Higher National Unit specification

General information for centres

Unit title: Ship Systems: Auxiliary Systems

Unit code: F43F 34

Unit purpose: This Unit is designed to enable the candidates to develop their knowledge and understanding of the common auxiliary systems/equipments installed on a variety of ship types. This will include understanding the functionality required of certain auxiliary systems, and the design constraints that must be given consideration for each system type.

On completion of this Unit, the candidate will be able to:

1 Explain the key performance requirements for a range of ships' auxiliary fluid systems
2 Explain the functional requirements for machinery and auxiliary systems onboard a vessel.
3 Assess the heating, ventilation and air conditioning (HVAC) requirements onboard a vessel.
4 Describe how to write Supplier Specifications for equipment, including the importance of the information therein.

Credit points and level: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**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.*

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the centre. However, it would be advantageous for candidates to have some knowledge and understanding of mechanical and/or ship systems.

Core Skills: There are opportunities to develop the following Core Skills in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Communication: Writing at SCQF level 5
Communication: Reading at SCQF level 5

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.

Assessment: Outcomes 1, 2, 3 and 4 may be assessed individually or the assessments could be combined by means of a closed-book assessment under supervised conditions.

Higher National Unit specification: statement of standards

Unit title: Ship Systems: Auxiliary Systems

Unit code: F43F 34

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

Explain the key performance requirements for a range of ships' auxiliary fluid systems

Knowledge and/or Skills

- Pump Duty — key determining factors
- Pipe Sizing — key determining factors
- Other factors which may impact on the above
- Components commonly used on auxiliary systems, and their purpose/function

Evidence Requirements

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

(a) Explain the key factors that would determine the duty of a pump installed in a given auxiliary fluid system.
(b) Explain the key factors that would determine the size of pipework on a given auxiliary fluid system.
(c) Describe any other factors that may impact the pump/pipe sizing outlined above.
(d) Describe the other components commonly used in a ship's auxiliary fluid system and their function, producing a sketch of a simple fluid system (including components) in support of this.

Assessment Guidelines

Outcome 1 may be assessed by means of a closed-book assessment under supervised conditions or alternatively a short project or case study could be employed.

Sketches provided in support of candidate's answers need not be to scale, but should be clearly annotated to allow the assessor to confirm the candidate has met the Evidence Requirements.

Outcome 1 may be incorporated with Outcomes 2, 3 and 4 for assessment purposes.

Higher National Unit specification: statement of standards (cont)

Unit title: Ship Systems: Auxiliary Systems

Outcome 2

Explain the functional requirements for machinery and auxiliary systems onboard a vessel

Knowledge and/or Skills

- Navigational equipment
- Deck machinery
- Cargo handling equipment
- Hotel load
- Machinery space systems

Evidence Requirements

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

(a) Evaluate the functional requirement for the machinery and auxiliary systems used onboard ships.
(b) Identify some of the functional issues a ship has to overcome that would not apply to a land based facility.
(c) Explain how the power supply onboard a ship is determined using the requirements of the various systems.

Assessment Guidelines

Outcome 2 may be assessed by means of a closed-book assessment under supervised conditions or alternatively a short project or case study could be employed.

Outcome 2 may be incorporated with Outcomes 1, 3 and 4 for assessment purposes.

Outcome 3

Assess the heating, ventilation and air conditioning (HVAC) requirements onboard a typical ship

Knowledge and/or Skills

- Passenger/crew accommodation ventilation requirements
- Cargo compartments' ventilation requirements
- Machinery spaces' ventilation requirements
- Compartment heat gains including equipment wild heat and the implications this has on the system design

Evidence Requirements

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

(a) Evaluate the HVAC demands of the different compartments of a ship.
(b) Describe how HVAC is generated and supplied to the different areas of the ship.
(c) Analyse how operational and environmental conditions affect the HVAC demands of the ship.
(d) Describe how the HVAC system on a front line warship might differ from that on a commercial ship.

Assessment Guidelines

Outcome 3 may be assessed by means of a closed-book assessment under supervised conditions or alternatively a short project or case study could be employed.

Outcome 3 may be incorporated with Outcomes 1, 2 and 4 for assessment purposes.

Outcome 4

Describe how to write Supplier Specifications for equipment including the importance of the information therein

Knowledge and/or skills

- Key information required by supplier
- Implications of bad/immature information being provided
- What makes a good Specification document?

Evidence Requirements

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

(a) Outline the key customer requirements that should be conveyed in a Supplier Specification document.
(b) Explain the implications of supplying bad or immature information to the equipment supplier.
(c) Describe the key constituents of a comprehensive and well written Supplier Specification document.

Assessment guidelines

Outcome 4 may be assessed by means of a closed-book assessment under supervised conditions or alternatively a short project or case study could be employed.

Outcome 4 may be incorporated with Outcomes 1, 2 and 3 for assessment purposes.

Administrative Information

Unit code: F43F 34

Unit title: Ship Systems: Auxiliary Systems

Superclass category: XQ

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: Ship Systems: Auxiliary 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

This Outcome is intended to cover the basics of auxiliary fluid systems, and the fundamental principles which determine aspects such as pipe sizing and pump sizing. This should also go on to cover some of the component parts of such systems such as valves, strainers, instrumentation, and the function these components perform. In terms of pump and pipe sizing, fundamentals such as the required flowrate and pressure requirements of the equipment/system being provided should be discussed. Awareness of the increased pressure drop associated with a higher fluid velocity could be touched on; hence the benefit in ensuring the system pipework is adequately sized. Overcoming the static head of a system is also key to ensuring a system will function and offset against this, perhaps uniquely on ships, is that any sea water inlet to a pump is generally a flooded suction thus providing a positive pump inlet pressure, which can be carried through to the discharge side. In addition it would be beneficial to talk through a standard suppliers pump curve, and cover both centrifugal and positive displacement pumps.

Fluid systems are obviously made up of a great number of components, however at a high level they are relatively generic in what they do. Valves perform flow control, whether it be isolating a supply to an equipment in an on/off scenario or located either side of a pump (for instance) such that the valves can be closed and the pump maintained. Non return valves are commonplace also, ensuring flow in one direction only. Pressure relief valves and pressure reducing valves could also be touched on, performing the function their name suggests. Electric actuation is also an important factor when specifying a valve, with some auxiliary systems being controlled completely remotely from a ships control centre. Instrumentation also supports this principle, whereby if a system is intended to be operated remotely then pressure/flow transducers may be required, perhaps linked to alarms, however there is always a place for local instrumentation and local pressure/temperature/flow indication is normal. Such is the cost associated with remote instrumentation and control, it is generally kept to a level that enables the system to function and highlight any faults. Strainers/filters are used commonly on sea water, fresh water and fuel/oil systems where the filtration of the fluid is important, albeit to varying degrees.

Higher National Unit specification: support notes (cont)

Unit title: Ship Systems: Auxiliary Systems

Outcome 2

This Outcome covers the machinery and systems that are required to support the ships operations. Whilst it is simply not possible to analyse every system type installed on a ship, a representative sample should be selected for investigation. The functionality provided by the systems selected will be analysed, as will the particular input the selected system has to the effective operation of the ship. For instance, the fuel system on a ship can be a complex and sizeable system, however at a basic level all it has to do is provide a supply of clean fuel to the internal combustion machinery described in Outcome 1. The same would apply to hotel load systems. Very simple in principle, with much of the complexity attributed to the fact they are installed on a ship and need to be entirely self-sufficient. For example a ship has to provide its own fresh water supply and process its own waste. Some of the technology involved in this could be touched on (Reverse Osmosis/Membrane Bio Reactors). Candidates should also be aware of the impact running the various ship systems has on the overall electrical load requirement for the ship. As this load is provided entirely by the power generation equipment (Diesel Generators/Gas Turbines) it is important that it is understood and appreciated for all modes of operation and for all equipments.

Outcome 3

Candidates will gain an understanding of the heating, ventilation and air conditioning requirements of a ship and how the demand for these services is dependant on the type of vessel and operational/ external ambient conditions. With this in mind, candidates should also be made aware of the fundamental differences between a commercial HVAC design and that of a Navy Vessel. This generally centres on the provision of Air Filtration Units and the ability of the ship (and those within), using special filters within the Air Filtration Units, to survive a nuclear, biological or chemical attack. This is obviously a very specific requirement of a navy vessel and certainly not commercial practice, however it would be beneficial for the candidate to appreciate the difference. The candidate should also understand how the air is taken on board, conditioned, heated or cooled and distributed to the many different compartment types on the vessel. This principle does not really vary between commercial and navy vessels. Also, the candidates will understand how internal ambient conditions can affect the performance of crew and machinery, hence why compartment min and max temperatures are generally always specified by the customer or the classification society. Same principle would apply to external ambient temperatures, as many modern vessels (naval or commercial) spend a significant portion of their time in warm climes.

Outcome 4

Specification writing is a very important of the ship design process. It is vital that the system/equipment required by the designer is what is actually bought. For this to be conveyed accurately to any potential supplier, an accurate, thorough and concise specification needs to be written. This should contain all the key information the supplier would require to establish what the designer requires, such as equipment performance, operational environment, space/weight/power limitations, classification society approval etc. etc. There will obviously be significant dialogue between the supplier and the designer during this phase, during which time most queries should be resolved. However once a contract is placed, any change to this will cost time and/or money, whether this be the fault of the contractor or the supplier. This is ultimately why it is important that the designer knows exactly what he is ordering, and as important, that the supplier understands the designers requirements and thus, exactly what he is supplying.

Higher National Unit specification: support notes (cont)

Unit title: Ship Systems: Auxiliary Systems

Guidance on the delivery and assessment of this Unit

Ideally this Unit should be delivered at the same time as HN Units F0LF 34 *Naval Architecture: Ship Construction* and DR2E 34 *Shipbuilding Principles: Advanced Hull and Associated Technologies*.

It is recommended that during the delivery of this Unit, drawings and pictures of the relevant systems or equipment be presented to the candidates to aid in their understanding of the subject. It would also be beneficial for a visit to an operational ship to be arranged, so the candidates can gain practical knowledge of the function and requirements of ship systems.

Opportunities for developing Core Skills

The Core Skill of *Communication: Reading and Writing* at SCQF level 5 may be developed in this Unit as the candidate will require to interpret technical information and clearly communicate their understanding throughout the course of the Unit and during the examination.

Open learning

It is preferable for this Unit to be delivered to the candidates by attendance at a college or similar centre. However, if this Unit is presented by distance learning then assessment should take place under closed-book examination conditions in order for the assessment to be authenticated.

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: Ship Systems: Auxiliary Systems

This Unit covers the function and requirements of the auxiliary systems and equipment that are required to enable a ship to operate. The topics contained in this Unit include how auxiliary fluid systems are designed, discussing the key component parts, an understanding of auxiliary machinery and HVAC systems and also the importance of writing an accurate and concise specification for any auxiliary equipment. The Unit is intended to give you an understanding of the variety of systems installed on ships, allowing you to evaluate their requirements during design, build and operation of ships.

Outcome 1 covers the fundamentals of design involved in a typical auxiliary fluid system. Aspects such as pump duty and pipe sizing will be covered, as well as an overview of the components installed in a typical fluid system, and the function they perform.

Outcome 2 covers the function and requirements of auxiliary ship systems. This will include the unique challenges a ship presents from a systems point of view, compared to a land based facility.

Outcome 3 covers the heating, ventilation and air conditioning (HVAC) requirements of different ships, depending on their operational profile. You will cover the importance these systems have on the performance of both machinery and crew onboard a ship.

Outcome 4 looks at the importance of accurately specifying systems/equipments, the implications of getting it wrong, and the key constituents of a well written equipment specification.

These Outcomes are designed to give you an understanding of ships systems, allowing you to evaluate their function and analyse the effect their operation has on the design and performance of a ship.

Assessment for this Unit will either be in the form of a closed-book examination or a number of short projects or case studies, allowing you to demonstrate the level of your knowledge and analytical skills.