



Higher National Unit specification

General information for centres

Unit title: Shipbuilding: Fitting Out

Unit code: F43E 34

Unit purpose: This Unit will introduce the candidate to the significant features of fitting out a ship during its build. This will include evaluating the technologies utilised during the fitting out phase of a ship build, and give consideration to the many requirements of a modern ship including comfort, functionality and performance. The significance of scheduling during fitting out will also be discussed.

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

- 1 Identify and explain the principal stages of fitting out.
- 2 Analyse and evaluate the benefits and implications of modularisation on fitting out.
- 3 Assess the methods by which fitting out requirements are communicated to the build yard.

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. It would be an advantage for the candidates to have a knowledge and understanding of the shipbuilding environment. It would be prudent for the candidate to have undertaken, or be undertaking HN Unit DR2F 34 *Ship Building Principles: Planning Production and Assembly*.

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 by means of closed-book assessments under supervised conditions, or they could be combined for assessment purposes.

Higher National Unit specification: statement of standards

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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

Identify and explain the principal stages of fitting out

Knowledge and/or Skills

- ◆ Initial fitting out, and the type of work generally undertaken during this stage
- ◆ Main ship fitting out, and the type of work generally undertaken during this stage
- ◆ Final fitting out, and the type of work generally undertaken during this stage
- ◆ Importance of scheduling of fitting out
- ◆ Impact of fitting out on the overall build programme
- ◆ Implications of having to undertake fitting out at a stage not in line with type of work

Evidence Requirements

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

- (a) Identify the various fitting out stages during ship build and generically outline the type of work undertaken during each stage, providing examples of each to supplement their answer.
- (b) Explain the importance of scheduling fitting out work and explain the implications if scheduled incorrectly.
- (c) Assess the impact of having to undertake initial fitting out work at a later stage of fitting out, and provide examples of why this might occur.

Assessment Guidelines

Outcome 1 may be assessed by means of a closed-book assessment under supervised conditions. Alternatively it may take the form of a short assignment/project or case study.

Sketches provided in support of candidate's answers need not be to scale but should be in proportion and of sufficient clarity to allow the assessor to confirm the candidate has met the Evidence Requirements.

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

Higher National Unit specification: statement of standards (cont)

Unit title: Shipbuilding: Fitting Out

Outcome 2

Analyse and evaluate the benefits and implications of modularisation on fitting out

Knowledge and/or Skills

- ◆ Types/areas of modularisation commonly adopted in modern ship build
- ◆ Fundamental difference between shipyard supplied modules and equipment supplier modules
- ◆ Benefits of modularisation to the build yard
- ◆ Implications of adopting modularisation during fitting out
- ◆ Importance of designing in modularisation at an early stage

Evidence Requirements

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

- (a) Explain the principles of modularisation in a modern ship build, and the benefits this brings over traditional fitting out. Sketches can be provided in support of this.
- (b) Evaluate the different types of modularisation commonly adopted in modern ship build, including examples of both shipyard supplied modules and those supplied by the Equipment Supplier. Candidates should state the advantages and disadvantages of each, including the fundamental differences between the two, using sketches where necessary.
- (c) Evaluate the importance of considering modularisation at an early stage of design to attain the maximum benefits. The implications of not considering this should be discussed also. Sketches can be provided in support of this.

Assessment Guidelines

Outcome 2 may be assessed by means of a closed-book assessment under supervised conditions. Alternatively it may take the form of a short assignment/project or case study.

Sketches provided in support of candidate's answers need not be to scale but should be in proportion and of sufficient clarity to allow the assessor to confirm the candidate has met the Evidence Requirements.

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

Higher National Unit specification: statement of standards (cont)

Unit title: Shipbuilding: Fitting Out

Outcome 3

Assess the methods by which fitting out requirements are communicated to the build yard

Knowledge and/or Skills

- ◆ Methods by which the fitting out requirements are relayed to the build yard
- ◆ Importance of the Bill of Materials, and the information contained therein
- ◆ Implications of incorrect or immature information

Evidence Requirements

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

- (a) Evaluate the methods used to communicate fitting out information to the build yard. This should include outlining the common methods used, using sketches where appropriate.
- (b) Discuss the importance of the bill of materials in fitting out, with emphasis on the content of the bill of materials and the accuracy of the content.
- (c) Assess the potential implications on fitting out of incorrect information being relayed to the build yard, and ultimately used in manufacture.

Assessment Guidelines

Outcome 3 may be assessed by means of a closed-book assessment under supervised conditions. Alternatively it may take the form of a short assignment/project or case study.

Sketches provided in support of candidate's answers need not be to scale but should be in proportion and of sufficient clarity to allow the assessor to confirm the candidate has met the Evidence Requirements.

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

Administrative Information

Unit code: F43E 34
Unit title: Shipbuilding: Fitting Out
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Higher National Unit specification: support notes

Unit title: Shipbuilding: Fitting Out

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

It is important for the candidate to understand, at a fundamental level, the type of work being undertaken at each stage of fitting out.

Initial fitting out being the stage where as much of the welded attachments to the ships structure (hotwork) are completed. This might include main equipment baseplates (seats), minor equipment seats, ship system supports (pipes, cables, vents etc.) which, when installed, can be bolted to the welded attachment. Welding itself is not a particularly clean process and undertaking a lot of this type of work in the latter fitting out stages would impact local surrounding areas, particularly if, for instance, they have been painted or fitted out with fabrics etc. Ideally welding should be kept to a minimum in the latter stages of fitting out.

Main fitting out is when as much of the larger equipments and components are installed in the vessel. Ideally these will be fixed to the ship by bolts or similar and would include, but not be limited to, such items as power generation equipment, propulsion equipment, pumps, and coolers.

Final fitting would be where much of the smaller items be installed and would include all the more delicate components including smaller electrical/electronic items and also perhaps linings for both the decks and deckheads, be it carpet, panels or similar.

The candidate must also understand the significance of scheduling fitting out. For instance, large components may need to be installed 'open sky', which in effect is prior to the deck above being installed on the ship. This means the large component can be relatively simply crane lifted into position. Poor scheduling, or a late delivery could impact this significantly. If the component is not delivered to the build yard in time then either the build programme suffers a delay, or a significant and unplanned large hole in the ship would need to be cut to fleet the component in. By the same token, if the build yard forgets about, or a design change introduces a large component then the same would apply. The costs associated with this are significant.

Fitting out the ship constitutes the majority of the build manhours, and as such must be undertaken as effectively and efficiently as possible. As discussed above, doing this out of stage or schedule can be significant. Ultimately this is what the candidate should understand at the end of this Outcome.

Higher National Unit specification: support notes (cont)

Unit title: Shipbuilding: Fitting Out

Outcome 2

Modularisation is becoming increasingly common in all types of ship build, having originated in the commercial/cruise industry and now being adopted in the latest UK Royal Navy vessels.

It is important that the candidate can distinguish between the two common types of module. The first is that supplied by an equipment supplier and will perhaps involve the supplier incorporating a number of components usually supplied separately, onto a single baseplate with the supplier responsible for all interconnecting pipework/cables etc., between the components on the module. All that is required by the shipyard then is to understand the link ups to the module (electrical, piping, structural etc.) and obviously to ensure that the module is delivered early enough during the build programme for it to be installed with minimum disruption. The benefits to the build yard are significant, and include only having to install one item where perhaps four or five components would previously have needed to be installed and linked up. Also the number of systems link ups are reduced. Also, only a single structural baseplate for the module needs designed, and not four or five. Common examples of this type of module are modular crews cabins, modular WCs, water purification (reverse osmosis) plants, sewage treatment plants.

The second module type is that defined and constructed by the build yard itself. This is generally incorporating a number of equipments or components onto a single baseplate. The fundamental difference is that these equipments or components generally are sourced from different suppliers. An example would be creating a module with two (or more) different pumps on it. The build yard would need to identify the potential to do this at an early stage of design, and evaluate whether there is a cost/schedule benefit in doing so. If so then the build yard would need to design and integrate this into the build programme. A further example of this type of module would be a pipe bank. Traditionally individual lengths of pipe no more than about 3m in length can be transported into the ship during main fitting out. It is however possible to identify where there might be a number of long straight pipes running side by side, and incorporate into a single, significantly longer module. This means that more pipework can be installed earlier in build, cheaper and easier than installing individual pipes

With modularisation it virtually always comes down to a cost trade off between the cost/schedule benefit of installing a module compared with the cost of actually designing and manufacturing the module itself. It is worth also pointing out that modularising equipment does generally introduce a weight increase, as both a structural baseplate and the module baseplate are required.

Outcome 3

Candidates should be aware that the build yard is entirely dependent on the information received from its design teams. If this information does not arrive on time, or contains errors, or indeed is based on immature information perhaps from equipment suppliers, then delay or risk is introduced to the fitting out process.

Higher National Unit specification: support notes (cont)

Unit title: Shipbuilding: Fitting Out

Generally drawings are the primary method of communicating what requires to be manufactured, and where it must be fitted in the ship. In modern times these drawings are generally produced as an output of a 3D CAD model of the entire ship and its contents. The candidate should appreciate the number and diversity of these drawings, which range from the main structural seat manufacturing drawing for a main engine, to a drawing of a small hotwork lug for connecting pipes to, used hundreds of times throughout the ship. Supplementing these drawings must be information on where they are to be located on the ship. These are only two components of the thousands on a modern ship, and do not consider suppliers drawings, or indeed drawings of modules discussed in Outcome 2, or the multitude of other drawings required by the build yard. Virtually every component on the ship, whether it be manufactured by the yard or provided by a supplier, will have a drawing associated with it.

If possible, it would be beneficial for the candidates to be shown example drawings used in fitting out, in support of this Outcome.

The candidate should be aware of the importance of the bill of materials in ensuring fitting out runs smoothly and to schedule. The build has an accurate and clearly defined list of items it has to manufacture and install, and perhaps more importantly, the information is stable and mature, then scheduling of work and planning are much easier to manage. If information is constantly changing and for instance the hotwork lug discussed above changes in design during build then due to its volume of use, the impact is significant despite it being a small innocuous component. By the same token if a structural seat for an equipment is manufactured and installed, and the suppliers delivers something slightly different to that anticipated then the impact is significant. Avoidance of re-work is key in all of this.

Finally the candidate should understand the importance of accurate part identification. The design team must define an item identifier for each unique component on the ship which is flowed down to the build yard. With so many components on the ship, and many of them perhaps looking similar, it is important that this is managed and traceable through build, from the manufacturing shop where the hotwork lug is made to its point of use on the ship. The implications of the wrong part being used in many locations are obviously significant.

Guidance on the delivery and assessment of this Unit

Ideally this Unit should be delivered/assessed at the same time as HN Unit DR2F 34 *Ship Building Principles Planning Production*. This will enable the candidate to gain an understanding of some of the shipbuilding detail around fitting out, and how this might impact overall planning, at the same time as understanding the detail of planning itself.

It is recommended during delivery of this Unit that example shipyard drawings and other ‘fitting out’ related information is obtained (if possible) to supplement the candidates understanding of the subject.

It is recommended that the assessment take the form of an examination on completion of the Unit, as the Outcomes are linked by their content and there will be opportunity to demonstrate this link via assessment. However it may also be carried out on completion of each Outcome.

Higher National Unit specification: support notes (cont)

Unit title: Shipbuilding: Fitting Out

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 and clearly communicate a fairly complicated and involved process during the assessment.

Open learning

This Unit is not suited to delivery by distance learning because it requires candidates to be able to view first hand the drawings and supporting documentation required by the build yard to support fitting out. It is not anticipated that these could be published such that the candidate could access electronically.

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: Shipbuilding: Fitting Out

This Unit introduces you to the Fitting Out stage of the shipbuilding process. This is perhaps the most significant and labour intensive stage of any new ship build programme and can cover many months or even years depending on the type and size of vessel. The Unit itself is intended to give you an overview of the fitting out process, and the stages therein, whilst also introducing some fitting out techniques being adopted in modern ship builds.

Outcome 1 considers the main stages of fitting out, when they generally occur in the overall build programme and the implications of poor scheduling of fitting out.

Outcome 2 focuses on modularisation, which is becoming an increasingly popular means of simplifying the fitting out process, used extensively in the Cruise industry and now more and more in the UK Naval Sector (Type 45 Destroyer and Future Aircraft Carrier included). The different types of modularisation will be considered and the pros and cons of each discussed.

Outcome 3 looks in some detail at the common methods of relaying fitting out information to the build yard. Primarily this centres on manufacturing drawings, but also considers the importance of managing this information flow, and considers the implications if it is incorrect, or immature.

The above Outcomes are designed to equip you with an overall understanding and appreciation of the fitting out principles involved in modern ship build, and an awareness of the implications of not getting it right.

Outcomes 1, 2 and 3 may be assessed by means of a closed-book assessment for each Outcome under supervised conditions. Alternatively, they could be combined for assessment purposes with one closed-book assessment for all three Outcomes.