



National Unit specification: general information

Unit title: Domestic Ground Source Heat Pumps

Unit code: FN4R 12

Superclass: XH

Publication date: July 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 ground source heat pumps (GSHP). The Unit will introduce candidates to the basic design principles, systems components and characteristics of domestic ground source heat pumps. The Unit will also introduce candidates to fundamental health and safety and installation requirements.

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

Outcomes

- 1 Describe basic principles of ground source heat pump installation.
- 2 Describe typical domestic ground source heat pump design and planning for new/existing installation.
- 3 State the relevant standards, regulations and codes of practice used when installing and commissioning ground source heat pump systems.

Recommended entry

Entry is at the discretion of the centre.

National Unit specification: general information (cont)

Unit title: Domestic Ground 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 Ground 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 basic principles of ground source heat pump installation.

Performance Criteria

- (a) Describe clearly the means of extracting heat through the GSHP.
- (b) Describe clearly the major components in the GSHP.
- (c) State the main advantages of using GSHP against that of a traditional system.
- (d) Describe clearly the type of collectors available.

Outcome 2

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

Performance Criteria

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

Outcome 3

State the relevant standards, regulations and codes of practice used when installing and commissioning ground source heat pump systems.

Performance Criteria

- (a) State clearly the risks associated with installing and commissioning domestic GSHP systems.
- (b) State clearly how the water regulations and building standards apply to domestic GSHP systems.
- (c) State clearly how to minimise risk for personnel when installing GSHP systems.
- (d) State clearly the basic need for earthing requirements for GSHP installations.

National Unit specification: statement of standards (cont)

Unit title: Domestic Ground Source Heat Pumps

Evidence Requirements for this Unit

Evidence is required to demonstrate that candidates have achieved 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 the form of '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:
- ◆ brine circuit
 - ◆ condenser
 - ◆ evaporator
 - ◆ refrigeration cycle
- (b) The candidate must clearly describe the main components of a GSHP. 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 GSHP against that of a traditional heating system.
- (d) The candidate must clearly describe the meaning of the following types of collectors:
- ◆ horizontal loop
 - ◆ borehole
 - ◆ horizontal slinky
 - ◆ vertical slinky
 - ◆ horizontal compact collectors

National Unit specification: statement of standards (cont)

Unit title: Domestic Ground Source Heat Pumps

Outcome 2

- (a) The candidate must clearly describe the main points to take into consideration when deciding on the suitability of a GSHP being installed. This description must include:
- ◆ insulation
 - ◆ double glazing
 - ◆ low flow temperatures
 - ◆ space for ground source heat pump
 - ◆ location for collectors and cylinders
- (b) The candidate must clearly describe the relevant issues when positioning brine circuit. This description must include:
- ◆ depth of collectors
 - ◆ local frost levels
- (c) The candidate must clearly describe the meaning of monovalent and bivalent systems.
- (d) The candidate must clearly describe the process of sizing suitable GSHP systems from a given brief.
- (e) The candidate must produce a basic sketch showing the lay-out of a GSHP installation for a 2–4 bed house. This may be achieved by a lined diagram of the GSHP 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 GSHP systems. This must include:
- ◆ contamination of water
 - ◆ earthing
 - ◆ frost
 - ◆ 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 GSHP systems.
- (c) The candidates must clearly state how to minimise risk for personnel when installing GSHP systems.
- (d) The candidate must clearly state the basic need for earthing requirements for GSHP installations.

National Unit specification: support notes

Unit title: Domestic Ground 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

- (a) The candidate must be able to demonstrate he/she understanding of the heat transfer process through the brine circuit, condenser, evaporator and refrigeration cycle.
- (b) The candidate must be able to demonstrate he/she understands the operation of the main components of a GSHP.
- (c) The candidate must give at least two answers proving the advantages over a traditional heating system.
- (d) The candidate must be able to show that he/she has knowledge of a number of collectors horizontal loop, borehole, horizontal slinky, vertical slinky and horizontal compact collectors manufacturers instruction and NOS may be used.

Outcome 2

- (a) The candidate must be able to show he/she understands the efficiency of the house may affect the suitability of a ground source heat pump installation. The following must be considered — insulation, double glazing, low flow temperatures, space for ground source heat pump and cylinders.
- (b) The candidate must be able to show he/she understands the depth of collectors and local frost levels, information from manufacturer's instruction and NOS.
- (c) The candidate must be able to show he/she understands the types of systems available, monovalent and bivalent. The candidate will also size a unit from a given brief using manufacturer's instructions.
- (d) The candidate must be able to show he/she understands the basic layout of a ground source heat pump installation for a 2–4 bed house; this may be achieved by a lined diagram of the GSHP to the brine circuit, emitters, 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 ground source heat pump 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 ground source heat pumps. 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 Ground Source Heat Pumps

Guidance on learning and teaching approaches for this Unit

This Unit is to be delivered using a variety of learning and teaching approaches such as structured lessons with formative and summative assessments; in addition to practical demonstration of components and characteristics of domestic ground source heat pumps. This Unit does not endorse successful candidates as competent operatives of domestic ground source heat pump systems.

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 GSHP technologies.

Summative assessment may take the following form:

Assessment may comprise of a single assessment paper covering the Outcomes and Performance Criteria requirements. The assessment should be taken as 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)*.

Opportunities for developing Core Skills

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

However there may be opportunities for the candidate to develop the Core Skills of Communication, Working with Others and Problem Solving at SCQF level 5.

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 Business Development and Customer Support team, telephone 0303 333 0330.