Higher National Unit Specification

General information for centres

Unit title: Farm Buildings and Controlled Environments

Unit code: F2G7 35

Unit purpose: The aims of this Unit are to enable candidates to develop the knowledge and skills required to oversee farm building development projects and to manage the built facilities required for farming. This will encompass new building work and the refurbishment of existing buildings for crop storage and livestock housing as well as for general purpose and machinery accommodation.

Candidates are required to identify, explain and evaluate the factors that lead to the successful operational performance of crop storage and livestock buildings with due regard to environmental and animal welfare issues where appropriate.

On completion of the Unit the candidate should be able to:

1 Evaluate the factors that impact on the design and construction of farm buildings.
2 Appraise housing environments and their significance to crop and livestock buildings.
3 Analyse the means of controlling an internal environment.

Credit points and level: 1 HN credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*).

**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 12.*

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the centre. Prior knowledge or skills are not essential for this Unit. However, it will be beneficial for candidates to have a working knowledge of the use of buildings in agricultural production and have had work experience in an appropriate role on a construction project or in managing a controlled environment building.

Core Skills: There may be opportunities to develop the Core Skills of *Numeracy* and *Communications* 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.

General information for centres (cont)

Assessment: Outcome 1 can be assessed on its own as it is about the development of a building or facility for agricultural production. Outcomes 2 and 3 are both concerned with operational management of a completed facility and can be assessed together by means of a report based upon a study of a particular building.

Higher National Unit specification: statement of standards

Unit title: Farm Buildings and Controlled Environments

Unit code: F2G7 35

The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

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. Candidates 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

Evaluate the factors that impact on the design and construction of farm buildings

Knowledge and/or Skills

- Site of buildings
- Project team working
- Building design practices
- Pre-construction permissions
- Construction processes
- Health and Safety and other legislative requirements

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- evaluate four significant factors that influence the selection of a site for a specified building type
- evaluate the role of three key professionals involved in the design, construction and/or management of a building project
- explain the impact of budget, legislation, environmental considerations, fit-for-purpose layout, aesthetics, and safety requirements on building design
- evaluate the applicability of planning permission, building warrant, public body and environmental assessment permissions in relation to a specified building project
- explain the construction site procedure for three of the following — site preparation, levelling, setting-out, progress evaluation, and health and safety in accordance with best industry practice

Assessment Guidelines

This Outcome can be assessed by means of a staged submission report meeting the Evidence Requirements. The report could involve a candidate evaluating, given appropriate case study information, the detail of the staged work of a construction development project, hence staged candidate submissions.

Higher National Unit specification: statement of standards (cont.)

Unit title: Farm Buildings and Controlled Environments

Outcome 2

Appraise housing environments and their significance to crop and livestock buildings

Knowledge and/or Skills

- Environmental parameter values
- Air psychrometry
- Instrumentation
- Livestock welfare

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- define three significant environmental parameter values appropriate to a given building type
- predict changes in air temperature, saturation, moisture content or enthalpy as a result of a heating or cooling process through the use of psychrometric data
- explain the application of three instruments for measuring air quality in a livestock or crop storage building
- evaluate the influence of three significant factors on the level of livestock welfare offered by a building

Assessment Guidelines

See Outcome 3

Higher National Unit specification: statement of standards (cont.)

Unit title: Farm Buildings and Controlled Environments

Outcome 3

Analyse the means of controlling an internal environment

Knowledge and/or Skills

- Building fabric
- Ventilation
- Mechanical plant
- Control systems

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- analyse the contribution of the building fabric to internal environmental conditions through an evaluation of thermal transmittance
- explain the principles of air movement in a designed building ventilation system by stack, wind and fan effect
- evaluate the need for mechanical plant for temperature, humidity and light control in a specified farm building
- evaluate the use of on/off and proportional control systems in a specified building including their impact on the energy performance of a building

Assessment Guidelines

Outcome 3 can be assessed as part of a combined submission with Outcome 2. This submission may be a report of approximately 1,500 words, supported by graphical material and appropriate building design analysis, and is best based upon a case study analysis of a controlled environment facility.

Administrative Information

Unit code: F2G7 35

Unit title: Farm Buildings and Controlled Environments

Superclass category: TC

Original date of publication: August 2008

Version: 01

History of changes:

Version	Description of change	Date

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

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

Higher National Unit specification: support notes

Unit title: Farm Buildings and Controlled Environments

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

The building industry exists to enable humans to control their environment. This Unit aims to develop candidates skills in the processes and practices involved in building and managing livestock housing, crop storage and other important farm facilities. Farm businesses, like all businesses, benefit from knowledge, understanding and application of appropriate environmental control technology, it is important for candidates in relevant programmes of study to look at these issues.

There are three elements to the Unit. Firstly, the challenges associated with developing farm buildings to house livestock and to store crops and other essentials of a production agriculture business. Secondly, the Performance Criteria against which the quality of the conditions of an indoor space can be evaluated. And, finally, the means by which the developed facilities, the structure, space, the building fabric and the engineering services and associated control systems, meet the project goals set out in the first two elements.

Outcome 1 should cover the general requirements of managing a building project. The starting point of the development process centres on the site. There is complexity and uncertainty attached to early meetings of the project team that must be overcome through good communication related to the essential purpose of the project. What is the development for? What timescale is to be imposed? What is the project budget limit? The professionals involved in a project team contribute design, specification, pricing and construction experience and skills. All of these matters could be dealt with in the work of Outcome 1 with the following suggested detail:

Factors governing siting of buildings (ground conditions and building foundations, proximity to other buildings, road access and building location, building orientation, site area measurement). Project team (client, architect, consulting engineer, planning supervisor, quantity surveyor, contractor). Design (building project budget, principal legislation, codes of practice, environmental building design, plan layout fit for purpose, building aesthetics, structural frames, building services, building materials and their properties, fire safety in building design). Pre-construction (planning permission, building warrant, consultation with interested public bodies, environmental assessment). Construction (procedures for site preparation, site levelling, setting-out, the purpose of drawings and specifications, building work progress evaluation, construction plant, health and safety).

In Outcome 2 candidates will study the specification of the internal environment. The purpose of controlling the environmental conditions is to enable farm businesses to plan output in the context of best commercial practice. Without knowledge of target environmental conditions, an idea for building is unlikely to be developed properly. Design codes of practice are essential reading as is specific information related to the effect of air conditions (the internal climate) upon the health and welfare of livestock and humans and upon the quality of stored crops and food. Fundamental measurements to be studied are temperature, humidity and percentage saturation, enthalpy, air pressure, vapour pressure, air contaminants. Outcome 2 should also look at livestock welfare measurement criteria, for example, comfort factors, animal injury, space, stock density, surface hygiene, light.

In Outcome 3 candidates will consider the factors that influence the ease with which the above criteria of the internal environment can be controlled and the energy costs associated to this. The internal climate is set by the external climate, but it can be modified. The building fabric, or building skin, is a passive modifier. Walls and roof fabric that are well insulated form a thermal buffer to the natural climate. Active modifiers are used thereafter. These could include equipment for heating, ventilation, cooling, humidification, de-humidification, refrigeration and lighting.

Study of the building fabric contribution to controlling an environment might include thermal conductivity, thermal resistance and transmittance, climatic effects, temperature profile and condensation prediction. Ventilation should consider both natural (stack and wind effect) and mechanical (fan-based) systems. The means of monitoring and maintaining a controlled environment involves sensors and meters and the fundamental principles of control in mechanical systems ranges in sophistication from the basic form of controller action, on/off, to complex control strategies using microprocessors.

Guidance on the delivery and assessment of this Unit

It is recommended that Outcome 1 is taught through a series of lectures and tutorials, which could be supplemented by practical classes in, for example, surveying, setting-out and concrete mixing. Practical classes could also include visits to construction project sites or to materials suppliers. In the context of Outcomes 2 and 3, lectures and tutorials could be supplemented by a practical session on the psychrometric properties of air and by visits to sites at which crops, food and/or livestock are stored in controlled environment conditions. If access to suitable site visits or to an air conditioning test rig is not possible, an alternative to these may be photographs, drawings and computer-based analysis of conditions in a controlled environment building.

The assessment structure of the Unit could be done in two parts: one part based upon the construction project work of Outcome 1 and a second part based upon the facilities management work set out in Outcomes 2 and 3. Outcome 1 may be assessed by a report in response to a case study and Outcomes 2 and 3 could be assessed by a report supported by graphical material and appropriate building design analysis also in response to a case study.

Opportunities for developing Core Skills

There are opportunities for the candidate to develop Written Communication at SCQF level 6 in the assessment of all Outcomes. If candidates complete written work for each Outcome they will have an opportunity to develop the general skill ‘Produce well structured written communication on complex topics’. Candidates when completing their responses to Outcomes will have to present essential ideas/information and supporting detail in a logical and effective order.

Open learning

It is possible for this Unit to be delivered by distance learning. Candidates may require access to suitable farm sites and this would require a degree of planning by the centre.

Higher National Unit specification: support notes (cont)

Unit title: Farm Buildings and Controlled Environments

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* **(www.sqa.org.uk)**.

General information for candidates

Unit title: Farm Buildings and Controlled Environments

This Unit is intended to develop your knowledge and skills in the processes and practices of building projects and managing controlled environment facilities to maximise farm business operational efficiency.

Outcome 1 introduces the general elements of a building project. The main message here is that building work should finish on time, within budget and to the level of quality expected by a discerning client group.

The professionals involved in designing, specifying and construction will be described and their various roles will be analysed in context. The importance of the project site will be stressed along with discussions about budget and timescale. Designing buildings is about technical knowledge applied to the site and the proposed building's functional specifics. Outcome 1 will introduce this technical knowledge, concepts of structure and fabric and building space. Also important is building services engineering (which will be linked to later discussions in the module on environmental control) building materials and their properties, the major legal constraints on building development projects, planning permission and building warrant. Without both of these an idea cannot be pursued. The final part of Outcome 1 is that related to the construction work itself. The design detail is prepared, the budget and timescale is in place and permissions have been secured. Site setting-out (marking the building outline in the ground) will be studied along with levelling techniques, the construction plant used in the work and, of major importance, construction health and safety.

Controlled environment facilities management is concerned with best practice in maintaining a high quality space for specific production agriculture needs. Specialised plant and controls are needed to minimise external climatic variations and understanding this concept is fundamental to success in your study of Outcomes 2 and 3. Outcome 2 explores the environmental parameters that have to be controlled (for example, temperature and humidity) and leads you into an understanding of the terminology used in this area of production agriculture. When you can measure what you are speaking about, you can make a reasonable claim to know something about it.

Outcome 3 is concerned with the methods of controlling environmental conditions in a building or facility. The purpose of this Outcome is to make candidates aware that the basis of the building development project is to allow humans to modify their environment, climate or microclimate. The work done in Outcome 3 centres upon the building fabric (walls and roof) providing a buffer to the natural climate. This might be understood as a passive modification method. Active modification methods are those that use energy, such as plant and equipment for heating, cooling, humidifying (or de-humidifying) and refrigeration. Given the high levels of energy used by all such equipment (and associated business costs), energy efficiency and energy management methods and strategies will be emphasised throughout the teaching of Outcome 3.

You may complete two assessments in this Unit: one based upon the construction project work of Outcome 1 and the second based upon the facilities management work set out in Outcomes 2 and 3. Your assessments in this Unit may be reports in response to case studies.