Exercise No. :	**5**
Exercise title :	**Direct control of a double-sided hydraulic cylinder operation and hydraulic gear motor**
Class:	Hydraulics and hydraulic drives
Field of study:	Erasmus+ - mechanical engineering

1. **Aim of the exercise:** To acquire skills in building direct control systems for double-acting hydraulic cylinders and a hydraulic gear motor
2. **Equipment and software necessary for the exercise:** - FESTO Didactic laboratory stand

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 hydraulic cylinder control is to achieve its intended operation after supplying it with a working medium. A double-acting cylinder and a gear hydraulic motor will be used for the exercises. A direct control system will be used to control the actuator extension. Direct control of the actuator operation is used when the distance between the actuator and the control panel is small, and the system has low absorbency elements and the operating 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 done using both logical pneumatic valves and building a control system from general pneumatic control elements in an appropriate way. 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 devices with high absorption (high flow rates) and high pressure. However, the control circuit systems are adapted to low flow rates and low, safe pressures.

2. Control system diagrams

Task 1.

The task of the system is lifting and lowering with a 120 N load cylinder. The system must ensure permanent weight stop at any point of movement. The control task is fulfilled by a manually controlled 4/3 directional valve, while maintaining the actuator in any position when controlling the directional valve in the middle position is accomplished by the use of a controlled check valve. The report should answer: where it would be safer to install a throttle check valve to control the speed of extension of the actuator?

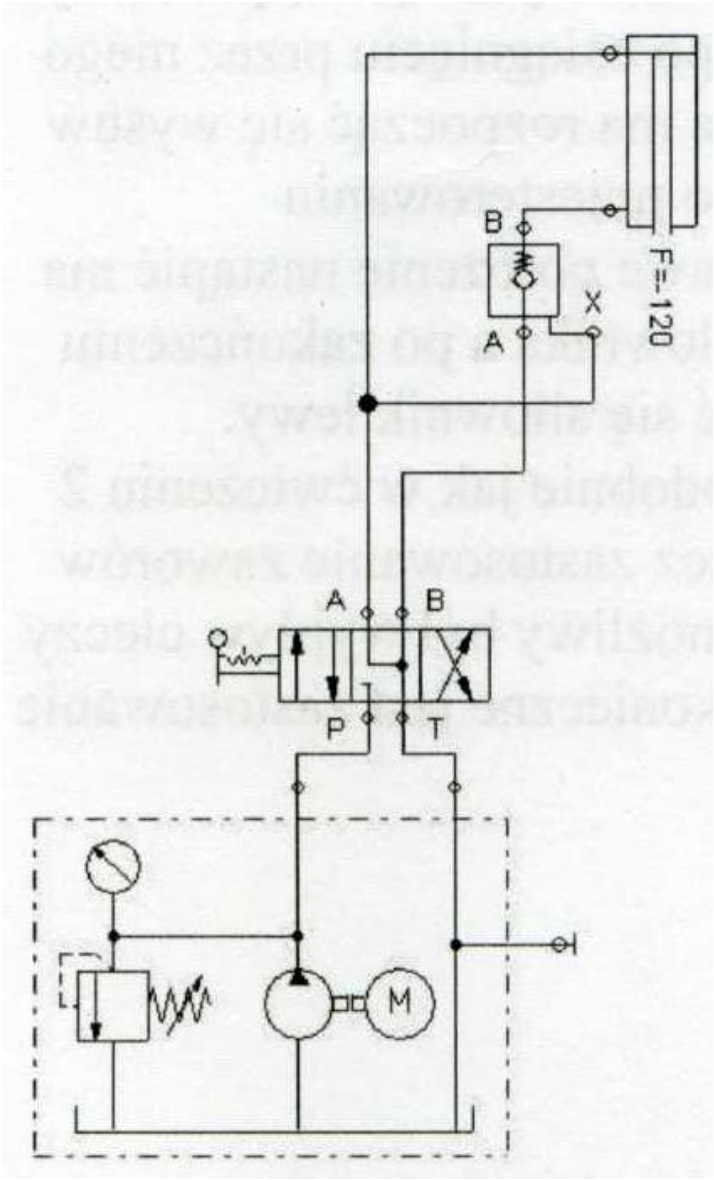

Fig. 1. Control system diagram

Task 2.

The system's task is to perform certain tasks sequentially. Initially, the cylinder is to extend, and when it reaches the end position, the hydraulic motor will be turned on. The overflow valve is responsible for starting the engine at the right time. The report should answer where the overflow valve should be connected in order for the system to operate according to the work regime specified in the task?

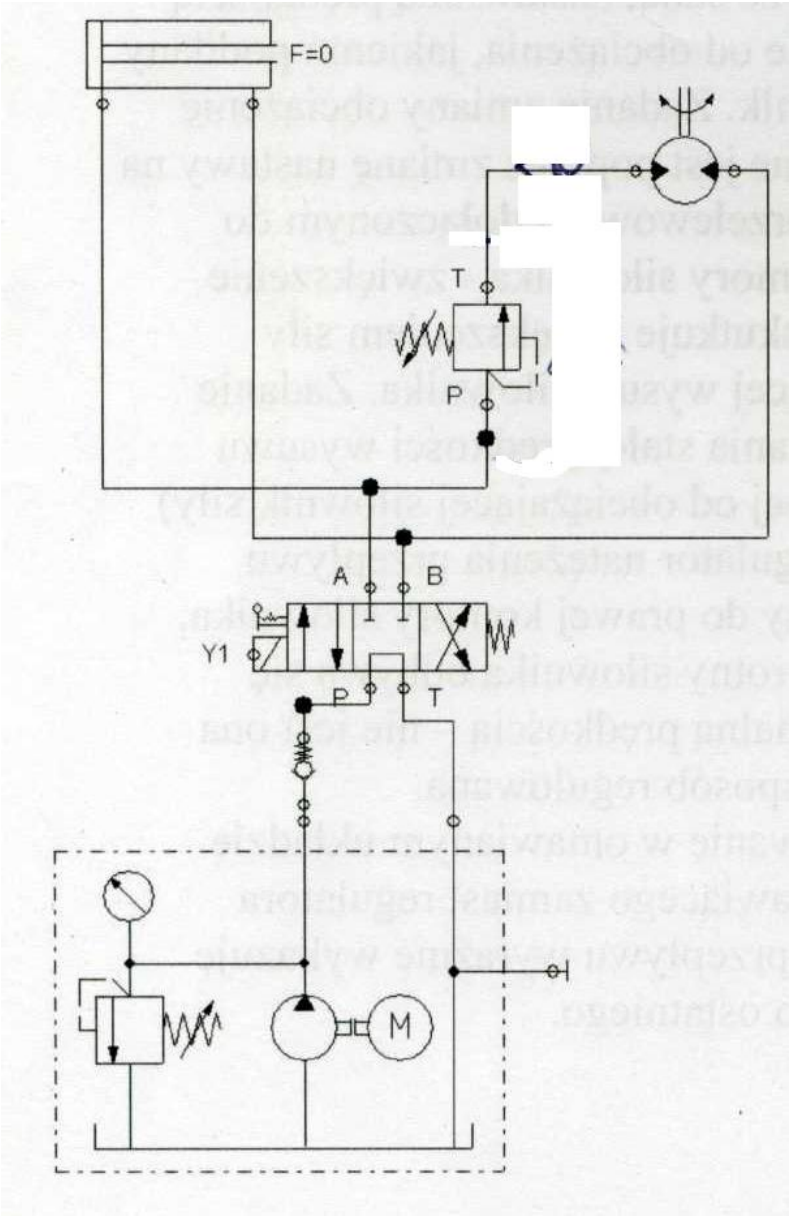

Fig. 2. Diagram of a sequential control system for the cylinder and hydraulic motor

3. Guidelines for the report

The report should answer: where it would be safer to install a throttle check valve to control the speed of extension of the actuator? (task 1)

Where should the overflow valve be connected so that the system works as specified in the task work regime? (task 2)

Calculate the maximum static forces (extension and return) that a double-acting cylinder can generate when assuming:

- Internal diameter of the hydraulic cylinder D = 30mm
- Piston rod diameter d = 6mm
- Oil working pressure p = 8bar

Indicate the possible areas of application of the control systems learned in the exercises.