DIESEL MECHANIC

MINING QUALIFICATIONS AUTHORITY

CODE: PN - 4

CONTROL THE SPEED OF A SINGLE ACTING CYLINDER

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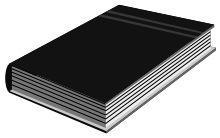
TRG 9

INDEX

The following elements are contained in this learning guide:



SOURCE REFERENCES

Demonstration by a competent person, e.g. a Training Officer.

FESTO – Pneumatics Basic Level Textbook

OBJECTIVE

You will be learning towards the outcome “Control the speed of a single acting cylinder”.
Whilst learning towards the outcome you will be required to achieve the following:

- Know the function of a variable flow control valve.
- Know the function of a check valve / non – return valve.
- Know the function of a quick exhaust.
- Know how to construct a circuit controlling the speed of a single acting cylinder.

On completion of this module, the learner must be able to:

- State the function of a variable flow control valve.
- State the function of a check valve / non – return valve.
- State the function of a quick exhaust.
- Construct a circuit controlling the speed of a single acting cylinder.

During this process you must adhere to certain specified requirements as listed in the Module.

ASSESSMENT AND EVALUATION CRITERIA

You will be assessed, when you are confident that you may achieve the outcomes as listed, to determine your competence as measured against the required criteria. This assessment will be in line with accepted best practices regarding assessment.

- Theoretical and practical assessments will be set during the module and must be completed without using reference.
- The learner will be required to answer all the questions without any reference.

HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM

PN - 4

CONTROL THE SPEED OF A SINGLE ACTING CYLINDER

STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. Construct a pneumatic circuit.	• Improper or careless handling of pneumatic components and pipes can lead to damage of equipment.	• Always handle components and pipes correctly, and with great care. • Wipe components and panel clean after use and store components.
2. Use of compressed air in a pressurised circuit.	• Circuit under pressure.	• Ensure circuit is depressurised before removing components or pipes
3. Insure work area is safe.	• Dirt particles in eyes and laceration of skin.	• Wear correct PPE.

NOTE: Before doing the practical work contained in this module, the learner must study the content of the above HIAC form again and then sign the statement below.

The above risks, which will be encountered in this module, are fully understood and will be controlled during the practical work.

Signature of learner: _____

Signature of Training Officer: _____

Date: _____

1. INTRODUCTION

ITEM / TASK: Introduction.

DESCRIPTION:

A. In module PN-1, it was explained that the speed of a cylinder is dependent on the flow of air supplied to it. Therefore, if the amount of air that flows to a cylinder can be controlled, the speed of the cylinder can be controlled.

2. VARIABLE FLOW CONTROL VALVE

ITEM / TASK: Components of a variable flow control valve.

DESCRIPTION:

A. This valve is a combination of two types of valves, namely, a variable flow control valve and a spring-loaded check / non return valve.

B. The variable flow control valve consist of the following components: (Fig 1)
   a. Housing
   b. Throttling screw
   c. Lock nut
   d. Sealing ring

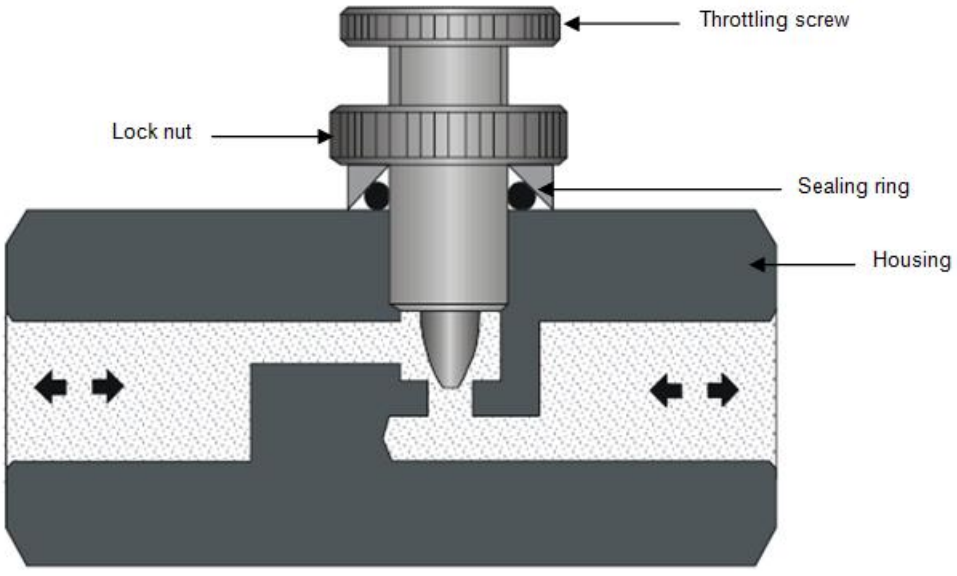


FIG 1.

C. The symbol for a variable flow control valve is shown in Fig 2.

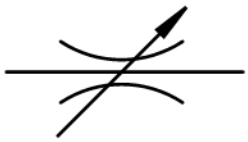


FIG 2.

ITEM / TASK: Function and application of a variable flow control valve.

DESCRIPTION:

A. Variable flow control valves influence the volumetric flow of the compressed air in both directions.
B. The throttle valve is also known as a variable flow control valve. Throttle valves are normally adjustable and the setting can be locked in position.
C. Throttle valves are used for speed control of cylinders.
D. Care must be taken that the throttle valve does not close completely, cutting off air to the system.

ITEM / TASK: Operation of a variable flow control valve.

DESCRIPTION:

A. The variable flow control valve restricts or throttles the air in a particular direction to reduce the flow rate of air and hence control the signal flow. The flow of air through the valve will be equal in both directions.
B. The variable flow control valve should be fitted as close to the working element as possible and must be adjusted to match the requirements of the application.
C. Most flow control valves are adjustable and permits flow control in both directions. The arrow shows that the component is adjustable, but does not refer to the direction of flow.

3. ONE-WAY FLOW CONTROL VALVE

ITEM / TASK: Components of a one-way flow control valve.

DESCRIPTION:

A. The one-way flow control valve consist of the following components: (Fig 3)

a. Housing
b. Throttle screw
c. Lock nut
d. Sealing ring
e. Throttle screw cone
f. Spring

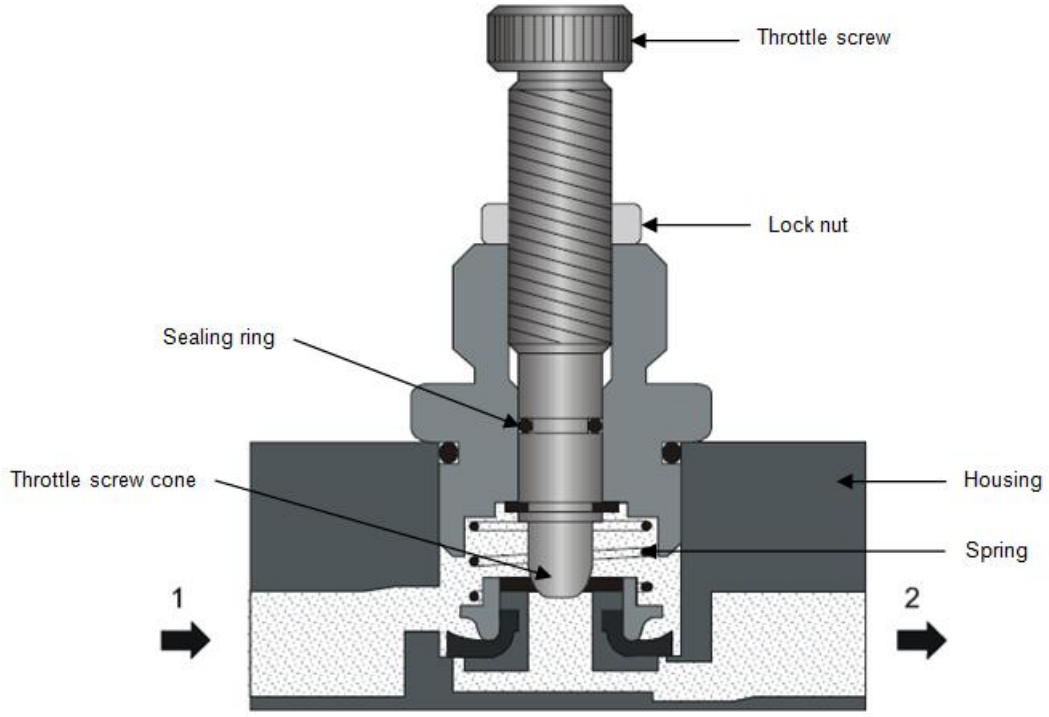


FIG 3.

B. The symbol for a one-way flow control valve is shown in Fig 4.

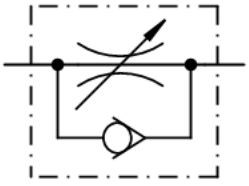


FIG 4.

ITEM / TASK: Function and operation of a one-way flow control valve.

DESCRIPTION:

A. In the case of the one-way flow control valve, the air flow is throttled in one direction only. A check / non return valve blocks the flow of air in the bypass leg. The air can flow only through the regulated cross-section. In the opposite direction, the air can flow freely through the opened check / non return valve.
B. These valves are used for speed regulation of actuators and should be mounted as close as possible to the cylinder.

4. CHECK / NON RETURN VALVES

ITEM / TASK: Introduction.

A. The check / non return valve is the basis for the development of many combined components. There are two main configurations for check / non return valve:
   a. Check / non return valve with spring return, and
   b. Check / non return valve without spring return.

ITEM / TASK: Components of a check / non return valve with spring return.

DESCRIPTION:

A. The check / non return valve with spring return consist of the following components: (Fig 5)
   a. Housing
   b. Sealing element
   c. Spring
   d. Seat

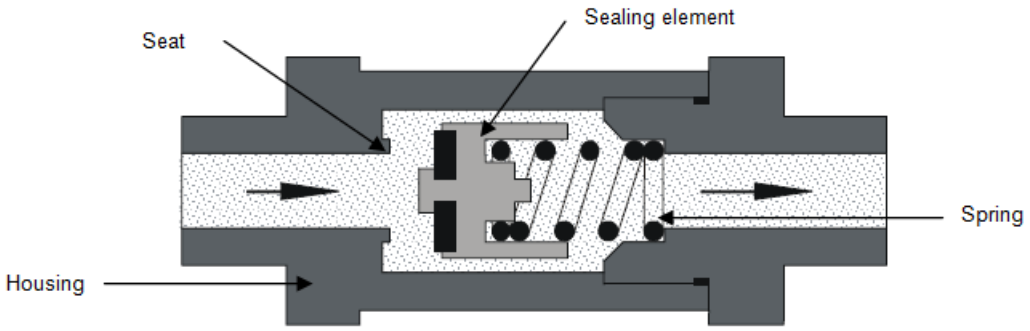


FIG 5

B. The symbol for a check / non return valve with spring return is shown in Fig 6.

FIG 6.

C. The symbol for a check / non return valve without spring return is shown in Fig 7.

FIG 7.

ITEM / TASK: Function and operation of a check / non return valve.

DESCRIPTION:

A. Check / non return valve are devices which preferentially stop the flow in one direction and permit flow in the opposite direction. The pressure on the downstream side acts against the restrictive component, thereby assisting the sealing effect of the valve.

B. Check / non return valve can stop the flow completely in one direction. In the opposite direction the flow is free with a minimal pressure drop due to the resistance of the valve. Blocking of the one direction can be effected by cones, balls, plates or diaphragms. (Sealing element)

C. In order to release flow, the pressure force must be greater than the spring force.

DO THE SELF TEST AND PRACTICE ON THE NEXT PAGES
BEFORE CONTINUING WITH THE REST OF THE MODULE.

SELF TEST 1

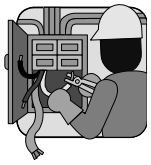
1. What is the function of a variable flow control valve?

2. What is the function of a check / non return valve?

Refer to your notes to check your answers.

Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



PRACTICE

1. Practice drawing the symbol for a variable flow control valve.

2. Practice drawing the symbol for a check / non return valve.

3. Practice drawing the symbol for a one-way flow control valve.

4. Identify the above mentioned components from the training panel / equipment.

Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

5. QUICK EXHAUST VALVE

ITEM / TASK: Introduction.

A. Each component in a pneumatic circuit, e.g. the pipe lines, valves, etc., offers a certain amount of resistance to flow. Due to this reduction in flow, the speed of the cylinder is also slowed down. The speed of a cylinder can be increased considerably by allowing the return (exhaust) air from the cylinder to escape into the atmosphere from a position which is as close as possible to the cylinder port.

ITEM / TASK: Components of a quick exhaust.

A. The quick exhaust consist of the following components: (Fig 8)
   a. Housing
   b. Sealing disc

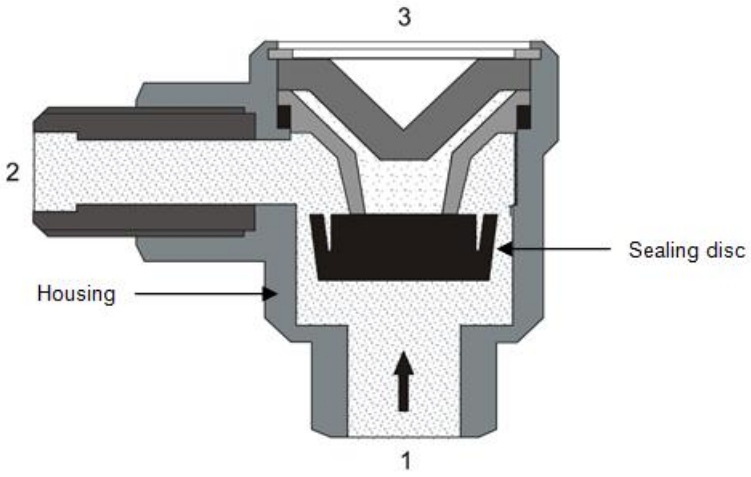


FIG 8.

B. The symbol for a quick exhaust is shown in Fig 9.

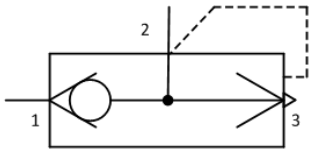


FIG 9.

ITEM / TASK: Function and operation of a quick exhaust.

A. Quick exhaust valves are used to increase the piston speed of cylinders. This enables lengthy return times to be avoided, particularly with single acting cylinders. The principle of operation is to allow the cylinder to retract at its near maximum speed by reducing the resistance to flow of the exhausting air during motion of the cylinder. To reduce resistance, the air is expelled to atmosphere close to the cylinder via a large orifice opening. The valve has a closable supply connection 1, a closable exhaust 3 and an outlet 2.

B. If pressure is applied at port 1, the sealing disc covers the exhaust port 3, whereby the compressed air passes from port 1 to 2. If pressure is no longer applied at port 1, the air from port 2 moves the sealing disc against port 1 and closes, whereby the exhaust air immediately vents to atmosphere via port 3. There is no need for the air to pass through a long and possibly restricted path to the directional control valve via the connecting lines. It is advantageous to mount the quick exhaust valve directly on the cylinder or as near to it as possible. (See Fig 10)

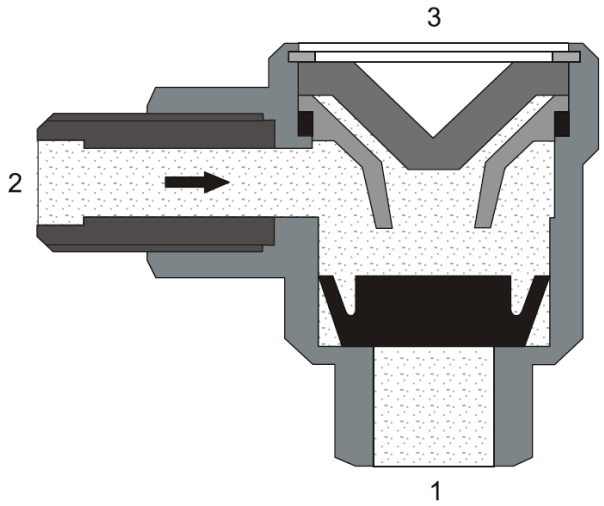


FIG 10.

DO THE SELF TEST AND PRACTICE ON THE NEXT PAGES BEFORE ATTEMPTING THE ASSESSMENT.

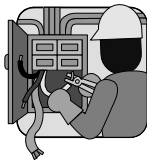
SELF TEST 2

1. What is the function of a quick exhaust valve?

Refer to your notes to check your answers.

Ask your Training Officer to check your work and if it is correct, to sign below.

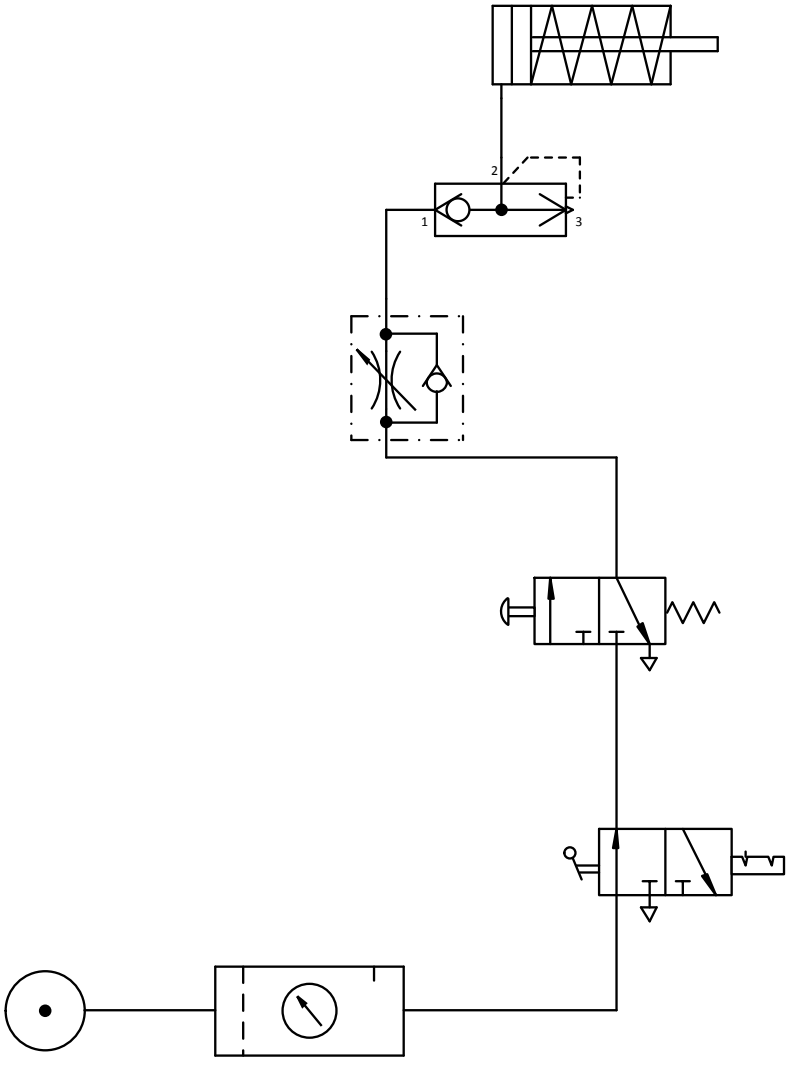
LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



PRACTICE

1. Practice drawing the symbol for a quick exhaust valve.

2. Identify the quick exhaust from the training panel / equipment.
3. Construct the circuit below on the training panel and adjust the variable flow control valve so that the piston will take six seconds to extend fully.



4. Indicate the flow of air for each position of the control valve on the above diagram.

Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

REMEMBER ALWAYS WORK SAFE

Once you have passed the entirepractices, you are now at liberty to requesta Formative Assessment from your Assessor.