



Higher National Unit specification

General information for centres

Unit title: Ship Systems: Propulsion

Unit code: F43G 34

Unit purpose: This Unit is designed to enable candidates to develop knowledge and understanding of propulsion systems and equipment installed on a variety of ship types. This will include analysing different means of producing main propulsion power, generating propulsion forces and maintaining directional control.

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

- 1 Evaluate a range of systems for producing and transmitting propulsion power onboard a vessel.
- 2 Analyse and evaluate a variety of propulsion systems.
- 3 Assess the function and requirements of the systems installed in a ship to provide directional control.

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 and 3 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: Propulsion

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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 a range of systems for producing and transmitting propulsion power onboard a vessel

Knowledge and/or Skills

- ◆ Diesel engines — slow, medium and high speed/2 and 4 stroke
- ◆ Gas turbines
- ◆ Steam turbines
- ◆ Traditional transmission systems
- ◆ Combined Diesel And Gas (CODAG)
- ◆ Integrated Electric Propulsion (IEP)
- ◆ Gearboxes

Evidence Requirements

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

- (a) Evaluate the characteristics of the different engines/ turbines shown in the list above and give examples of ships where these are commonly installed.
- (b) Produce diagrams of the different transmission systems from the above list, showing the location of all key components, and discuss the type of ships these different systems are commonly installed on.
- (c) Explain the function of gearboxes and their advantages/disadvantages.

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 and 3 for assessment purposes.

Higher National Unit specification: statement of standards (cont)

Unit title: Ship Systems: Propulsion

Outcome 2

Analyse and evaluate a variety of propulsion systems

Knowledge and/or Skills

- ◆ Fixed pitch propellers
- ◆ Controllable pitch propellers
- ◆ Azimuth thrusters
- ◆ Voith Schneider propellers
- ◆ Water jets

Evidence Requirements

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

- (a) Evaluate the propulsion systems in the above list, justifying their use for different ships.
- (b) Describe the advantages and disadvantages associated with the different propulsion systems.
- (c) Match types of main engine to the above list of propulsion systems and analyse systems commonly installed on ships.

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 and 3 for assessment purposes.

Higher National Unit specification: statement of standards (cont)

Unit title: Ship Systems: Propulsion

Outcome 3

Assess the function and requirements of the systems installed in a ship to provide directional control

Knowledge and/or Skills

- ◆ Ships' steering gear including rudders
- ◆ Thrusters
- ◆ Dynamic Positioning (DP) systems

Evidence Requirements

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

- (a) Assess the function and requirements of a ship's steering gear, including the associated control system. The advantages and disadvantages of different systems should be described and related to different classes of ship, depending on the level of manoeuvrability required.
- (b) Assess the function and requirements of thrusters, including the use of tunnel and azimuth thrusters.
- (c) Evaluate the requirements of a Dynamic Positioning (DP) system and explain why DP is used instead of other station keeping systems.

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. Schematic sketches of systems should be shown where appropriate.

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

Administrative Information

Unit code: F43G 34
Unit title: Ship Systems: Propulsion
Superclass category: XQ
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Version	Description of change	Date

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Higher National Unit specification: support notes

Unit title: Ship Systems: Propulsion

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 will understand how main propulsion power is generated and transmitted to the propulsion Unit using a variety of commonly installed systems. A basic knowledge of how diesel engines, gas turbines and steam turbines operate will allow the candidate to understand the advantages and disadvantages in using each. The benefits of using the different power transmission arrangements will be covered, as well as the factors affecting the choice depending on the operational requirements of the specific ship. Topics such as efficiency of systems, arrangement of equipment within the ship and purchase/ maintenance costs should be covered. The candidate should be able to identify all the primary components in the different transmission systems, as well as explain their functions and operational requirements.

Outcome 2

Candidates will learn about a variety of propulsion Units that are commonly installed on ships, with justifications why a particular system is installed on a given class of vessel. They will have an understanding of how the propulsion devices generate thrust, allowing them to explain the applicability of each system. The effect the choice of propulsion Unit has on the type of main engine installed will be covered, as well as the auxiliary equipment required for it to operate correctly.

Outcome 3

Candidates will learn about the systems used to maintain directional control of a vessel. The function of a conventional rudder will be covered, as well as the requirements for the associated equipment used to control the rudder (including redundancy of systems). The candidate will also learn about the use of different thrusters (including tunnel and azimuth thrusters) and the types of ship that they are installed on. The advantages and disadvantages of using different thrusters will be covered and comparisons will be made to the conventional propeller and rudder arrangement. The candidate will learn about the components of a dynamic positioning system. They will be able to explain the function of the different components within a DP system and evaluate their requirements depending on the operational requirements of the ship.

Higher National Unit specification: support notes (cont)

Unit title: Ship Systems: Propulsion

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 propulsion systems.

Opportunities for developing Core Skills

The Core Skill of *Communication: Reading and Written* 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: Propulsion

The Ship Systems: Propulsion Unit covers the function and requirements of systems and equipment that provide a ship with propulsion and manoeuvrability. The topics contained in this Unit include how power is produced and transmitted in order to generate propulsion, different propulsion systems commonly installed on modern ships and systems used to provide directional control. The Unit is intended to give you an understanding of a variety of propulsion systems installed on ships, allowing you to evaluate their requirements during design, build and operation of ships.

Outcome 1 covers the most common types of main propulsion engines and systems used to transmit this power to the propulsion Unit. Diesel engines, gas turbines and steam turbines are analysed as well as modern systems such as Integrated Electric Propulsion.

Outcome 2 deals the different types of propulsion Units used on ships, from traditional fixed pitch propellers to azimuth thrusters and water jets. The different systems will be analysed allowing you to evaluate the implications of their use on a ship's design and performance.

Outcome 3 focuses on the steering gear and other systems used to control the heading of a vessel. The systems covered range from a conventional rudder to a more sophisticated Dynamic Positioning system, with each being analysed to show their specific applications.

These Outcomes are designed to give you an understanding of different systems that are used to propel a vessel and provide directional control. On completion of this Unit, you should be able to analyse the use of these systems for a variety of vessels.

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.