

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

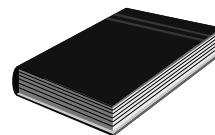
CODE: PN - 7

DESIGN AND CONSTRUCT A PNEUMATIC CIRCUIT

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SOURCE REFERENCES

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

FESTO – Pneumatics Basic Level Textbook

OBJECTIVE

You will be learning towards the outcome “Design and construct a pneumatic circuit”. Whilst learning towards the outcome you will be required to achieve the following:

- Know the application of a 4/2 way double pilot valve.
- Know how to design and construct a circuit.

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

- State the application of a 4/2 way double pilot valve.
- Design and construct a circuit so that a double acting cylinder piston rod will extend fully after operating a push button and, after extended to its maximum, automatically return to its original position.

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.

HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM**PN - 7****DESIGN AND CONSTRUCT A
PNEUMATIC CIRCUIT**

STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. Construct a pneumatic circuit.	<ul style="list-style-type: none"> Improper or careless handling of pneumatic 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 compressed air 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"> Dirt particles in eyes and laceration of skin. 	<ul style="list-style-type: none"> Wear correct PPE.

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. 4/2 WAY DOUBLE PILOT VALVE

ITEM / TASK: Components of a 4/2 way double pilot valve.

DESCRIPTION:

A. The 4/2 way double pilot valve consist of the following components: (Fig 1)

- a. Housing
- b. Spool
- c. Spring

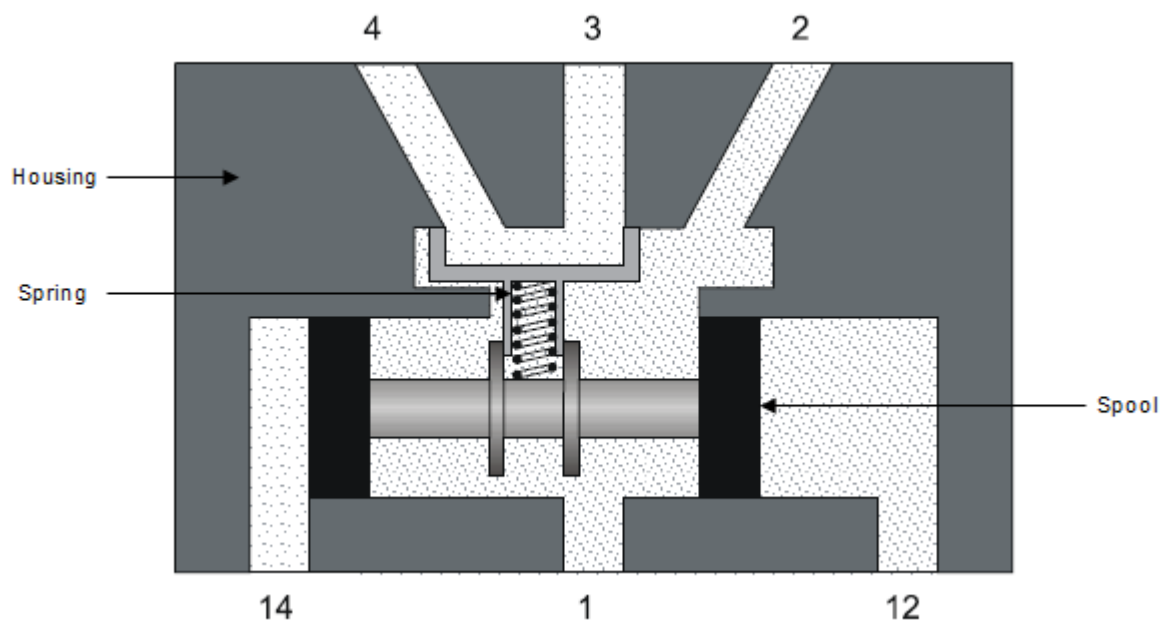


FIG 1.

B. The symbol for a 4/2 way double pilot valve is shown in Fig 2.

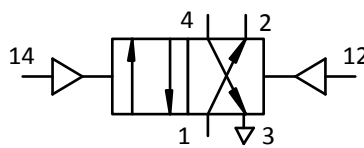


FIG 2.

ITEM / TASK: Function of a 4/2 way double pilot valve.

DESCRIPTION:

A. A 4/2-way double pilot valve (impulse valve) is used for controlling double acting cylinders in automatic controlled sequence.

ITEM / TASK: Operation of a 4/2 way double pilot valve.

DESCRIPTION:

A. The valve is operated by means of compressed air supplied to either control port 12 (X) or 14 (Y). If compressed air is supplied to control port 12 (X), the flat slide is moved to the left by the spool. In this position the supply air will flow from port 1 (P), through port 2 (A), to the cylinder. The return air from the cylinder will flow from port 4 (B) to port 3 (R) and into the atmosphere.

(Fig 3)

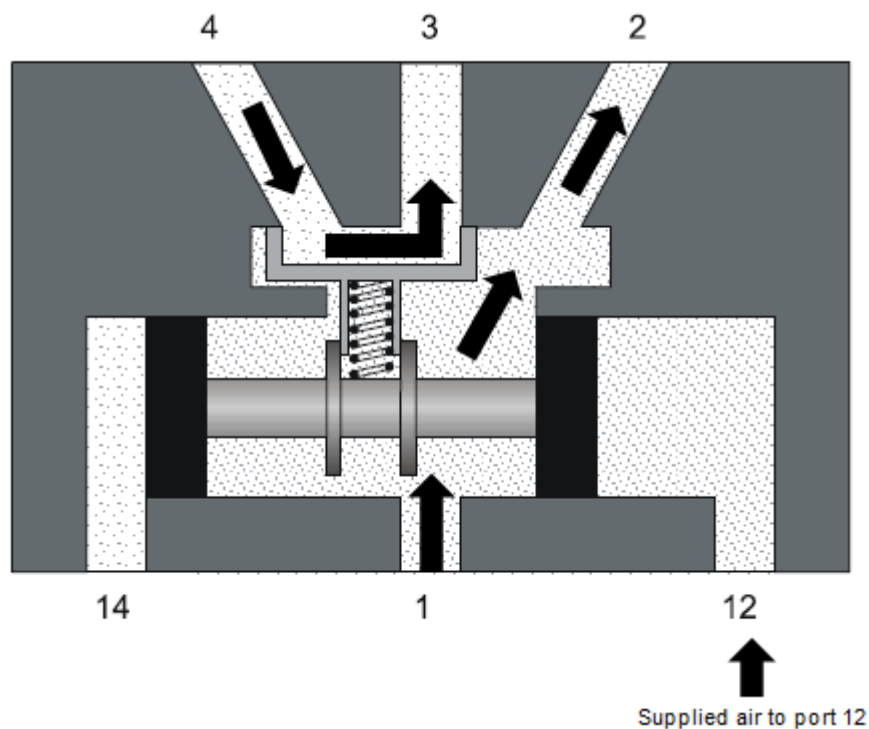


FIG 3.

- B. If compressed air is supplied to control port 14 (Y), the flat slide is moved to the right by the spool. In this position, the supply air will flow from port 1 (P), through port 4 (B), to the cylinder. The return air from the cylinder will flow from port 2 (A), to port 3 (R), and into the atmosphere. (Fig 4)

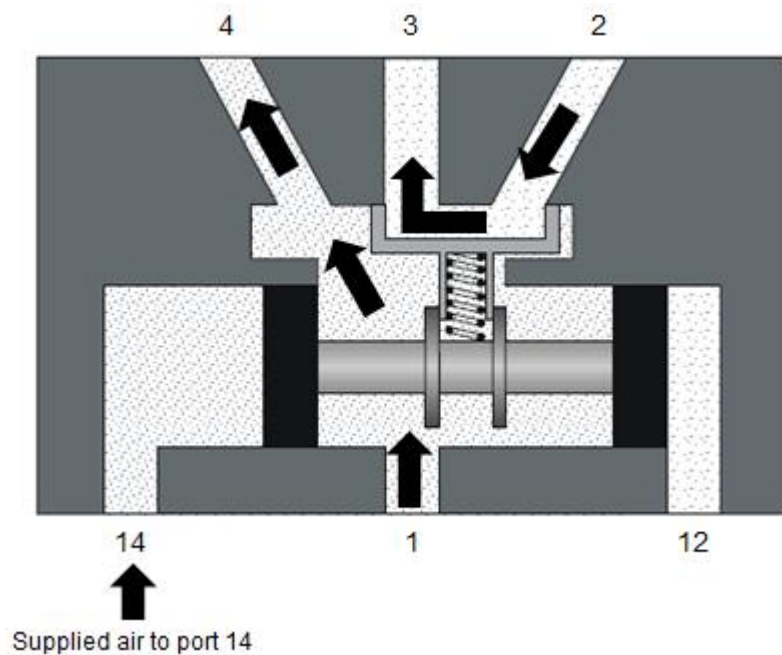


FIG 4.

- C. The valve is reversed by means of direct pneumatic actuation. When the compressed air is removed from the control port 12 (X) or 14 (Y), the control piston remains in the respective position until it receives a signal from the opposite site control port.

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



SELF TEST 1

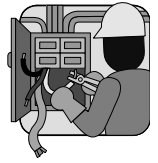
1. What is the function of a 4/2 way double pilot valve (impulse valve)?

2. What cause a spool of a 4/2 way double pilot valve (impulse valve) to move?

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 :

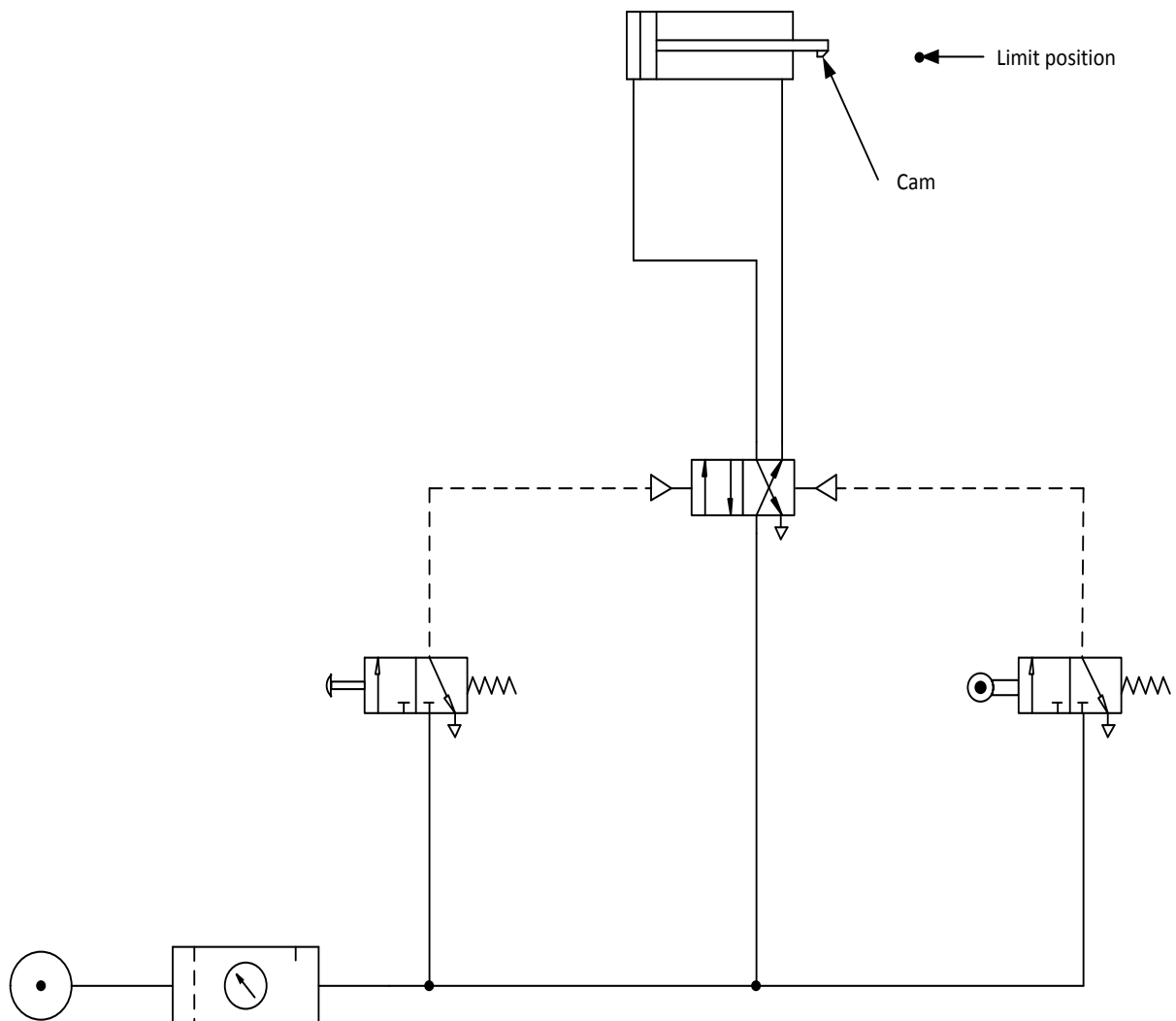


PRACTICE

1. Practice drawing the symbol for a 4/2 way double pilot valve (impulse valve).

2. Identify the 4/2 way double pilot valve from the training panel / equipment.

3. Construct the circuit below on the training panel.
 - The roller of the roller lever control valve must line up with the piston rod.
 - The control valve must be placed in such a position that when the piston is fully extended, the valve will be operated by the cam on the piston rod.



4. Check the function of the circuit by operating the 3/2 way directional control valve. The piston rod must return automatically after it has travelled out to its fullest extent.
5. Indicate the flow of air for each position of the directional control valves on the above schematic drawing.

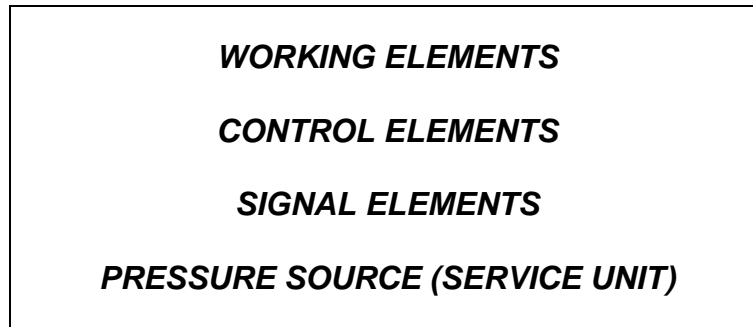
Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

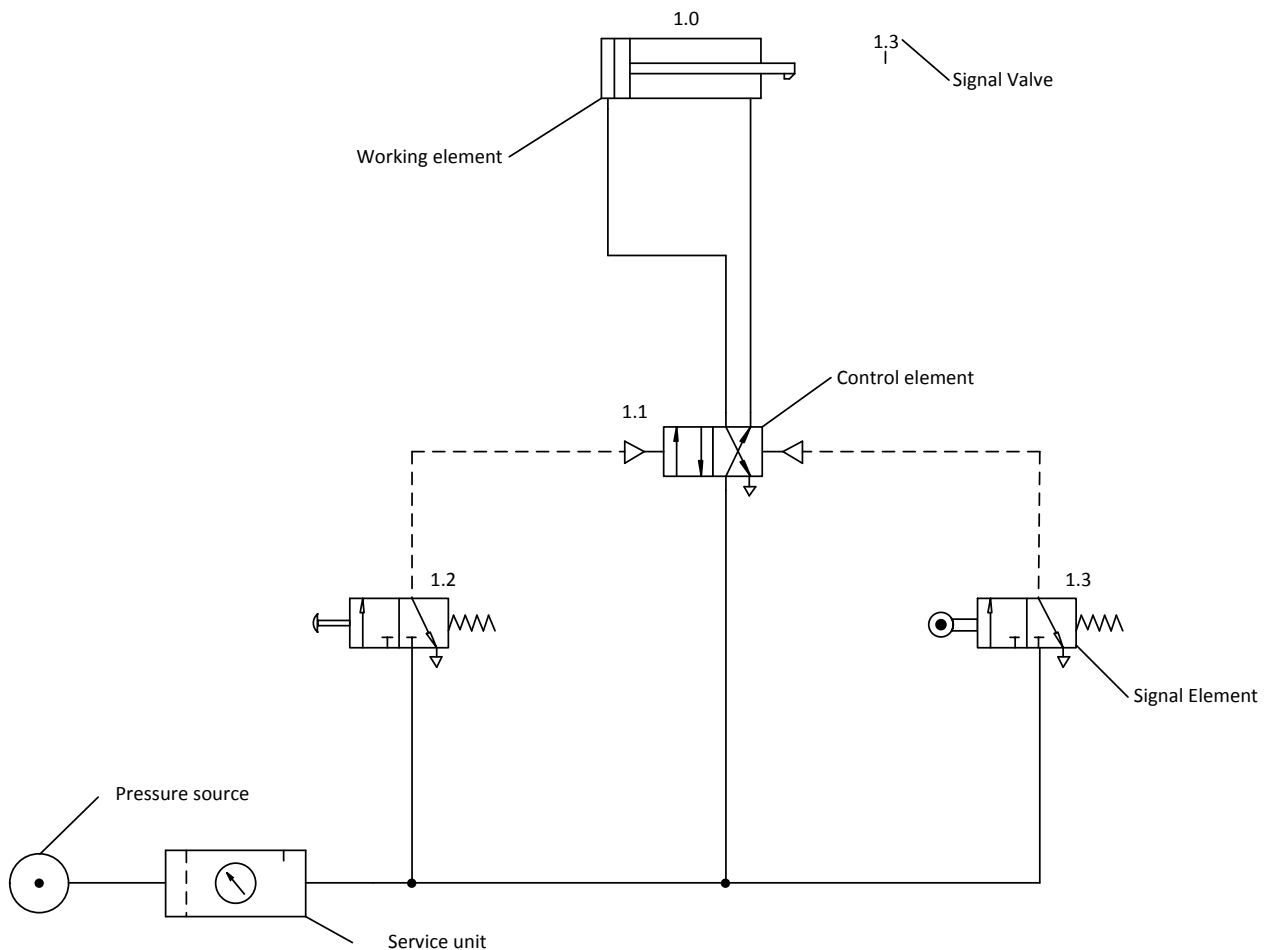
2. DESIGNING OF A CIRCUIT

ITEM / TASK: Layout.

A. To clearly arrange the circuit diagram, the components are drawn in according to the operations they perform. This is done in ascending levels from the bottom to the top as shown below.



B. In Fig 5, the names of the components are entered in the circuit.



C. The true positions of the components are more often than not different from the circuit diagram. See Fig 6.

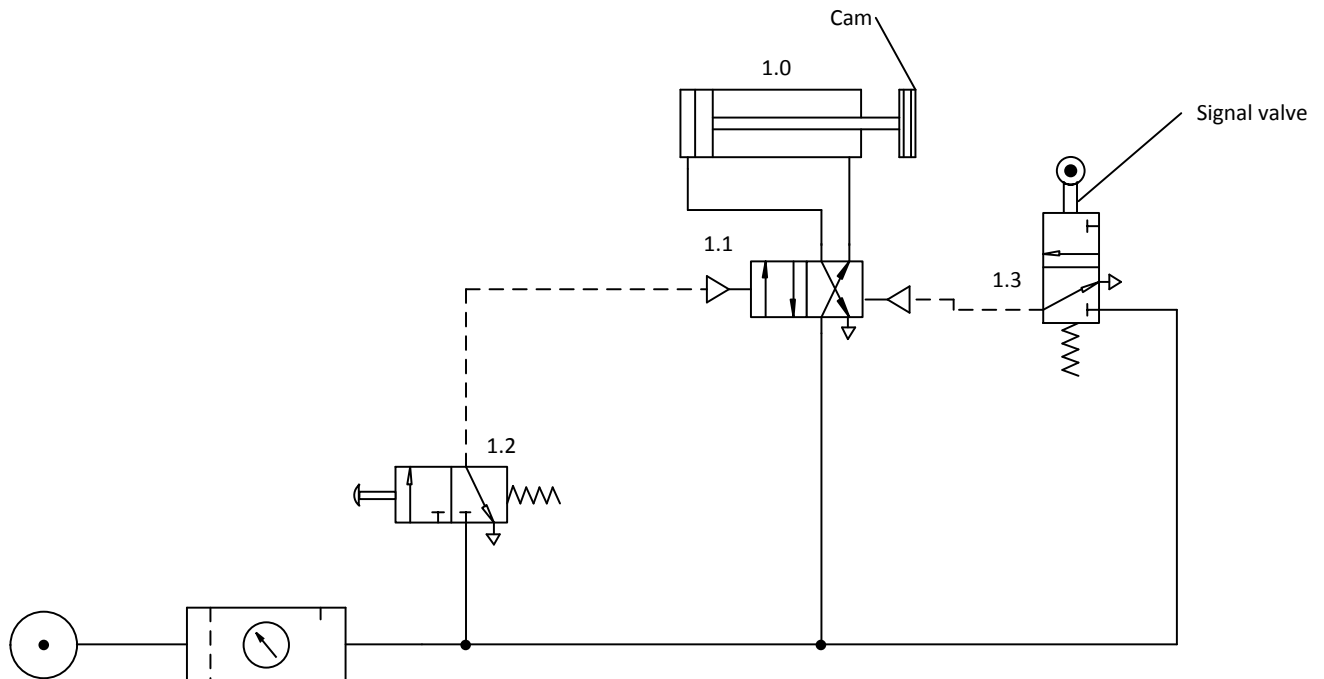
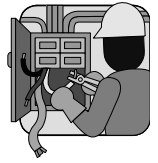


FIG 6.

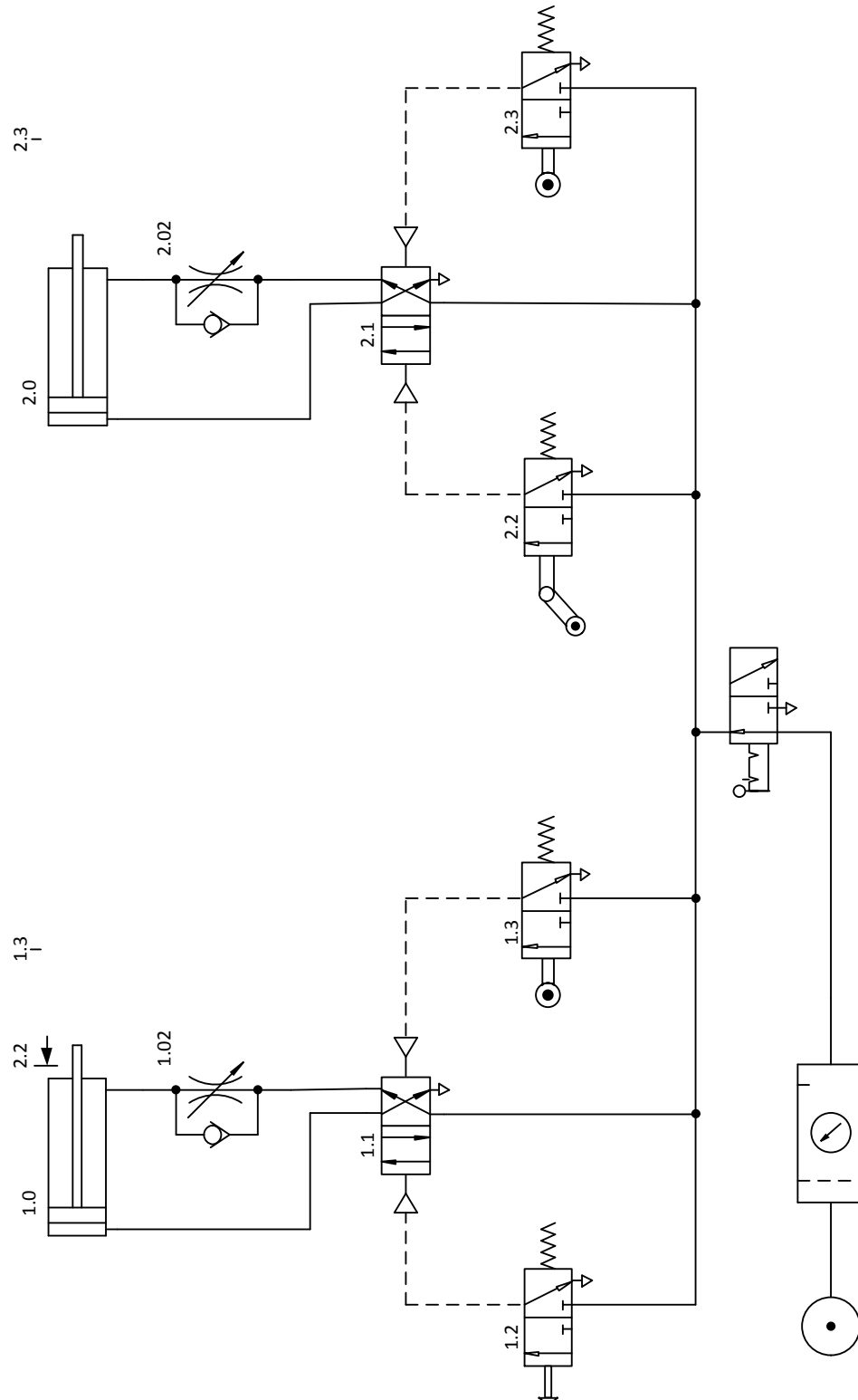
- D. In Fig 6 it can be seen that the signal valve will be triggered by the cam on the piston rod when it is extended.
- E. The position of a signal element is shown by a vertical line below the number of the signal element concerned. In Fig 5, this is the signal valve 1.3.
- F. It is obvious that the signal element to be triggered by the piston rod of the cylinder must be positioned close to the cylinder and on the same plane as the travel of the piston rod.

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



PRACTICE

- Construct the circuit below on the training panel.



2. Directional control valves must be positioned so that when operating the push button control valve 1.2:
- Cylinder 1.0 must be fully extended before cylinder 2.0 starts to move.
 - Cylinder 2.0 must automatically return to its retracted position when it has been fully extended.
 - Both the cylinders must be returned to its retracted position when the circuit is at rest.

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

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.