

## SQA Advanced Unit specification

### General information

**Unit title:** Plant Systems: Services (SCQF level 7)

**Unit code:** HV35 47

**Superclass:** VG

**Publication date:** November 2017

**Source:** Scottish Qualifications Authority

**Version:** Version 01

### Unit purpose

This Unit is designed to give learners a knowledge and understanding of the operational requirements of industrial pneumatic and hydraulic systems and to allow learners to develop a maintenance plan for either a pneumatic or hydraulic system.

### Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Investigate the operational requirements of compressed air generating systems.
- 2 Describe the operation of factory air distribution systems.
- 3 Describe plant equipment used in a hydraulic system.
- 4 Produce a maintenance plan for a plant system.

### Credit points and level

1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

### Recommended entry to the Unit

Entry to the Unit is at the discretion of the centre however it would be an advantage if learners had a basic knowledge and understanding of engineering principles, thermo fluids, engineering drawing, and engineering materials although this is not absolutely essential. Some of this knowledge and understanding may be evidenced by possession of the following SQA Advanced Unit: *Mechanical Engineering Principles* (HV2V 47).

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### **Core Skills**

There are opportunities to develop the Core Skills of Written Communication, Using Graphical Information and Critical Thinking at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

### **Context for delivery**

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

### **Equality and inclusion**

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

### SQA Advanced Unit Specification: Statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

#### Outcome 1

Investigate the operational requirements of compressed air generating systems.

##### Knowledge and/or Skills

- ◆ Compressed air power system
- ◆ Properties of air as working fluid
- ◆ Air compressors
- ◆ Compressor ancillary equipment
- ◆ Health and Safety requirements
- ◆ Symbol recognition

#### Outcome 2

Describe the operation of factory air distribution systems.

##### Knowledge and/or Skills

- ◆ Moisture removal
- ◆ Filtration
- ◆ Lubrication
- ◆ Energy efficiency
- ◆ Noise
- ◆ Air tools
- ◆ Current legislation
- ◆ Health and Safety considerations

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### **Outcome 3**

Describe plant equipment used in a hydraulic system.

#### **Knowledge and/or Skills**

- ◆ Pump
- ◆ Motor
- ◆ Actuator
- ◆ Directional control valves
- ◆ Accumulator
- ◆ Pressure relief valves
- ◆ Symbols
- ◆ Lubrication
- ◆ Ancillary items
- ◆ Health and Safety considerations

### **Outcome 4**

Produce a maintenance plan for a plant system.

#### **Knowledge and/or Skills**

- ◆ Equipment
- ◆ Tools
- ◆ Labour
- ◆ Location
- ◆ Schedule
- ◆ Procedure
- ◆ Costs

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### Evidence Requirements for this Unit

#### Outcome 1

All Knowledge and Skills items should be assessed.

Learners will need to provide written and/or oral recorded evidence to demonstrate their Knowledge and/or Skills across all Outcomes by showing that they can:

- ◆ describe the operation of the air power system
- ◆ describe the properties of air as a working fluid
- ◆ describe the operation of the air compressor used in the system
- ◆ explain the function of three compressor ancillary items
- ◆ describe the precautions and relevant health and safety legislation required when operating or working with the air system
- ◆ recognise current standard symbols for compressed air generating systems

#### Outcome 2

Evidence for the Knowledge and/or Skills items in Outcome 2 should be provided on a sample basis. The evidence may be provided in response to specific questions. Each learner will need to demonstrate that she/he can answer correctly questions based on a sample of the items shown under the Knowledge and/or Skills items in Outcome 2. In any assessment of the Outcome **five out of eight** Knowledge and/or Skills items should be sampled.

In order to ensure that learners will not be able to for see what items they will be questioned on, a different sample of five out of eight Knowledge and/or Skills items are required each time the Outcome is assessed. Learners must provide a satisfactory response to all items.

Learners will need to provide written and/or oral recorded evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe equipment used for moisture removal
- ◆ describe equipment used for air filtration
- ◆ explain the need for lubrication in air systems
- ◆ explain the need for energy efficiency within air systems
- ◆ describe noise considerations within air systems
- ◆ describe the operation of air tools
- ◆ state two current regulations pertaining to air systems
- ◆ state two current Health and Safety regulations pertaining to air systems

The assessment for Outcome 2 should last 30 minutes and be conducted under controlled, closed-book, supervised conditions. As such learners should not be allowed to bring any textbooks, handouts or notes to the assessment.

#### Outcome 3

Evidence for the Knowledge and/or Skills items in Outcome 3 should be provided on a sample basis. The evidence may be provided in response to specific questions. Each learner will need to demonstrate that she/he can answer correctly questions based on a sample of the items shown under the Knowledge and/or Skills items in Outcome 3. In any assessment of the Outcome **six out of ten** Knowledge and/or Skills items should be sampled.

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In order to ensure that learners will not be able to for see what items they will be questioned on, a different sample of six out of ten Knowledge and/or Skills items are required each time the Outcome is assessed. Learners must provide a satisfactory response to all items.

Learners will need to provide written and/or oral recorded evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe the operation of a hydraulic pump
- ◆ describe the operation and application of a hydraulic motor
- ◆ describe the operation and application of a hydraulic actuator
- ◆ state at least three types of hydraulic directional control valves
- ◆ describe the operation of a hydraulic accumulator
- ◆ explain the need for pressure relief valves
- ◆ recognise current standard symbols
- ◆ describe how lubricants are used in a hydraulic system
- ◆ state at least three ancillary items associated with hydraulic systems
- ◆ state two current Health and Safety regulations pertaining to air systems

The assessment for Outcome 3 should last 30 minutes and be conducted under controlled, closed-book, supervised conditions. As such learners should not be allowed to bring any textbooks, handouts or notes to the assessment.

### **Outcome 4**

All Knowledge and/or Skills items should be assessed in this Outcome.

Learners should prepare a maintenance plan on a pneumatic or hydraulic system with which they are familiar. The plan must include details of the following:

- ◆ actual items of equipment that will be maintained
- ◆ tools used to implement maintenance plan
- ◆ the skills and labour requirements (electrical/mechanical/instrument)
- ◆ the location where equipment will be maintained
- ◆ the schedule for maintenance work (daily/weekly/monthly/annual)
- ◆ a procedure for the work to be carried out
- ◆ an example cost calculation for management purposes

Maintenance plans should be developed in the learners own time. Centres should make every reasonable effort to ensure the assignment solution is the learner's own work. Where copying or plagiarism is suspected learners may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the learner's knowledge and understanding.

## **SQA Advanced Unit Support Notes**

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Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

### **Guidance on the content and context for this Unit**

This Unit has been written in order to allow learners to develop knowledge, understanding and skills in the following areas:

**(1) The operational requirements of compressed air generating systems**

Learners will not require an in-depth knowledge and understanding of the topics listed in the Knowledge and/or Skills section of this Outcome. However, learners will find it useful to develop an awareness of the significance of the items in relation to the operation and maintenance of air systems. The suggested delivery and assessment time for this Outcome is 8 hours.

**(2) The operation of factory air distribution systems**

Learners should be introduced to the various inputs required in order to fully understand the layout of a factory air distribution system. It is recommended that emphasis is placed on current European legislative requirements together with best practice currently adopted in industry. The suggested delivery and assessment time for this Outcome is 8 hours.

**(3) Describe plant equipment used in a hydraulic system**

Learners will not require an in-depth knowledge and understanding of the topics listed in the Knowledge and/or Skills section of this Outcome. However, learners will find it useful to develop an awareness of the significance of the items in relation to the operation and maintenance of hydraulic systems. Emphasis should be placed on symbol recognition and the functionality of each component in a typical hydraulic system. The suggested delivery and assessment time for this Outcome is 10 hours.

**(4) Describe and develop a maintenance plan for a plant system**

Learners should be introduced to the various maintenance requirements so that they can develop a logical and consistent maintenance plan for a plant system. Various examples should be sourced using available resources such as the World Wide Web, supplier data and existing examples from the workplace. Current legislative requirements should be emphasised. Learners should be encouraged to select an application with which they are familiar with or have an interest in as a result of the delivery of the Unit. The suggested delivery and assessment time for this Outcome is 14 hours.

### Guidance on approaches to delivery of this Unit

When delivering this Unit emphasis should be placed on a 'hands on' approach whenever possible. Examples of systems and procedures should be related, where possible, to the learner's work environment. Practical exercises could be copies of actual systems or parts of systems in operation at learners' place of work. The use of computer models, simulation and/or design packages are useful in reinforcing learning and their use is encouraged.

### Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Outcome 1 could be assessed by learners undertaking a practical investigation on a pneumatic system including a compressor and producing a report on aspects of the system. Outcomes 2 and 3 could be assessed by two separate assessment papers (one paper for each Outcome) and should be conducted under controlled, supervised conditions. Learners should not be allowed to bring any textbooks, handouts or notes to the assessment events.

Outcome 4 should be assessed by learners producing a maintenance plan for a pneumatic or hydraulic system. The system used for assessment purposes could be the same as that used in Outcome 1.

#### Outcome 1

A suitable air powered systems may be one that services part of a production line in a factory or a laboratory in a college. Reports should normally be between 400 and 500 words in length plus suitable diagrams. Centres may provide learners with a format for presenting their reports or leave it to learners to devise their own format.

#### Outcome 2

The assessment paper could comprise of a suitable balance of short answer and restricted response questions.

#### Outcome 3

The assessment paper could comprise of a suitable balance of short answer and restricted response questions.

#### Outcome 4

Centres may allow learners to develop their maintenance plans for the pneumatic system used in the assessment of Outcome 1. Centres may wish to issue learners with suitable guidance notes giving advice on the best way to structure their maintenance plan or leave to learners to structure their own maintenance plans.



### Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

There are opportunities to develop the Core Skills components of Written Communication, Using Graphical Information and Critical Thinking at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Learners may have opportunities to develop the Core Skills component Written Communication for Outcome 1. There will also be opportunities to develop the Core Skills component Using Graphical Information while referring to and using pneumatic and hydraulic symbols. Learners should be encouraged to develop critical thinking skills while solving pneumatic and hydraulic formative assessment questions and when working on practical or computer simulated pneumatic or hydraulic circuits.

## History of changes to Unit

Version	Description of change	Date

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

**FURTHER INFORMATION:** Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our [Centre Feedback Form](#).

### General information for learners

#### **Unit title:** Plant Systems: Services (SCQF level 7)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This Unit has been designed to provide you with knowledge and understanding of the operational requirements of pneumatic and hydraulic systems within industry. You will also learn how to develop a maintenance plan for either a pneumatic or hydraulic plant system.

This Unit will normally be delivered by a combination of lectures, tutorial exercises, practical work and/or computer work. The tutorial exercises will be designed to develop your knowledge, skills and confidence in solving pneumatic and hydraulic problems. Practical work is particularly important as it will allow you to confirm theory in practice as well as allowing you to learn important skills such as interpreting diagrams, assembling and testing circuits and interpreting the results of experiments. Please ask your lecturer what practical work you will do in this Unit. You will be expected to complement learning in all Outcomes by referring to various information sources such as supplier journals/magazines, videos and supplier sites on the World Wide Web.

The Knowledge and/or Skills in Outcomes 1 and 4 will be assessed under open-book conditions while Outcomes 2 and 3 will be assessed under closed-book supervised conditions. To complete this Unit successfully you will have to achieve a satisfactory level of performance in the assessment event(s).