DIESEL MECHANIC

MINING QUALIFICATIONS AUTHORITY

CODE: HYD - 8

CONTROL THE SPEED OF AN ACTUATOR

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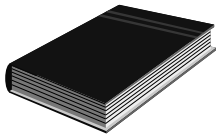
TRG 9

INDEX

The following elements are contained in this learning guide:



SOURCE REFERENCES

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

FESTO – Basic Level Textbook

OBJECTIVE

You will be learning towards the outcome “Control the speed of an actuator”. Whilst learning towards the outcome you will be required to achieve the following:

- Construct a circuit with the relevant valves and actuators.
- Adjust the relief valves to open at the prescribed pressures.
- Adjust the one way flow control valve so that the motor will run at a certain speed in the one direction and at another speed in the opposite direction.
- Know the function of a flow control valve.
- Know the three types of flow control valves.

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

- Indicate flow when the motor is running.
- Indicate the flow when the control valve is in a neutral position and the flywheel tends to produce further rotation.
- State the purpose of a flow control valve.
- State the three types of flow control valves.

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.
- There must not be any damage to any equipment.

HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM

HYD - 8

CONTROL THE SPEED OF AN ACTUATOR

STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. Construct a hydraulic circuit.	• Improper or careless handling of hydraulic 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 hydraulic oil in a pressurised circuit.	• Circuit under pressure.	• Ensure circuit is depressurised before removing components or pipes
3. Insure work area is safe	• Oil in eyes and laceration of skin. • Slip and fall.	• Wear correct PPE. • Ensure working area is clean and safe. • Wear correct safety boots.

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: Flow control valves.

DESCRIPTION:

A. Flow control valves are used to reduce the speed of a cylinder or the rpm of a motor. Since both values are dependent on the flow rate, this must be reduced. The valve which is used for this purpose in a hydraulic circuit is called a flow control valve.

B. On the basis of their controlling or regulating function, flow control valves are classified as either: (Fig 1)
   - Flow control valves or
   - Flow regulating valves.

Examples of flow control valves as restrictors and orifice valves:

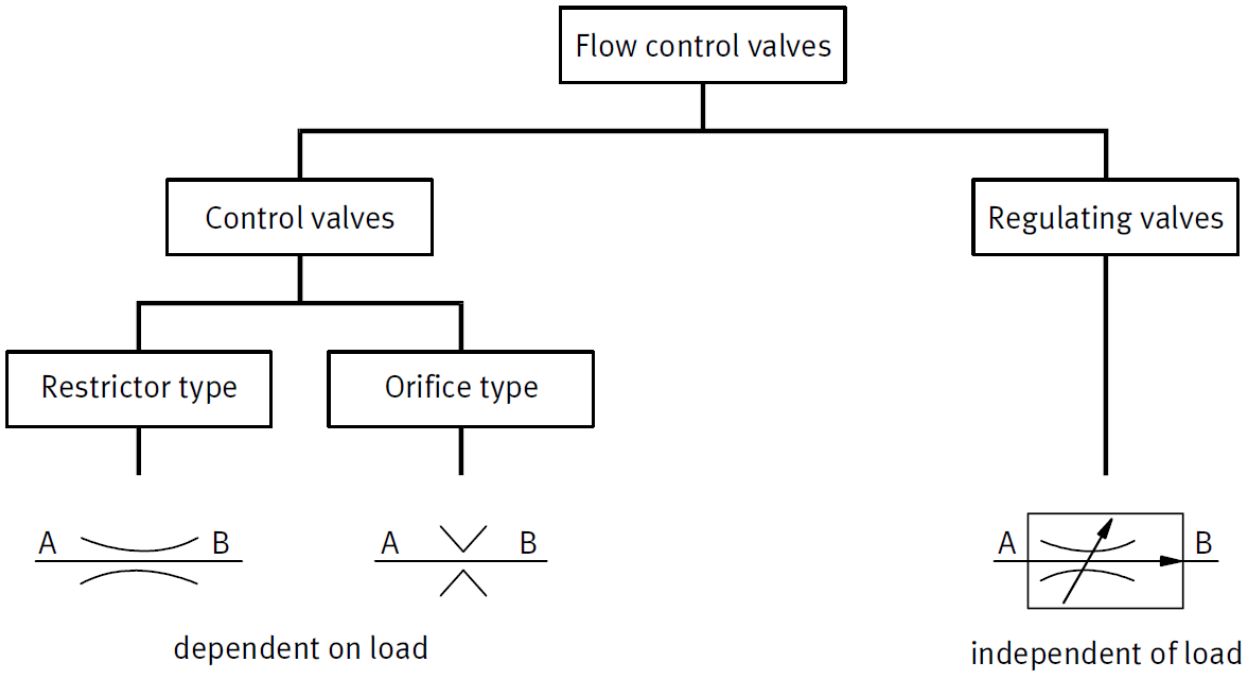


FIG 1.

C. Different types of flow control valves are used, namely :
   a. adjustable flow control valve,
   b. 2-way flow control valve, and
   c. Adjustable one way flow control valve.

2. ADJUSTABLE FLOW CONTROL VALVE

ITEM / TASK: Construction and operation.

DESCRIPTION:

A. The adjustable flow control valve is used in hydraulic systems for numerous, adjustable flow control purposes, where the flow rate does not have to be particularly accurate, e.g. lifting platforms and clamping fixtures.

B. The pressure that builds up in front of the valve enables the oil to be divided into two paths. Part of the oil delivered by the pump flows through the relief valve and back to the reservoir. The remainder flows through the adjustable restriction formed between the throttling screw and the housing of the valve. The size of this restriction can be increased or decreased by turning the throttling screw which also increases or decreases the speed of the actuator. (Fig 2)

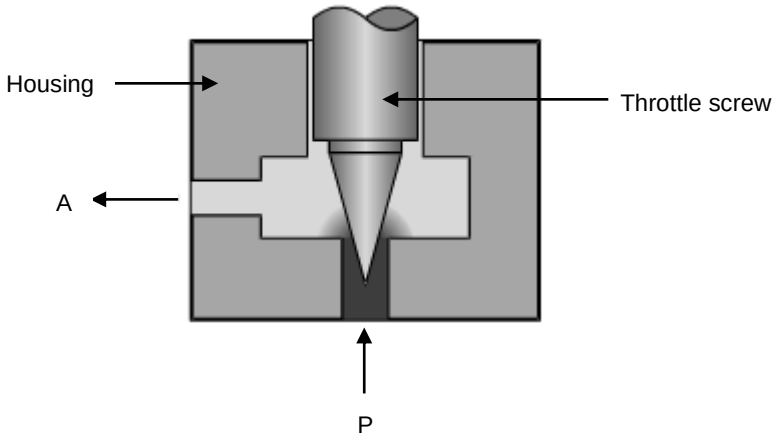


FIG 2.

D. The symbol for an adjustable flow control valve is shown in Fig 3.

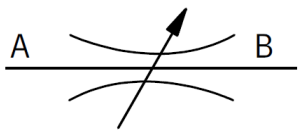


FIG 3.

3. 2 WAY FLOW CONTROL VALVE

ITEM / TASK: Construction and operation.

DESCRIPTION:

A. The 2-way flow control valve is designed so that it will compensate for any variation in the pressure. Thus, the flow rate V (litres/minute) will remain constant at varying output and input pressures.

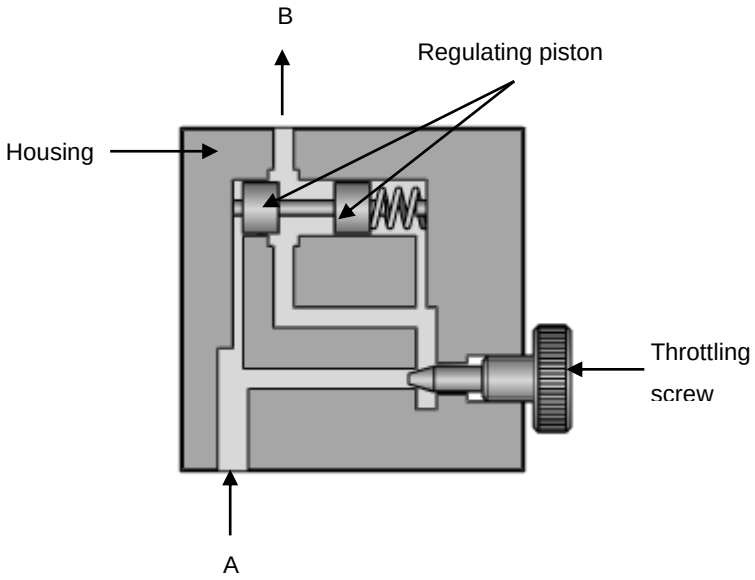


FIG 4.

B. The flow of the fluid can be varied by turning the throttling screw to increase or decrease the gap between the housing and the throttling screw.

C. The flow rate is obtained by a certain position of the restrictor, the regulating piston and the compression spring. This ensures that the flow rate is maintained in the event of pressure fluctuations in the inlet or the outlet of the valve.

D. These valves are used where a constant flow rate is required under varying loads. These valves provide a constant flow rate in the face of changing loads meaning that they are suitable for the following application examples:
   - Workpiece slides which operate at a constant feed speed with varying working loads,
   - Lifting gear where the lowering speeds need to be carefully restricted.

E. The symbol for a 2-way flow control valve is shown in Fig 5.

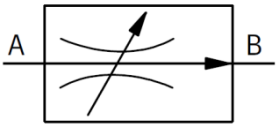


FIG 5.

F. When the pressure Pe1 increases, it tends to force more oil through the valve. However, when Pe1 increases, the force F1 also increases, causing the regulating piston to move to the right and reducing gap S2 to such a size that the same quantity of oil still flows through the circuit. (Fig 6)

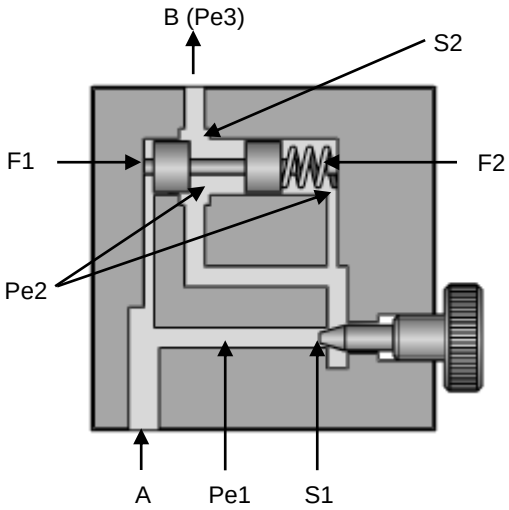


FIG 6.

G. When the size of the load is increased, the pressure Pe3 increases, tending to reduce the oil flow. However, when Pe3 increases, pressure Pe2 and force F2 also increase, causing the regulating piston to move to the left and increasing the gap S2 to such a size that the same quantity of oil will still flow through the circuit.

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

SELF TEST 1

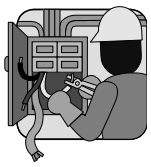
1. What is the function of an adjustable flow control valve?

2. Name the three types of flow control valves.

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 an adjustable flow control valve.

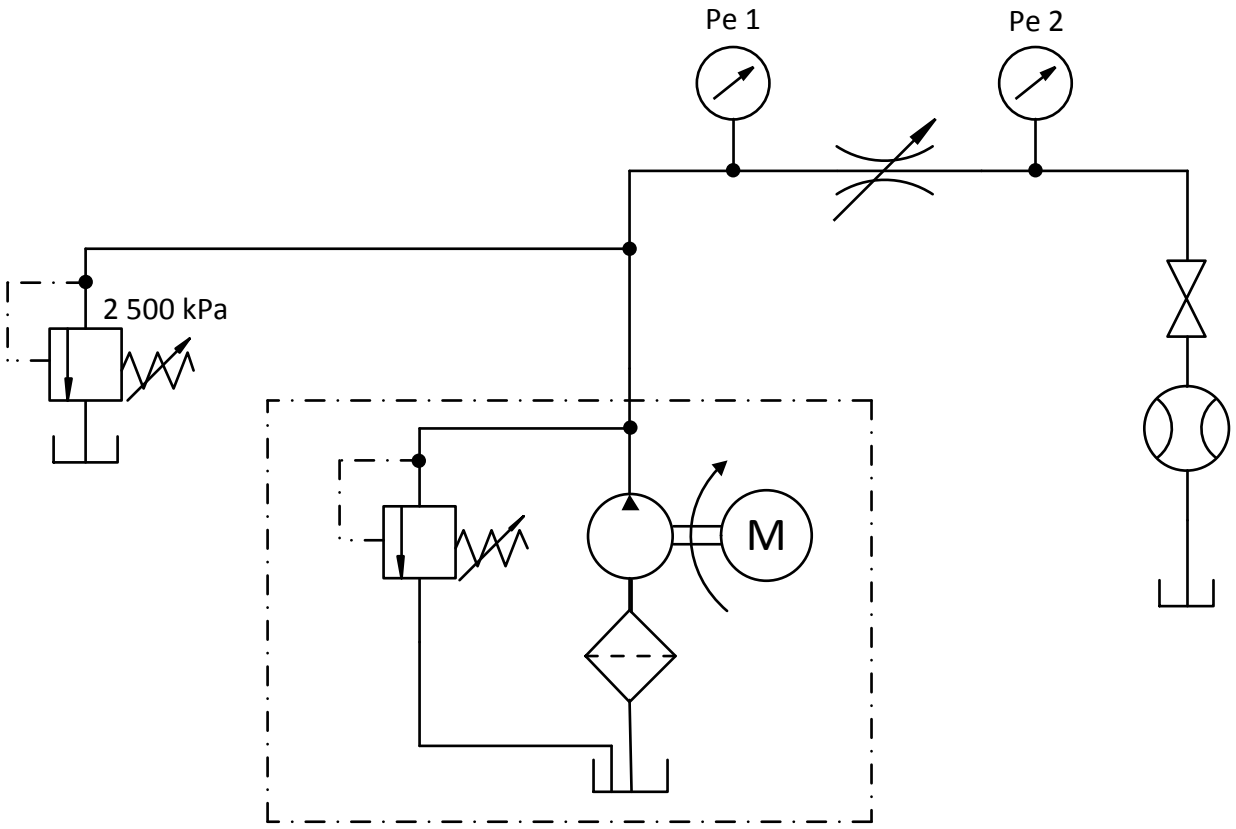
2. Practice drawing the symbol for a 2 way flow control valve.

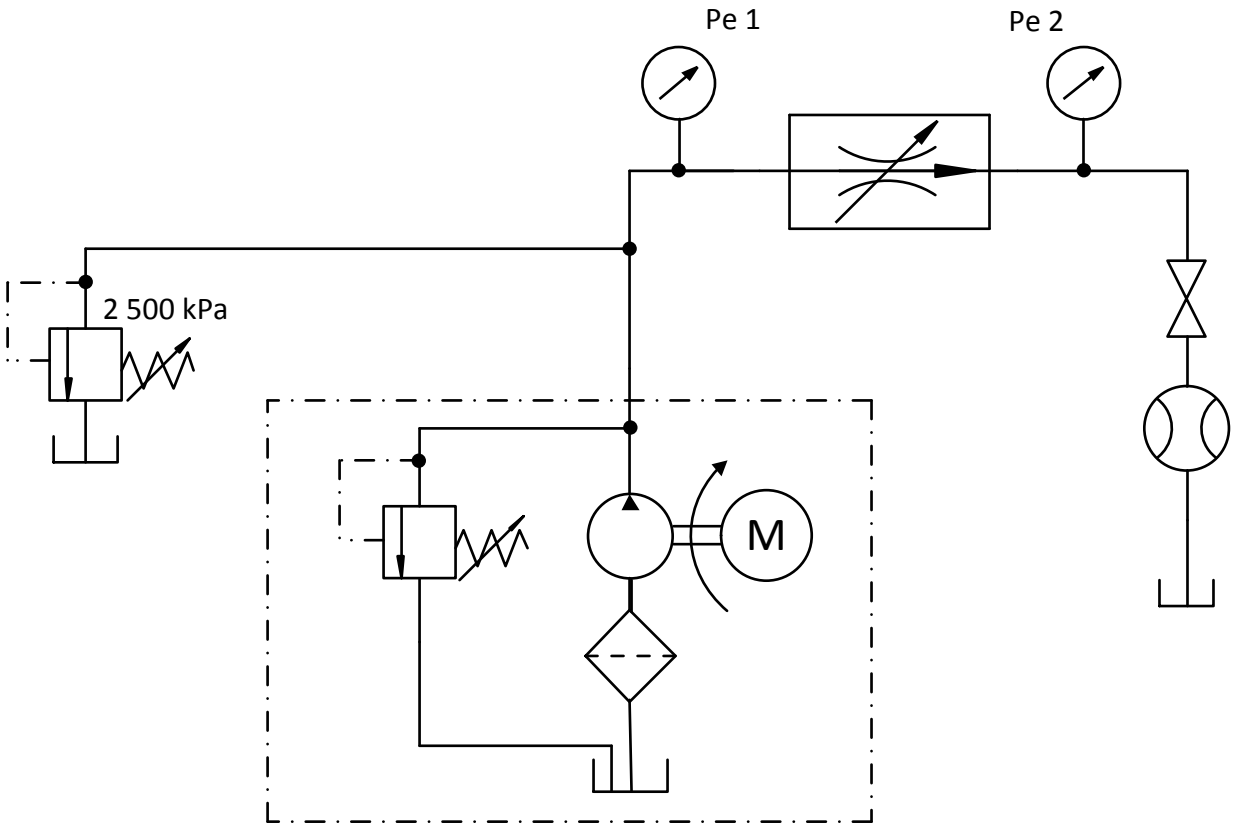
3. Identify the different flow control valves from the training equipment.
4. Construct the circuit as shown in the diagram (below) on the training panel by using an adjustable flow control valve. Adjust the relief valve to open at 2500 kPa.

   Set the pressure Pe1 according to the table on the next page by opening or closing the shut-off valve. Record the flow indicated on the flow meter for each pressure in column a.

   Replace the adjustable flow control valve with a 2-way flow control valve.
   Set the pressure Pe1 according to the table by opening or closing the shut-off valve.
   Record the flow indicated on the flow meter for each pressure in column b.

   Compare the readings from the two columns and write down your conclusions.





Pressure 1 (Pe 1)	Volume in l/min	
	a	b
500 kPa		
1 000 kPa		
1 500 kPa		
2 000 kPa		
2 500 kPa		

Conclusion:

Ask your Training Officer to check your work and if it is correct, to sign below and then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

4. ADJUSTABLE ONE WAY FLOW CONTROL VALVE

ITEM / TASK: Adjustable braking.

DESCRIPTION:

A. Adjustable one way flow control valves control the fluid flow in one direction through the restrictor. They also ensure free flow through the check valve in the opposite direction. They are used where only an approximate constant flow rate is required in one direction.

B. The hydraulic flow is throttled in the flow direction from A to B. (Fig 7)

C. Flow is not restricted in the opposite direction (B to A) as the sealing cone of the non-return valve is lifted from its valve seat and the full cross-sectional flow is released. (Fig 8)

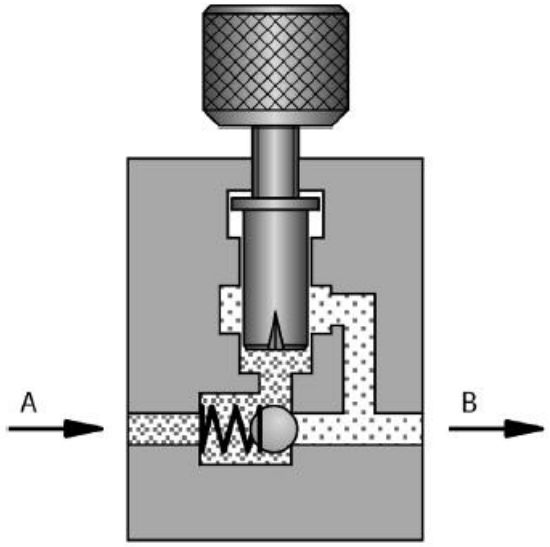


FIG 7.

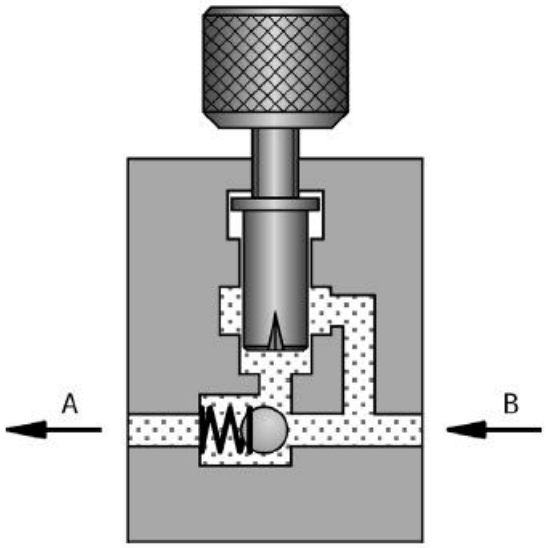


FIG 8.

D. When the oil is flowing from "A" to "B" the flow can be varied by adjusting the throttling screw. In this case the check valve remains closed.

E. When the oil is flowing from "B" to "A", the check valve is forced against the low tension spring and opens, thus allowing an unrestricted flow through the valve.

F. The symbol for an adjustable one way flow control valve is shown in Fig 10.

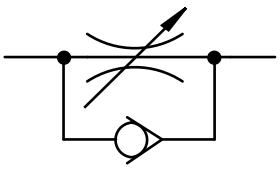
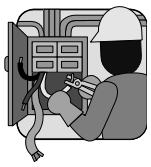


FIG 10.

DO THE PRACTICE ON THE NEXT PAGES
BEFORE ATTEMPTING THE ASSESSMENT.

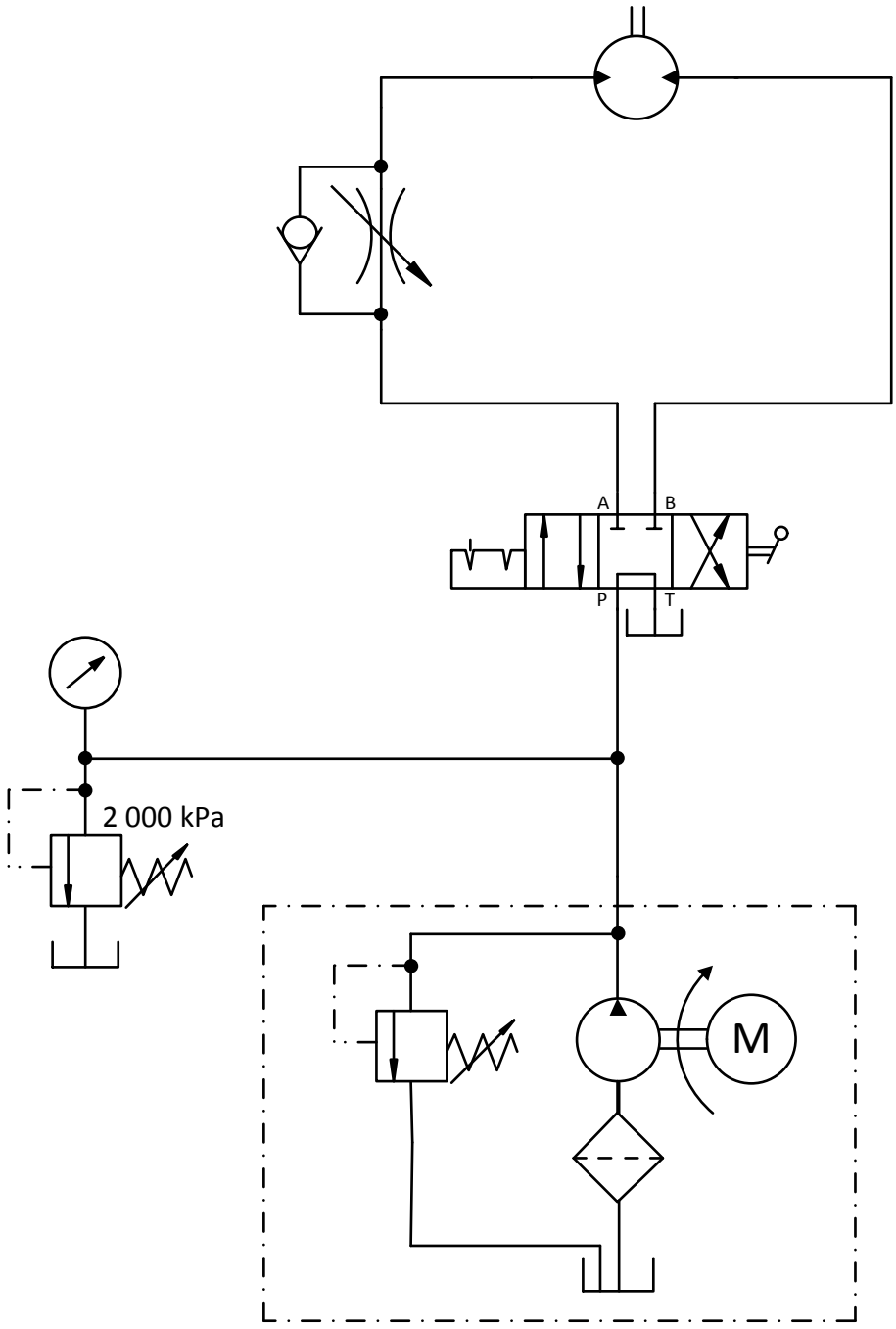


PRACTICE

1. Practice drawing the symbol for an adjustable one way flow control valve.

2. Identify the one way flow control valves from the training equipment.
3. Construct the circuit as shown in the diagram (below) on the training panel.
   Adjust the relief valve to open at 2500 kPa.

4. Adjust the one way flow control valve so the motor will turn at 20 revs/min in the one direction and maximum revolutions in the opposite direction.



5. Use different colour highlighters and indicate (on the drawing) the flow for when:
   - The motor is running forward.
   - The motor is reversed.

Ask your Training Officer to check your work and if it is correct, to sign below and then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

REMEMBER ALWAYS WORK SAFE

Once you have passed the entire practices, you are now at liberty to request a Formative Assessment from your Assessor.