



Group Award Specification for:

HND Marine Electro-Technology

SCQF level 8

Group Award Code: GF98 16

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1 Introduction

This is the Arrangement documents for the Higher National Diploma (HND) in Marine Electro-Technology, at SCQF level 8, which was validated in May 2012.

This document includes: background information on the development of the Qualification, its aims, guidance on access, details of the Qualifications structure, and guidance on delivery.

The qualification provides learners with the knowledge required for a broad range of employment opportunities, but specifically those knowledge elements required with the Merchant Navy for Electro-technical staff. The qualification name reflects this specialism.

In 2010 the International Maritime Organisation (IMO) introduced a new certification category for the position of Electro-Technical Officer (ETO). This will enable officers on Merchant Navy vessels to gain acknowledgement for their technical skills and hold 'Certificates of Competency (CoC)' at the Operational level. These new CoC requirements are to be introduced from January 2013 in the IMO 'Standards of Training, Certification and Watchkeeping' (STCW) convention as amended in 2010 (Manila 2010).

To comply with this new certification requirement, the maritime authority for the UK Government, the Maritime and Coastguard Agency (MCA) has accepted that new training schemes which meet the training profile for the current Deck and Engineering Operational level CoC will be acceptable for their award of an Electro-Technical Officer CoC.

Client group

The qualification is being created to support additional routes to MCA certification within the context of the STCW 2010 Certificates of Competency for Electro-Technical Officers. The target group ranges from school leavers entering the Merchant Navy to adult returners. For those adults who require professional recognition of the skills, they may already have the required industrial experiences but do not currently have the full range of knowledge and skills to gain academic recognition and therefore improved employment opportunities. This award will contribute to these improved employment opportunities.

Employment opportunities

The HND in Marine Electro-Technology has been designed to develop the skills and knowledge required by the maritime sector and industry.

The retention rates on the current schemes are 95% and the existing trainees will gain employment at sea as ETO's on graduation. The current position of demand over trainee supply is expected to be maintained in the medium term, until the number of training schemes increase.

In addition the profile of the new STCW certification route will further increase the attractiveness of suitably skilled ETO's. This new route is designed to provide both a front ended academic training (Option 1) and provide an entry route for Standard Grade/GCSE entrants via the Marine Engineering Higher Education Access course (Option 2).

2 Qualification structure

In the design of the HND in Electro-Technology a high level of priority has been placed on producing an award which will allow learners to develop appropriate technical and practical skills which will meet the requirements of employers, prepare learners for the level of responsibility aboard ship and allow future progression to a higher rank within the industry, as well as progress to higher qualifications.

It is not possible to quantify such technical and practical skills in exact detail. The best way to prepare learners to meet the changing requirements of the modern maritime industry is to have a solid foundation of theory and practice on which they can build new knowledge, understanding and skills.

This HND will provide all the higher-level technical competencies and other attributes needed for employment at a professional level within the maritime sector, and enable individuals to serve successfully as an ETO on a range of vessels within the Merchant Navy. With further experience they would also further develop skills and techniques, personal qualities and attributes that are essential for employment and career progression in the shipping industry and in the wider maritime sector where seagoing expertise and skills are in demand.

Some maritime sectors provide promotional advancement within the vessel manning profiles (cruise industry) or within shore based technical support roles (technical superintendent).

Whilst this HND is specifically written for the Merchant Navy sector, there are a range of transferable knowledge and skills that could be used within:

- ◆ Oil and chemical process industry
- ◆ Offshore installations
- ◆ Technology based educational training

2.1 Structure

| 4 Code | 2 Code | Unit title | SQA Credit | SCQF Credit points | SCQF level |
|--------|--------|--|------------|--------------------|------------|
| H7K0* | 33 | Engineering Mathematics 1 | 1 | 8.0 | 6 |
| FY9T | 34 | Analogue Electronic Principles | 2 | 16.0 | 7 |
| DG31 | 34 | Applications of Programmable Logic Controllers | 1 | 8.0 | 7 |
| DG40 | 34 | Implementing Small Local Area Networks | 1 | 8.0 | 7 |
| H7K1* | 34 | Engineering Mathematics 2 | 1 | 8.0 | 7 |
| FY9E | 34 | DC and AC Principles | 1 | 8.0 | 7 |
| DN3T | 34 | Electrical Systems in Potentially Explosive and Gas Hazardous Environments | 1 | 8.0 | 7 |
| DN3Y | 34 | Fundamentals of Control Systems and Transducers | 1 | 8.0 | 7 |
| FY9R | 34 | Power Electronics | 1 | 8.0 | 7 |
| H01V | 34 | Electrical Safety | 1 | 8.0 | 7 |
| DT9X | 34 | Pneumatics and hydraulics | 1 | 8.0 | 7 |
| DX48 | 34 | Distributed Control systems | 2 | 16.0 | 7 |
| F90W | 34 | Marine Engineering: Electrical and Electronic Devices | 1 | 8.0 | 7 |
| F90X | 34 | Marine Engineering: Electrical Motors and Generators | 1 | 8.0 | 7 |
| F912 | 34 | Marine Engineering: Propulsion | 1 | 8.0 | 7 |
| H0EJ | 35 | Marine Engineering: Marine Management | 2 | 16.0 | 8 |
| DG3J | 35 | Electronic Fault Finding | 1 | 8.0 | 8 |
| DN43 | 35 | Switchgear and Protection of High Voltage Systems | 1 | 8.0 | 8 |
| DN49 | 35 | Transformers | 1 | 8.0 | 8 |
| DN4C | 35 | Applications of Power Electronics in Electrical Motor Drive Systems | 1 | 8.0 | 8 |
| H1FC | 35 | Marine Navigation Systems | 2 | 16.0 | 8 |
| H1FD | 35 | Radio Communications | 2 | 16.0 | 8 |
| H1ST | 34 | Marine Electro-Technology: Graded Unit 1 Examination | 1 | 8.0 | 7 |
| H1SV | 35 | Marine Electro-Technology: Graded Unit 2 Project | 2 | 16.0 | 8 |
| HJ46 | 34* | Marine Engineering: Propulsion | 1 | 8.0 | 7 |
| HJ44 | 34* | Marine Legislation and Leadership | 1 | 8.0 | 7 |
| HJ45 | 35* | Marine Engineering: Management | 1 | 8.0 | 8 |
| H0EK | 34* | Marine Engineering: Pneumatics and Hydraulics | 1 | 8.0 | 7 |
| | | Total credit value | 30 | 240 | |

*Refer to History of Changes for revision changes.

3 Aims of the qualification

3.1 General aims of the qualification

The HND qualification has a number of generic aims which can be summarised as follows:

- 1 Develop the ability to analyse and plan tasks commonly encountered in the workplace.
- 2 Develop approaches to problem solving and critical thinking.
- 3 Develop an evaluative and reflective approach to work and studies.
- 4 Develop the ability to plan and organise studies.
- 5 Develop skills for employability and allow for progression to higher qualifications.
- 6 To enable the learner to consolidate knowledge and skills to enhance career progression.
- 7 To develop Core Skills required by employers.
- 8 To develop skills which are transferable to other employment opportunities.
- 9 Progression within the SCQF framework.

3.2 Specific aims of the qualification

The HND has a number of specific aims which can be summarised as follows:

- 10 Prepare learners for oral examinations for ETO certification at the Operational level.
- 11 Contribute towards developing skills to enable learners to contribute to the safe and effective operation and maintenance of merchant vessels.
- 12 Contribute towards developing skills to enable learners to work with others in safe and effective manner.
- 13 Contribute towards developing skills to deal with emergency situations.
- 14 Develop awareness of current maritime legislation.
- 15 Provide an award that on successful completion will allow learners to progress to a degree in an engineering related discipline area.
- 16 Develop a range of project management skills.
- 17 Develop the analysis and synthesis skills necessary to ensure the efficient operation of the electrical, electronic and control elements within a modern merchant vessel.

3.3 Graded Units

Graded Unit 1

The rationale for including a Graded Unit at SCQF level 7 is to support the delivery within Option 1, where it is expected that the college phase 1 will be delivered at non-EU partner colleges, linked to the approved centre.

By utilising examination based Graded Units as an assessment, it will allow external bodies such as the MCA, to monitor the quality of the delivery and assessment at partner colleges.

The responsibility for the setting and marking of the Graded Unit at level 7 will remain with the approved centre.

Centres are also strongly recommended not to limit opportunities for the transferability of knowledge, understanding and skills within *Marine Electro-technology to the Marine Electro-technology: Graded Unit 1* only but to seek opportunities for the consolidation of these critical skills throughout the whole HND Marine Electro-technology Award.

Graded Unit 2

A project is preferred at SCQF level 8 because an investigative project-based assignment provides learners with opportunities to demonstrate not only their knowledge and skills in a technical area(s) relating to modern vessels, but also in personal development areas such as planning, scheduling, testing, evaluating and reporting which are important generic aims within this HND award.

An investigative based assignment will allow learners to demonstrate research, analytical and evaluative skills acquired during the course. It allows them to use written reporting skills, evidenced by a logbook/diary of their activities as well as the final report including practical recommendations for future improvement.

4 Recommended entry to the qualification

Entry to this qualification is at the discretion of the centre.

Learners would benefit from having attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

Direct entry to the HND award (Option 1)

At least two Higher level or A2 level passes of which one should be Mathematics or a Physical science, or equivalent to meet the minimum 120 UCAS points entry level. Learners should also have Standard Grade English Language at grade 3 or better (equivalent GCSE English at grade C or better). The following examples would also meet the minimum 120 UCAS points entry level:

- ◆ National Certificate in Electrical/Electronics at Pass/Merit grade
- ◆ National Diploma in Electrical/Electronics at Pass/Pass/Pass grade
- ◆ National Diploma in Engineering at Pass/Pass/Merit grade

Where non-UK qualifications are used to measure suitable entry level, then the learner would have High School certificates with pass in 12th Standard (10+2) from recognised articulation board in Physics, Chemistry and Maths group in Class XII, and at least 50% in English Language (equivalent to minimum IELTS 5.0 standard)

Indirect entry to the HND award (Option 2)

At least five Standard Grade passes at grade 3 or better (GCSE at grade C or better) in Mathematics, Physics or Chemistry, and English Language.

After the completion of the Higher Education Access course, such as the SQA Diploma in Shipping and Maritime Operations GA6F 57, then learners can directly enter this HN award.

Whilst the sea service articulated in both routes is an integral element of the certification to MCA Certificate of Competency, it does not form part of the HN award. For MCA certification a sea service requirement in excess of seven (7) months is required, with a suggested sea service of eight (8) months.

In all cases, the learner will be informed that for progression into a career in the Merchant Navy a level of physical health and fitness is required. This will be assessed via the MCA Medical Standard as detailed within Merchant Guidance Notice (MGN) 264.

Mature students

There will be a separate certification route for experienced seafarers to gain MCA certification, and the full HND award may not be required by such learners. Applicants for the experienced seafarer route will be directed to contact the MCA for a 'Letter of Initial Assessment' where an individual assessment will be undertaken.

4.1 Core Skills entry profile

The recommended Core Skill entry profile for the HND Marine Electro-Technology is as follows:

| Core Skills | HND Recommended Entry profile | HND Recommended Exit profile |
|---|--------------------------------------|-------------------------------------|
| Communication | SCQF level 6 | SCQF level 6 |
| Information and Communication Technology (CT) | SCQF level 6 | SCQF level 6 |
| Numeracy | SCQF level 6 | SCQF level 6 |
| Problem Solving | SCQF level 6 | SCQF level 6 |
| Working with Others | SCQF level 6 | SCQF level 6 |

5 Additional benefits of the qualification in meeting employer needs

Mapping of the Units with:

- 5.1 Mapping of qualification aims to Units
- 5.2 Mapping of National Occupational Standards
- 5.3 Mapping of Core Skills to Units
- 5.4 Mapping of STCW 2010 to qualification

5.1 Mapping of qualification aims to Units

| Code | Unit title | Aims | | | | | | | | | | | | | | | | |
|---------|--|------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| DG4H33 | Mathematics for Engineering 1: Electronics and Electrical | | | | | | | X | | | | | | | | | | |
| FY9T 34 | Analogue Electronic Principles (double Unit) | X | | | | X | | | | | | | | | | | | |
| DG31 34 | Applications of Programmable Logic Controllers | | | X | | | | | X | | | | | | | | | |
| DG40 34 | Implementing Small Local Area Networks | | | | | | | | X | | | | | | | | | |
| DG4L 34 | Mathematics for Engineering 2 | | | | | | | X | | | | | | | | | | |
| FY9E 34 | DC and AC Principles | | X | | | | | | | | | | | | | | | |
| DN3T 34 | Electrical Systems in Potentially Explosive and Gas Hazardous Environments | X | | | | X | | | X | | | | | | | | | |
| DN3Y 34 | Fundamentals of Control Systems and Transducers | | X | | | | | | X | | | | | | | | | |
| FY9R 34 | Power Electronics | | | | | | | | X | | | | | | | | | |
| H01V 34 | Electrical Safety | | | | | | | | | | | | | | | | | |
| DT9X 34 | Pneumatics and hydraulics | | X | | | X | | | X | | | | | | | | | |
| DX48 34 | Distributed Control systems (double Unit) | | X | | | | | | | | | | | | | | | |
| F90W 34 | Marine Engineering: Electrical and Electronic Devices | X | | | | | | X | | | | | | | | | | |
| F90X 34 | Marine Engineering: Electrical Motors and Generators | X | | | | | | X | | | | | | | | | | |

| Code | Unit title | Aims | | | | | | | | | | | | | | | | |
|---------|--|------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| F912 34 | Marine Engineering: Propulsion | X | | | | | | | | | | | | | | | | |
| H0EJ 35 | Marine Engineering: Marine Management (double Unit) | X | | X | | | | | X | | | | | | | | | |
| DG3J 35 | Electronic Fault Finding | X | X | | | | | | X | | | | | | | | | |
| DN43 35 | Switchgear and Protection of High Voltage Systems | X | | | | X | | | X | | | | | | | | | |
| DN49 35 | Transformers | | | | | | | | | | | | | | | | | |
| DN4C 35 | Applications of Power Electronics in Electrical Motor Drive Systems | | X | | | | | | | | | | | | | | | |
| H1FC 35 | Marine Navigation Systems (double Unit) | X | X | X | X | X | | | | | | | | | | | | |
| H1FD 35 | Radio Communications (double Unit) | X | X | X | X | X | | | | | | | | | | | | |
| H1ST 34 | Marine Electro-Technology: Graded Unit 1 Examination for level 7 Units | | | | X | | X | | | | | | | | | | | |
| H1SV 35 | Marine Electro-Technology: Graded Unit 2 Project (double Unit) | | X | | X | X | X | | | X | | | | | | | | |
| DG4H 33 | Mathematics for Engineering 1: Electronics and Electrical | | | | | | | | | | | | | | | | | |
| FY9T 34 | Analogue Electronic Principles (double Unit) | | | | | | | | | | X | | | | | | | X |
| DG31 34 | Applications of Programmable Logic Controllers | | | | | | | | | | | X | | | | | | X |
| DG40 34 | Implementing Small Local Area Networks | | | | | | | | | | | | | | | | | X |
| DG4L 34 | Mathematics for Engineering 2 | | | | | | | | | | | | | | | | | |

| Code | Unit title | Aims | | | | | | | | | | | | | | | | | |
|---------|--|------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| FY9E 34 | DC and AC Principles | | | | | | | | | | | | | | | | | | |
| DN3T 34 | Electrical Systems in Potentially Explosive and Gas Hazardous Environments | | | | | | | | | | | X | | | | | | | |
| DN3Y 34 | Fundamentals of Control Systems and Transducers | | | | | | | | | | X | X | | | | | | | |
| FY9R 34 | Power Electronics | | | | | | | | | | | | | | | | | | |
| H01V 34 | Electrical Safety | | | | | | | | | | X | X | X | | | | | | |
| DT9X 34 | Pneumatics and hydraulics | | | | | | | | | | | X | | | | | | | X |
| DX48 34 | Distributed Control systems (double Unit) | | | | | | | | | | X | X | | | | | | | |
| F90W 34 | Marine Engineering: Electrical and Electronic Devices | | | | | | | | | | X | | | | | | | | |
| F90X 34 | Marine Engineering: Electrical Motors and Generators | | | | | | | | | | X | X | | | | | | | X |
| F912 34 | Marine Engineering: Propulsion | | | | | | | | | | | | | | | | | | |
| H0EJ 35 | Marine Engineering: Marine Management (double Unit) | | | | | | | | | | X | | | | X | | | | |
| DG3J 35 | Electronic Fault Finding | | | | | | | | | | | X | | | | | | | X |
| DN43 35 | Switchgear and Protection of High Voltage Systems | | | | | | | | | | X | | X | | | | | | |
| DN49 35 | Transformers | | | | | | | | | | | X | | | | | | | X |
| DN4C 35 | Applications of Power Electronics in Electrical Motor Drive Systems | | | | | | | | | | | X | | | | | | | |

| Code | Unit title | Aims | | | | | | | | | | | | | | | | | |
|---------|--|------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| H1FC 35 | Marine Navigation Systems (double Unit) | | | | | | | | | | | X | X | | | | | X | X |
| H1FD 35 | Radio Communications (double Unit) | | | | | | | | | | | X | X | X | | | | X | X |
| H1ST 34 | Marine Electro-Technology: Graded Unit 1 Examination for level 7 Units | | | | | | | | | | | | | | | | | | |
| H1SV 35 | Marine Electro-Technology: Graded Unit 2 Project (double Unit) | | | | | | | | | | | | X | | | | X | X | |

5.2 Mapping of National Occupational Standards (NOS) and/or trade body standards

| | | A32 Maintain safe, legal and effective working practices on board a vessel | A36 Manage your own resources | C13 Operate and adjust vessel electrical equipment | C14 Operate and maintain vessel electrical variable speed drives and propulsion systems | C15 Operate and maintain electrical equipment in hazardous areas on board a vessel | C16 Operate and maintain vessel internal communication and computer network systems | C17 Operate and maintain high voltage equipment on board a vessel | C33 Carry out maintenance of vessel electrical machinery and systems | C35 Carry out maintenance of vessel telecommunications and navigation systems | C41 Identify and report variations in vessel electrical, instrumentation and control systems |
|-------------|--|--|-------------------------------|--|---|--|---|---|--|---|--|
| Code | Unit title | National Occupation Standards | | | | | | | | | |
| DG4H33 | Mathematics for Engineering 1: Electronics and Electrical | | | X | | | | | X | | |
| FY9T 34 | Analogue Electronic Principles (double Unit) | | | X | | | X | | | | |
| DG31 34 | Applications of Programmable Logic Controllers | | | | | | X | | | | X |
| DG40 34 | Implementing Small Local Area Networks | | | | | | X | | | | |
| DG4L 34 | Mathematics for Engineering 2 | | | | X | | | | | | X |
| FY9E 34 | DC and AC Principles | | | X | | | | | | | X |
| DN3T 34 | Electrical Systems in Potentially Explosive and Gas Hazardous Environments | | | | | X | | | | | |
| DN3Y 34 | Fundamentals of Control Systems and Transducers | | | | | | | | | | X |
| FY9R 34 | Power Electronics | | | | X | | | | | | |
| H01V 34 | Electrical Safety | | | | | X | | X | | | |
| DT9X 34 | Pneumatics and hydraulics | | | | | | | | X | | |

| | | A32 Maintain safe, legal and effective working practices on board a vessel | A36 Manage your own resources | C13 Operate and adjust vessel electrical equipment | C14 Operate and maintain vessel electrical variable speed drives and propulsion systems | C15 Operate and maintain electrical equipment in hazardous areas on board a vessel | C16 Operate and maintain vessel internal communication and computer network systems | C17 Operate and maintain high voltage equipment on board a vessel | C33 Carry out maintenance of vessel electrical machinery and systems | C35 Carry out maintenance of vessel telecommunications and navigation systems | C41 Identify and report variations in vessel electrical, instrumentation and control systems |
|---------|---|--|-------------------------------|--|---|--|---|---|--|---|--|
| Code | Unit title | National Occupation Standards | | | | | | | | | |
| DX48 34 | Distributed Control systems (double Unit) | | | | | | | | | | X |
| F90W 34 | Marine Engineering: Electrical and Electronic Devices | | | X | | | | | X | | |
| F90X 34 | Marine Engineering: Electrical Motors and Generators | | | X | | | | | X | | |
| F912 34 | Marine Engineering: Propulsion | X | | | X | | | | X | | |
| H0EJ 35 | Marine Engineering: Marine Management (double Unit) | | | | | | | | | | |
| DG3J 35 | Electronic Fault Finding | | | | | | | | | X | X |
| DN43 35 | Switchgear and Protection of High Voltage Systems | | | | | | | X | | | |
| DN49 35 | Transformers | | | X | X | | | | X | | |
| DN4C 35 | Applications of Power Electronics in Electrical Motor Drive Systems | | | | X | | | | | | |
| H1FC 35 | Marine Navigation Systems (double Unit) | | | | | | | | | X | |
| H1FD 35 | Radio Communications (double Unit) | | | | | | X | | | X | |

| Code | Unit title | A32 Maintain safe, legal and effective working practices on board a vessel | A36 Manage your own resources | C13 Operate and adjust vessel electrical equipment | C14 Operate and maintain vessel electrical variable speed drives and propulsion systems | C15 Operate and maintain electrical equipment in hazardous areas on board a vessel | C16 Operate and maintain vessel internal communication and computer network systems | C17 Operate and maintain high voltage equipment on board a vessel | C33 Carry out maintenance of vessel electrical machinery and systems | C35 Carry out maintenance of vessel telecommunications and navigation systems | C41 Identify and report variations in vessel electrical, instrumentation and control systems |
|---------|--|--|-------------------------------|--|---|--|---|---|--|---|--|
| | | National Occupation Standards | | | | | | | | | |
| H1ST 34 | Marine Electro-Technology: Graded Unit 1 Examination for level 7 Units | | | | | | | | | | |
| H1SV 35 | Marine Electro-Technology: Graded Unit 2 Project (double Unit) | | X | | | | | | | | |

5.3 Mapping of Core Skills development opportunities across the qualification(s)

| Unit code | Unit title | Communication | | Numeracy | | ICT | | Problem Solving | | | Working with Others | |
|-----------|--|---------------|------|--------------|-----------------------------|-----------------------|--------------------------------|-------------------|-------------------------|--------------------------|------------------------------------|-------------------------------------|
| | | Written | Oral | Using Number | Using Graphical Information | Accessing Information | Providing/Creating Information | Critical Thinking | Planning and Organising | Reviewing and Evaluating | Working Co-operatively with Others | Reviewing Co-operative Contribution |
| DG4H 33 | Mathematics for Engineering 1: Electronics and Electrical | | | F | F | | | | | | | |
| FY9T 34 | Analogue Electronic Principles (double Unit) | | | | | | | | | | | |
| DG31 34 | Applications of Programmable Logic Controllers | S | | S | S | S | S | | | | | |
| DG40 34 | Implementing Small Local Area Networks | S | | S | S | S | S | | | | | |
| DG4L 34 | Mathematics for Engineering 2 | | | F | F | | | | | | | |
| FY9E 34 | DC and AC Principles | S | | S | S | S | S | | | | | |
| DN3T 34 | Electrical Systems in Potentially Explosive and Gas Hazardous Environments | S | | | | | | | | | | |
| DN3Y 34 | Fundamentals of Control Systems and Transducers | S | | | S | | | S | | | S | |
| FY9R 34 | Power Electronics | S | | S | S | S | S | S | | S | | |
| H01V 34 | Electrical Safety | S | S | | | | | S | | | S | |
| DT9X 34 | Pneumatics and hydraulics | S | | | | | | S | | | | |

| Unit code | Unit title | Communication | | Numeracy | | ICT | | Problem Solving | | | Working with Others | |
|-----------|---|---------------|------|--------------|-----------------------------|-----------------------|--------------------------------|-------------------|-------------------------|--------------------------|------------------------------------|-------------------------------------|
| | | Written | Oral | Using Number | Using Graphical Information | Accessing Information | Providing/Creating Information | Critical Thinking | Planning and Organising | Reviewing and Evaluating | Working Co-operatively with Others | Reviewing Co-operative Contribution |
| DX48 34 | Distributed Control systems (double Unit) | S | | | | | S | | | | S | |
| F90W 34 | Marine Engineering: Electrical and Electronic Devices | S | S | | | | | | | | | |
| F90X 34 | Marine Engineering: Electrical Motors and Generators | | | | | | | | | | S | |
| F912 34 | Marine Engineering: Propulsion | | | | | | S | S | | | | |
| H0EJ 35 | Marine Engineering: Marine Management (double Unit) | S | S | | | | | S | S | S | S | |
| DG3J 35 | Electronic Fault Finding | | | | | | | | | | | |
| DN43 35 | Switchgear and Protection of High Voltage Systems | S | | S | | | | S | | | | |
| DN49 35 | Transformers | S | | S | | | | S | | | | |
| DN4C 35 | Applications of Power Electronics in Electrical Motor Drive Systems | S | | S | S | | S | S | | | | |
| H1FC 35 | Marine Navigation Systems (double Unit) | | | | | | | S | | S | S | |
| H1FD 35 | Radio Communications (double Unit) | | | | | | | S | | S | S | S |

| Unit code | Unit title | Communication | | Numeracy | | ICT | | Problem Solving | | | Working with Others | |
|-----------|--|---------------|------|--------------|-----------------------------|-----------------------|--------------------------------|-------------------|-------------------------|--------------------------|------------------------------------|-------------------------------------|
| | | Written | Oral | Using Number | Using Graphical Information | Accessing Information | Providing/Creating Information | Critical Thinking | Planning and Organising | Reviewing and Evaluating | Working Co-operatively with Others | Reviewing Co-operative Contribution |
| H1ST 34 | Marine Electro-Technology: Graded Unit 1 Examination for level 7 Units | | | | | | | | | | | |
| H1SV 35 | Marine Electro-Technology: Graded Unit 2 Project (double Unit) | | | | | | | E | E | E | | |

Key to tables

S = signposted

E = embedded

- OC = Oral communications
- WC = Written Communication (Reading and Writing)
- UN = Using numbers
- UGI = Using Graphical Information
- AI = Accessing Information
- PCI = Providing/Creating Information
- CT = Critical Thinking
- P&O = Planning and Organising
- R&E = Reviewing and Evaluating
- WCO = Working Co-operatively with Others
- RCC = Reviewing Co-operative Contribution

Oral Communication — SCQF level 6

- a Use vocabulary and a range of spoken language structures consistently and effectively at an appropriate level of formality.
- b Convey all essential information, opinions, or ideas with supporting detail accurately and coherently, and with varied emphasis as appropriate.
- c Structure communication to take full account of purpose and audience.
- d Take account of situation and audience during delivery.
- e Respond to others, taking account of their contributions.

| Units | Developed/ assessed | a | b | c | d | e |
|---|------------------------|---|---|---|---|---|
| Marine Engineering: Electrical and Electronic Devices | Developed | ✓ | | | | ✓ |
| Marine Engineering: Electrical Motors and Generators | Developed | ✓ | | | | |
| Marine Engineering: Marine Management | Developed | | ✓ | ✓ | ✓ | ✓ |

Key:

✓ = link between Unit and learning Outcome

Written Communication (Reading) — SCQF level 6

- a Identify and summarise all significant information, ideas and supporting details in a complex written communication.
- b Evaluate fully the effectiveness of a communication in meeting its purpose and the needs of its intended readership

| Knowledge/Skills/Evidence | Developed/ assessed | a | b |
|--|------------------------|---|---|
| Marine Engineering: Propulsion | Developed | ✓ | |
| Marine Engineering: Electrical Motors and Generators | Developed | ✓ | |
| Fundamentals of Control Systems and Transducers | Developed | ✓ | |
| Switchgear and Protection of High Voltage Systems | Developed | ✓ | |
| Electrical systems in potentially explosive and gas hazardous environments | Developed | ✓ | |
| Power Electronics | Developed | ✓ | |
| Marine Engineering: Marine Management | Developed | ✓ | ✓ |
| Electrical Safety | Developed | ✓ | |
| Application of Power Electronics in Electrical Motor Drive Systems | Developed | ✓ | |
| Transformers | Developed | ✓ | |

Written Communication (Writing) — SCQF level 6

- a Present all essential ideas/information and supporting detail in a logical and effective order.
- b Use a structure which takes account of purpose and audience and links major and minor points in ways which assist the clarity and impact of the writing.
- c Use conventions which are effective in achieving the purpose of the piece and adapted as necessary for the target audience.
- d Use spelling, punctuation, and sentence structures which are consistently accurate .
- e Vary sentence structure, paragraphing, and vocabulary to suit the purpose and target audience.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b | c | d | e |
|--|------------------------|---|---|---|---|---|
| Applications of Programmable Logic Controllers | Developed | ✓ | | | | ✓ |
| Implementing Small Local Area Networks | Developed | | ✓ | | ✓ | |
| DC and AC Principles | Developed | | ✓ | ✓ | ✓ | |
| Electrical Systems in Potentially Explosive and Gas Hazardous Environments | Developed | ✓ | | | | |
| Fundamentals of Control Systems and Transducers | Developed | ✓ | | | | ✓ |
| Power Electronics | Developed | | | ✓ | | |
| Electrical Safety | Developed | ✓ | | | ✓ | |
| Pneumatics and hydraulics | Developed | ✓ | | ✓ | | |
| Distributed Control systems | Developed | | ✓ | ✓ | | |
| Marine Engineering: Electrical and Electronic Devices | Developed | | | ✓ | | |
| Marine Engineering: Electrical Motors and Generators | Developed | ✓ | | | | ✓ |
| Marine Engineering: Propulsion | Developed | ✓ | | | | ✓ |

Using Graphical Information — SCQF level 6

- a Extract, analyse, and interpret graphical information.
- b Select an appropriate form of complex table, chart, diagram, or qualitative form, and communicate complex information in that form.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b |
|--|------------------------|---|---|
| Mathematics for Engineering 1: Electronics and Electrical | Developed | ✓ | ✓ |
| Analogue Electronic Principles | Developed | ✓ | ✓ |
| Applications of Programmable Logic Controllers | Developed | ✓ | |
| Implementing Small Local Area Networks | Developed | ✓ | |
| Mathematics for Engineering 2 | Developed | ✓ | ✓ |
| DC and AC Principles | Developed | ✓ | ✓ |
| Fundamentals of Control Systems and Transducers | Developed | ✓ | ✓ |
| Power Electronics | Developed | ✓ | ✓ |
| Pneumatics and hydraulics | Developed | ✓ | ✓ |

Using Number — SCQF level 6

- a Work confidently with numerical or statistical methods.
- b Decide on the steps and operations to be carried out to solve a complex problem.
- c Carry out a number of sustained, complex calculations.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b | c |
|--|------------------------|---|---|---|
| Mathematics for Engineering 1: Electronics and Electrical | Developed | ✓ | ✓ | ✓ |
| Analogue Electronic Principles | Developed | ✓ | ✓ | ✓ |
| Applications of Programmable Logic Controllers | Developed | ✓ | ✓ | |
| Implementing Small Local Area Networks | Developed | ✓ | ✓ | |
| Mathematics for Engineering 2 | Assessed | ✓ | ✓ | ✓ |
| DC and AC Principles | Developed | ✓ | ✓ | ✓ |
| Fundamentals of Control Systems and Transducers | Developed | ✓ | ✓ | ✓ |
| Power Electronics | Developed | ✓ | | |
| Pneumatics and hydraulics | Developed | ✓ | ✓ | |

Accessing Information — SCQF level 6

- a Use a range of ICT equipment, observing security procedures.
- b Carry out complex searches for information.
- c Evaluate reliability of information using given criteria.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b | c |
|---|--------------------------------|----------|----------|----------|
| Applications of Programmable Logic Controllers | Developed | ✓ | ✓ | ✓ |
| Implementing Small Local Area Networks | Developed | ✓ | | |
| DC and AC Principles | Developed | ✓ | | |
| Fundamentals of Control Systems and Transducers | Developed | ✓ | ✓ | ✓ |
| Power Electronics | Developed | ✓ | | |

Providing/Creating Information — SCQF level 6

- a Use a range of ICT equipment, observing security procedures and needs of other users.
- b Resolve simple hardware or software problems.
- c Use software in unfamiliar contexts.
- d Evaluate information.
- e Present findings in an appropriate format.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b | c | d | e |
|---|------------------------|---|---|---|---|---|
| Applications of Programmable Logic Controllers | Developed | | ✓ | ✓ | ✓ | |
| Implementing Small Local Area Networks | Developed | ✓ | | | ✓ | ✓ |
| DC and AC Principles | Developed | ✓ | | | | |
| Fundamentals of Control Systems and Transducers | Developed | ✓ | | | ✓ | |
| Power Electronics | Developed | ✓ | | | | |
| Pneumatics and hydraulics | Developed | | ✓ | ✓ | ✓ | ✓ |
| Distributed Control systems | Developed | ✓ | ✓ | ✓ | | |

Critical Thinking — SCQF level 6

- a Identify the factors involved in the situation or issue.
- b Assess the relevance of these factors to the situation or issue.
- c Develop and justify an approach to deal with the situation or issue.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b | c |
|---|------------------------|---|---|---|
| Marine Engineering: Marine Management | Developed | ✓ | | ✓ |
| Electronic Fault Finding | Developed | ✓ | ✓ | |
| Switchgear and Protection of High Voltage Systems | Developed | ✓ | ✓ | |
| Electrical Safety | Developed | ✓ | ✓ | |
| Transformers | Developed | ✓ | ✓ | ✓ |
| Marine Navigation Systems | Developed | ✓ | ✓ | ✓ |
| Radio Communications | Developed | ✓ | ✓ | ✓ |
| Marine Electro-Technology: Graded Unit 2 Project | Assessed | ✓ | ✓ | ✓ |

Planning and Organising — SCQF level 6

- a Develop a plan.
- b Identify and obtain resources to carry out the plan.
- c Carry out the task.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b | c |
|--|--------------------------------|----------|----------|----------|
| Marine Engineering: Marine Management | Developed | ✓ | | |
| Marine Electro-Technology: Graded Unit 2 Project | Assessed | ✓ | ✓ | ✓ |

Reviewing and Evaluating — SCQF level 6

- a Evaluate the effectiveness of the strategy/strategies.
- b Identify and gather appropriate evidence.
- c Draw conclusions and make recommendations.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b | c |
|--|------------------------|---|---|---|
| Marine Engineering: Marine Management | Developed | | ✓ | ✓ |
| Electronic Fault Finding | Developed | ✓ | ✓ | |
| Power Electronics | Developed | | ✓ | |
| Marine Navigation Systems | Developed | ✓ | ✓ | ✓ |
| Radio Communications | Developed | ✓ | ✓ | ✓ |
| Marine Electro-Technology: Graded Unit 2 Project | Assessed | ✓ | ✓ | ✓ |

Working Co-operatively with Others — SCQF level 6

- a Analyse own role and the roles that make up the activity and/or activities and the relationship between them.
- b Organise own role to contribute effectively to the activity and/or activities, adapting own role as necessary.
- c Negotiate working methods.
- d Promote co-operative working with others, progress towards shared goal.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b | c | d |
|---------------------------------------|------------------------|---|---|---|---|
| Marine Engineering: Marine Management | Developed | | | ✓ | ✓ |
| Marine Navigation Systems | Developed | ✓ | ✓ | ✓ | ✓ |
| Radio Communications | Developed | ✓ | ✓ | ✓ | ✓ |

Reviewing Co-operative Contribution — SCQF level 5

- a Evaluate overall co-operative working, considering own involvement and the involvement of others, referring to supporting evidence.
- b Draw conclusions and justify them with reference to supporting evidence.
- c Identify own learning and objectives for future co-operative working.

| Knowledge/Skills/Evidence | Developed/ assessed | a | b | c |
|---------------------------------------|--------------------------------|----------|----------|----------|
| Marine Engineering: Marine Management | Assessed | | ✓ | |
| Marine Navigation Systems | Developed | ✓ | ✓ | |
| Radio Communications | Developed | ✓ | ✓ | |

5.4 Mapping of STCW 2010 to qualification (A-III/6)

ETO competencies (Operational level)

Mapped to *Table A-III/6* (See table below) — Specification of minimum standards of competence for electro-technical officers.

Reference: STCW, including 2010 Manila Amendments ISBN 978-92-801-1528-4

| Competence | Knowledge, understanding and proficiency | |
|---|--|---|
| Monitor the operation of electrical, electronic and control systems | <p>Basic understanding of the operation of mechanical engineering systems, including:</p> <ol style="list-style-type: none"> 1 prime movers, including main propulsion plant 2 engine-room auxiliary machinery 3 steering systems 4 cargo handling systems 5 deck machinery 6 hotel systems <p>Basic knowledge of heat transmission, mechanics and hydromechanics</p> <p><i>Knowledge of:</i></p> <p>Electro-technology and electrical machines theory</p> <p>Fundamentals of electronics and power electronics</p> <p>Electrical power distribution boards and electrical equipment</p> <p>Fundamentals of automation, automatic control systems and technology</p> | <p>TRB section</p> <p>C13.1, C13.3, C33.10, C33.11, C33.13</p> <p>Marine Engineering Propulsion F912 34</p> <p>Marine Engineering: Electrical and electronic devices F90W 34</p> <p>Marine Engineering: Electrical motors and generators F90X 34</p> <p>Control systems & transducers DN3Y 34</p> <p>Power electronics FY9R 34</p> <p>Electrical safety H01V 34</p> <p>Pneumatics and Hydraulics</p> <p>DT9X 34</p> <p>Transformers DN49 35</p> <p>Diploma in Maintenance (GD20 60)</p> |

| Competence | Knowledge, understanding and proficiency | |
|--|--|---|
| | Instrumentation, alarm and monitoring systems Electrical drives Technology of electrical materials Electro-hydraulic and electro-pneumatic control systems Appreciation of the hazards and precautions required for the operation of power systems above 1,000 volts | <ul style="list-style-type: none"> ◆ Marine lighting and control systems ◆ Main vessel electrical installation ◆ Maintaining electrical equipment/systems |
| Monitor the operation of automatic control systems of propulsion and auxiliary machinery | Preparation of control systems of propulsion and auxiliary machinery for operation | Diploma in Maintenance (GD20 60) <ul style="list-style-type: none"> ◆ Marine lighting and control systems Distributed control systems DX48 34 Applications of power electronics in Electrical motor drive systems DN4C 35 |
| Operate generators and distribution systems | Coupling, load sharing and changing over generators Coupling and breaking connection between switchboards and distribution panels | Diploma in Maintenance (GD20 60) <ul style="list-style-type: none"> ◆ Main vessel electrical installation ◆ Maintaining electrical equipment/systems Marine Engineering: Electrical motors and generators F90X 34 Transformers DN49 35 TRB tasks C13.2, C13.3 & C17.4 |

| Competence | Knowledge, understanding and proficiency | |
|---|--|---|
| Operate and maintain power systems in excess of 1,000 volts | <p><i>Theoretical knowledge</i></p> <p>High-voltage technology</p> <p>Safety precautions and procedures</p> <p>Electrical propulsion of the ships' electrical motors and control systems</p> <p><i>Practical knowledge</i></p> <p>Safe operation and maintenance of high-voltage systems, including knowledge of the special technical type of high-voltage systems and the danger resulting from operational voltage of more than 1,000 volts</p> | <p>Diploma in Maintenance (GD20 60)</p> <ul style="list-style-type: none"> ◆ High voltage awareness <p>MNTB HV Awareness course</p> <p>Switchgear and protection of High Voltage Systems DN43 35</p> |
| Operate computers and computer networks on ships | <p>Understanding of:</p> <ol style="list-style-type: none"> 1 main features of data processing 2 construction and use of computer networks on ships 3 bridge-based, engine-room-based and commercial computer use | <p>Implementing Small Local Area Networks DG40 34</p> <p>Diploma in Maintenance (GD20 60)</p> <ul style="list-style-type: none"> ◆ Marine lighting and control systems |
| Use English in written and oral form | <p>Adequate knowledge of the English language to enable the officer to use engineering publications and to perform the officer's duties</p> | <p>Assessment within HND programme and MCA oral</p> <p>Entry level requirements of programme</p> |
| Use internal communication systems | <p>Operation of all internal communication systems on board</p> | <p>Diploma in Maintenance (GD20 60)</p> <ul style="list-style-type: none"> ◆ Marine vessel communication systems |

| Competence | Knowledge, understanding and proficiency | |
|---|--|---|
| Maintenance and repair of electrical and electronic equipment | <p>Safety requirements for working on shipboard electrical systems, including the safe isolation of electrical equipment required before personnel are permitted to work on such equipment</p> <p>Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment</p> <p>Detection of electric malfunction, location of faults and measures to prevent damage</p> <p>Construction and operation of electrical test and measuring equipment</p> <p>Function and performance tests of the following equipment and their configuration:</p> <ol style="list-style-type: none"> 1 Monitoring systems 2 Automatic control systems 3 Protective devices <p>The interpretation of electrical and electronic diagrams</p> | <p>Diploma in Maintenance (GD20 60)</p> <ul style="list-style-type: none"> ◆ Marine vessel electronic systems assembly ◆ Marine vessel electronic systems design and test ◆ Maintaining electrical equipment/systems <p>Electronic fault finding DG3J 35 Marine Engineering: Electrical motors and generators F90X 34 Radio Communications (H1FD 35)</p> <p>TRB tasks C33.1, C33.4, C33.5, C33.6, C33.8, C35.1</p> |
| Maintenance and repair of automation and control systems of main propulsion and auxiliary machinery | <p>Appropriate electrical and mechanical knowledge and skills</p> <p><i>Safety and emergency procedures</i></p> <p>Safe isolation of equipment and associated systems required before personnel are permitted to work on such plant or equipment</p> <p>Practical knowledge for the testing, maintenance, fault finding and repair</p> | <p>Diploma in Maintenance (GD20 60)</p> <ul style="list-style-type: none"> ◆ Marine lighting and control systems ◆ Maintaining electrical equipment/systems <p>Control systems & transducers DN3Y 34</p> |

| Competence | Knowledge, understanding and proficiency | |
|--|--|---|
| | Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition | Electrical Safety H01V 34 TRB tasks C33.4, C33.5, C33.6, C33.7, C33.8, C41 (all) |
| Maintenance and repair of bridge navigation equipment and ship communication systems | <p>Knowledge of the principles and maintenance procedures of navigation equipment, internal and external communication systems</p> <p><i>Theoretical knowledge</i></p> <p>Electrical and electronic systems operating in flammable areas</p> <p><i>Practical knowledge</i></p> <p>Carrying out safe maintenance and repair procedures</p> <p>Detection of machinery malfunction, location of faults and action to prevent damage</p> | <p>Diploma in Maintenance (GD20 60)</p> <ul style="list-style-type: none"> ◆ Marine vessel communication systems ◆ Marine vessel Electronic Navigation Equipment Maintenance <p><i>Analogue electronic principles</i> DG2X 34</p> <p>Marine Navigation systems (H1FC 35)</p> <p>Electrical systems in hazardous areas DN3T 34</p> <p>Radio Communications (H1FD 35)</p> <p>TRB tasks C35 (all), C15</p> |

| Competence | Knowledge, understanding and proficiency | |
|---|---|---|
| Maintenance and repair of electrical, electronic and control systems of deck machinery and cargo-handling equipment | <p>Appropriate electrical and mechanical knowledge and skills</p> <p><i>Safety and emergency procedures</i></p> <p>Safe isolation of equipment and associated systems required before personnel are permitted to work on such plant or equipment</p> <p>Practical knowledge for the testing, maintenance, fault finding and repair</p> <p>Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition</p> | <p>Diploma in Maintenance (GD20 60)</p> <ul style="list-style-type: none"> ◆ Maintaining electrical equipment/systems <p>Electronic fault finding DG3J 35 Electrical systems in potentially explosive and gas hazardous environments DN3T 34 Marine Engineering: Electrical motors and generators F90X 34 Electrical Safety H01V 34</p> <p>TRB tasks C33, C15</p> |
| Maintenance and repair of control and safety systems of hotel equipment prevent damage | <p><i>Theoretical knowledge</i></p> <p>Electrical and electronic systems operating in flammable areas</p> <p><i>Practical knowledge</i></p> <p>Carrying out safe maintenance and repair procedures</p> <p>Detection of machinery malfunction, location of faults and action to</p> | <p>Diploma in Maintenance (GD20 60)</p> <ul style="list-style-type: none"> ◆ Maintaining electrical equipment/systems <p>Marine Engineering: Electrical motors and generators F90X 34</p> <p>Electrical Safety H01V 34</p> |

| Competence | Knowledge, understanding and proficiency | |
|--|---|---|
| Ensure compliance with pollution prevention requirements | <p><i>Prevention of pollution of the marine environment</i></p> <p>Knowledge of the precautions to be taken to prevent pollution of the marine environment</p> <p>Anti-pollution procedures and all associated equipment</p> <p>Importance of proactive measures to protect the marine environment</p> | <p>Marine Engineering: Marine Management H0EJ 35</p> <p>TRB tasks 3.1</p> |
| Prevent, control and fight fire on board | <p><i>Fire prevention and fire-fighting appliances</i></p> <p>Knowledge of fire prevention</p> <p>Ability to organize fire drills</p> <p>Knowledge of fire-fighting systems</p> <p>Action to be taken in the event of fire, including fires involving oil systems</p> | <p>STCW advanced fire fighting course</p> <p>TRB tasks A11</p> |
| Operate life-saving appliances | <p><i>Life saving</i></p> <p>Ability to organize abandon ship drills and knowledge of the operation of survival craft and rescue boats, their launching appliances and arrangements, and their equipment, including radio life-saving appliances, satellite EPIRBs, SARTs, immersion suits and thermal protective aids</p> <p>Knowledge of survival at sea techniques</p> | <p>STCW Proficiency in Survival Craft and Rescue Boats + Personal Survival Training</p> <p>TRB tasks A11, A15</p> |

| Competence | Knowledge, understanding and proficiency | |
|---|--|---|
| Apply medical first aid on board ship | <p><i>Medical aid</i></p> <p>Practical application of medical guides and advice by radio, including the ability to take effective action based on such knowledge in the case of accidents or illnesses that are likely to occur on board ship</p> | STCW medical first aid course |
| Application of leadership and team working skills | <p>Working knowledge of shipboard personnel management and training</p> <p>Ability to apply task and workload management, including;</p> <ol style="list-style-type: none"> 1 Planning and co-ordination 2 Personnel assignment 3 Time and resource constraints 4 Prioritisation <p>Knowledge and ability to apply effective resource management:</p> <ol style="list-style-type: none"> 1 Allocation, assignment, and prioritization of resources 2 Effective communication on board and ashore 3 Decisions reflect consideration of team experiences 4 Assertiveness and leadership, including motivation 5 Obtaining and maintaining situational awareness <p>Knowledge and ability to apply decision-making techniques:</p> | Stcw Leadership & Management course at Operational level. |

| Competence | Knowledge, understanding and proficiency | |
|--|---|--|
| | <ol style="list-style-type: none"> 1 Situational and risk assessment 2 Identify and consider generated options 3 Selecting course of action 4 Evaluation of Outcome effectiveness | |
| Contribute to the safety of personnel and ship | <p>Knowledge of personal survival techniques</p> <p>Knowledge of fire prevention and ability to fight and extinguish fires</p> <p>Knowledge of elementary first aid</p> <p>Knowledge of personal safety and social responsibilities</p> | Basic STCW courses of PST, BFF, EFA and PSSR |

5.5 Assessment strategy

An appropriate assessment strategy is in place for the HND in Electrical and Electro-Technology. This strategy had to reflect the needs of the award with regard to STCW and therefore MCA certification. The assessment strategy is outlined below.

Aims

To ensure that:

- ◆ A consistent, rigorous and efficient approach to assessment is used.
- ◆ Assessment instruments for general and graded units satisfy national agreed standards.
- ◆ The assessment load on learners and staff is reasonable and does not unduly detract from teaching and learning elements
- ◆ Reliable and rigorous verification processes are put in place in order to ensure that national standards are achieved.

Objectives

Adopt a holistic approach to assessment. The implications of this are:

- 1 Assessment instruments will be designed to sample Knowledge and Skills in each Unit.
- 2 A Unit assessment strategy will be adopted, where possible, to produce a single assessment instrument for the whole Unit. Where this is not possible the minimum number of assessment instruments required should be used.
- 3 While not seeking to be entirely prescriptive with regard to time spent on assessment in each HN Unit, over assessment should be avoided.
- 4 Ensure that consistent and rigorous internal and external verification procedures operate throughout.

Graded Unit assessment

It is recommended that learners study the key contributing HN Units prior to sitting the Graded Unit examination for the SCQF level 7 Units. The final HND Graded Unit at SCQF level 8 is a project based assessment during which learners should be studying, and include, all the contributing HN Units.

Formative assessment

Formative assessment should be used throughout Unit delivery to reinforce learning, build learners' confidence and prepare them for summative assessment.

Re-assessment

The way in which centres re-assess learners is integral to the way they manage the award assessment process as a whole. Re-assessment should be subject to same rigorous internal verification as the primary assessment process.

Due to the sampling nature of assessment for the Group Award Units and the need for a 50% pass mark level, all learners must be reassessed utilising a substantially different and alternative assessment. This will be undertaken by the re-assessment of the Unit that has not yet achieved the pass grade, and should be based on a substantially different assessment paper.

Re-assessment should be operated in accordance with a centre's assessment policy and the professional judgement of the assessor. The award will utilise current SQA advice that there should normally be at least one re-assessment opportunity available to all learners.

Developing alternative assessments

The design of original assessments should inform the re-assessment process to a large extent as the original determines the type of assessment instruments used and the purpose of the assessment. It is normal practice for centres to build up a bank of assessments which can be used for re-assessment purposes.

Assessment writers should always refer to the Unit specification when developing an alternative assessment to ensure that it is of equal demand to the original and that it covers the relevant criteria.

6 Guidance on approaches to delivery and assessment

The elements of this training scheme will be:

A higher education qualification which delivers the knowledge and understanding required under Table A-III/6 (see table in Section 5.4) of the STCW 2010 Manila Amendments.

A practical skills development qualification that provides the skills required under Table A-III/6 (See table in Section 5.4). The SQA qualification GD20 60 (QCF 600/2814/2) has already been developed to meet this training need.

An onboard ETO Training Record Book developed by the Merchant Navy Training Board.

Two training routes are available:

| | Duration | Content |
|----------------------|------------------|---|
| First College Phase | 40 weeks | STCW Basic Training Courses HND Year 1 ETO workshop skills (delivery of relevant electrical proportion) |
| Second College Phase | 40 weeks | HND Year 2 Delivery of electronic elements and final assessment of ETO workshop skills |
| First sea phase | 8 months onboard | Shipboard induction, familiarisation with ETO roles onboard. Undertake planned onboard training documented in the Training Record Book |
| Third College Phase | 8 weeks | STCW advanced courses. Preparation for MCA oral examination for STCW 2010 reg. A-III/6 ETO certificate of competency. |

| | Duration | Content |
|----------------------|-----------------|---|
| First College Phase | 32 weeks | STCW Basic Training Courses Industry, company and college induction. Higher Education Access course (Marine Engineering scheme profile) Delivery of electrical elements of ETO workshop skills |
| First sea phase | 28 weeks | Shipboard induction, familiarisation with electrical operations. Undertake planned training documented in the Training Record Book |
| Second College Phase | 36 weeks | Assess/consolidate learning from sea phase. HND Year 1 programme (15 Units) Delivery of electronic elements of ETO workshop skills |

| | Duration | Content |
|---------------------|-----------------|--|
| Second sea phase | 26 weeks | Development of shipboard operations and skills - emphasis moves from basic skills to full ETO duties and responsibilities, including understudying the ETO where feasible Complete programme of shipboard training documented in the Training Record Book |
| Third College Phase | 30 weeks | STCW advanced courses HND Year 2 programme (15 Units) Preparation for MCA oral examination for STCW2010 Reg. III/6 ETO certificate of competency. |

6.1 Sequencing/integration of Units

| Unit No | Unit title | Year | Credit value | SCQF level |
|---------|--|------|--------------|------------|
| DG4H 33 | Mathematics for Engineering 1: Electronics and Electrical | 1 | 1 | 3 |
| FY9T 34 | Analogue Electronic Principles | 1 | 2 | 4 |
| DG4L 34 | Mathematics for Engineering 2 | 1 | 1 | 4 |
| FY9E 34 | DC and AC Principles | 1 | 1 | 4 |
| DN3Y 34 | Fundamentals of Control Systems and Transducers | 1 | 1 | 4 |
| FY9R 34 | Power Electronics | 1 | 1 | 4 |
| H01V 34 | Electrical Safety | 1 | 1 | 4 |
| DT9X 34 | Pneumatics and hydraulics | 1 | 1 | 4 |
| DX48 34 | Distributed Control systems | 1 | 2 | 4 |
| F90W 34 | Marine Engineering: Electrical and Electronic Devices | 1 | 1 | 4 |
| F90X 34 | Marine Engineering: Electrical Motors and Generators | 1 | 1 | 4 |
| F912 34 | Marine Engineering: Propulsion | 1 | 1 | 4 |
| H1ST 34 | Marine Electro-Technology: Graded Unit 1 Examination | 1 | 1 | 4 |
| | | | 15 | |
| DN3T 34 | Electrical Systems in Potentially Explosive and Gas Hazardous Environments | 2 | 1 | 4 |
| DG31 34 | Applications of Programmable Logic Controllers | 2 | 1 | 4 |
| DG40 34 | Implementing Small Local Area Networks | 2 | 1 | 4 |
| H0EJ 35 | Marine Engineering: Marine Management | 2 | 2 | 5 |
| DG3J 35 | Electronic Fault Finding | 2 | 1 | 5 |
| DN43 35 | Switchgear and Protection of High Voltage Systems | 2 | 1 | 5 |
| DN49 35 | Transformers | 2 | 1 | 5 |
| DN4C 35 | Applications of Power Electronics in Electrical Motor Drive Systems | 2 | 1 | 5 |
| H1FC 35 | Marine Navigation Systems | 2 | 2 | 5 |
| H1FD 35 | Radio Communications | 2 | 2 | 5 |
| H1SV 35 | Marine Electro-Technology: Graded Unit 2 Project | 2 | 2 | 5 |
| | | | 15 | |

6.2 Recognition of Prior Learning

Applications for Accreditation of Prior Learning would be accepted where the same or similar HN Units have been undertaken. Evidence of the previous full award would be provided by the learner, to enable centre academic staff to make a review of whether prior learning could be accepted.

Where the learner requires only the MCA Certificate of Competency, then the learner would be directed to contact the MCA for a 'Letter of Initial Assessment'

6.2.1 Articulation and/or progression

Learners who complete the award will have the opportunity to progress to higher level qualifications. Students who successfully achieve the HND programme can progress to a number of higher education programmes which match their career aspirations.

Current articulation routes includes Northumbria University validated B.Eng. in Marine Engineering, one year top-up award

6.2.2 Professional recognition

On completion of the HND award learners may have the opportunity to apply for associate membership of the Institute of Marine Engineering, Science and Technology and subsequently gain Incorporated Engineer status with the Engineering Council with additional learning as outlined by IMarEST.

6.2.3 Credit Transfer

| New Unit Title | New Unit Code | Old Unit Title | Old Unit Code | Credit Transfer Conditions |
|---------------------------|---------------|---|---------------|--|
| Engineering Mathematics 1 | H7K033 | Mathematics for Engineering 1: Electronics and Electrical | DG4H33 | To gain credit transfer to the new unit candidates will have to provide additional evidence relating to functions as specified in the Evidence requirements in respect of the first three knowledge/skills in Outcome 1 and relating to vectors as specified in the first three knowledge/skills in outcome 3. |
| Engineering Mathematics 1 | H7K033 | Mathematics for Engineering 1: Mechanical and Manufacturing | DT5X33 | To gain credit transfer to the new unit candidates will have to provide additional evidence relating to functions as specified in the Evidence requirements in respect of the first three knowledge/skills in Outcome 1 and relating to 3D vectors and complex numbers as |

| | | | | |
|---------------------------|------------|-------------------------------|------------|---|
| | | | | specified in the knowledge/skills in outcome 3. |
| Engineering Mathematics 2 | H7K1 34 | Mathematics for Engineering 2 | DG4L 34 | To gain credit transfer to the new unit candidates will have to provide additional evidence relating to trigonometric and hyperbolic functions as specified in the Evidence requirements in respect of Outcome 1. |

6.3 Opportunities for e-assessment

This mode of delivery will not form any part of the qualification, until a proven record of learner achievement is available. Support materials will utilise an e-learning platform, but this is to supplement existing learning materials.

6.4 Support materials

The majority of Units within this qualification already exist within other SQA qualifications. As such, use will be made by the Delivery Centre to request existing pre-validated assessment material.

For the new Units, assessment will be created and validated internally utilising the centre's existing relationship with AMERC, who are recognised by the MCA as having technical expertise within the field of maritime radio communications and electronic navigation aids.
<http://www.amerc.ac.uk/>

6.5 Resource requirements

Each centre delivering this award will be required to have a range of electrical and electronic equipment that will enable the centre to replicate operational equipment onboard a modern merchant vessel. Operational radio and electronic navigational aids must be used within those Units where fault finding techniques are gained.

The range of physical resources available should include:

- Electrical distribution or switchboard
- Electrical circuit breaker
- Various electrical motors of sizes in excess of 20kW
- Hydraulic and pneumatic control valves
- Digital and analogue computer controllers
- Three term controller rig
- Pneumatic valve positioner
- Gyro compass
- Echosounder
- Speed log
- Radar with 'ARPA' capability
- GPS navigating Unit
- MF/HF transceiver
- Navtex receiver
- Marine VHF walkie talkie
- GMDSS station or simulation system

7 General information for centres

Equality and inclusion

The Unit specifications making up this Group Award have been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners will 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.

Internal and external verification

All assessments used within this/these qualification(s) should be internally verified, using the appropriate policy within the centre and the guidelines set by SQA.

External verification will be carried out by SQA to ensure that internal assessment is within the national guidelines for these qualifications.

Further information on internal and external verification can be found in *SQA's Guide to Assessment* (www.sqa.org.uk/GuideToAssessment).

In the UK outside of Scotland, Higher National Diploma (HND) or Higher National Certificate (HNC) is the registered trademark of Pearson Education Limited and the trademark is used under licence from Pearson Education Limited.

8 Glossary of terms

Embedded Core Skills: is where the assessment evidence for the Unit also includes full evidence for complete Core Skill or Core Skill components. A learner successfully completing the Unit will be automatically certificated for the Core Skill. (This depends on the Unit having been successfully audited and validated for Core Skills certification.)

Finish date: The end of a Group Award's lapsing period is known as the finish date. After the finish date, the Group Award will no longer be live and the following applies:

- ◆ learners may not be entered for the Group Award
- ◆ the Group Award will continue to exist only as an archive record on the Awards Processing System (APS)

Graded Unit: Graded Units assess learners' ability to integrate what they have learned while working towards the Units of the Group Award. Their purpose is to add value to the Group Award, making it more than the sum of its parts, and to encourage learners to retain and adapt their skills and knowledge. (**Note to writer:** delete if not applicable to product type)

Lapsing date: When a Group Award is entered into its lapsing period, the following will apply:

- ◆ the Group Award will be deleted from the relevant catalogue
- ◆ the Group Award specification will remain until the qualification reaches its finish date at which point it will be removed from SQA's website and archived
- ◆ no new centres may be approved to offer the Group Award
- ◆ centres should only enter learners whom they expect to complete the Group Award during the defined lapsing period

SQA credit value: The credit value allocated to a Unit gives an indication of the contribution the Unit makes to an SQA Group Award. An SQA credit value of 1 given to an SQA Unit represents approximately 40 hours of programmed learning, teaching and assessment.

SCQF: The Scottish Credit and Qualification Framework (SCQF) provides the national common framework for describing all relevant programmes of learning and qualifications in Scotland. SCQF terminology is used throughout this guide to refer to credits and levels. For further information on the SCQF visit the SCQF website at www.scqf.org.uk.

SCQF credit points: SCQF credit points provide a means of describing and comparing the amount of learning that is required to complete a qualification at a given level of the Framework. One National Unit credit is equivalent to 6 SCQF credit points. One National Unit credit at Advanced Higher and one Higher National Unit credit (irrespective of level) is equivalent to 8 SCQF credit points.

SCQF levels: The level a qualification is assigned within the framework is an indication of how hard it is to achieve. The SCQF covers 12 levels of learning. HNCs and HNDs are available at SCQF levels 7 and 8 respectively. Higher National Units will normally be at levels 6–9 and Graded Units will be at level 7 and 8. National Qualification Group Awards are available at SCQF levels 2–6 and will normally be made up of National Units which are available from SCQF levels 2–7.

Subject Unit: Subject Units contain vocational/subject content and are designed to test a specific set of knowledge and skills.

Signposted Core Skills: refers to opportunities to develop Core Skills arise in learning and teaching but are not automatically certificated.

9 General information for learners

The HND in Marine Electro-Technology has been designed to compliment and extend the current training routes for the Merchant Navy Officer Training Scheme. This phased training scheme consists of college and sea phases over the duration of approximately three and a half years, of which over eight months of the training will take place at sea.

Access to the programme is set by the delivering centre however you would normally be expected to have already achieved either:

At least two Higher level or A2 level passes of which one should be Mathematics or a Physical science, or equivalent to meet the minimum 120 UCAS points entry level. Learners should also have Standard Grade English Language at grade 3 or better (equivalent GCSE English at grade C or better). The following examples would also meet the minimum 120 UCAS points entry level:

- ◆ National Certificate in Electrical/Electronics at Pass/Merit grade
- ◆ National Diploma in Electrical/Electronics at Pass/Pass/Pass grade
- ◆ National Diploma in Engineering at Pass/Pass/Merit grade

Where non-UK qualifications are used to measure suitable entry level, then the learner would have High School certificates with pass in 12th Standard (10+2) from recognised articulation board in Physics, Chemistry and Maths group in Class XII, and at least 50% in English Language (equivalent to minimum IELTS 5.0 standard)

For those learners with at least five Standard Grade passes at grade 3 or better (GCSE at grade C or better) in Mathematics, Physics or Chemistry, and English Language, then a Higher Education Access course, such as the SQA Diploma in Shipping and Maritime Operations GA6F 57 would be required which matches the existing Access course for Marine Engineering schemes.

The HND has a number of aims which can be summarised as follows:

- ◆ Prepare you for oral examinations for ETO certification at the Operational level
- ◆ Contribute towards developing skills to enable learners to contribute to the safe and effective operation and maintenance of merchant vessels
- ◆ Contribute towards developing skills to enable you to work with others in safe and effective manner
- ◆ Contribute towards developing skills to deal with emergency situations
- ◆ Develop awareness of current maritime legislation
- ◆ Provide an award that on successful completion will allow you to progress to a degree in an engineering related discipline area
- ◆ Develop a range of project management skills
- ◆ Develop the analysis and synthesis skills necessary to ensure the efficient operation of the electrical, electronic and control elements within a modern merchant vessel
- ◆ Develop approaches to problem solving and critical thinking.
- ◆ Develop an evaluative and reflective approach to work and studies.
- ◆ Develop the ability to plan and organise studies.

- ◆ Develop skills for employability and allow for progression to higher qualifications.
- ◆ To enable you to consolidate knowledge and skills to enhance career progression.
- ◆ To develop Core Skills required by employers
- ◆ To develop skills which are capable of being transferred to any employment.
- ◆ To progress academically within the SCQF/QCF framework

When you complete the full training programme and have the required medical fitness certificate (ENG1) you will receive the ETO Certificate of Competency which will enable you to perform duties at the Operational level as Officers on a Merchant Navy vessel.

In addition after obtaining your HND you can progress onto the final year of a B.Eng. programme of some universities, as well as within the SCQF framework.

The award itself consists of twenty four mandatory Units listed (equates to 30 HN credits at SCQF level 7/8) with two Graded Units.

- 1 Mathematics for Engineering 1: Electronics and Electrical
- 2 Analogue Electronic Principles (double Unit)
- 3 Applications of Programmable Logic Controllers
- 4 Implementing Small Local Area Networks
- 5 Mathematics for Engineering 2
- 6 DC and AC Principles
- 7 Electrical Systems in Potentially Explosive and Gas Hazardous Environments
- 8 Fundamentals of Control Systems and Transducers
- 9 Power Electronics
- 10 Electrical Safety
- 11 Pneumatics and hydraulics
- 12 Distributed Control systems (double Unit)
- 13 Marine Engineering: Electrical and Electronic Devices
- 14 Marine Engineering: Electrical Motors and Generators
- 15 Marine Engineering: Propulsion
- 16 Marine Engineering: Marine Management (double Unit)
- 17 Electronic Fault Finding
- 18 Switchgear and Protection of High Voltage Systems
- 19 Transformers
- 20 Applications of Power Electronics in Electrical Motor Drive Systems
- 21 Marine Navigation Systems (double Unit)
- 22 Radio Communications (double Unit)
- 23 Marine Electronic Engineering: Graded Unit 1 Examination for level 7 Units
- 24 Marine Electronic Engineering: Graded Unit 2 Project (double Unit)

The majority of these Units are assessed by one or more closed-book assessments. In order to meet the MCA requirements for the stcw Certification the pass marks for these assessments have been set at 50%.

In addition the HND award also contains a Graded Unit examination at SCQF level 7. This is a three hour examination which will take place towards the end of your first year of the HND programme. The exam is based on a selection of questions from key Units in the year one programme. The HND award also a project Graded Unit built around key HND Units.

In order to gain an HND in Marine Electro-Technology you must gain the 30 SQA credits from the Units and Graded Units you study.

The Graded Units will be marked out of 100. Assessors will aggregate the marks you achieve to arrive at an overall mark for the examination. Assessors will then assign a grade for your Graded Unit based on the following grade boundaries.

- ◆ A = 70%–100%
- ◆ B = 60%–69%
- ◆ C = 50%–59%

Further information on the format and content of the Graded Units will be given to you by lecturing staff at the start of your course.

During the first year of the HND you will develop 5 Core Skills to SCQF level 6 in *Communication, Numeracy, Information and Communication Technology (ICT), Problem Solving* and *Working with Others*. In addition you will be certificated for the Core Skill Numeracy at SCQF level 6 when you pass the *Marine Engineering: Mathematics* Unit.