

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

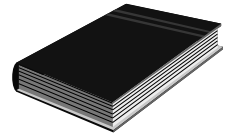
CODE: HYD - 6

CONSTRUCT A CIRCUIT WITH A CHECK VALVE

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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 “Construct a circuit with a check valve”. Whilst learning towards the outcome you will be required to achieve the following:

- Construct a circuit with the relevant valves.
- Know the purpose of a check valve / non-return valve.
- Know the purpose of a pilot operated check valve / non-return valve.

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

- Indicate flow when the directional control valve / valves are operated.
- State the purpose of a check valve / non-return valve.
- State the purpose of a pilot operated check valve / non-return valve.

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 - 6****CONSTRUCT A CIRCUIT
WITH A CHECK VALVE**

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. 3/2 WAY DIRECTIONAL CONTROL VALVE

ITEM / TASK: Construction and operation.

DESCRIPTION:

A. The 3/2-way valve has a working port (A), a pressure port (P) and a tank connection (T).
(Fig 1)

B. It controls the flow rate via the following switching positions:

- **Normal position:** P is closed and A to T is open;
- **Actuated position:** Outlet T is closed, flow from P to A.

C. 3/2-way valve can be normally open, i.e. there may be a flow from P to A.

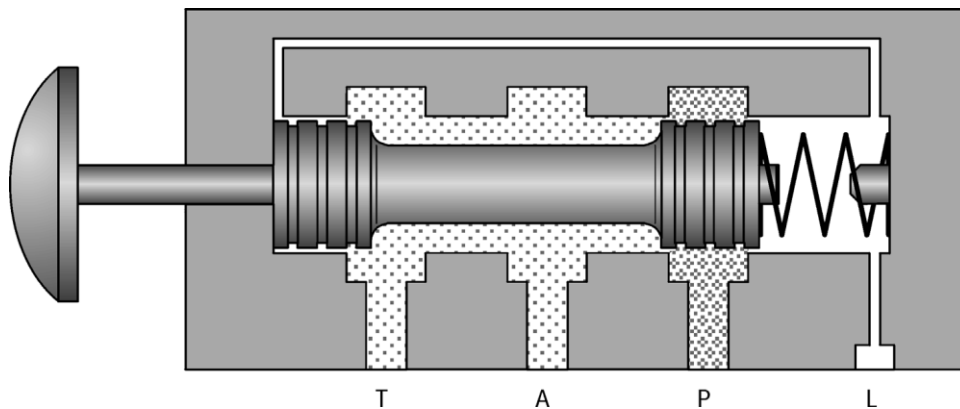


FIG 1.

D. When operated, the oil will flow from port “P” to port “A”. If released, the returned oil from the cylinder (due to spring) will flow freely from port “A” to port “T” back to the reservoir.
See Fig 3 on the next page.

E. The symbol for a 3/2 way directional control valve is shown in Fig 2.

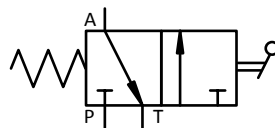


FIG 2.

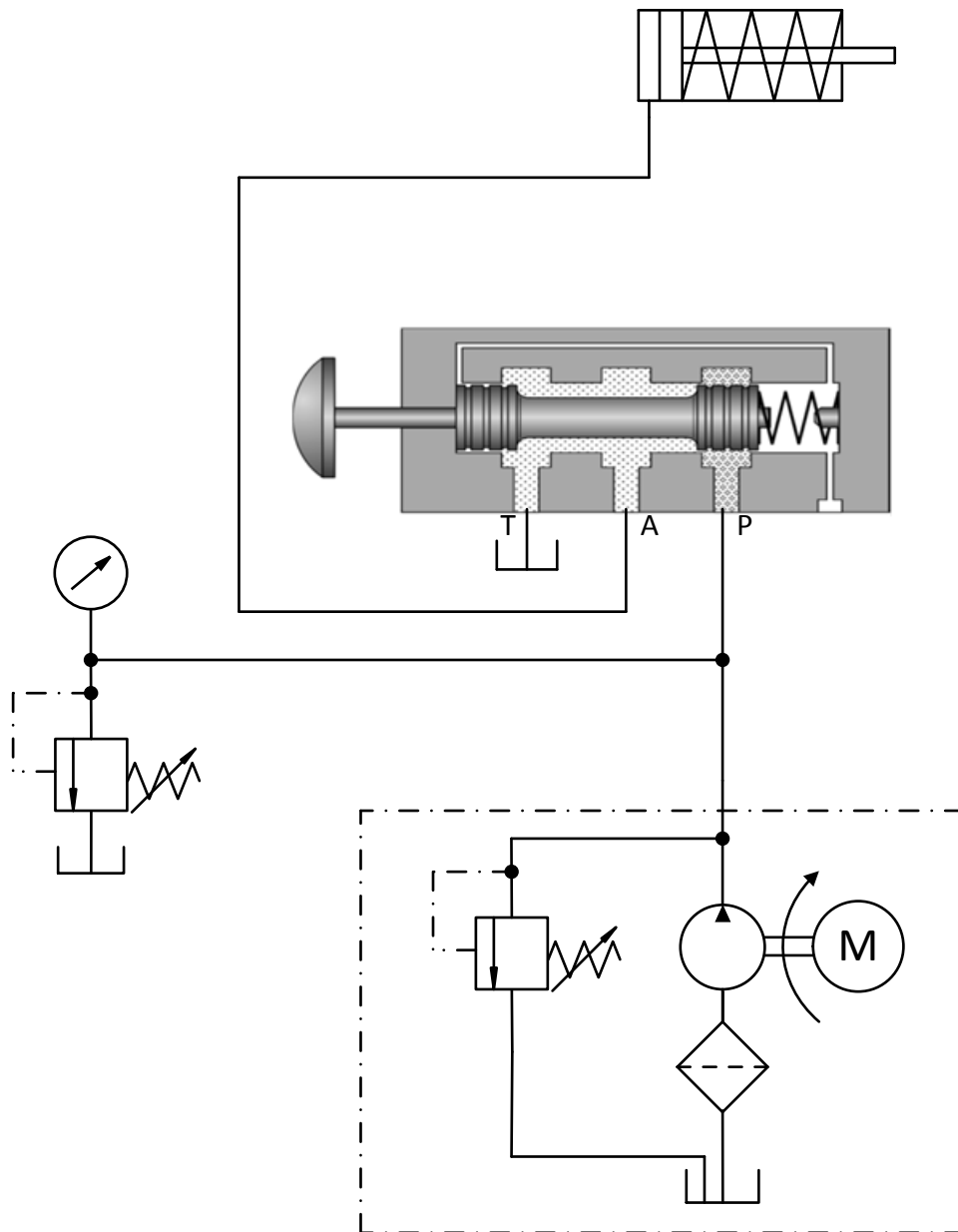


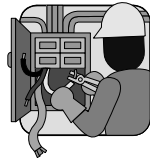
FIG 3.

Note :



If no 3/2 way directional control valve is available, a 4/2 way directional control valve with a block port "B" can be used. It will function the same as a 3/2 way directional control valve. This will be explained in the next section.

**DO THE PRACTICE ON THE NEXT PAGE
BEFORE CONTINUING WITH THE REST OF THE MODULE.**



PRACTICE

1. Practice drawing the symbol for a 3/2 way directional control valve.

2. Identify a 3/2 way directional control valve from the training equipment.

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. 4/2 WAY DIRECTIONAL CONTROL VALVE

ITEM / TASK: Construction and operation.

DESCRIPTION:

A. The 4/2-way directional control valve has two working ports (A and B), a pressure port (P) and a tank connection (T). The 4/2 way directional control valve is manual operated with spring return. Note that it's possible for the two positions to be changed around. (Fig 4)

B. It controls the flow rate via the following switching positions:

- **Normal position:** flow from P to B and from A to T;
- **Actuated position:** flow from P to A and from B to T.

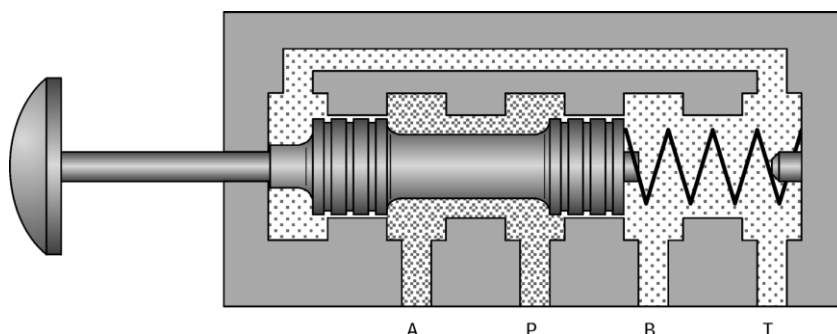


FIG 4.

C. Possible applications of the 4/2-way directional control valve:

- Activating of double-acting cylinders;
- Activating of motors with either clockwise or anti-clockwise rotation;
- Activating of two circuits.

D. In position "a", the oil will flow from port "P" to port "A". The cylinder piston will extend. The oil in the annular side of the cylinder returns through the control valve port "B" to port "T". If operated, the oil will flow from port "P" to port "B", retracting the cylinder. See Fig 7 on the next page.

E. The symbol for a 4/2 way directional control valve is shown in Fig 5 and 6 below.

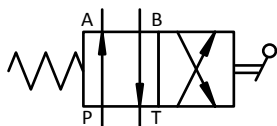


FIG 5.

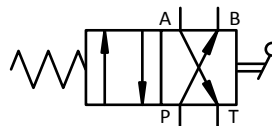


FIG 6.



Note:
The different positions for the 4/2 way directional control valves !!

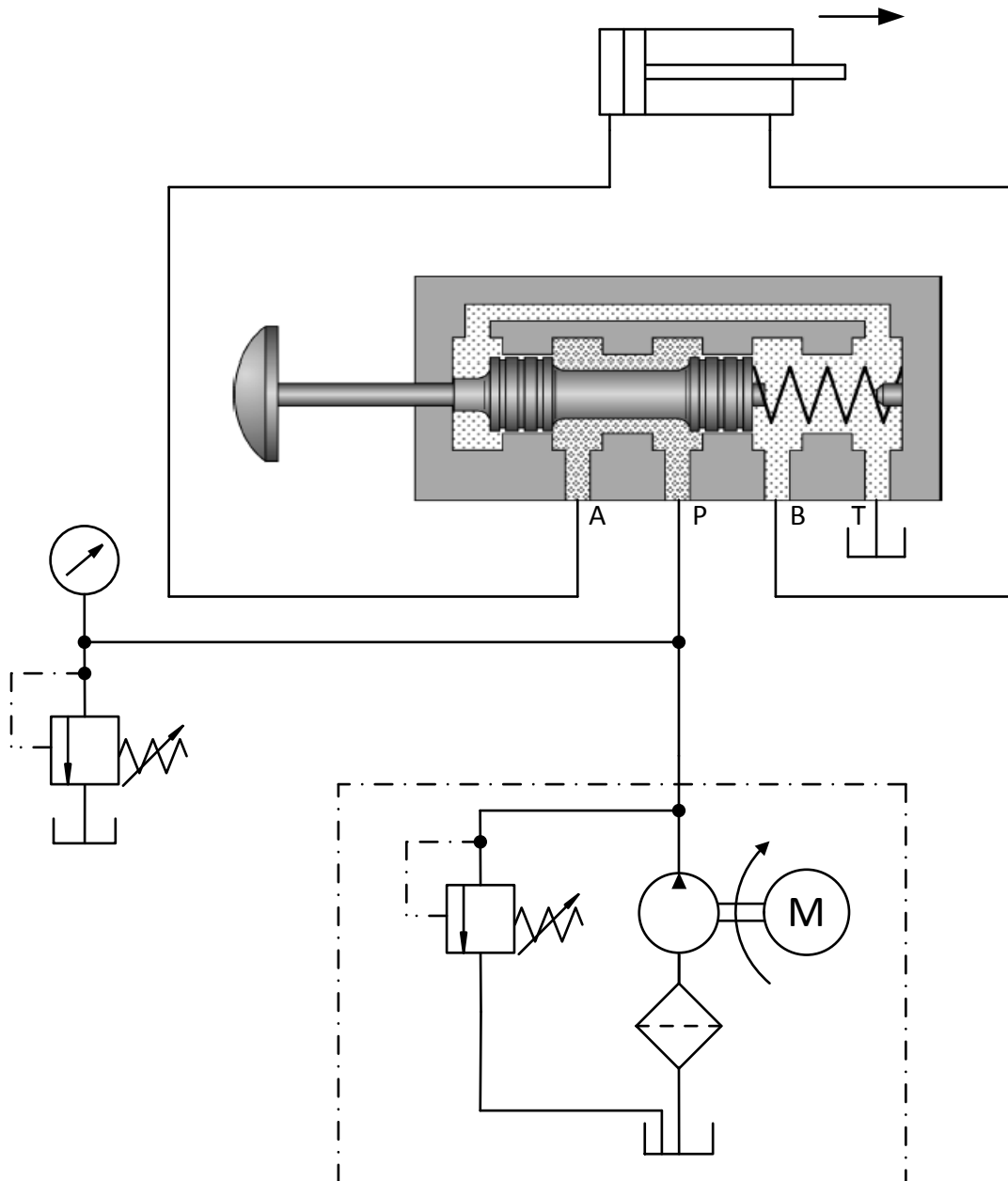


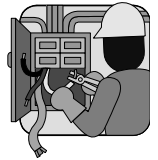
FIG 7.

Note :



A 4/2 way directional control valve can be used if a 3/2 way directional control valve is not available. Port “B” on the 4/2 way directional control valve need to be blocked for this application.

**DO THE PRACTICE ON THE NEXT PAGE
BEFORE CONTINUING WITH THE REST OF THE MODULE.**



PRACTICE

1. Practice drawing the symbol for a 4/2 way directional control valve.

2. Identify a 4/2 way directional control valve from the training equipment.

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 :

3. CHECK VALVES / NON RETURN VALVES

ITEM / TASK: Construction and operation.

DESCRIPTION:

- A. Check valves / Non-return valves block the flow in one direction and permit free flow in the other direction. (Fig 8)
- B. They are also used to prevent pressure surges which may occur in the system entering the pump.
- C. As there must be no leaks in the closed direction, these valves are always of poppet design and are constructed according to the following basic principle:
 - The sealing element (generally a ball or cone) is pressed against an appropriately shaped seat. The valve is opened by volumetric flow in the flow direction, the sealing element being lifted from the seat.

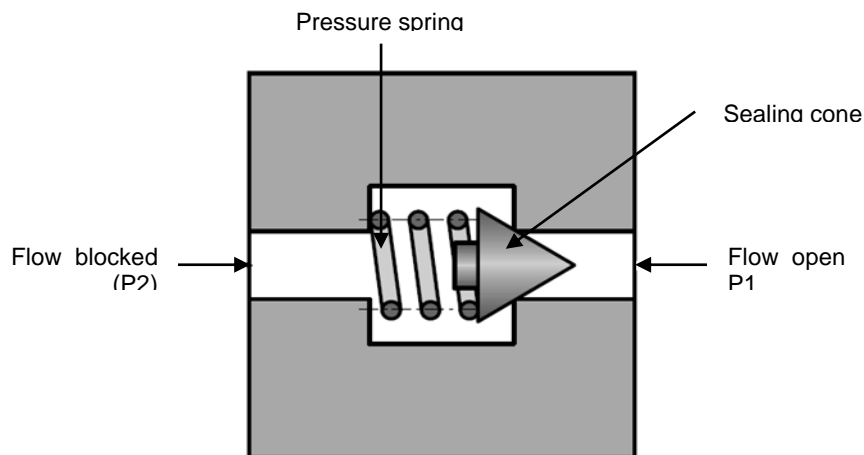


FIG 8.

- If a pressure (P_1) operates on the sealing cone, this is lifted from its seat releasing the flow. If the oil enters the port on the opposite side (P_2), it increases the spring force causing the valve cone to be forced against the seat. This blocks the flow.

D. The symbol for a check valve / non return valve is shown in Fig 9.



FIG 9.

E. The symbol for a spring loaded check valve / non return valve is shown in Fig 10.



FIG 10.

F. In some check valves / non return valves, the spring is designed so that the valve will open at a specified pressure range between 150 kPa to 300 kPa. This valve is called a check valve with a back pressure spring or spring loaded. (Fig 10)

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



SELF TEST 1

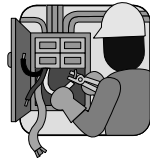
1. What is the function of a check valve / non return valve?

2. State one application of a check valve / non return valve in a hydraulic circuit.

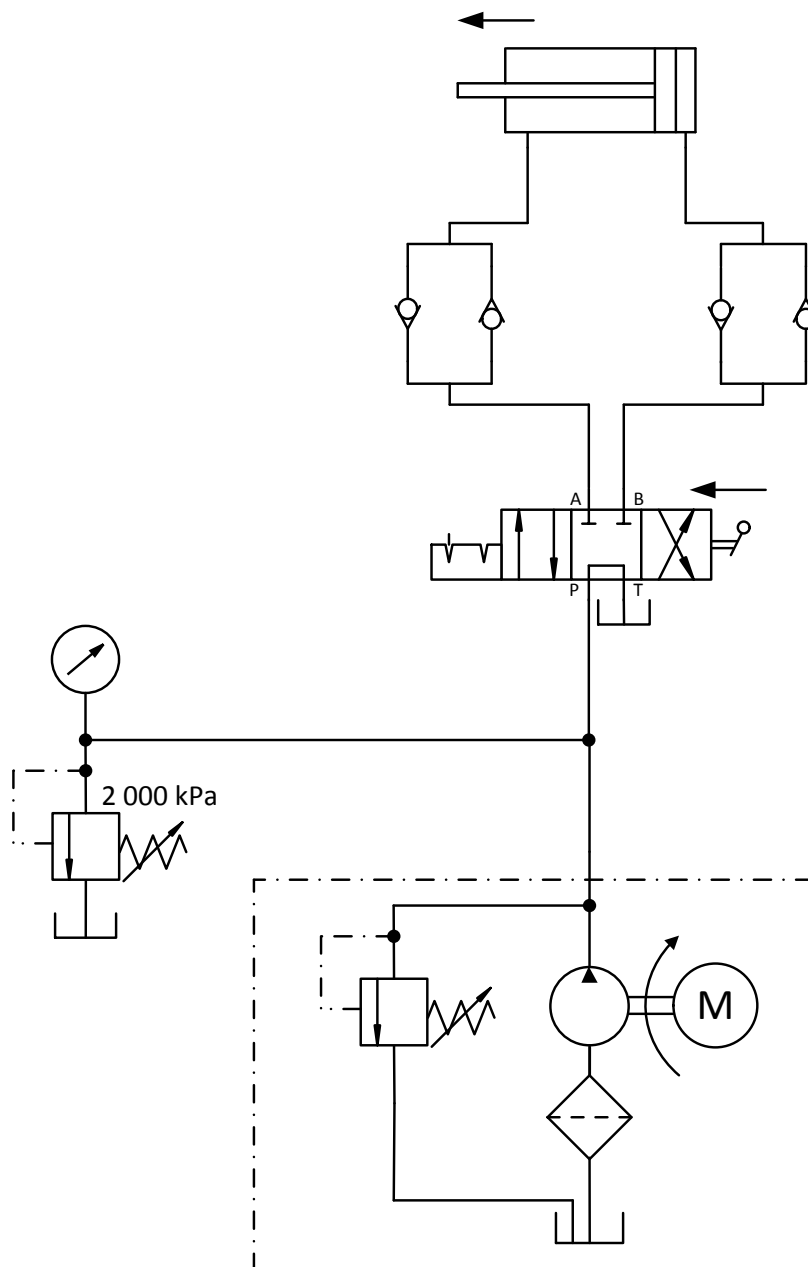
Refer to your notes to check your answers.

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

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



1. Practice drawing the symbol for a check valve / non return valve. (Unloaded)
2. Practice drawing the symbol for a spring loaded check valve / non return valve.
3. Identify the different check valves / non return valves from the training equipment.
4. Construct the circuit as shown in the diagram (below) on the training panel and adjust the relief valve to open at 2000 kPa.
5. Use different colour highlighters and indicate (on the drawing) the flow when:
 - the 4/3 way directional control valve is in position “a”
 - the 4/3 way directional control valve is in position “o” (Neutral)
 - the 4/3 way directional control valve is in position “b”



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. PILOT OPERATED CHECK / NON RETURN VALVE

ITEM / TASK: Construction and operation.

DESCRIPTION:

- A. A check valve / non return valve are mostly used to stop reverse flow. Sometimes, however, reverse flow is needed during one phase of circuit operation. In this case a pilot operated check valve is used.
- B. A pilot operated check valve is used when a hydraulic cylinder is needed to hold an external load (mass) without moving its position for an indefinite period. This cannot be done with a directional control valve, because oil is always leaking past the valve spool and back to the reservoir, and thus causing creep in the cylinder.
- C. Where a danger of accidents exists, it is required by law that some form of safety device be fitted to machinery. The pilot operated check valve is such a safety device.
- D. Examples of where they are used are on the stabilizing legs of large mobile cranes, braking systems of hoists and other underground equipment and hydraulic platform lifts.
- E. In piloted operated check / non return valves, flow can be released in the closed position by pilot control of the valve poppet through port "X". This takes place according to the following principle:
 - Flow is possible from ports "A" to "B". (Fig 11)
 - Flow is blocked from ports "B" to "A". (Fig 12)
 - Flow is possible from ports "B" to "A" due to pressure at port "X". (Fig 13)

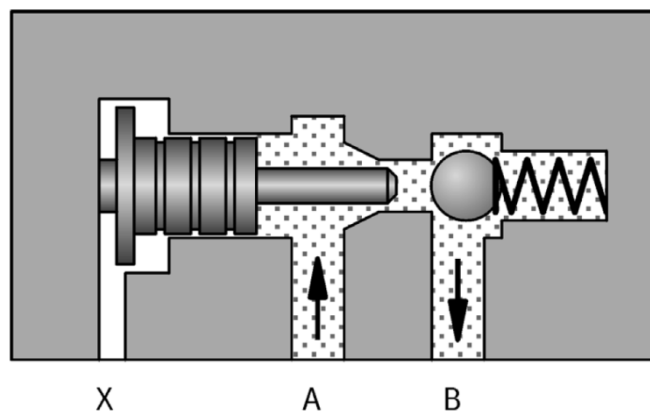


FIG 11.

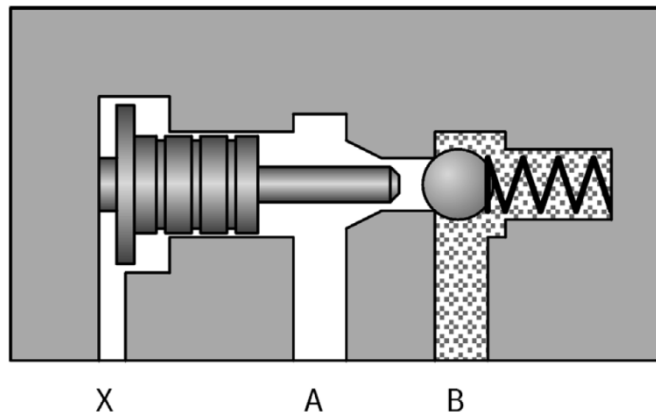


FIG 12.

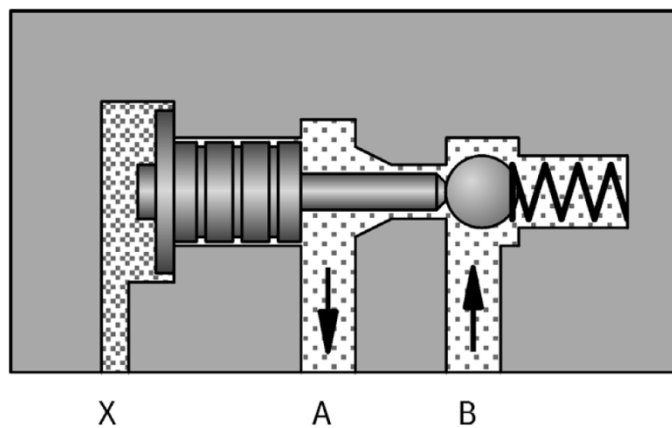


FIG 13.

- F. If the hydraulic oil is to flow from port “B” to port “A”, the valve poppet with the de-locking piston must be lifted away from its seat. The de-locking piston is pressurised via control port “X”.
- G. The symbol for a pilot operated check valve / non return valve is shown in Fig 14.

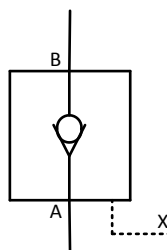


FIG 14.

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



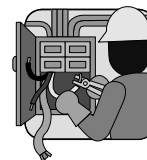
SELF TEST 2

1. What is the function of a pilot operated check valve / 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 pilot operated check / non return valve.
2. Identify a pilot operated check / non return valve from the training equipment.
3. Construct the circuit as shown in the diagram (below) on the training panel and adjust the relief valve to open at 2 500 kPa.
4. Use different colour highlighters and indicate (on the drawing) the flow when both control valves are operated.

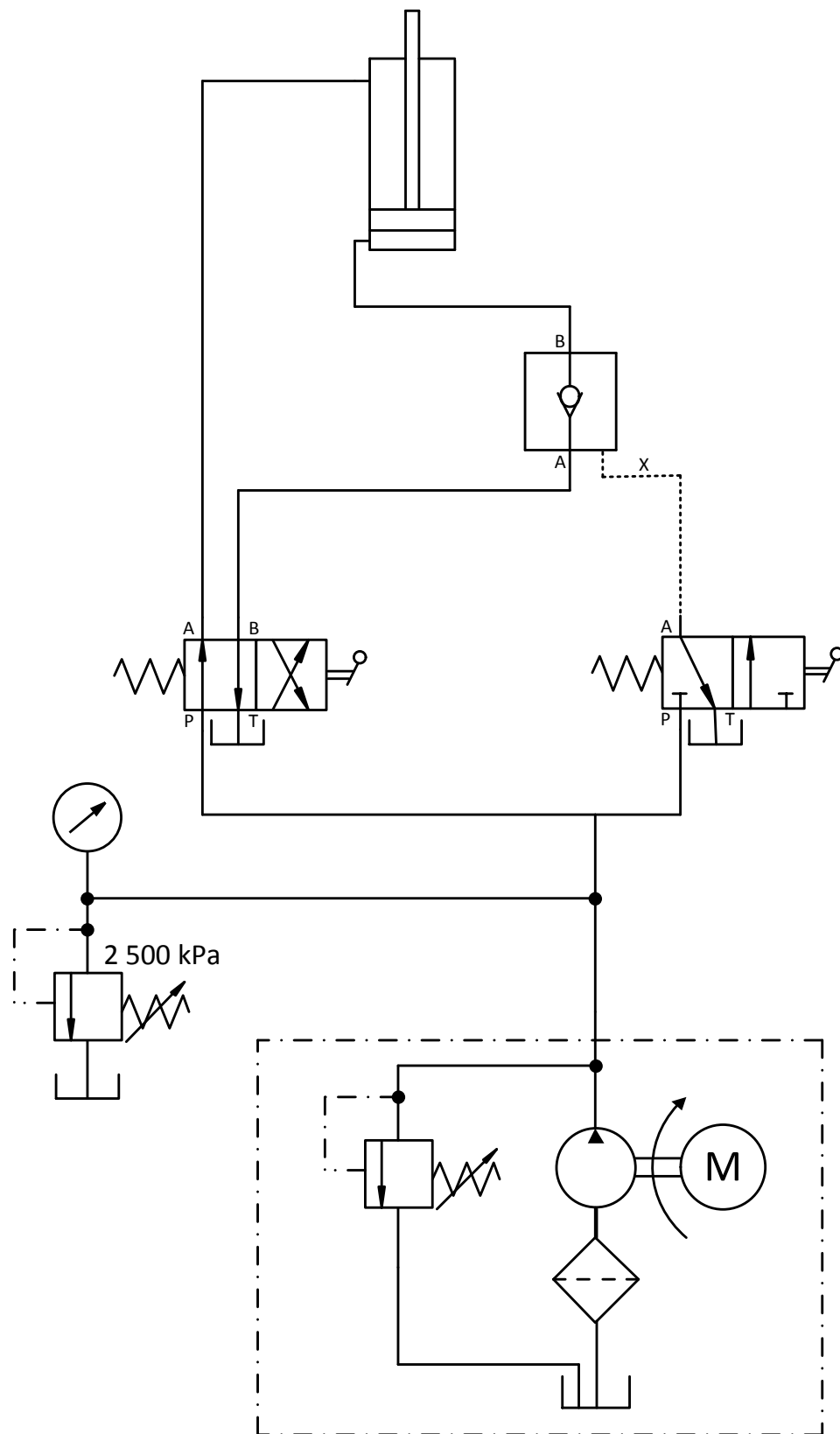


Note:

A 4/2 way directional control valve can be used if a 3/2 way directional control valve is not available. Port B on the 4/2 way directional control valve need to be blocked for this application.



The 3/2-way valve blocks the hydraulic flow in the normal position. Oil flow is released at the 4/2-way valve on the piston rod side. The piston rod cannot retract as the non-return valve is blocked. Once the 3/2-way valve is actuated, the pilot piston is pressurised and the sealing element of the non-return valve opens. This allows the hydraulic oil to flow away from the piston side via the 4/2-way valve to the reservoir. When the 4/2-way valve is actuated, the hydraulic oil flows via the non-return valve to the cylinder – the piston rod extends.



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.