National Unit specification: general information

Unit title: Domestic Mechanical Heat Recovery Ventilation Systems

Unit code: FF2N 12

Superclass: XH

Publication date: February 2011

Source: Scottish Qualifications Authority

Version: 01

Summary

This Unit is designed to provide candidates with knowledge and understanding on the provision of mechanical heat recovery ventilation. The Unit will introduce candidates to the basic design principles, systems components and characteristics of mechanical heat recovery ventilation systems. The Unit will also introduce candidates to fundamental health and safety and installation requirements for mechanical heat recovery ventilation systems.

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

Outcomes

1 Describe the basic operating principles of mechanical heat recovery ventilation systems.
2 Describe the component parts of a mechanical heat recovery ventilation system.
3 Identify the relevant Standards and Regulations used for the design, installation, commissioning and maintenance of mechanical heat recovery ventilation systems.
4 Describe the integration of additional heating in mechanical heat recovery systems for a PassivHaus designed house.

Recommended entry

Entry is at the discretion of the centre.

National Unit specification: General information (cont)

Unit title: Domestic Mechanical Heat Recovery Ventilation Systems

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 Mechanical Heat Recovery Ventilation Systems

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 operating principles of mechanical heat recovery ventilation systems.

Performance Criteria

(a) Describe clearly the purpose of ventilation in buildings.
(b) Describe clearly the basic operating principles of a mechanical heat recovery ventilation system.
(c) Solve accurately ventilation heat loss calculations.
(d) State clearly the main advantages of using mechanical heat recovery systems compared to conventional ventilation systems.

Outcome 2

Describe the component parts of a mechanical heat recovery ventilation system.

Performance Criteria

(a) Show clearly by means of a diagram the location of the main component parts of a mechanical heat recovery system.
(b) Describe clearly the function of the main component parts of mechanical heat recovery systems.
(c) Describe clearly various types of heat exchanger with respect to their air flow and energy efficiency.
(d) Explain clearly the relationship between surface area and heat transfer for heat exchangers.

Outcome 3

State the relevant Standards and Regulations used for the design, installation, commissioning and maintenance of mechanical heat recovery ventilation systems.

Performance Criteria

(a) State clearly the basic planning requirements and procedures in relation to the design and installation of mechanical heat recovery ventilation systems.
(b) State clearly how the Building Regulations apply to mechanical heat recovery ventilation systems
(c) State clearly how to minimise the risk to personnel and building occupiers when installing mechanical heat recovery ventilation systems.
(d) State clearly the basic commissioning and maintenance requirements of a mechanical heat recovery ventilation system.

National Unit specification: statement of standards

Unit title: Domestic Mechanical Heat Recovery Ventilation Systems

Outcome 4

Describe the integration of additional heating in mechanical heat recovery systems used for a PassivHaus designed house.

Performance Criteria

(a) Describe clearly the reasons for an additional heating requirement for mechanical heat recovery systems.
(b) Describe clearly various types of integrated additional heating methods used in mechanical heat recovery systems.
(c) Show clearly by means of a diagram the integration into a mechanical heat recovery ventilation system of one type of additional heating method.
(d) Describe clearly how additional heating can be provided by a free standing appliance.

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.

Outcome 1

(a) The candidate must correctly describe the purpose of ventilation in buildings. This description must include:

- breathing air
- pollutant control
- humidity control
- prevention of fabric damage

(b) The candidates must correctly describe the basic operating principles of a mechanical heat recovery ventilation system. This description must include the transfer of heat from:

- outgoing air via the heat exchanger
- preheating of supply air

(c) The candidate must correctly solve ventilation heat loss calculations using the formula:

- Ventilation Heat Loss = Room Volume x Air Change Rate x Temperature Rise Needed x Ventilation Factor

(d) The candidate must clearly state at least three advantages of using a Mechanical Heat Recovery Ventilation System compared to conventional ventilation systems

National Unit specification: statement of standards (cont)

Unit title: Domestic Mechanical Heat Recovery Ventilation Systems

Outcome 2

(a) The candidate must show by production of a diagram the location of the main component parts of a mechanical heat recovery system. The diagram must indicate:

- heat exchanger
- inlet filter
- extract filter
- inlet fan
- outlet fan
- condensation drain
- distribution ducting

(b) The candidate must correctly describe the function of the following component parts of a mechanical heat recovery system:

- heat exchanger
- inlet filter
- extract filter
- inlet fan
- outlet fan
- condensation drain
- distribution ducting

(c) The candidate must correctly describe with respect to air flow and energy efficiency at least three of the following types of heat exchangers:

- concurrent
- cross flow
- counter-flow
- channel flow

(d) The candidate must be able to correctly explain the relationship between surface area and heat transfer for heat exchangers.

National Unit specification: statement of standards (cont)

Unit title: Domestic Mechanical Heat Recovery Ventilation Systems

Outcome 3

(a) The candidate must correctly state the basic planning requirements and procedures in relation to the design and installation of mechanical heat recovery ventilation systems. Design and installation factors must include:

- location of ventilation components
- location of ventilation devices
- ducting installation
- air transfer
- control systems

(b) The candidate must state clearly how the Building Regulations apply to mechanical heat recovery ventilation systems.

(c) The candidate must clearly state the measures required to minimise risk to personnel and building occupiers when installing mechanical heat recovery ventilation systems. This must include the following:

- avoidance of recirculation of moist air
- avoidance of fire spreading
- maintain air barrier continuity
- use of automatic controls to avoid build up of combustion products in the kitchen
- component and ducting accessibility
- prevention of ducting blockages

(d) The candidate must clearly state the basic commissioning and maintenance requirements of a mechanical heat recovery ventilation system and the importance of the following:

- installation checklists
- air flow measuring devices
- annual maintenance plans

National Unit specification: statement of standards (cont)

Unit title: Domestic Mechanical Heat Recovery Ventilation Systems

Outcome 4

(a) The candidate must correctly describe the reasons for an additional heating requirement for mechanical heat recovery ventilation systems. This description must include:

- initial heating from cold
- top up to design temperature for optimum comfort
- recognition that some users may like the rooms hotter than average

(b) The candidates must correctly describe at least three types of integrated additional heating methods used in mechanical heat recovery systems from the following:

- electric heating element
- solar hot water installation
- ground source heat pump
- air source heat pump

(c) The candidate must draw a diagram showing the integration into a mechanical heat recovery ventilation system for at least one of the following:

- electric heating element
- solar hot water installation
- ground source heat pump
- air source heat pump

(d) The candidate must correctly describe how additional heating can be provided by a free standing stove. This description must include:

- convection currents
- combustion air connection and source

National Unit specification: support notes

Unit title: Domestic Mechanical Heat Recovery Ventilation Systems

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

Candidates must be able to demonstrate the need for ventilation with respect to breathing air, pollutant control, humidity control, prevention of fabric damage and the ventilation versus energy use balance in buildings. Candidates must also be able to demonstrate the basic operating principles of mechanical heat recovery ventilation systems including a description of the transfer of heat from outgoing air via the heat exchanger and the subsequent preheating of supply air. Candidates must be able to solve ventilation heat loss calculations using the formula:

Ventilation Heat Loss = Room Volume x Air Change Rate x Temperature Rise Needed x Ventilation Factor.

Candidates must be able to demonstrate an understanding of the main advantages of mechanical heat recovery ventilation systems namely the provision of preheated air from an outgoing heat source, the consequential reduction in heating demand and the benefits to the building fabric.

Outcome 2

Candidates must be able to demonstrate knowledge of the location and function of the main component parts of a mechanical heat recovery ventilation system. Components to be identified and located in a diagram are; Heat Exchanger, Inlet Filter, Extract Filter, Inlet Fan, Outlet Fan, Condensation Drain and the Distribution Ducting. The candidates must also be able to describe the basic function of each of these components.

Candidates must be able to describe with respect to air flow and energy efficiency any three types of heat exchangers from the following: Concurrent, Cross flow, Counter-flow and Channel flow.

Candidates must also be able to explain the relationship between surface area and heat transfer in heat exchangers.

National Unit specification: support notes (cont)

Unit title: Domestic Mechanical Heat Recovery Ventilation Systems

Outcome 3

Candidates must be able to identify the basic planning requirements and procedures for the design and installation of mechanical heat recovery ventilation systems and how the Building Regulations apply. Design and installation factors will include location of ventilation components and devices, ducting installation, air transfer and control systems.

Candidates must also demonstrate awareness of the measures required to minimise risks when designing and installing mechanical heat recovery systems. In particular, the following risks should be detailed: avoidance of recirculation of moist air, avoidance of fire spreading, maintain air barrier continuity, use of automatic controls to avoid build up of combustion products in the kitchen, component and ducting accessibility and the prevention of ducting blockages.

Candidates will be able to demonstrate an understanding of the commissioning and maintenance of mechanical heat recovery ventilation systems and the importance of installation checklists, air flow measuring devices and annual maintenance plans.

Outcome 4

Candidates must be able to describe the reasons for additional heating within a PassivHaus designed house using mechanical heat recovery ventilation systems such as user preferences, top up to design comfort temperatures and initial heating from cold.

Candidates must be able to describe three types of integrated additional heating from an electric heating element, solar hot water installation, and ground and air source heat pumps and be able to illustrate this integration by means of a diagram for one of these types of additional heating.

Candidates must also be able to describe additional heating using a free standing appliance such as a stove with specific regard to the combustion air connections.

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 an electrical engineering/energy context and as such relevant engineering/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 mechanical heat recovery ventilation equipment exists candidates should be allowed to carry out simple performance tests on these systems.

National Unit specification: support notes (cont)

Unit title: Domestic Mechanical Heat Recovery Ventilation Systems

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

Component parts of mechanical heat recovery ventilation e.g. heat exchanger can be used to support the learning, candidates can assemble and test small systems and form opinions/evaluations on the merits or otherwise of mechanical heat recovery ventilation.

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

This Unit is not intended to endorse successful candidates as competent operatives of mechanical heat recovery ventilation systems.

Opportunities for developing Core Skills

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

Elements of *Numeracy* at SCQF level 5 may be developed in Outcome 1 where numerical skills are required particularly carrying out calculations associated with ventilation heat loss. Using Graphical Information at SCQF level 5 may be developed in Outcome 2 where candidates are given graphical information to explain the relationship between surface area and heat transfer in heat exchangers.

The Core Skill *ICT* at SCQF level 5 may be developed in Outcome 2 where candidates may access and interpret information, research and select differing heat exchangers used in mechanical heat recovery ventilation.

The Critical Thinking component of *Problem Solving* at SCQF level 5 may be developed in Outcome 2 while candidates are interpreting drawings associated with component parts and their location in mechanical heat recovery ventilation systems.

The Planning and Organisation component of *Problem Solving* at SCQF level 5 may be developed as candidates undertake basic planning procedures in Outcome 3 in relation to design and installation of mechanical heat recovery ventilation systems.

Elements of *Working with Others* Core Skill at SCQF level 4 may be developed in Outcome 3. Although candidates do not have to demonstrate practical skills, formative activities could enhance the skills of working with others in relation to the basic commissioning of mechanical heat recovery ventilation systems. Candidates could be given constructive feedback to encourage review and evaluation of their approaches to practical work including their contribution to team working.

National Unit specification: support notes (cont)

Unit title: Domestic Mechanical Heat Recovery Ventilation 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 Mechanical Heat Recovery Ventilation Systems.

Summative assessment may take the following form:

Outcomes 1, 2 and 4

Assessment may comprise of a single assessment paper covering the outcome and performance criteria requirements for Outcomes 1, 2 and 4. The assessment paper should be taken at a single assessment event lasting 1 hour and comprise of a suitable balance of short answer, restricted response or structured questions.

Outcome 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 communications 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