

SQA Advanced Unit Specification

General information for centres

Unit title: Naval Architecture: Ship Construction (SCQF level 7)

Unit code: HW6K 47

Superclass: XQ

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Unit purpose

This unit will introduce the learner to the significant features of a ship's structure and the salient features of a range of ship types. It also covers the location, cause, effect and means to counteract internal and external forces exerted on a ship and introduces the learner to the use of ship's stress-calculating equipment for monitoring structural loads.

This unit is primarily aimed at learners who intend to seek sea-going employment as a Merchant Navy Deck Officer. However it could also be studied by someone with an interest in the subject area. It is a mandatory unit in SQA Advanced Certificate in Nautical Science.

Outcomes

On completion of the unit the learner should be able to:

- 1 Identify the significant features of a ship's structure.
- 2 Describe the salient features of a range of ship types.
- 3 Explain ship stresses and use ship stress calculating equipment.

Credit points and level

1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

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Recommended entry to the unit

Access to this unit is at the discretion of the centre. However, learners would benefit most from this unit if they have successfully completed the NC Unit *Ship Construction and Stability: An introduction* F7HC 12 as part of NC Shipping and Maritime Operations/NC/SQA Advanced Certificate Deck Officer Trainee Programme (Level 6) associated with SQA Advanced Certificate/Diploma in Nautical Science.

Core Skills

Achievement of this Unit gives automatic certification of the following Core Skills components:

Complete Core Skill	None
Core Skill component	Critical Thinking at SCQF level 6 Using Graphical Information at SCQF level 6

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.

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

SQA Advanced Unit Specification: Statement of standards

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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.

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. Learners 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

Identify the significant features of a ship's structure.

Knowledge and/or skills

- ◆ Standard terminology pertaining to ship construction
- ◆ Framing systems
- ◆ Structural features with regard to keel, side shell and decks
- ◆ Structural features with regard to holds, cargo, double bottom and peak tanks
- ◆ Structural arrangements to ensure the vessel's watertight integrity
- ◆ Structural arrangements in areas liable to damage in heavy weather
- ◆ Structural arrangements with regard to openings in the hull or deck
- ◆ Structural arrangements to ensure continuity of strength
- ◆ Piping and pumping systems

Outcome 2

Describe the salient features of a range of ship types.

Knowledge and/or skills

- ◆ Tankers (oil, gas and chemical tanker)
- ◆ Cargo ships (general cargo, ro-ro, container, bulk carrier)
- ◆ Passenger ships
- ◆ Support vessels (supply, stand-by vessel and tugs)
- ◆ Specialist vessels (surface effect vessels, high speed craft)

Outcome 3

Explain ship stresses and use ship stress calculating equipment.

Knowledge and/or skills

- ◆ Causes and effect of stresses in still water
- ◆ Causes and effect of stresses in a seaway
- ◆ Structural features to resist shearing and bending
- ◆ Stress calculating machines

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Evidence requirements for this unit

Written and/or recorded oral evidence is required for Outcomes 1, 2 and 3 under closed-book and supervised conditions. Outcomes 1–3 can be combined for assessment and should last no longer than three hours but each learning outcome can also be assessed separately. All knowledge and skills are assessed however there is a sampling within some of the knowledge and skills. Where sampling is used a different sample should be used on each assessment occasion.

Outcome 1

Learners will need to provide written and/or recorded oral evidence to demonstrate their knowledge and/or skills to identify the significant features of a ship's structure by showing that they can:

- (a) Define with the aid of a sketch, four standard structural terms from the following:
 - Displacement, deadweight, Length over All (LOA), Length Between Perpendiculars (LBP), waterline length, Lloyd's length, moulded breadth and depth, camber, sheer, rise of floor, beam flare and rake.

- (b) Explain with the aid of a sketch, the identifying characteristics of one framing system from the following sample:
 - Longitudinal Framing Systems
 - Transverse Framing Systems
 - Combined Framing Systems

Learners should state the advantages and disadvantages of each system and describe the salient features that identify the system.

- (c) Explain, with the aid of sketches, the structural features of two items from the following:
 - Hatchways and coamings, bulwarks, bilge keels, hatch covers, weathertight doors, watertight doors, open floors, plate floors, duct keels, side shell doors, water tight bulkhead.

- (d) Produce a fully labelled sketch of a transverse section through a cargo hold of one of the following:
 - (i) a container vessel
 - (ii) a ro-ro vessel
 - (iii) a bulk carrier
 - (iv) a general cargo vessel
 - (v) a tanker

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Outcome 2

Learners will need to provide written and/or recorded oral evidence to demonstrate their knowledge and/or skills to describe the salient features of ship's structure by showing that they can:

Describe the roles, functions and general layout of a sample of two of the ship types given in (a)–(e) below.

- (a) Tankers (oil, gas and chemical tanker)
- (b) Cargo ships (general cargo, ro-ro, container, bulk carrier)
- (c) Passenger ships
- (d) Support vessels (supply, stand-by vessel and tugs)
- (e) Specialist vessels (surface effect vessels, high speed craft)

Outcome 3

Learners will need to provide written/and or recorded oral evidence to demonstrate their knowledge and/or skills to explain ship stresses and use ship stress calculating equipment by showing that they can:

- (a) Explain how stresses arise in a vessel in still water. Learners should produce evidence for a sample of three situations from the following:

- Racking forces
- Centre loading
- Wing loading
- Dry docking
- Alternate hatch loading
- Hogging
- Sagging

On each assessment occasion the learner should identify features which resist the stresses selected and a different sample must be used on each occasion.

- (b) Explain how stresses arise in a vessel operating in a seaway. Evidence should be generated by sampling one of the following:

- Panting
- Pounding
- Hogging
- Sagging
- Torsional Bending
- Longitudinal Bending

On each assessment occasion the learner should identify features which resist the stresses selected and a different sample must be used on each occasion.

- (c) Learners will be required to explain how stress calculating equipment is used on board ship and demonstrate how this helps to monitor and control stresses during loading/unloading operations and whilst at sea. They should have a clear understanding of the maximum permissible stress limits in harbour and at sea and why the seagoing condition has a more onerous requirement than the harbour condition.

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SQA Advanced Unit support notes

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Unit support notes are offered as guidance and 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 content of this unit forms part of the underpinning knowledge for a UK MCA Officer of the Watch Certificate of Competency and reflects the content of International Maritime Organisation's Standards of Training Certification and Watchkeeping (STCW 95).

The knowledge and skills acquired in this unit will be underpinned extensively at sea so that the experience gained can be utilised in units *Marine Vessels: Structures and Maintenance* and *Ship Stability: Theory and Practical Application*, which feature in the later stages of the SQA Advanced Diploma in Nautical Science.

Outcome 1

Identify the significant features of a ship's structure.

Outcome 1 covers the standard terminology pertaining to ship construction, framing system, structural arrangements of holds, tanks and ship's watertight integrity and piping arrangements. Learning outcome also covers areas liable to damage in heavy weather.

Outcome 2

Describe the salient features of a range of ship types.

Outcome 2 covers the salient features of the layout and structure of ship types for example tankers, cargo ships, passenger ships, support vessels and specialist vessels.

Outcome 3

Explain ship stresses and use ship stress calculating equipment.

Outcome 3 covers the causes and effects of stresses on ships in still water and in a seaway. It also explains the structural features to resist shearing and bending moments due to changing weather conditions and cargo loading conditions. This outcome also explains the use of various stress calculating machines.

Guidance on approaches to delivery of this unit

This unit contains knowledge and skills which are critical to the safe operation of any vessel. The unit could be delivered by combination of class teaching, tutorial work and practical application cargo loading equipment.

It is therefore vital that all learners are thoroughly familiar with the principles detailed above. It is suggested that the delivery follows the sequence of the outcomes as they develop the required knowledge and skills in a sequential order.

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Learners will benefit most if *Naval Architecture: Ship Construction* is delivered in conjunction with the unit *Ship Stability: An Introduction*. The knowledge and skills acquired in this unit will be underpinned extensively at sea so that the experience gained can be utilised in units *Marine Vessels: Structures and Maintenance* and *Ship Stability: Theory and Practical Application*, which feature in the later stages of the SQA Advanced Diploma in Nautical Science.

Those learners with no prior seagoing experience would benefit from practical demonstrations, where applicable, of the various concepts. This may be possible using models or simple beams showing the effect of transferring weights in a ship. Wherever possible diagrams should be used in explaining concepts regarding movement of weights and the use of presentations and ICT delivery would be of great benefit.

Use of stress calculation software loaded with various ship structures before and after loading to the effect as the changes can be shown almost instantaneously and learners can see for themselves how changes can affect the stability of the vessel in both numeric and diagrammatic formats. The learner can apply their theoretical knowledge and analyse the practical application of ship's structure due to stability and trim calculations in various seagoing conditions of intact and damage stability of the ship in the simulators.

Guidance on approaches to assessment of this unit

Written and/or oral evidence is required for Outcomes 1, 2 and 3 under closed-book and supervised conditions. Outcomes 1–3 can be combined for assessment and should last no longer than three hours but each learning outcome can also be assessed separately. All knowledge and skills are assessed however there is a sampling within some of the knowledge and skills. Where sampling is used a different sample should be used on each assessment occasion. Assessment could be either a question paper or an assignment.

Outcome 1

Written and/or recorded oral evidence is required for Outcome 1 under closed-book and supervised conditions.

The use of pre-printed diagrams of various structural features, where the learner has to name identified structural items, may be used. However any assessment should involve the learner physically drawing at least one structural feature.

Drawings need not be to scale but should be in proportion and of sufficient clarity to allow the assessor to confirm that the learner has met the evidence requirements.

Outcome 2

In the case of a closed-book assessment the use of pre-printed diagrams of the side elevation of the vessel's features, where the learner has to name identified structural items and explain their significance may be used.

Alternatively the instrument of assessment could require the learner to draw a labelled side elevation of each vessel, indicating all accommodation, cargo and machinery spaces. Learners should also identify all cargo gear, bunker spaces and fore and aft peak compartments.

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Outcome 3

Learners should be able to explain with the help of a labelled sketch the following with respect to location, cause, effect and means (both the structural and operational) to counteract them:

- (a) Panting
- (b) Pounding
- (c) Hogging
- (d) Sagging

Evidence for element (c) and (d) of the evidence requirements can be obtained by learners carrying out a practical exercise using an appropriate software package for stress calculation, and learners are required to submit their completed tasks in the form of work sheet/screen shots of their work.

Outcomes 1, 2 and 3 can be combined for assessment purposes.

Evidence for the above may be reproduced by the learner using typical stability software packages to investigate a proposed loading plan for the vessel in question. Alternatively learners could be asked what the input/output parameters are for typical stress software packages, about torsional bending and longitudinal bending of a ship in various sea going conditions. The learners are required to submit their completed tasks in the form of work sheet/screen shots.

Opportunities for 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 social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core Skills

This unit has the Critical Thinking component of Problem Solving embedded in it. This means that when learners achieve the unit, their Core Skills profile will also be updated to show they have achieved Critical Thinking at SCQF level 6.

This unit also has the Using Graphical Information component of Numeracy embedded in it. This means that when learners achieve the unit, their Core Skills profile will also be updated to show they have achieved Using Graphical Information at SCQF level 6.

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History of changes to unit

Version	Description of change	Date

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our [Centre Feedback Form](#).

General information for learners

Unit title: Naval Architecture: Ship Construction (SCQF level 7)

This unit introduces you to the significant features of a ship's structure and the salient features of a range of ship types. It also covers the location, cause, effect and means to counteract internal and external forces exerted on a ship and introduces you to the use of ship's stress-calculating equipment for monitoring structural loads. This unit is primarily aimed at learners who intend to seek employment within the maritime industry.

On completion of the unit you should be able to:

- ◆ Identify the significant features of a ship's structure.

Outcome 1 covers the standard terminology pertaining to ship construction, framing system, structural arrangements of holds, tanks and ship's watertight integrity and piping arrangement. Outcome 1 also covers the areas liable to damage in heavy weather.

- ◆ Describe the salient features of a range of ship types.

Outcome 2 covers the salient features of the layout and structure of ship types for example tankers, cargo ships, passenger ships, support vessels and specialist vessels.

- ◆ Explain ship stresses and use ship stress calculating equipment.

Outcome 3 covers the causes and effects of stresses on ships in still water in a seaway. It also explains the structural features to resist shearing and bending moments due to changing weather conditions and cargo loading conditions. This outcome also explains the use of various stress calculating machines.

Outcomes 1, 2 and 3 will be assessed by means of a closed-book assessment for each Outcome under supervised conditions. Alternately, they could be combined for assessment purpose with one closed-book assessment for all three outcomes. All knowledge and skills are assessed however there is a sampling within each of the knowledge and skills items.

The assessment could be a question paper or an assignment.

This unit has the Critical Thinking component of Problem Solving embedded in it. This means that when you achieve the unit, your Core Skills profile will also be updated to show you have achieved Critical Thinking at SCQF level 6.

This unit also has the Using Graphical Information component of Numeracy embedded in it. This means that when you achieve the unit, your Core Skills profile will also be updated to show you have achieved Using Graphical Information at SCQF level 6.