Higher National Unit specification

General information for centres

Unit title: Ship Stability within Naval Architecture: An Introduction

Unit code: F503 34

Unit purpose: This Unit addresses the application of the principles of ship stability, to ship shape vessels, encouraging the development of the knowledge and the principles of statical, transverse and longitudinal stability. The Unit is designed primarily for candidates with an interest in the marine naval construction/architecture subject area.

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

1 Apply the principles of statical stability.
2 Apply the principles of transverse stability to list calculations at small angles of heel.
3 Apply the principles of longitudinal stability.

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 delivery centre. However, it would be beneficial for candidates to have achieved at least Standard Grade 2 in both Mathematics and Physics.

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

Using Number at SCQF level 6

There are also further opportunities to develop the Core Skill of:

- Communication: Oral at SCQF level 4

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 to which it contributes.

Assessment: Basic loadline calculations may be assessed using a closed-book assessment under supervised conditions or may be incorporated in an assessment covering Outcomes 1, 2, and 3.

Higher National Unit specification: statement of standards

Unit title: Ship Stability within Naval Architecture: An Introduction

Unit code: F503 34

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

Where evidence for Outcomes is assessed on a sample base, the whole of the content listed in the knowledge and/or skills section must be taught and available 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

Apply the principles of statical stability

Knowledge and/or Skills

- Inclining experiment
- Centre of buoyancy, centre of gravity, initial transverse metacentre, righting lever, righting moment, metacentric height. angle of vanishing stability
- Stable, neutral and unstable conditions of stability at small angles of heel
- Stiff and tender vessels
- Angle of loll

Evidence Requirements

Candidates are required to generate evidence that measures the competence of their Knowledge and Skills by:

- adequate explanation of the terms relating to statical stability
- competently calculating the metacentric and centres of gravity heights on a ship from varying contributing conditions
- correct determination of a vessel's state of statical stability

In order to measure competence in the above requirements candidates will be assessed using a variety of methods that may include written statements, multiple choice questions plus the written identification of terms on cross sectional drawings of a ship in both a state of equilibrium and stability.

Alternative methods of measuring a candidate's competence against the Evidence Requirements can be through the assessment of their response to set written questions. All questions are to be designed to encourage the candidate to combine generated evidence of competence for the Evidence Requirements of more than one Outcome from this Unit.

Assessment Guidelines

Outcome 1 shall be sample assessed through assessment held under supervised conditions on the subject of statical stability.

Outcomes 1,2 and 3 may be assessed by a single assessment.

Outcome 2

Apply the principles of transverse stability to list calculations at small angles of heel

Knowledge and/or Skills

- Effect on gravity (G) of loading, discharging, and moving weights
- Differences between list, loll and heel
- List and loll correction methods
- Effect of tank subdivision on free surface effect
- Allowances for free surface effect

Evidence Requirements

In order to measure candidates' competence in their Knowledge and Skills relating to the principles of transverse stability to list calculations, candidates are required to generate evidence as a means of measuring their competence in their knowledge and skills by:

- competently calculating the effect on a ship's transverse stability by the vertical and transverse distribution of weights
- explanations of the difference of the conditions of loll, list and heel.
- explanation of methods to reduce free surface effect and the dangers involved

Candidates shall be expected to generate evidence of competence by responding to set written questions on the different contributing circumstances that instigate changes to a ship's angle of list by the movements of weights on board a ship both horizontally and vertically. Candidates will also be expected to include in their response the difference between list and loll.

Assessment Guidelines

Outcome 2 should be assessed under supervised conditions and cover transverse stability calculations, the dangers of free surface and the correction to angle of list and loll.

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

Higher National Unit specification: statement of standards (cont)

Unit title: Ship Stability within Naval Architecture: An Introduction

Outcome 3

Apply the principles of longitudinal stability

Knowledge and/or Skills

- True Mean Draught (TMD), Longitudinal Centre of Floatation (LCF), Longitudinal Centre of Gravity (LCG), Longitudinal Centre of Buoyancy (LCB), Trimming Moment and Moment to Change Trim 1 Centimetre (MCTC)
- Principles of longitudinal stability to calculations involving the inter-relationship of draught, trim and weight

Evidence Requirements

Candidates will be required to demonstrate their Knowledge and/or Skills by competently calculating:

- the effect on a ship of altering the longitudinal distribution of weights

Under supervised conditions all candidates will be given an opportunity to respond to set questions relating to this Outcome in order to demonstrate their competence in the knowledge and skills relating to the calculations of a ship's True Mean draft as a datum for the calculation of new drafts resulting from the effects of loading, discharging and transferring of weights around a ship.

If the Outcomes are combined, the Evidence Requirements for each Outcome must be clearly identifiable within the candidate's response.

NOTE: Calculations involving longitudinal stability should be carried out using the method of taking moments about the after perpendicular. The method of taking moments about the LCF should be discussed but in the assessment only the taking of moments about the after perpendicular should be given any credit

Assessment Guidelines

Outcome 3 should be assessed under supervised conditions.

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

Administrative Information

Unit code: F503 34

Unit title: Ship Stability within Naval Architecture: An Introduction

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 Stability within Naval Architecture: An Introduction

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 delivering centre, the notional design length is 40 hours

Guidance on the content and context for this Unit

This Unit is primarily intended for technician apprentices who are commencing a career in a commercial ship build and/or ship repair organisation. It is equally suited to Ministry of Defence technician apprentices who are pursuing a career path in any of the Integrated Project Teams responsible for the upkeep of HM Ships.

It is not a prerequisite of this Unit for candidates to have shipboard, build or repair experience but, if they have, it may be beneficial.

Completion of this Unit as part of an identified Higher National Group Award contributes towards the minimum entry level for a Ministry of Defence technician apprentice training towards the post DESG B and D officer.

The Unit contributes towards the minimum requirement in commercial ship builder and ship repair yards for the post of draughtsman responsible for the design and technology of new built ships and alterations.

The following notes give additional information on the knowledge and skills for each of the four Outcomes.

Outcome 1

Candidates will have to investigate and confirm all the contributory factors to a ship being in various conditions of stable, unstable and neutral stability.

Candidates must also demonstrate a competent awareness of the variety of factors that affect the transverse stability of a ship.

Outcome 2

This Outcome focuses on the various contributing factors to a ship's transverse stability resulting from the distribution of weights around a ship from loading and discharging. Candidates will calculate the changes to statical stability of a ship resulting from the movement of weights both vertically and horizontally.

Candidates will also describe the contributions of the concept of free surface to a ship's calculated stability, continuing onto the further dangers to a ship, from excessive free surface and the dangers and effect from small angles of heel from partially filled tanks.

This Outcome shall look at the effect of tank division on free surface considering both longitudinal and transverse methods of tank subdivisions.

Higher National Unit specification: support notes (cont)

Unit title: Ship Stability within Naval Architecture: An Introduction

Outcome 3

This Outcome introduces the candidate to the methods of calculating a ship's longitudinal stability. Candidates will be in a position to establish if a ship is trim by stern, trim by the head or lying in a level keel condition.

Candidates will calculate the effect to the bodily increase in draught and the change in trim due to the addition of small masses when placed at the centre of floatation, then moved forward or aft into a final position.

Guidance on the delivery and assessment of this Unit

In this Unit the knowledge skills and principles of an Outcome are required to be carried on to the following Outcome. Tutors are therefore encouraged to deliver the Outcomes in a sequential fashion.

Candidates will require practical demonstrations that reflect accurately a simulation through diagrams, models and CDs of transverse and longitudinal ships' sections with accurate relationships to waterlines, centre of gravity, centre of buoyancy, angles of heel, displacement tonnage, figures etc.

Tutors are encouraged to make use of the amply available electronic software that is complimentary to this subject. Candidates should be encouraged to visit recommended sites relating to ship stability.

The assessment of the 3 Outcomes of this Unit may be carried out on an individual basis or as a permutation of various Outcomes or even as an amalgamation of all 3 Outcomes. The benefit of option 1 will permit the assessor to measure the candidate's competence against the standards of each Outcome. Option 2 will allow the assessor to measure a candidate's competence to combine the various Outcome skills in a lesser capacity. Option 3 will allow the assessor to measure a candidate's competence in combining all of the knowledge and skills of all the Outcomes of the Unit.

Opportunities for developing Core Skills

The achievement of this Unit gives automatic certification of the following:

- Using Number at SCQF level 6

Throughout this Unit Numerical data is analysed, processed, calculated and transferred to graphic mode in the process of establishing a ship stability against various scenarios.

Oral Communications at SCQF level 4 can be developed with this Unit during a candidate's correct use of a hydrometer in the establishing the density of water and through the assessor's use of oral assessment methods and candidate oral responses.

Higher National Unit specification: support notes (cont)

Unit title: Ship Stability within Naval Architecture: An Introduction

Open learning

The preferred traditional method for delivery of this Unit is by attendance at college. Many of the candidates on this Unit will be from the Merchant Navy, off shore oil and gas installations and the shipbuilding and repair industry. It is therefore essential that alternative methods of delivery are considered in recognition of the varying engineering sectors the current candidates are sponsored from.

It is therefore essential, in order to meet with the needs of industry, that online distance learning should be considered as an alternative to the traditional college attendance. This would meet with the needs of the modern ship build and repair industry which are now more sparsely spread around the country resulting in many colleges removing shipbuilding courses from the curriculum as demand locally is no longer viable. However the collective demand nationally would benefit from the introduction of online distance learning of this Unit. Further to this online distance learning could be made available globally.

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 Stability within Naval Architecture: An Introduction

This Unit is about applying the principles of ship stability, at small angles of list for box and ship shape vessels in routine situations. It develops knowledge of the principles of statical stability, transverse stability and gives an introduction to longitudinal stability.

On completion of this Unit you should be able to apply the principles of:

- statical stability
- transverse stability to list calculations at small angles of heel
- longitudinal stability

You will be assessed on statical, transverse and longitudinal stability.