



National Unit specification: general information

Unit title: Domestic Air Source Heat Pumps

Unit code: FF2J 12

Superclass: XH

Publication date: February 2011

Source: Scottish Qualifications Authority

Version: 01

Summary

This Unit is designed to provide candidates with the necessary knowledge and understanding on the provision of domestic air source heat pumps. The Unit will introduce candidates to the basic design principles, systems components and characteristics of domestic air source heat pumps. The Unit will also introduce candidates to fundamental health and safety and installation requirements.

This Unit is suitable for candidates who are undertaking this study for the first time or wish to obtain a basic knowledge of domestic air source heat pumps. The Unit will allow for those currently employed in the building services industry to develop further knowledge specifically related to domestic rainwater harvesting systems.

Outcomes

- 1 Describe the basic principles of air source heat pump installation.
- 2 Describe typical domestic air source heat pump design and planning for a new/existing installation.
- 3 State the relevant Standards, Regulations and Codes of Practice used when installing and commissioning air source heat pump systems.

Recommended entry

Entry is at the discretion of the centre.

National Unit specification: General information (cont)

Unit title: Domestic Air Source Heat Pumps

Credit points and level

1 National Unit credit at SCQF level 6: (6 SCQF credit points at SCQF level 6*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the support notes of this Unit specification.

There is no automatic certification of Core Skills or Core Skill component in this Unit.

National Unit specification: statement of standards

Unit title: Domestic Air Source Heat Pumps

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.

Outcome 1

Describe the basic principles of air source heat pump (ASHP) installation.

Performance Criteria

- (a) Describe clearly the means of transferring heat through the ASHP.
- (b) Describe clearly the major components in the ASHP installation.
- (c) State the main advantages of using ASHP against that of a traditional heating system.
- (d) Describe clearly the meaning of local annular air temperature in regard to the ASHP performance.

Outcome 2

Describe typical domestic air source heat pump design and planning for a new/existing installation.

Performance Criteria

- (a) Describe clearly the main points to be taken into account when deciding if the home is suitable for ASHP.
- (b) Describe clearly the relevant issues when positioning and fixing ASHP.
- (c) Describe clearly the meaning of monovalent and bivalent systems.
- (d) Describe clearly the process on sizing suitable ASHP systems.
- (e) Show by means of a basic sketch the ASHP installation for a basic 2-4 bedroom house.

Outcome 3

State the relevant Standards, Regulations and Codes of Practice used when installing and commissioning air source heat pump systems.

Performance Criteria

- (a) State clearly the risks associated with installing and commissioning domestic ASHP systems.
- (b) State clearly how the Water Regulations and Building Standards apply to domestic ASHP systems.
- (c) State clearly how to minimize risk for personnel when installing ASHP systems.
- (d) State clearly the basic need for earthing requirements for ASHP installations.

National Unit specification: statement of standards (cont)

Unit title: Domestic Air Source Heat Pumps

Evidence Requirements for this Unit

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Written and/or recorded oral evidence should be produced to demonstrate that the candidate has achieved all the Outcomes and Performance Criteria.

The evidence should be produced under 'open-book' supervised and controlled conditions.

The evidence may be produced by one or more than one assessment covering all Outcomes. A suitable instrument of assessment covering all Outcomes could be by short answer, restricted response and structured questions, lasting no more than 90 minutes in duration.

Outcome 1

- (a) The candidate must clearly describe the means of the heat transfer process through the following:
- ◆ condenser
 - ◆ evaporator
 - ◆ refrigeration cycle.
- (b) The candidate must clearly describe the main components of an ASHP. This description must include:
- ◆ low pressure switch
 - ◆ compressor
 - ◆ high pressure switch
 - ◆ condenser
 - ◆ dryer
 - ◆ sight glass
 - ◆ expansion valve
 - ◆ evaporator.
- (c) The candidate must state at least two advantages of using ASHP against that of a traditional heating system.
- (d) The candidate must clearly describe the meaning of local annular air temperature in regard to ASHP.

National Unit specification: statement of standards (cont)

Unit title: Domestic Air Source Heat Pumps

Outcome 2

- (a) The candidate must clearly describe the main points to be taken into account when deciding if the home is suitable for ASHP. This description must include:
- ◆ insulation
 - ◆ double glazing
 - ◆ low flow temperatures
 - ◆ space for ASHP and cylinders.
- (b) The candidate must clearly describe the issues when positioning and fixing ASHP internally and externally from a given brief using manufacturing instructions and National Occupational Standards.
- (c) The candidate must clearly describe the meaning of monovalent and bivalent.
- (d) The candidate must clearly describe the process for sizing suitable ASHP systems from a given brief.
- (e) The candidate must produce a basic sketch showing the lay-out of an ASHP installation for a 2-4 bed house. This may be achieved by a lined diagram of the ASHP to the emitters, hot water cylinder and buffer tank from a given brief.

Outcome 3

- (a) The candidate must clearly state the risks associated with installing and commissioning domestic ASHP systems. This must include:
- ◆ contamination of water
 - ◆ earthing
 - ◆ frost temperature protection
 - ◆ excess temperature protection
 - ◆ installation of heat pump
 - ◆ cylinders
 - ◆ refrigerant gas and associated pipe work support both structural and thermal.
- (b) The candidate must clearly state how the Water Regulations and Building Standards apply to domestic ASHP systems.
- (c) The candidate must clearly state how to minimize risk for personnel when installing ASHP systems.
- (d) The candidate must clearly state the basic need for earthing requirements for ASHP installations.

National Unit specification: support notes

Unit title: Domestic Air Source Heat Pumps

This part of the Unit specification is offered as guidance. The support notes 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

Outcome 1

The following should be covered:

- ◆ Knowledge of the major components in typical ASHP installations
 - heat transfer process through the condenser, evaporator and refrigeration cycle.
 - operation of the main components of an ASHP.
 - at least two answers proving the advantages over a traditional heating system.
 - the importance of local annual air temperature and the effects that it has in different parts of the country.

Outcome 2

The following should be covered:

- ◆ Knowledge of the main points to be taken into account when deciding if the home is suitable for ASHP.
 - how the efficiency of the house may affect the suitability of an ASHP being installed. Insulation, double glazing, low flow temperatures, space for air source heat pump and cylinder. Standards for positioning ASHP internally and externally using manufacturer's instructions or NOS. The types of systems available monovalent and bivalent.
 - the process of sizing ASHP from a given brief.
 - the basic layout of an ASHP installation for a 2-4 bed house; this may be achieved by a lined diagram of the ASHP to the emitters, hot water cylinder and buffer tank.

Outcome 3

Within the delivery of this Unit current relevant regulations, standards and codes of practice associated with respect to domestic ASHP systems should be integrated in the teaching and learning process.

Candidates must be able to identify and describe the risks associated with installing and using ASHP. The candidate must take measures to minimise risks. In particular, the following risks should be detailed: contamination of water, earthing, frost and excess temperature protection, installation of heat pump, cylinders, refrigerant gas and associated pipe work support both structural and thermal.

National Unit specification: support notes (cont)

Unit title: Domestic Air Source Heat Pumps

Guidance on learning and teaching approaches for this Unit

It is recommended that the Outcomes are delivered in the sequence presented in the Unit specification. The Unit may be delivered by a combination of lectures, tutorial work and practical laboratory work. The Unit should be taught very much in a plumbing electrical/energy context and as such relevant plumbing electrical/energy examples should be used throughout Unit delivery.

While the majority of the Unit can be delivered in a classroom, centres should allow candidates to undertake practical experiments so that they have opportunities to relate theory learnt in the classroom to practice. For example, where ASHP equipment exists candidates should be allowed to carry out simple performance tests on these systems.

The Internet contains a rich source of materials on Renewable Energy and ASHP Installations. Candidates should be aware of the different regulations, climates etc when using non UK based web sites.

The Unit should be fully supported with relevant learning materials (e.g. handouts in paper and electronic form, textbooks, on-line materials etc.)

Opportunities for developing Core Skills

Elements of *Numeracy* at SCQF level 5 may be developed in Outcomes 1 and 2 where various aspects of theory require numerical skills particularly carrying out calculations associated with planning.

The Core Skill *ICT* at SCQF level 5 may be developed in Outcomes 1, 2 and 3 where candidates may use research from the internet.

The Critical Thinking component of *Problem Solving* at SCQF level 5 may be developed in Outcome 1 while candidates are interpreting drawings and practically planning artefacts. The Planning and Organisation component of *Problem Solving* at SCQF level 5 may be developed as candidates undertake theory and practical activities if the centre has working models Outcomes 1, 2 and 3 when candidates are developing electrical and plumbing skills.

Elements of *Working with Others* Core Skill at SCQF level 4 may be developed in Outcomes 1 and 2 while candidates complete design and installation calculations whilst working co-operatively with others.

Guidance on approaches to assessment for this Unit

Centres are encouraged to use formative assessment extensively as it plays a particularly important role in allowing candidates to develop a sound knowledge and understanding of ASHP technologies.

Summative assessment may take the following form:

National Unit specification: support notes (cont)

Unit title: Domestic Air Source Heat Pumps

Outcomes 1, 2 and 3

Assessment may comprise of a single assessment paper covering the outcome and performance criteria requirements. The assessment paper should be taken at a single assessment event lasting 1 hour and comprise of a suitable balance of; multiple choice, short answer, restricted response or structured questions

Opportunities for the use of 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 e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

History of changes to Unit

Version	Description of change	Date

© Scottish Qualifications Authority [2011]

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre, telephone 0845 279 1000.