

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

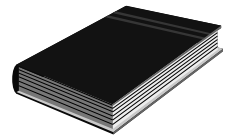
CODE: PN - 3

FIT AND ADJUST A SERVICE UNIT

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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 “Fit and adjust a service unit”. Whilst learning towards the outcome you will be required to achieve the following:

- Know the function of a filter with a water separator.
- Know the function of a lubricator.
- Know the function of a pressure regulating valve.
- Know the position of a service unit in a pneumatic circuit.

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

- State the function of a filter with a water separator.
- State the function of a lubricator.
- State the function of a pressure regulating valve.
- Indicate the position of a service unit in a pneumatic circuit.

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 - 3****FIT AND ADJUST A SERVICE UNIT**

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. SERVICE UNITS

ITEM / TASK: Introduction.

DESCRIPTION:

- A. The service unit ensures that the air is conditioned so that it can be used for operating in a pneumatic system. All the contaminants in the air must be removed and the water must be trapped and drained. This is done by fitting a filter with a water separator.
- B. The air must be regulated to a safe constant pressure by fitting a pressure regulating valve.
- C. The air must be enriched by oil so that it can lubricate the component parts by means of a lubricator.
- D. The filter is normally combined with a pressure regulator and lubricator to form a compressed air service unit.
- E. The service unit is always located on the supply side of the pneumatic installation.

ITEM / TASK: Components of a service unit.

DESCRIPTION:

- A. The air service unit is a combination of the following components: (Fig 1 on the following page)
 - a. Compressed air filter (with water separator)
 - b. Compressed air regulator
 - c. Compressed air lubricator
 - d. Pressure gauge

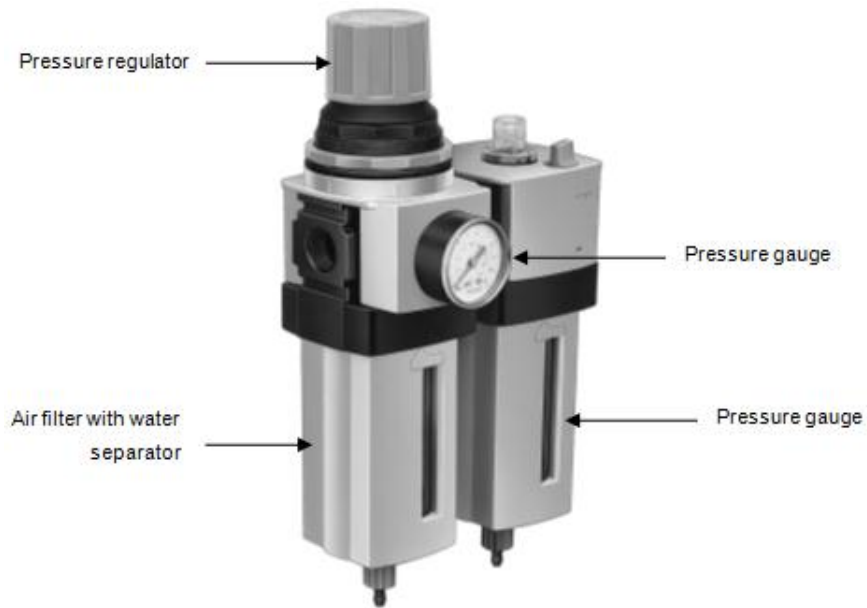


FIG 1.

B. The detailed symbol for a service unit is shown in Fig 2.

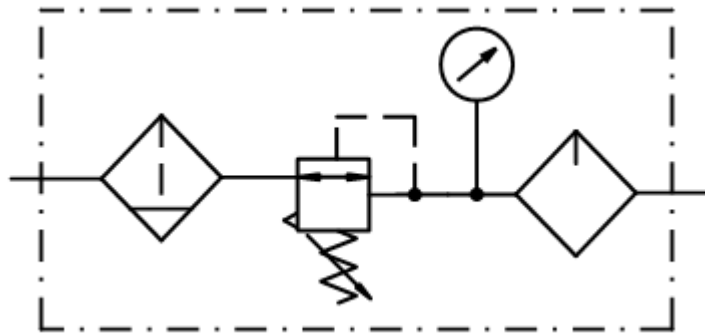


FIG 2.

C. The simplified symbol for a service unit is shown in Fig 3.

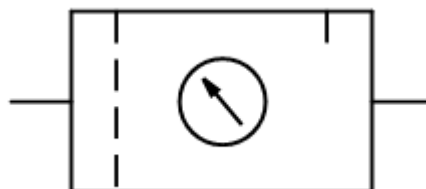


FIG 3.

2. AIR FILTER WITH WATER SEPARATOR

ITEM / TASK: Components of an air filter.

A. The air filter consist of the following components: (Fig 4)

- a. Filter bowl
- b. Filter element
- c. Baffle
- d. Drain screw

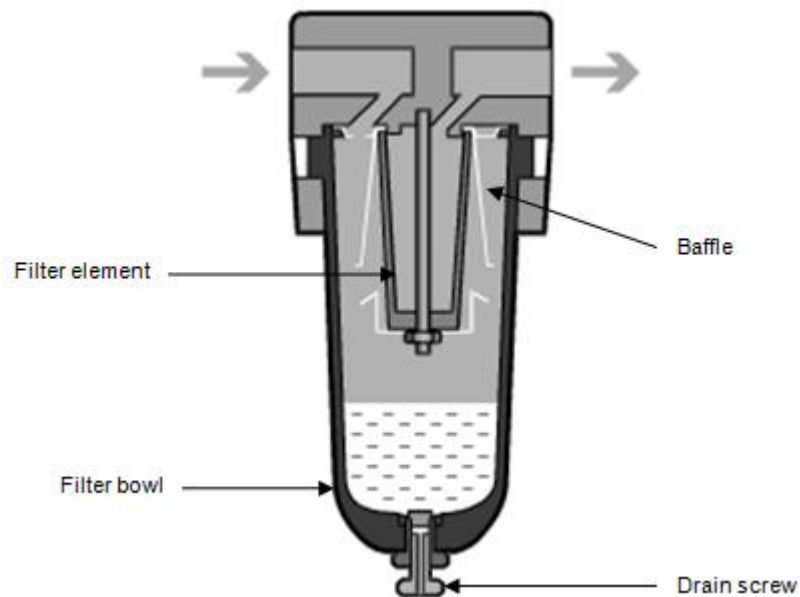


FIG 4.

B. The symbol for a filter only is shown in Fig 5.

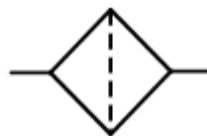


FIG 5.

C. The symbol for a filter with a water separator is shown in Fig 6.



FIG 6.

ITEM / TASK: Function and operation of a filter.

- A. The compressed air filter has the function of removing all contaminants from the compressed air flowing through it, as well as water which has already condensed. The compressed air enters the filter bowl through guide slots. Liquid particles and larger particles of dirt are separated centrifugally collecting in the lower part of the filter bowl. The collected condensate must be drained before the level exceeds the maximum condensate mark, as it will otherwise be re-entrained in the air stream.
- B. The selection of the correct filter plays an important role in determining the quality and performance of the working system which is to be supplied with compressed air. One characteristic of compressed-air filters is the pore size. The pore size of the filter element indicates the minimum particle size which can be filtered out of the compressed air.
- C. If a large amount of condensate accumulates, it is advisable to fit an automatic drain in place of the manually operated drain cock. However, in such cases, the cause of the accumulated condensate is to be established. For example, an unsuitable pipe layout may be the cause of the condensate accumulation.
- D. The automatic drain uses a float to determine the level of condensate in the bowl. When the limit is reached a control piston opens a valve seat that ejects the condensate under air pressure via a drain line. If the float reaches the minimum level of condensate, the seat valve is closed and the process stopped. The filter bowl can also be emptied manually.
- E. The compressed air passes through the filter from left to right and is fed through a baffle plate in the filter bowl. The function of the baffle plate causes the air to rotate. The heavier dust particles and water droplets are spun by centrifugal force against the inner wall of the filter bowl. They then run down the wall of the housing and collect in the filter bowl. The air which has been pre-cleaned in this way then passes through the filter element, which filters out the smaller dirt particles. The filter element in this case consists of a highly-porous sintered material. The degree of separation depends on the pore size of the filter element used. Inserts with different pore sizes are available. The usual pore sizes are between 5 microns and 40 microns.
- F. In order to recognise the correct time to change the filter element, a visual inspection or a measurement of the pressure difference across the filter should be carried out.

3. LUBRICATOR

ITEM / TASK: Components of a lubricator.

A. The lubricator consist of the following components: (Fig 7)

- a. Housing
- b. Oil reservoir
- c. Rise tube
- d. Inspection glass

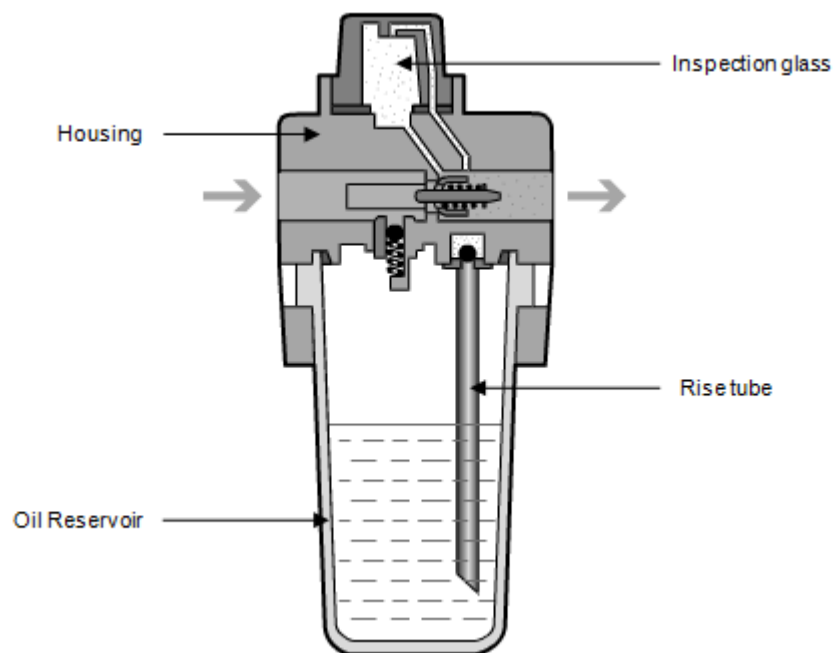


FIG 7.

B. The symbol for a lubricator is shown in Fig 8.

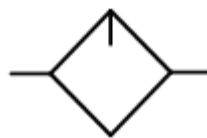


FIG 8.

ITEM / TASK: Function and operation of a lubricator.

- A. As a rule the compressed air which is generated should be dry, i.e. free of oil. For some components lubricated air is damaging, for others, it is undesirable, but for power components it may in certain cases be necessary. Lubrication of the compressed air should therefore always be limited to the plant sections which require lubrication. For this purpose, mist lubricators are fitted to feed the compressed air with specially selected oils. Oils which are introduced into the air from the compressor are not suitable for the lubrication of control system components.
- B. The purpose of the lubricator is to deliver a metered quantity of oil mist into a leg of the air distribution system, where necessary for the operation of the pneumatic system and components.
- C. Air passing through the lubricator causes a pressure drop between the oil reservoir and the upper part of the lubricator. This pressure difference forces the oil upwards through the rise tube and drips into a nozzle which can be seen through an inspection glass. The oil is atomized and carried along by the air stream.
- D. It is necessary to carefully adjust the oil discharge rate by adjusting the adjustment screw.
- E. A reference value for oil dosage is a quantity of 1 to 10 droplets per cubic metre of compressed air. The correct metering can be checked as follows: A piece of white cardboard should be held at a distance of approximately 10 cm from the exhaust port of the power valve of the cylinder which is furthest away from the lubricator. If the system is then allowed to operate for some time, it should be possible to see only a pale yellow colour on the cardboard. Dripping oil is a clear sign of over lubrication.

4. PRESSURE GAUGE

ITEM / TASK: Application of a pressure gauge.

A. The pressure gauge is used to measure the pressure in any part of the circuit.



FIG 9.

B. The symbol for a pressure gauge is shown in Fig 10.



FIG 10.

5. PRESSURE REGULATOR

ITEM / TASK: Components of a pressure regulator.

A. The pressure regulator consist of the following components: (Fig 11 on the following page)

- a. Regulating knob
- b. Main spring
- c. Membrane
- d. Sealing element
- e. Regulator piston
- f. Regulator piston spring
- g. Bottom seal seat.

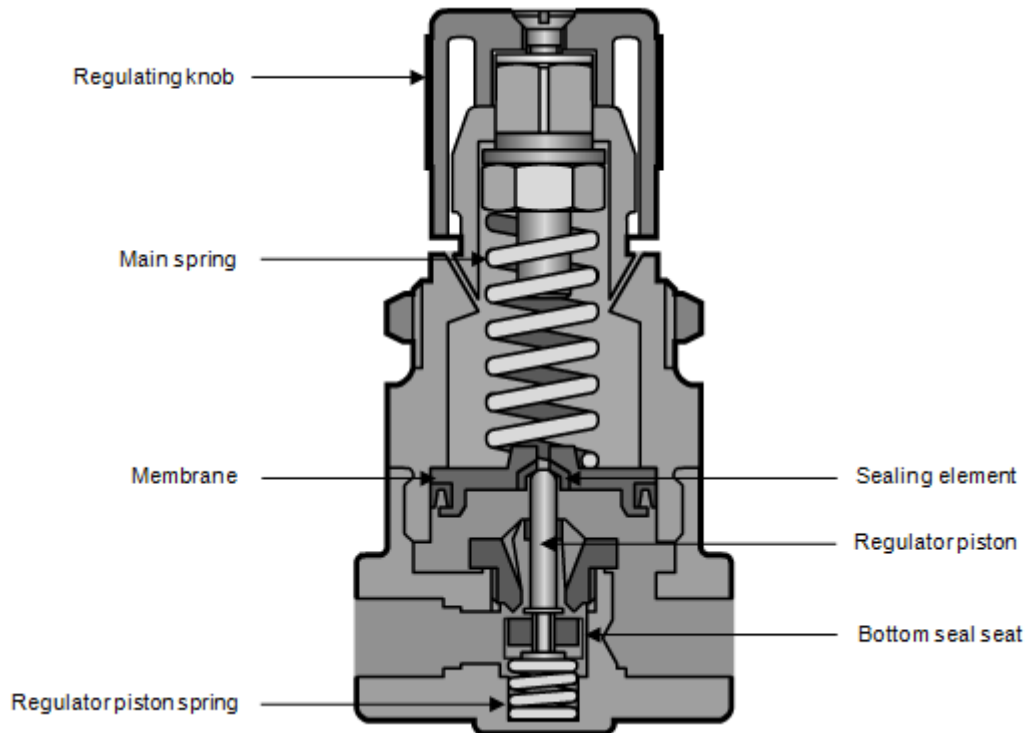


FIG 11.

B. The symbol for a pressure regulator valve is shown in Fig 12.

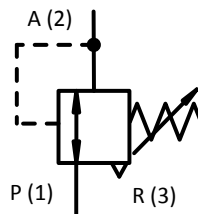


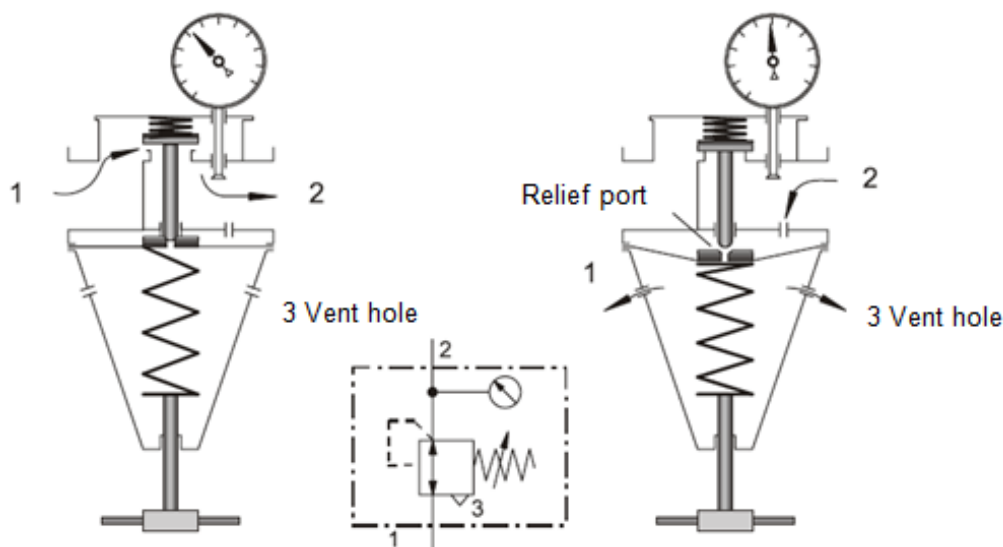
FIG 12.

ITEM / TASK: Function of a pressure regulator.

- A. The purpose of the regulator is to keep the operating pressure of the system (secondary pressure) virtually constant regardless of fluctuations in the line pressure (primary pressure) and the air consumption.
- B. The compressed air generated by the compressor will fluctuate. Changes in the pressure level in the pipe system can adversely affect the switching characteristics of valves, the running times of cylinders and the timing characteristics of flow control and memory valves.

ITEM / TASK: Operation of a pressure regulator.

- A. The input pressure (primary pressure) at the pressure regulator must always be higher than the output pressure (secondary pressure). The pressure is regulated by a diaphragm. The output pressure acts on one side of the diaphragm and a spring acts on the other side. The spring force can be adjusted by means of an adjusting screw.
- B. When the output pressure increases for example during cylinder load changes, the diaphragm moves against the spring force, causing the outlet cross-sectional area at the valve seat to be reduced or closed entirely. The centrepiece of the diaphragm opens and the compressed air can flow to atmosphere through the vent holes in the housing.
- C. When the output pressure decreases, the spring force opens the valve. Regulation of the preset output pressure is thus a continual opening and closing of the valve seat caused by the flow of air. The operating pressure is indicated on a gauge.

**FIG 13.**

**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 the filter with a water separator?

2. What is the function of a lubricator?

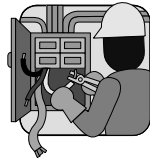
3. What is the function of a pressure regulator valve?

4. Where will you fit a service unit in a pneumatic circuit? Why?

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 filter with a water separator.
2. Practice drawing the symbol for a lubricator.
3. Practice drawing the symbol for a pressure gauge.
4. Practice drawing the symbol for a pressure regulator valve.

5. Practice drawing the symbol for a service unit.

6. Identify the above mentioned components from the training panel / equipment.

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

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

6. ADJUSTING A SERVICE UNIT

ITEM / TASK: How to adjust the service unit.

A. Select the components and construct the circuit as shown in Fig 14.

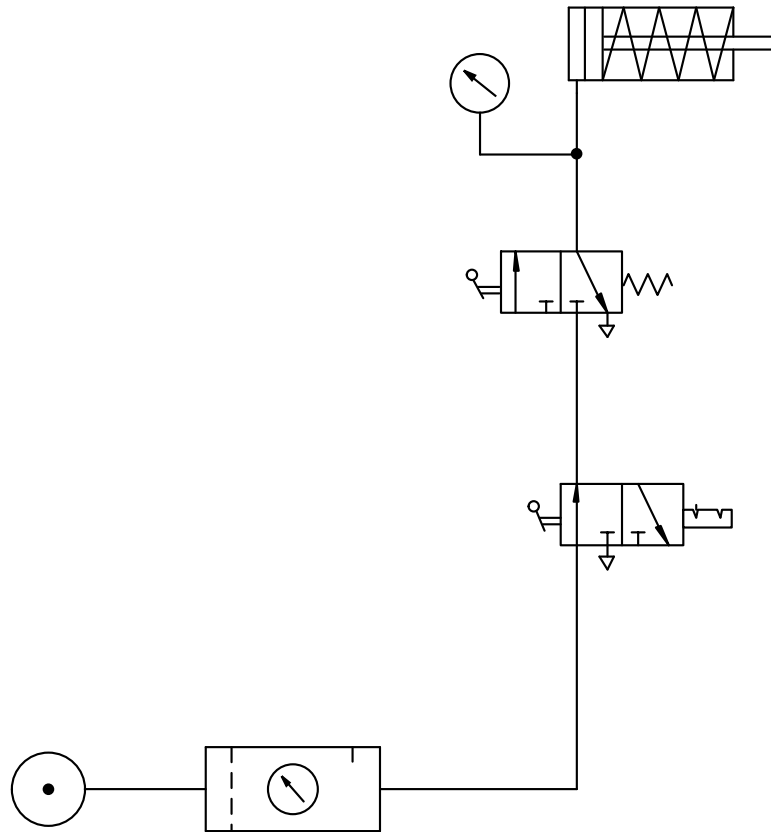


FIG 14.

- B. Undo the lock-nut on the pressure regulator valve. (If fitted)
- C. Unscrew the adjusting knob / screw until there is no tension on the main spring.
- D. Open the air supply.
- E. Shift the directional control valve levers to such a position that it will allow air to flow to the cylinder.
- F. Turn in the adjusting knob / screw on the pressure regulating valve until the piston starts to move.
- G. Let the piston move out to the furthest position.
- H. While the control valves are kept in this position, adjust the pressure regulator valve until a pressure of 300 kPa is registered on the pressure gauge.
- I. Close the air supply.
- J. Operate the control valves and release any pressure in the system.

- K. Disconnect the pipe between the control valves at the second valve.
- L. Open the air supply to obtain a continuous flow.
- M. Check the rate at which the oil drips from the rise tube through the inspection glass of the lubricator.
- N. Adjust until a rate of 2 drops/minute is obtained.

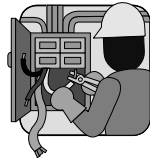


NB:

Do not add too much oil as this could lead to the fine nozzles in the units being blocked.

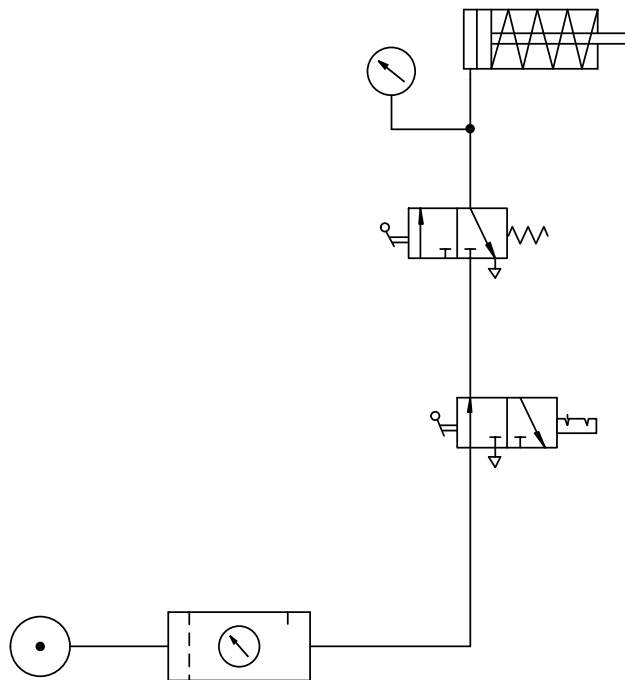
It should also be mentioned that some units, and some branches in the industry, require oil-free compressed air.

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



PRACTICE

1. Connect up the circuit below on the training panel and adjust the pressure regulator valve and the lubricator to the specifications indicating by the Training Officer.



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.