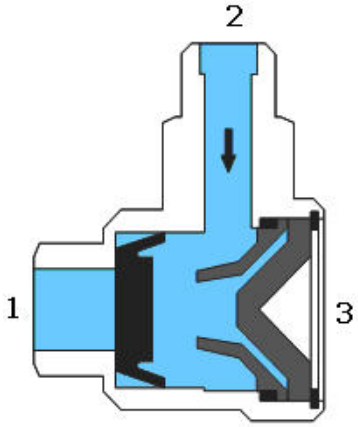
3.2 Way of operation

Compressed air flows from the pilot valve to the cylinder via the quick exhaust valve from port (1) to port (2). Exhaust port 3 is closed at this time. When pressure at port 1 drops, exhaust flow occurs from port (2) to port (3) as illustrated in figure (4.4.c). In order to implement optimized quick exhaust, the valve must be connected directly to the cylinder's supply port.

(a) Quick exhaust valve



(b) ISO symbol of quick exhaust valve



(c) Schematic diagram of the quick exhaust valve

Figure 4.4

4 Practical Task 2: Controlling the cylinder return stroke by using quick exhaust valve

Required components: These are the required items for completing this task

- Single – acting cylinder.
- 3/2 way valve N\C
- Quick exhaust valve

4.1 Procedures

1- Prepare the components according to equipments list.

2- Mount all components according to Pneumatic circuit.

3- Connect pneumatic tubes according to the pneumatic circuit.

4- Check all parts are connected properly with each other.

5- Switch on the service unit .

6- Start the circuit.

7- Turn off the service unit

8- Dismantle and tidy up.

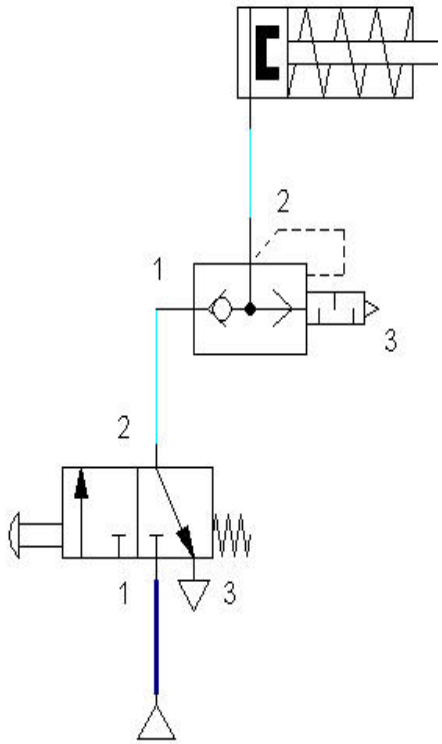


Fig.4.5
Pneumatic circuit diagram

5 Practical Task 3: Actuating a shut-off device

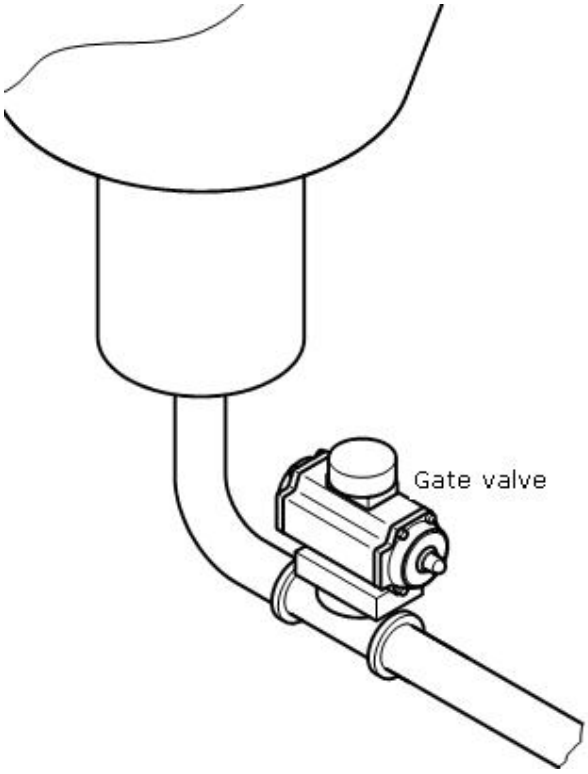
5.1 Learning objectives:

Upon the completion of this task, the students will be

- able to adjust cylinder advancing and retracting speeds.
- familiar with one type of signal storage in pneumatic control system.

5.2 Task description:

The gate valve in a filling system for plastic pellets is operated by double acting cylinder that needs to be closed quickly during the forward stroke. However, it should be opened slowly during the backward stroke. The circuit should be controlled indirectly using 5/2 way, double pilot (memory valve).



Positional sketch

5.3 Task requirements:

1. Draw pneumatic circuit diagram
2. Simulate the circuit using FluidSim software.
3. Assemble the circuit practically and check its operation.

Draw the pneumatic circuit here

References:

1- Festo manuals and workbook TP501
2- www. Fest-didactic.com

Student's notes

Worksheet 1

Describe the single acting cylinder and draw its symbol.

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What is the function of quick exhaust valve?

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Describe the operation of quick exhaust valve.

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Draw the ISO symbol for quick exhaust valve.

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Describe the one way flow control valve and draw its symbol.

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What is the function of one way flow control valve?

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Worksheet 2

In a diary production line, a stamping machine is used to print the production and expiry dates on certain products. The stamping machine is operated by a single acting cylinder. Draw a pneumatic circuit that controls the movement of the above single acting cylinder taking in consideration the following conditions:

1- The speed of the forward stroke is adjustable in order to avoid any damage of the product.

2- The retract (backward) stroke is to be achieved rapidly in order to increase the production.

Draw the pneumatic circuit here