

Unit 020

Assembling and testing fluid power systems

Level: 2

Credit value: 14

NDAQ number: 500/9514/6

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to cover a broad range of basic fluid power assembly activities that will prepare the learner for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or that will provide a basis for the development of additional skills and occupational competences in the working environment.

The learner will be expected to prepare for the assembly activities by obtaining all necessary information, documentation, tools and equipment required, and to plan how they intend to carry out the required assembly activities and the sequence of operations they intend to use. The learner will be required to select the appropriate equipment to use, based on the assembly operations to be carried out and the type of fluid power equipment being assembled, which will include hydraulic, pneumatic or vacuum systems.

In carrying out the fluid power assembly operations, the learner will be required to follow specific assembly techniques in order to assemble the various components, which will include rigid and flexible pipework, hoses, valves, actuators and cylinders, regulators, switches and sensors. The assembly activities will also include making all necessary checks and adjustments to ensure that fluid power components are correctly positioned and aligned, are dimensionally accurate and secure; pipework is dimensionally accurate and free from ripples, creases and damage; and joints are checked for security, with threaded devices tightened correctly. The learner will also be expected to carry out appropriate test procedures (such as leak or pressure) to confirm that the fluid power assembly meets the operational performance required.

The learner's responsibilities will require them to comply with health and safety requirements and organisational policy and procedures for the fluid power assembly activities undertaken. The learner will need to take account of any potential difficulties or problems that may arise with the assembly activities, and to seek appropriate help and advice in determining and implementing a suitable solution. The learner will work under a high level of supervision, whilst taking responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide an understanding of their work, and will enable them to apply appropriate fluid power assembly techniques and procedures safely. The learner will understand the assembly process, and its application, and will know about the fluid power equipment being assembled, the system components, tools and consumables used, to the required depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when carrying out the assembly activities, and when using assembly tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assemble and test fluid power systems
2. Know how to assemble and test fluid power systems

Guided learning hours

It is recommended that **64** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from national occupational standard Performing Engineering Operations Unit No. 20: Assembling and testing fluid power systems (Suite 2)

Support of the unit by a sector or other appropriate body

This unit is endorsed by Semta.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from Semta's website:

http://www.semta.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by Semta. These additional assessment requirements are set down in Semta's Performing Engineering Operations Level 2 unit assessment strategy which can be downloaded from Semta's website:

http://www.semta.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit specific additional assessment requirements:

In order to prove their ability to combine different fluid power assembly operations, at least one of the fluid power assemblies produced must be of a significant nature, and must contain a minimum of six of the components listed in assessment criteria 1.7.

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Outcome 1

Assembling and testing fluid power systems

Assemble and test fluid power systems

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines
2. carry out all of the following during the assembly of the fluid power system:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - ensure the safe isolation of equipment (such as mechanical, electrical, gas, air or fluids)
 - follow job instructions, assembly drawings and procedures
 - check that assembly tools and test instruments to be used are within calibration date and are in a safe and usable condition
 - ensure that the fluid power system is kept free from foreign objects, dirt or other contamination
 - return all tools and equipment to the correct location on completion of the assembly activities
3. assemble one of the following types of fluid power system:
 - pneumatic
 - hydraulic
 - vacuum
4. plan the assembly activities before they start them
5. obtain all the information they need for the safe assembly of the fluid power system
6. obtain and prepare the appropriate components, assembly tools and test equipment
7. produce fluid power assemblies that contain a range of components, including all of the following:
 - rigid pipework
 - hoses
 - valves
 - cylinders/actuators
 - Plus six more from the following:
 - pumps
 - compressors
 - accumulators
 - reservoirs/storage devices
 - motors
 - lubricators
 - pressure intensifiers
 - regulators
 - gauges/indicators

- switches
 - sensors
 - receivers
 - filters
 - bearings
 - cables and wires
 - gaskets and seals
 - other specific components
8. use the appropriate methods and techniques to assemble the components in their correct positions
 9. apply fluid power assembly methods and techniques to include all of the following:
 - checking components for serviceability
 - positioning equipment/components
 - aligning pipework and connections
 - dressing and securing pipes and hoses
 - setting, aligning and adjusting system components
 - securing by using mechanical fixings
 - applying screw fastener locking devices
 - tightening fastenings to the required torque
 - applying hose/cable clips and fasteners
 - making de-energised checks before filling and/or pressurising the system
 10. secure the components, using the specified connectors and securing devices
 11. check the completed assembly to ensure that all operations have been completed and that the finished system meets the required specification
 12. carry out quality checks, to include all of the following, using appropriate equipment:
 - the system is complete, as per specification
 - dimensions are within specification requirements
 - components are correctly positioned
 - components are correctly aligned
 - direction and flow indicators on components are correct
 - components are securely held in place
 - connections to components are tightened to the required torque
 - pipework is free from ripple and creases
 - electrical connections are correctly made (where applicable)
 13. carry out tests on the assembled system, in accordance with the test schedule/defined test procedures
 14. carry out all of the following checks to ensure the accuracy and quality of the tests carried out:
 - the test equipment is correctly calibrated
 - the test equipment used is appropriate for the tests being carried out
 - test procedures used are as recommended in the appropriate specifications
 - test readings are taken at the appropriate points, and where appropriate components are adjusted to give the required readings
 - test equipment is operated within its specification range

15. carry out tests and adjustments on the assembled system, to include:
 - leak test
 - Plus one more from the following:
 - pressure line pressure tests
 - return line pressure test
 - flow
 - speed
 - sequence
 - operational performance
16. produce fluid power assemblies which meet all of the following:
 - all components are correctly assembled and aligned, in accordance with the specification
 - moving parts are correctly adjusted and have appropriate clearances
 - the system functions in line with the specification requirements
 - the system is leak free
17. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve
18. leave the work area in a safe and tidy condition on completion of the assembly activities

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Outcome 2

Assembling and testing fluid power systems

Know how to assemble and test fluid power systems

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements, and safe working practices and procedures required for the fluid power assembly activities undertaken
2. describe the importance of wearing appropriate protective clothing and equipment, and keeping the work area safe and tidy
3. describe the hazards associated with carrying out assembly activities on fluid power equipment (such as handling fluids, stored energy/force, misuse of tools), and how these can be minimised
4. explain how to obtain and interpret drawings, charts, circuit and physical layouts, specifications, manufacturers' manuals, symbols used in fluid power, and other documents needed in the assembly activities
5. describe the procedure for obtaining drawings, job instructions, related specifications, components, materials and other consumables necessary for the assembly activities
6. describe the basic principles of how the fluid power equipment functions, its operating sequence, the purpose of individual units/components and how they interact
7. describe the different types of pipework, fittings and manifolds, and their application
8. describe the identification and application of different types of valve (such as poppet, spool, piston, disc)
9. describe the identification and application of different types of sensors and actuators (such as rotary, linear, mechanical, electrical)
10. describe the identification and application of different types of cylinder (such as single acting, double acting)
11. describe the identification and application of different types of pump (such as positive and non-positive displacement)
12. describe the application and fitting of static and dynamic seals
13. describe the techniques used to assemble/install fluid power equipment (such as marking out the positions of components; making pipe bends using fittings and by hand bending methods; connecting components using rigid and flexible pipework; using gaskets/seals and jointing/sealing compounds)
14. describe the need to ensure that pipework is supported at appropriate intervals, and the need to eliminate stress on the pipework connections
15. describe the need to ensure cleanliness of the fluid power system, and the ways of purging pipework before connection to components and pressure sources
16. describe the recognition of contaminants and the problems they can create, and the effects and likely symptoms of contamination in the system
17. describe the methods of testing the fluid power system; the types of test equipment to be used, and their selection for particular tests
18. explain how to make safety checks of the system before carrying out tests, to ensure that all pipes and components are secure and that moving parts are chocked or parked
19. explain how to connect suitably calibrated test equipment into the circuit, and how to connect the circuit to a suitable pressure source containing appropriate ancillary equipment

20. explain how to carry out the tests (such as applying test pressures in incremental stages; checking for leaks; taking appropriate test readings; adjusting appropriate components to give required operating conditions)
21. explain how to determine pressure settings, and their effect on the system
22. explain how to display/record test results, and the documentation used
23. explain how to interpret the test readings obtained, and the significance of the readings gained
24. describe the importance of ensuring that test equipment is used only for its intended purpose and within its specified range and limits
25. explain how to check that tools and test equipment are free from damage or defect, are in a safe and usable condition, are within calibration, and are configured correctly for the intended purpose
26. describe the problems associated with the fluid power assembly and testing activity, and how they can be overcome
27. explain when to act on their own initiative and when to seek help and advice from others
28. describe the importance of leaving the work area in a safe and clean condition on completion of the assembly activities (such as returning hand tools and test equipment to its designated location, cleaning the work area, and removing and disposing of waste)