

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

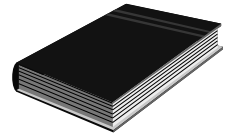
CODE: HYD - 7

CONTROL A CIRCUIT WITH A ROTARY MOTION

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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 a circuit with rotary motion”. Whilst learning towards the outcome you will be required to achieve the following:

- Construct a circuit with the relevant valves and motor.
- Know the purpose of a hydraulic motor.
- Know the three types of motors.
- Know what need to be done to change the speed of a gear and vane motor.

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

- Indicate flow when the directional control valve is operated.
- State the purpose of a hydraulic motor.
- State the three types of hydraulic motors.
- State what need to be done to change the speed of a gear or vane motor.

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 - 7****CONTROL A CIRCUIT WITH
ROTARY MOTION**

STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. Construct a hydraulic circuit.	<ul style="list-style-type: none"> Improper or careless handling of hydraulic components and pipes can lead to damage of equipment. 	<ul style="list-style-type: none"> Always handle components and pipes correctly, and with great care.
2. Use of hydraulic oil in a pressurised circuit.	<ul style="list-style-type: none"> Circuit under pressure. 	<ul style="list-style-type: none"> Wipe components and panel clean after use and store components. Ensure circuit is depressurised before removing components or pipes
3. Insure work area is safe	<ul style="list-style-type: none"> Oil in eyes and laceration of skin. Slip and fall. 	<ul style="list-style-type: none"> 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. HYDRAULIC MOTORS

ITEM / TASK: Construction and operation.

DESCRIPTION:

- A. Like cylinders, hydraulic motors are drive components controlled by valves. They too convert hydraulic power into mechanical power with the difference that they generate rotary or swivel movements instead of linear movements. Hydraulic motors have the same characteristic values as pumps.
- B. In a hydraulic motor the fluid is forced in and exhausted out, thus converting fluid force into mechanical force.

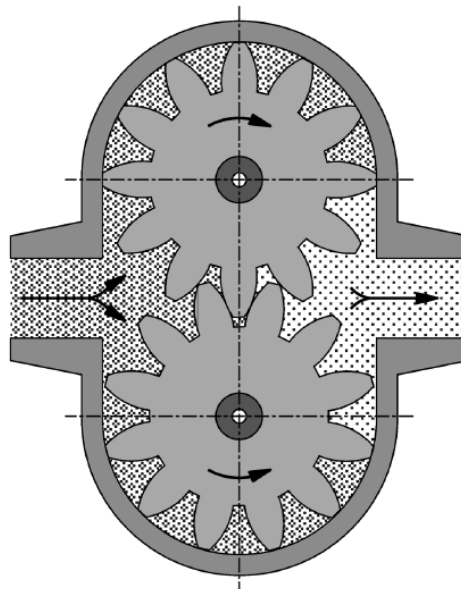


FIG 1.

C. Types of motors:

- a. Gear motors.
- b. Vane motors.
- c. Piston motors

a. **Gear motors**

Gear motors are widely used because of their simple design and are economical. (Fig 2 on the next page)

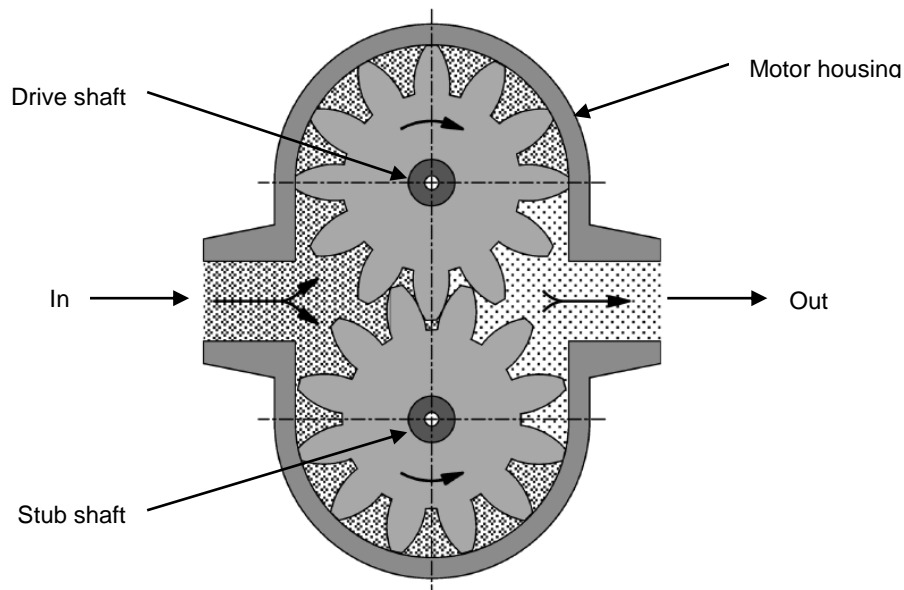


FIG 2.

b. Vane motors

In a vane pump, centrifugal force is used to keep the vanes against the rotor ring.

In a motor however, spring clips are used to hold the vanes in contact with the rotor ring. Refer to Fig 3.

To change the speed of gear and vane motors, the quantity of oil supplied to the motor must be altered.

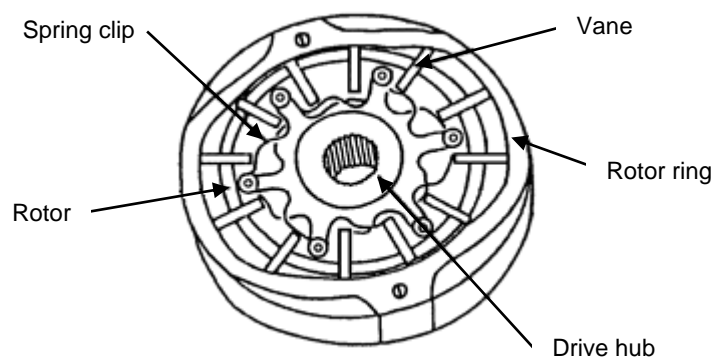


FIG 3.

c. Piston motor

The feature of some piston motors is that when the angle of the swash plate (Fig 4 on the next page) is altered, the speed of the motor increases or decreases. This change in speed is achieved without changing the flow of oil supplied to the motor.

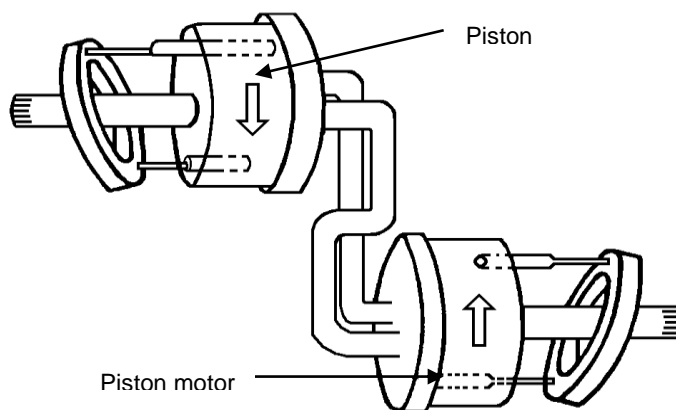


FIG 4.

D. Hydraulic motors are represented by means of a circle which shows where the drive or output shaft is located. Triangles within the circle give information about the direction of flow. These triangles are filled in, since hydraulic oil are used for hydraulics. If a gaseous pressure medium were being used, as is the case in pneumatics, the triangles would not be filled in. The symbols for hydraulic motors and hydraulic pumps can only be distinguished from one another by the fact that the arrows indicating the direction of flow are drawn pointing one way for the pumps and the other for the motors. See Fig 5.



NB:

The only difference between the symbol for a pump and the symbol for a motor is the direction in which the arrow is pointing.

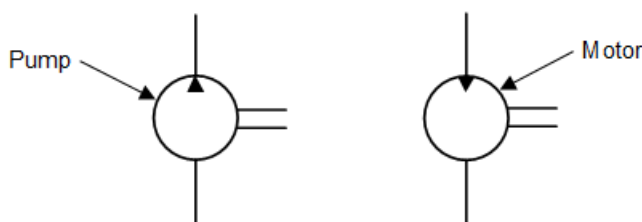


FIG 5.

E. The symbol for a hydraulic motor (fixed displacement) with one direction of flow is shown in Fig 6.

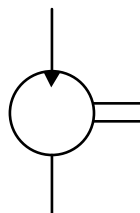


FIG 6.

F. The symbol for a hydraulic motor (fixed displacement) with two direction of flow is shown in Fig 7.

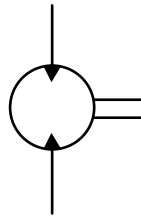


FIG 7.

G. The symbol for a hydraulic motor (variable capacity) with one direction of flow is shown in Fig 8.

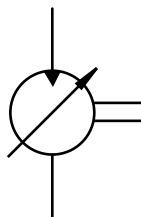


FIG 8.



Note:

An arrow drawn at an angle through the symbol indicates that setting possibilities exist.

**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 motor in a hydraulic circuit?

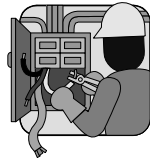
2. Name the three types of motors.

3. What must be done to change the speed of vane and gear motors?

Refer to your notes to check your answers.

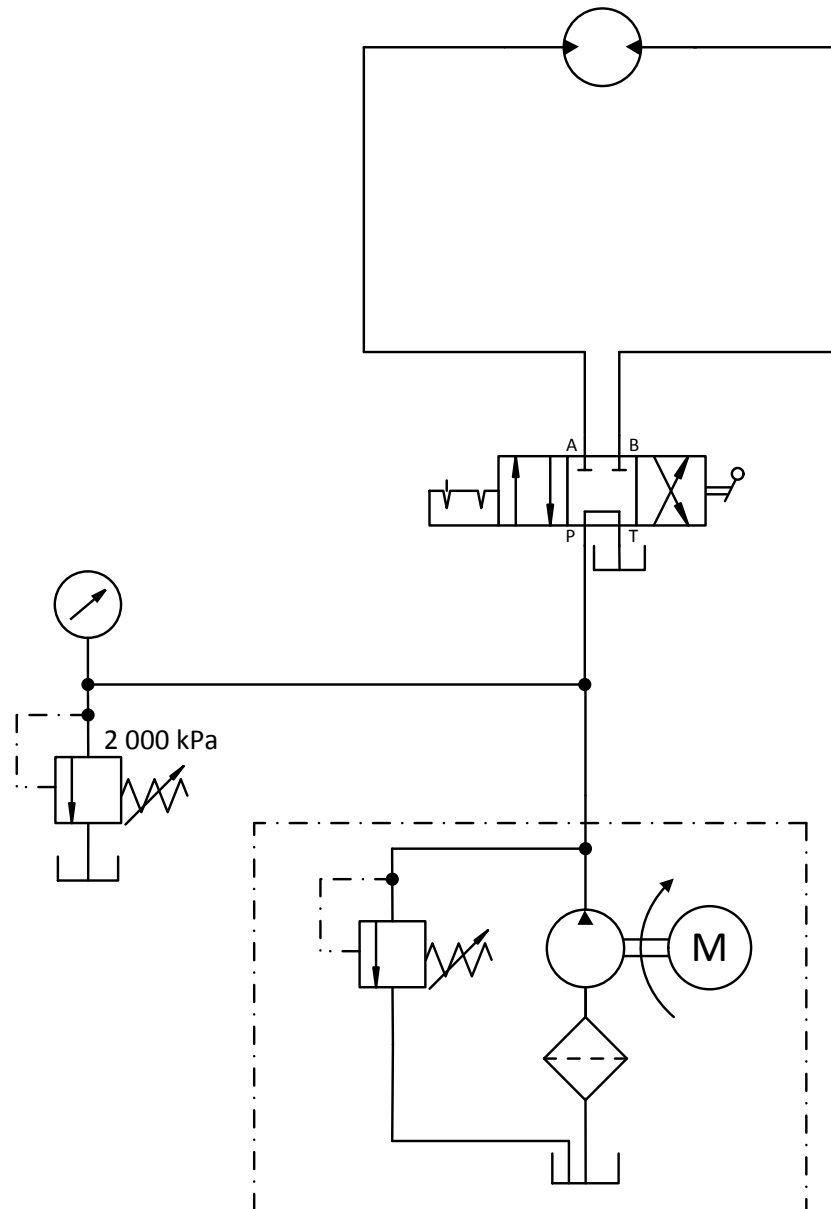
Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



PRACTICE

1. Practice drawing the symbol for a hydraulic motor (fixed displacement) with one direction of flow.
2. Practice drawing the symbol for a hydraulic motor (fixed displacement) with two direction of flow.
3. Practice drawing the symbol for a hydraulic motor (variable capacity) with one direction of flow.
4. Identify the different hydraulic motors from the training equipment. (Where applicable)
5. Construct the circuit as shown in the diagram (below) on the training panel and adjust the relief valve to open at 2000 kPa.



6. Use different colour highlighters and indicate (on the drawing) the flow for **all three positions** of the control valve.

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 :

2. ADJUSTABLE BRAKING OF A MOTOR

ITEM / TASK: Adjustable braking.

DESCRIPTION:

- A. When the shaft of a hydraulic motor is turned by hand, or by means of an electric motor, the hydraulic motor becomes a pump.
- B. This means that the hydraulic motor can also perform the duty of a pump when torque is delivered at the output shaft. This will happen when a large flywheel is set in motion by a hydraulic motor.
- C. When the outlet lines are blocked by a 4/3-way directional control valve, the flywheel mass tends to produce further rotation of the motor. This results in the hydraulic motor displacing the oil against the blocked control valve, which causes the pressure to rise. This can result in severe damage to the hydraulic equipment. (Fig 9).

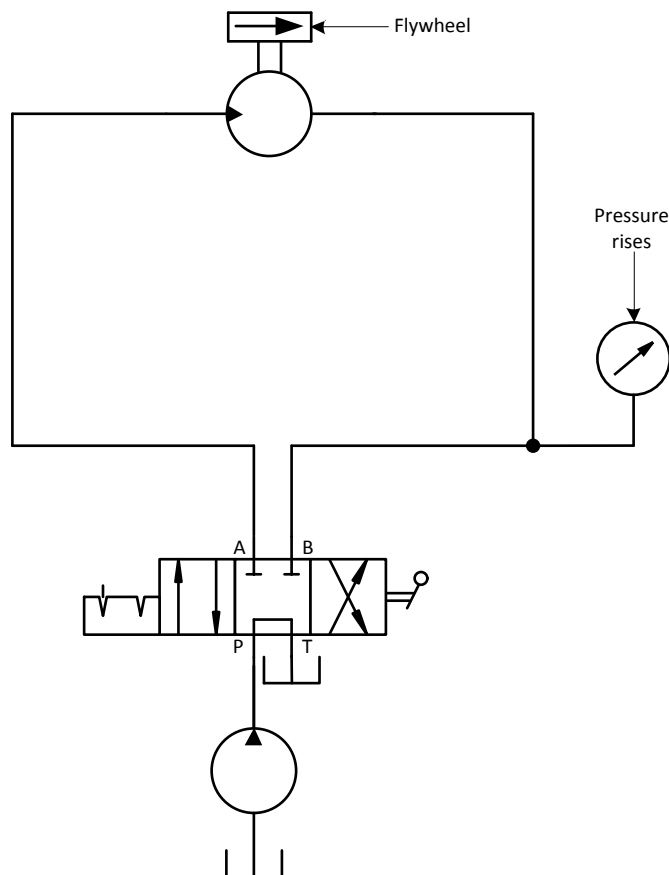


FIG 9.

- D. Such an occurrence can be prevented by fitting a relief valve which will provide adjustable braking of the motor with the flywheel mass and will also determine the maximum torque for the opposite direction of rotation. Refer to Fig 10.

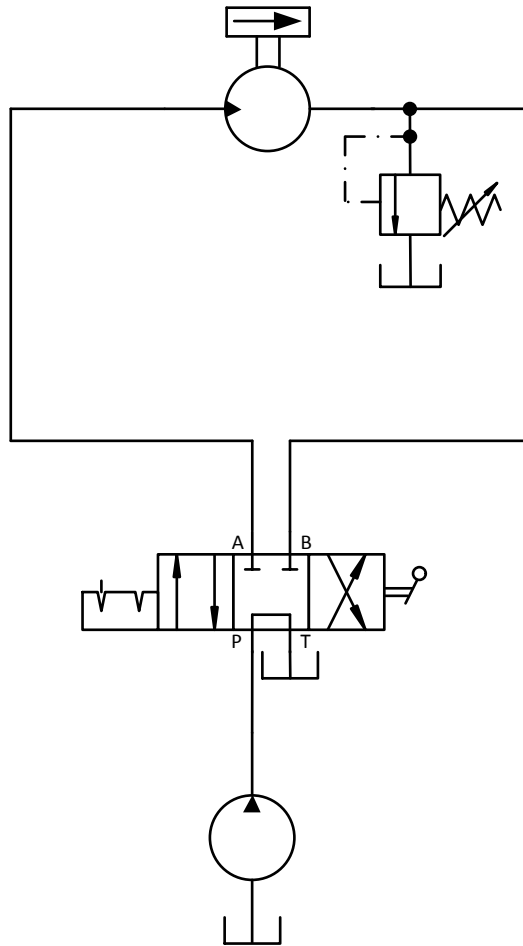


FIG 10.

- E. In the blocked inlet line, the hydraulic motor produces a vacuum which may lead to material damage as a result of (so-called cavitation). This can be prevented by fitting a replenishing line via a check valve. (Fig 11 on the next page)

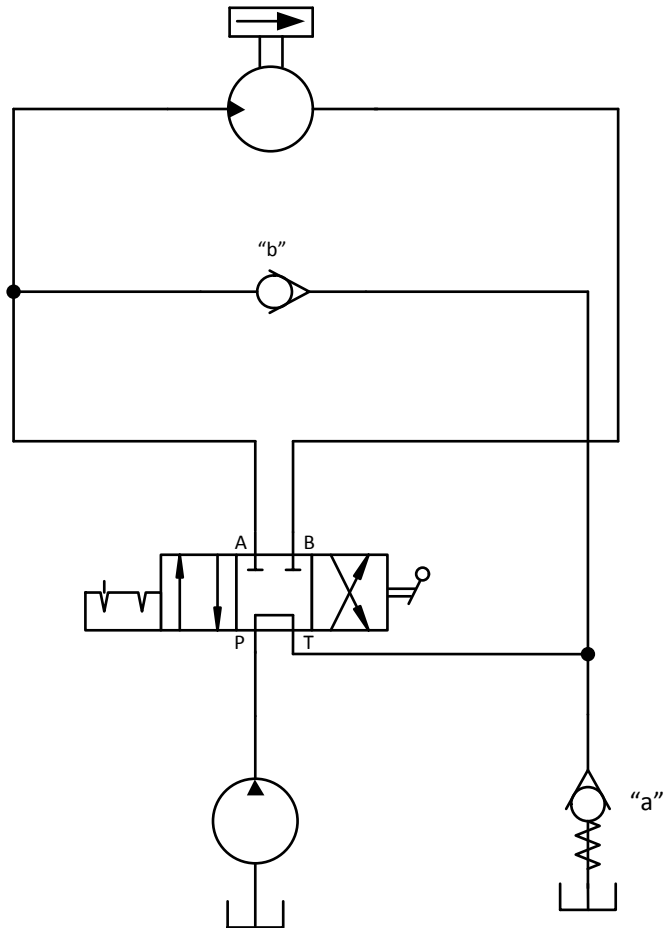


FIG 11.

- F. Since it does not open until a pressure of 150 kPa to 300 kPa has built up, the check valve "a" facilitates replenishment while simultaneously allowing pre-loading of the oil discharged by the motor.

3. CLOSED LOOP SYSTEMS (HYDROSTATIC DRIVES)

ITEM / TASK: Closed loop circuits.

DESCRIPTION:

A. Fig 12 shows a simple closed loop circuit.

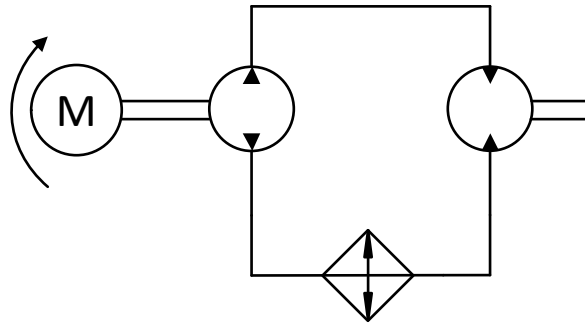


FIG 12.

B. In a closed loop circuit:

- The output of the motor forms the input of the pump.
- Only a small tank (reservoir) is required.
- There must be a replenishment system.
- An oil cooler must be fitted.

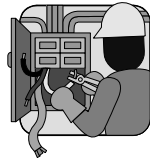
C. The symbol for a hydraulic oil cooler is shown in Fig 13.



FIG 13.

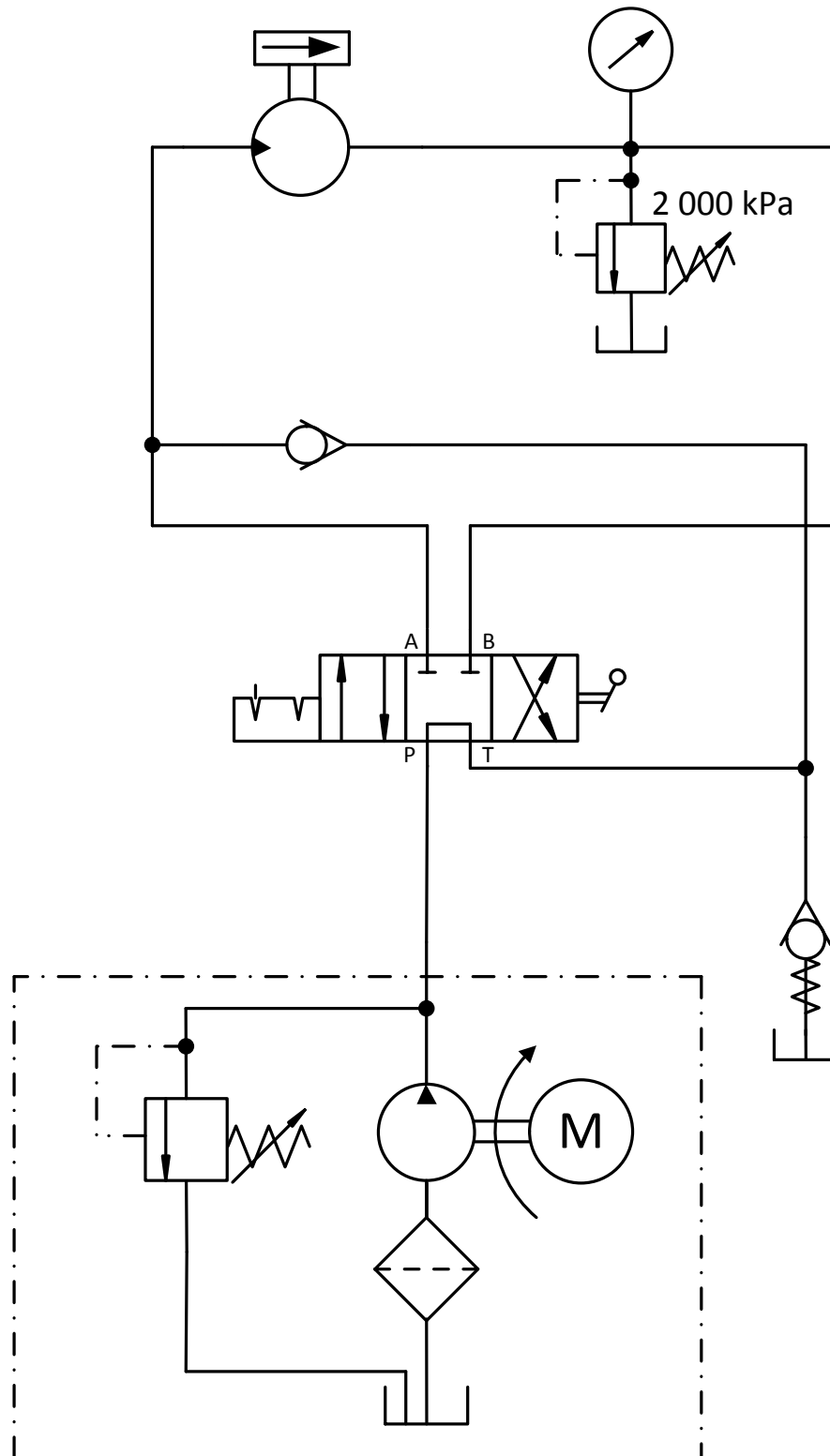
D. Practical application: Most mobile machinery using hydraulic drives have closed loop circuits, e.g. diesel locos and coal cutters, etc.

**DO THE PRACTICE ON THE NEXT PAGE
BEFORE ATTEMPTING THE ASSESSMENT.**



PRACTICE

- Construct the circuit as shown in the diagram (below) on the training panel and adjust the relief valve to open at 2000 kPa.



2. Use different colour highlighters and indicate (on the drawing) the flow when:

- the control valve is in position “a”.
- the control valve is in a neutral position and the flywheel tends to produce further rotation.

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.