Exercise No. :	**1**
Exercise title :	**Direct and indirect control of single-acting and double-acting pneumatic cylinders**
Class:	Hydraulics and hydraulic driver
Field of study:	Erasmus+ - mechanical engineering

1. **Aim of the exercise:** To acquire skills in building direct and indirect control systems of single-acting and double-acting pneumatic cylinders

2. **Equipment and software necessary to complete the exercise:**
   - laboratory stadion of FESTO Didactic

3. **Exercise:**
   1. Introduction to the topic of the exercise
   2. Control system diagrams
   3. Guidelines for preparing the report**:**

1. Introduction

The purpose of pneumatic cylinder control is to achieve its intended operation after supplying it with compressed air. A single-acting pulling cylinder with spring-loaded return movement and a double-acting cylinder will be used for the exercises. Two control systems will be used to control the cylinder extension: direct and indirect.

Direct control of the actuator's operation is used when the distance between the actuator and the control panel is small, and the system has low absorbency elements and the working pressure is small.

Indirect control is used to control elements with high absorbency and at a considerable distance between the actuator and the control panel. Usually, the operating pressure supplying the actuator is considerable and can pose a danger to the operator. They use indirect control, we are able to control the work of the high-absorbency cylinder and high pressure operating the control system, which is supplied with low, safe pressure. In addition,

using indirect control it is possible to build logic circuits that perform functions according to the assumed work programs. This can be accomplished using both logical pneumatic valves and the right way to build a control system from general pneumatic control elements.

There are two circuits in the indirect control system: the control circuit and the working circuit. The actuator control systems are adapted to work with high absorbency (high flow rates) and high pressure equipment. However, the control circuit systems are adapted to low flow rates and low, safe pressures.

2. Control system diagrams

Excercise 1

Build a single-acting cylinder control system (direct and indirect) activated by a single 1S1 directional control valve.

System operation: after pressing the 1S1 directional control valve, the cylinder piston will extend, after releasing it will immediately return.

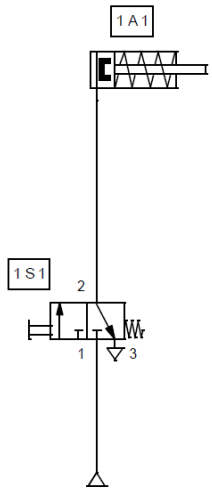

Fig. 1. Direct control system

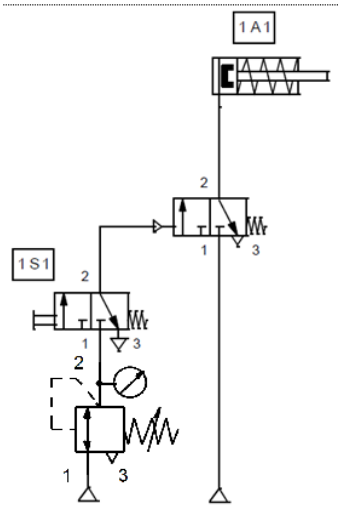

Fig. 2. Indirect control system

For direct control of the system, use the:

1. Single acting pneumatic cylinder,
2. 3/2 pneumatic directional control valve (3-way, 2-position) with manual control (monostable),
3. Compressed air at 6 bar

For indirect control of the system, use the:

1. Single acting pneumatic cylinder,
2. 3/2 pneumatic directional control valve (3-way, 2-position) with manual control (monostable),
3. 3/2 pneumatic directional control valve (3-way, 2-position) with pneumatic control,
4. Compressed air at 6 bar (actuator supply)
5. Pressure reducing valve up to 3 bar (power supply to the directional control valve 2)

Excercise 2

Build a double-acting cylinder direct control system activated by a single 1S1 directional control valve with position switch.

System operation: after switching the 1S1 distributor button, the cylinder piston will extend, after re-switching it will immediately return.

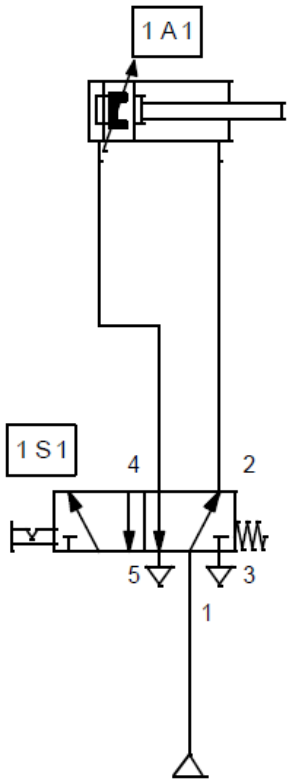

Fig. 3. Double-acting direct actuator control system

For direct control of the system, use the:

1. Double-acting pneumatic cylinder,
2. 5/2 pneumatic directional control valve (5-way, 2-position) with with position switch,
3. Compressed air at 6 bar

Attention:
Before starting the measuring station, this fact should be reported to the teacher.

3. Guidelines for preparing the report

The report should include diagrams of implemented control systems, explain the principle of operation of the single-acting push cylinder (symbol and construction diagram) and the double-acting cylinder.

Calculate the forces developed by the actuators used in the exercises for the following input data:

Single-acting cylinder:

- nominal diameter D = 10 mm
- working pressure 6 bar

Double-acting cylinder:

- nominal diameter D = 10 mm
- piston rod diameter d = 5 mm
- working pressure 6 bar

In the conclusions, give examples of how to use direct and indirect control.