

Level 3 Diploma in Marine Engineering (Advanced) (2473-13)

June 2019 Version 1.0

Qualification Handbook

Qualification at a glance

Subject area	Marine
City & Guilds number	2473
Age group approved	16-19, 19+
Entry requirements	None
Assessment types	Multiple Choice; Centre Devised
Approvals	Qualification approval
Support materials	Qualification handbook; Assessment pack; Centre-devised recording forms
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds number	Accreditation number
Level 3 Diploma in Marine Engineering (Advanced)	2473-13	603/4726/0

Version and date	Change detail	Section
V1.0 June 2019	Original publication	

Contents

Qualification at a glance	2
Contents	3
1 Introduction	4
Structure	5
Total Qualification Time	6
2 Centre requirements	7
Approval	7
Resource requirements	7
Internal quality assurance	7
Learner entry requirements	8
Age restrictions	8
3 Delivering the qualification	9
Initial assessment and induction	9
Support materials	9
4 Assessment	10
Summary of assessment methods	10
Assessment strategy	12
5 Grading	14
5 Units	15
Structure of the units	15
Unit 203 Business improvement techniques	16
Unit 351 Safe and effective working in the marine industry (marine engineering)	20
Unit 352 Principles of marine construction and components	34
Unit 353 Installation and repair of vessel services	49
Unit 354 Installation, fault diagnosis and repair of marine engines	55
Unit 355 Installation and repair of marine propulsion systems	60
Sources of general information	68

1 Introduction

This document tells you what you need to do to deliver the qualifications:

Area	Description
Who is the qualification for?	This qualification is aimed at learners aged 16 and above who would like to gain the advanced knowledge and skills required during their training to become a marine engineer either as part of the development phase of their apprenticeship, or as full time students.
What does the qualification cover?	Following the skills and knowledge gained during the Level 2 Diploma in Marine Engineering (Foundation), learners will be trained at an advanced level in the following areas: <ul style="list-style-type: none">• Respond appropriately to customer needs (internal and external)• planning and setting up projects• work methods, including using specialist equipment and minimising hazards and risks• Install and maintain marine engines and marine ancillary systems and components• Support commission of the boat, test and sea trials
What opportunities for progression are there?	Upon completion of this qualification, learners will be equipped with the level of competence required to progress into the end point assessment of their apprenticeship to become a marine engineer On successful completion of the whole apprenticeship standard, learners will be recognised by the Institute of Marine Engineering, Science and Technology (IMarEST) at 'Engineering Technician' level.
Who did we develop the qualification with?	This qualification has been developed in collaboration with the marine engineering employer group which is led by Berthon Boat Company (chair), Broom Boats, English Harbour Yachts, Fairline Boats, Golden Arrow, Goodchild Marine, Green Marine, Hamble Yacht Services, RNLi, Pendennis Shipyard, Princess Yachts, Pioneer Sailing Trust, Sunseeker International, Windboats and the British Marine Federation.
Is it part of an apprenticeship framework or initiative?	This qualification has been developed to be included within the Advanced phase of the new Apprenticeship Standard for marine engineers, which will replace the current Level 2 and Level 3 Marine, Construction, Systems Engineering and Maintenance (Marine Engineering) SASE Frameworks. The qualification will also be included in the SASW Frameworks for apprenticeships delivered in Wales. The qualification can also be used for full time students who would like to gain the advanced knowledge and skills that will enable them to progress into further training to become a marine engineer

Structure

To achieve the **Level 3 Diploma in Marine Engineering (Advanced)** learners must achieve all mandatory units (203, 351-355)

Centres should use the following certification units to claim for the achieved grade

910 Pass

911 Merit

912 Distinction

Please see the Grading section for the grading process.

City & Guilds unit number	Unit title	GLH
Mandatory		
203	Business improvement techniques	50
351	Safe and effective working in the marine industry (marine engineering)	70
352	Principles of marine construction and components	70
353	Installation and repair of vessel services	100
354	Installation, fault diagnosis and repair of marine engines	100
355	Installation and repair of marine propulsion systems	100

Total Qualification Time

Total Qualification Time (TQT) is the number of notional hours which represents an estimate of the total amount of time that could reasonably be expected for a learner to achieve and demonstrate the achievement of the level of attainment necessary for the award of a qualification.

TQT is comprised of the following two elements:

- 1) The number of hours which an awarding organisation has assigned to a qualification for Guided Learning, and

An estimate of the number of hours a Learner will reasonably be likely to spend in preparation, study or any other form of participation in education or training, including assessment, which takes place as directed by - but, unlike Guided Learning, not under the Immediate Guidance or Supervision of - a lecturer, supervisor, tutor or other, appropriate provider of education or training

Title and level	GLH	TQT
Level 3 Diploma in Marine Engineering (Advanced)	490	648

2 Centre requirements

Approval

To offer this qualification, all centres will need to gain both centre and qualification approval. Please refer to the *Centre Manual - Supporting Customer Excellence* for further information.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualifications before designing a course programme.

Resource requirements

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be occupationally competent or technically knowledgeable in the area[s] for which they are delivering training and/or have experience of providing training. this knowledge must be to the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but cannot internally verify their own assessments.

Internal quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications.

Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance.

Standards and rigorous quality assurance are maintained by the use of:

- internal quality assurance
- City & Guilds external quality assurance.

In order to carry out the quality assurance role, Internal Quality Assurers must have appropriate teaching and vocational knowledge and expertise. Assessor/Verifier (A/V) units are valued as qualifications for the centre, but they are not currently a requirement for this qualification.

Staff must:

- be familiar with the occupation and technical content covered within the qualification
- be familiar with the requirements of the Apprenticeship Standard requirements.

Learner entry requirements

City & Guilds does not set entry requirements for this qualification. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully.

Individual employers will set the criteria, but most candidates will have four GCSEs at grade C (or equivalent) or above on entry (including English, Maths & Science). Employers who recruit learners without English, Maths and Science at Grade C or above, must ensure that the learner achieves this requirement, or an equivalent Level 2, prior to completion of the Apprenticeship.

This qualification is a mandatory component of the on-programme of the Marine Engineer Apprenticeship Standard (ST0364/AP1).

The Standard and Assessment plan has been designed by Employers. Centres should make themselves familiar with the Standard, Assessment Plan requirements, details of which can be found at:

<https://www.instituteforapprenticeships.org/apprenticeship-standards>

Age restrictions

City & Guilds cannot accept any registrations for candidates under 16 as these qualifications are not approved for under 16s.

3 Delivering the qualification

Initial assessment and induction

An initial assessment of each candidate should be made before the start of their programme to identify:

- if the candidate has any specific training needs,
- support and guidance they may need when working towards their qualifications.
- any units they have already completed, or credit they have accumulated which is relevant to the qualifications.
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the candidate fully understands the requirements of the qualification, their responsibilities as a candidate, and the responsibilities of the centre. This information can be recorded on a learning contract.

Support materials

The following resources are available for this qualification:

Description	How to access
Assessment pack	www.cityandguilds.com

Recording documents

Candidates and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems, including our own, **Learning Assistant**, an easy-to-use and secure online tool to support and evidence learners' progress towards achieving qualifications. Further details are available at: www.cityandguilds.com/eportfolios.

City & Guilds has developed a set of *Recording forms* including examples of completed forms, for new and existing centres to use as appropriate. *Recording forms* are available on the City & Guilds website.

Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used by candidates and assessors at the centre. Amendable (MS Word) versions of the forms are available on the City & Guilds website.

4 Assessment

Summary of assessment methods

Candidates must successfully complete:

- multiple-choice tests for unit 351 and 352
- short-answer question assessment for unit 203
- centre-devised assignment with supporting short-answer questions for units 353 - 355

Available assessments/assignments:

City & Guilds has written the following assessments to use with this qualification:

- multiple-choice tests to be delivered online for 351 and 352
- externally set, internally marked short-answer questions for unit 203.
- guidance for centre-devised assignments along with example short-answer questions for units 353-355.

Centre set and marked assessments

City & Guilds has provided separate guidance for writers of centre based assessments which should be read in conjunction with this document, entitled, 'GM1 - Developing centre-devised assessments – guidance for centre based assessment writers'.

A set of generic recording forms is also provided as follows:

- Assessment tasks (AD1)
- Assessment grading criteria (AD2)
- Assessment sign off form (AD3)
- Evidence recording form (GF1)
- Assessment unit front and mark sheet (GF2)
- Assessment task front sheet (GF3)
- Assessment unit mark sheet (GF4)
- Assessment feedback and action plan form (GF5)
- Qualification assessment tracking form (GF6)
- Group assessment tracking form (GF7)

A full explanation of the use of these forms can be found in the centre-devised assessment writing guidance. All of these materials are available to download from the City & Guilds website.

Approval process for centre set assignments

Centre set assignments must be approved by the external quality assurer before use. For each assignment, the Assessment sign off form (AD3) must be completed and be made available to the EQA for inspection.

Assessment Types

Unit	Title	Assessment method	Where to obtain assessment materials
2473-203	Business improvement techniques	Centre devised short-answer questions	www.walled-garden.com
2473-351	Safe and effective working in the marine industry (marine engineering)	Multiple-choice online test	Evolve
2473-352	Principles of marine construction and components	Multiple-choice online test	Evolve
2473-353	Installation and repair of vessel services	Centre-devised practical assignment and short-answer questions	www.cityandguilds.com
2473-354	Installation, fault diagnosis and repair of marine engines	Centre-devised practical assignment and short-answer questions	www.cityandguilds.com
2473-355	Installation and repair of marine propulsion systems	Centre-devised practical assignment and short-answer questions	www.cityandguilds.com

Time constraints

The following must be applied to the assessment of this qualification:

- all assessments must be completed within the candidate's period of registration.

Assessment strategy

Test Specifications for the multiple choice tests

The way the knowledge is covered by **each** test is laid out in the tables below:

Assessment title: Safe and effective working in the marine industry (marine engineering)

Assessment type: Multiple-choice online test

Assessment conditions: Invigilated examination conditions

Grading: X/P/M/D

Unit	Duration: 75 minutes		
351	Learning Outcome	Number of questions	%
	01: Understand the importance of compliance with statutory legislation, regulations and organisational requirements in the marine industry	17	34
	02: Understand safe working practices and procedures	14	28
	03: Know how to plan, organise and monitor work needed to carry out marine industry activities	14	28
	04: Understand safe and effective production systems used in the marine industry	5	10
Total		50	100

The grade boundaries for this test will be approximately:

Pass: 60%

Merit: 70%

Distinction: 80%

These boundaries may be subject to slight variation to ensure fairness should any variations in the difficulty of the test be identified.

Assessment title: Principles of marine construction and components

Assessment type: Multiple-choice online test

Assessment conditions: Invigilated examination conditions

Grading: X/P/M/D

Permitted candidate resources: non-programmable calculator

Unit	Duration: 75 minutes		
352	Learning Outcome	Number of questions	%
	01: Understand materials used in marine construction	14	28
	02: Understand the use of drawings and specifications used in marine engineering	11	22
	03: Understand marine construction techniques	7	14
	04: Understand the engineering systems used on boats	8	16
	05: Understand the fittings and components used in marine construction	10	20
Total		50	100

The grade boundaries for this test will be approximately:

Pass: 60%

Merit: 70%

Distinction: 80%

These boundaries may be subject to slight variation to ensure fairness should any variations in the difficulty of the test be identified.

5 Grading

Grading of individual assessments

Individual assessments will be graded Pass/Merit/Distinction.

For the units to be achieved, candidates must achieve a minimum of Pass in each assessment, as per marking scheme provided for each assessment.

Pass reflects the minimum requirements that are expressed in the unit, with Merit and Distinction showing progression in the depth and breadth of the learner's knowledge, as well as in the type of cognitive operations learners demonstrate.

Grading of qualification

The Marine Engineer Employer Group has taken the decision to grade this qualification Pass/Merit/Distinction, through the aggregation of the individual assessments graded Pass/Merit/Distinction.

All assessments must be achieved at a minimum of Pass for the qualification to be awarded. All assessments graded Pass/Merit/Distinction contribute to the overall qualification grade.

For full details on how to grade the qualification, refer to the Assessment Pack available on the qualification page of www.cityandguilds.com.

Overall qualification grades must be entered using one of the following overall grading modules on the Walled Garden:

- 910 Pass
- 911 Merit
- 912 Distinction.

5 Units

Structure of the units

These units each have the following:

- City & Guilds reference number
- Title
- Level
- Guided learning hours (GLH)
- Assessment type
- Learning outcomes, which are comprised of a number of assessment criteria

Centres must deliver the full breadth of the range. Specialist equipment or commodities may not be available to all centres, so centres should ensure that their delivery covers their use. This may be covered by a practical demonstration (eg video). For the practical assessments for this qualification, centres should ensure that there are sufficient resources to complete the task but are not required to use all the equipment or commodities in the range.

Unit 203

Business improvement techniques

Unit level:	Level 2
GLH:	50
Unit aim:	This unit aims to provide the learner with the knowledge of lean business process and quality improvement in order to effectively monitor and make enhancements to production, manufacturing and maintenance processes.
Assessment type	Centre-devised short answer questions

Learning outcome

The learner will:

- 1 Know what is meant by continuous improvement

Assessment criteria

The learner can:

- 1.1 explain the meaning of continuous improvement
- 1.2 outline the benefits of applying continuous improvement techniques
- 1.3 define each stage of the Plan – Do – Check – Act (PDCA) improvement cycle
- 1.4 define the different categories of waste

Range

(AC1.2) **Benefits**

- reduced cost (e.g. production)
- improved quality (e.g. reduced defects)
- improved safety (e.g. safe to use)
- improved working practices (e.g. reduced operator motion)
- improved delivery (e.g. reduced transportation time, reduced lead time)
- reduction of waste (e.g. over processing, excess inventory)
- resource utilisation (e.g. reduced waiting time)
- improved customer satisfaction (e.g. meeting customer requirements)

(AC1.4) **Categories of work**

- value added
- non-value added
- waste

(AC1.4) **Categories of waste**

- transport
 - inventory
 - motion
 - waiting
 - over-production
 - over-processing
 - defects
 - skills/unrecognised people potential
-

Learning outcome

The learner will:

- 2 Understand what is meant by workplace organisation

Assessment criteria

The learner can:

- 2.1 explain the meaning of workplace organisation
- 2.2 outline the benefits of having an organised working environment
- 2.3 describe the effects an unorganised work environment may have
- 2.4 explain the importance of Standard Operating Procedures (SOPs) within workplace organisation
-

Range

(AC2.3) **Effects**

- poor quality
 - increased costs
 - reduced efficiency
 - poor delivery times
 - poor morale/teamwork
 - poor health and safety
-

Learning outcome

The learner will:

- 3 Know what is meant by visual management
-

Assessment criteria

The learner can:

- 3.1 explain the meaning of visual management
 - 3.2 describe the benefits of applying good visual management
 - 3.3 describe different types of visual management
-

Range

(AC3.2) **Good visual management**

- accurate and relevant
- eye-catching
- simple
- greater ownership

(AC3.3) **Types of visual management**

- shadow boards
 - PDCA worksheets
 - colour coding
 - floor footprints
 - storyboards
 - gauges
 - photographs/pictures
 - labelling
 - lights
 - schedule boards
 - Kanban (pull systems)
 - graphs
 - management boards
 - other area specific types of visual management
-

Learning outcome

The learner will:

- 4 Understand problem solving techniques

Assessment criteria

The learner can:

- 4.1 explain what is meant by a problem within a work environment
 - 4.2 describe the benefits of solving work related problems
 - 4.3 outline different techniques used for identifying and analysing problems
 - 4.4 explain the importance of applying the appropriate corrective action and eliminating the root cause of a problem
-

Range

(AC4.3) **Techniques**

- tally charts
- flowcharts
- histogram/Pareto chart
- benchmarking
- process mapping
- correlation diagram
- run diagram
- Statistical Process Control
- control charts
- Gantt charts
- root cause paths
- value stream maps
- Ishikawa diagrams (cause and effect, fishbone)
- brainstorming
- mind mapping
- 5 Why analysis

Unit 351

Safe and effective working in the marine industry (marine engineering)

Unit level:	Level 3
GLH:	70
Unit aim:	<p>This unit is concerned with safety awareness and communication skills needed to work effectively in the marine industry.</p> <p>The unit covers health and safety, interaction with other employees and an understanding of the terminology and structure of the industry.</p>
Assessment type	Multiple choice online test

Learning outcome

The learner will:

- 1 Understand the importance of compliance with statutory legislation, regulations and organisational requirements in the marine industry

Assessment criteria

The learner can:

- 1.1 describe the requirements of the health and safety legislation and regulations applicable to the marine industry
- 1.2 describe the requirements of environmental legislation and regulations relevant to the marine industry
- 1.3 state employers' responsibilities to maintain a safe working environment
- 1.4 state employees' responsibilities to maintain a safe working environment
- 1.5 describe how the Management of Health and Safety Regulations should be implemented and maintained
- 1.6 describe how the environmental regulations should be implemented and maintained
- 1.7 explain the roles, responsibilities and powers of people in health, safety and environmental positions
- 1.8 describe where and how health and safety and environmental information and advice can be accessed
- 1.9 describe the hazards and acts that can lead to observations, near misses, accidents and fatalities
- 1.10 describe methods of accident prevention in the workplace
- 1.11 describe the requirements of the Recreational Craft Directive (RCD)

- 1.12 describe the requirements of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013
 - 1.13 state the organisational procedures for reporting accidents or incidents
 - 1.14 explain how to carry out a risk assessment
 - 1.15 identify potential health and environmental hazards
 - 1.16 state the qualifications required for those operating craft in categorised waters and at sea
-

Range

(AC1.1) **Safety legislation/regulations**

- Health and Safety at Work Act 1974 (HSAWA)
- Management of Health and Safety at Work Regulations 1999
- Workplace (Health, Safety and Welfare) Regulations 1992
- Control of Substances Hazardous to Health Regulations 2002 (COSHH)
- Supply of Machinery (Safety) Regulations 2008
- Lifting Operations and Lifting Equipment Regulations 1998 (LOLER)
- Provision and Use of Work Equipment Regulations 1998 (PUWER)
- Electrical Equipment (Safety) regulations 1994
- Portable Appliance Testing Regulations. (PAT)
- Personal Protective Equipment at Work Regulations 1992
- Manual Handling Operations Regulations (MHOR) 1992
- Health and Safety (Display Screen Equipment) Regulations 1992
- Health and Safety (First Aid) Regulations 1981
- Health and Safety Information for Employees Regulations 1989
- Employers' Liability (Compulsory Insurance) Act 1969
- Work at Height Regulations 2005
- Safe Working in Confined Spaces Regulations and Code of Practice 1997
- Control of Major Accident and Hazards Regulations 2015
- Noise and Statutory Nuisance Act 1993
- Control of Noise at Work Regulations 2005
- Electricity at Work Regulations 1989
- Confined Spaces Regulations 1997
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995 and 2013
- Control of Vibration at Work Regulations 2005

(AC1.2) **Environmental legislation/regulations**

- Environmental Protection Act 1990
 - Pollution Prevention and Control Act 1999
 - Clean Air Act 1993
 - Controlled Waste Regulations 2012
 - Control of Substances Hazardous to Health (COSHH)
 - Preparations and Chemicals Regulations 2000
 - Biocidal Products and Chemicals (appointment of Authorities and enforcement) Regulations 2013
 - Control of Major Accident Hazards Regulations (COMAH) 2015
 - Carriage of Dangerous Goods and the Use of Transportable Pressure Equipment Regulations 2013
 - CRC Energy Efficiency Scheme Order 2013
-

- Dangerous Substances and Explosive Atmospheres Regulations 2002 (DESAR)
- Environmental Permitting (England and Wales) Regulations 2010
- Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation (EC) (REACH) 2006
- Recreational Craft Regulations 2004
- Hazardous Waste (England and Wales) (Amendment) Regulations 2016
- Waste (England and Wales) Regulations 2011
- Waste Batteries and Accumulators Regulations 2009
- Waste Electric and Electronic Equipment Regulations (WEEE) 2013

(AC1.3) Employers' responsibilities

- safe place of work – good housekeeping, provision of fire safety equipment and training, communicated health and safety policy, display of health and safety information, training
- safe plant and equipment – planned maintenance of plant and equipment, inspection record keeping, method statements, periodical test for electrical installations, portable appliance testing, control of vibration tools, health surveillance, guards on machines, thorough examination of lifting equipment, local exhaust ventilation (LEV) tests
- safe system of work – risk assessment, safety data sheets, adequate management and supervision
- safe methods of handling, storing, and transporting goods and materials
- reporting of accidents and near misses
- protection of environment - processes for reporting spills on land and in water, waste separation, energy saving processes, efficient use of resources, waste hierarchy, segregation of waste

(AC1.4) Employees' responsibilities

- wear the appropriate Personal Protective Equipment (PPE)
- wear the appropriate Respiratory Protective Equipment (RPE)
- follow safe systems of work
- comply with organisational health, safety and environmental policies
- safe use and storage of equipment, tools, machinery and materials
- elevate health, safety and environmental concerns to appropriate persons
- protect self and others at all times
- ensure standards of personal hygiene
- follow organisational housekeeping standards
- working so that actions do not cause damage to the environment in terms of air, water, or ground pollution

(AC1.5) How Management of Health and Safety Regulations and the Environmental Regulations should be implemented

- specify and maintain a Health and Safety and Environmental policy in accordance with the respective legislation /regulations
- nominate a Health and Safety Officer
- set up a safety committee with cross company membership
- assess risks and record results (risk assessments)
- encourage a strong safety culture
- provide regular Health, Safety and Environmental staff information, training and updating
- operate health screening
- maintain appropriate health and safety records
- keep up-to-date with health, safety and environmental matters by all means available, Internet etc.

- establish and communicate safe working practices and procedures, encourage strong safety and environmental practices
- establish and maintain the control of waste streams
- establish and maintain the control of emissions
- establish and maintain the control of contractors and visitors
- establish and maintain emergency response procedures

(AC1.7) Roles, responsibilities and powers

- company director
- company safety manager/officer/advisor
- safety representative
- company trained first aider
- fire wardens
- competent crew
- occupational health provider
- appointed person for lifting operations
- Health and Safety Inspectors
- Environmental Health Officers

(AC1.8) Access to Health & Safety and Environmental information

- company health and safety and environmental officer(s)
- company health, safety and environmental management system
- company notice boards
- safety data sheets
- Health and Safety Executive
- internet - commercial safety organisations and companies selling safety equipment

(AC1.9) Hazards and acts leading to observations, near misses, accidents and fatalities

- not wearing or maintaining the appropriate PPE
- poor housekeeping
- lack of staff training in correct use of equipment, machinery, etc.
- lack of adequate supervision
- lack of respect for company health, safety and environmental policies and processes
- poorly maintained and serviced equipment
- unguarded machinery
- inadequate extraction/ventilation of workshops
- inappropriate use of tools, machinery and equipment
- misuse of lifting equipment
- distractions in the workplace
- improper / careless behaviour in the workplace
- badly lit workplace
- staff fatigue
- drug-taking and drinking
- lack of collective protection

(AC1.10) Methods of accident prevention

- identify hazards and control risks
- adhere to risk assessments
- good planning
- information and awareness of hazards and ways to minimise these
- eliminating hazards

- being respectful of machinery and equipment and the risks they pose
- guard the hazard
- provision of personal protection
- safety training and publicity
- planned and reactive machinery/tooling maintenance
- shut down/lock out procedures
- quarantine procedures

(AC1.11) **Requirements of the Recreational Craft Directive (RCD)**

- uniform level of safety in the design and manufacture of recreational craft throughout the European Economic Area
- relationship between the European Directive and UK Legislation
- RCD conformity assessment process
- compliance to 32 Essential Requirements of the RCD
- relationship between the RCD and International Standards
- RCD Annex II Components, installing the right vessel components.

(AC1.13) **Organisational procedures**

- report accident/incident to first aider or other relevant person
- complete accident book
- complete accident form/incident report form

(AC1.15) **Health and environmental hazards**

- slippery or uneven surfaces
- spillages
- scrap or waste material
- flammable materials
- faulty or missing machine guards or interlocks
- faulty, blunt or incorrectly set up of tools and equipment
- faulty electrical connections or damaged cables
- material ejection causing injury damage
- pressure
- stored energy
- unshielded processes
- volatile and toxic materials
- dust
- fumes
- hot works
- contaminants and irritants
- materials handling and transportation
- falls from working at heights
- working afloat
- untidy work habits
- weather conditions
- air pressure systems
- confined spaces
- moving machinery
- suspended loads
- noise
- vibration
- chemicals
- water borne infections

- incorrect or poorly maintained PPE

(AC1.16) **Qualifications required**

- Powerboat Level 2
 - Advanced Powerboat
 - Day Skipper
 - Boatman's Licence
 - Coastal Skipper
 - Yachtmaster (ocean and offshore)
 - STCW
 - VHF radio
-

Learning outcome

The learner will:

- 2 Understand safe working practices and procedures

Assessment criteria

The learner can:

- 2.1 describe Personal Protective Equipment (PPE) used for different tasks or operations
 - 2.2 describe types of Respiratory Protective Equipment (RPE) and when they should be used
 - 2.3 describe the general and personal safety equipment found on boats
 - 2.4 describe the safety rules for the use of mechanical lifting equipment
 - 2.5 identify accessories for lifting equipment
 - 2.6 explain how lifting equipment accessories are used
 - 2.7 state the different types of knots used in ropes and slings, and their application
 - 2.8 describe the current Manual Handling Operations Regulations
 - 2.9 identify vibrating tools associated with Hand-Arm Vibration Syndrome (HAVS)
 - 2.10 explain what HAVS is and how the associated risks can be managed
 - 2.11 state why it is necessary to have a permit to work
 - 2.12 identify to whom hazards should be reported
 - 2.13 state situations in which it is unsafe to work in isolation
-

Range

(AC2.1) **Personal Protective Equipment (PPE)**

- safety boots when moving heavy materials
 - ear attenuators / defenders when working in a noisy machinery or environment
 - safety goggles or glasses when grinding, etc.
 - gloves when working with resins and chemicals, or sharps
 - overalls for working in dirty or unclean environment
 - harnesses when working at heights
 - buoyancy aids/life jackets when working on or near water
 - high visible jackets when lifting or in transport situations
 - hard hats when lifting anything overhead
-

- wet weather gear when working in adverse weather conditions
- thermal jackets when entering freezers

(AC2.2) RPE equipment and when it should be used

- masks – dust masks when sanding wood/GRP and vapour masks when working with paints or chemicals, or welding
- hoods – air fed hoods when paint spraying, shot blasting, laminating in confined spaces
- full breathing equipment when working in oxygen depleted environments or confined spaces, entering ovens
- fit testing

(AC2.3) General and personal safety equipment

- flares
- first aid box
- fire-fighting equipment
- emergency locker
- life buoys
- flashlights
- life raft
- bilge pump
- fire pump
- salvage pump
- sea anchor
- EPIRB
- Radar reflector
- Safety harness
- Life jacket

(AC2.4) Safety rules mechanical lifting

- use authorised and trained personnel (banksman training, appointed person training, etc.)
- appropriate PPE
- ensure lifting equipment thoroughly examined and in date
- ensure all lifting tackle is tagged appropriately
- never exceed the maximum safe working load (SWL) indicated
- avoid shock loading the lifting equipment
- swinging and twisting
- estimate the centre of gravity, position the lifting hook above the centre of gravity of the load
- avoid pushing or pulling the load to adjust the balance
- do not transport loads over the heads of people or walk under a load
- do not leave a load hanging unattended
- always lower the load gently into position
- make sure the load does not move once the lifting equipment is removed
- check date of equipment tests
- do not work under suspended loads
- quarantine procedures

(AC2.5) Accessories for lifting

- forks
- hooks: swivel & safety hooks
- slings: chain & ropes of wire, natural and man-made fibres
- eyebolts
- shackles
- rings
- strops/slings
- beams
- cargo nets
- rigging equipment – bosun chair, climbing ropes, descenders
- halyards
- winches
- chain pull/block
- wire pull
- spreaders
- special- to-purpose equipment

(AC2.6) How lifting equipment accessories are used

- always undertake with lifting plan
- always observe the SWL and its date of test
- check equipment is tagged and in date
- visual inspection of equipment before use
- use appropriate equipment for the task/work operation
- never bend slings around sharp corners and edges and avoid over-bending
- use protective covers on corners of loads with slings and chains
- never twist or kink the sling or chain
- never use a worn or damaged slings or chains
- importance of the angle at the top, forces in the legs proportional to the angle at the top LOLER

(AC2.7) Knots

- reef knot - joining ropes of equal thickness
- clove hitch - joining ropes to a pole or bar, single or double loop - preventing a sling from slipping off a crane hook
- two half-hitches - connecting a rope to a sling
- bowline - preventing a load from tightening a loop

(AC2.8) Manual Handling Operations Regulations

- carrying out a risk assessment on the types of manual handling in operation in a boatyard or marina
- methods employed in transporting equipment to support boats in a yard or marina
- correct posture and technique for manual lifting and carrying portable machinery, tools, equipment
- the provision and use of suitable clothing, footwear or other personal effects
- providing adequate or appropriate knowledge and training to the workforce about manual handling

(AC2.9) Vibrating tools

- sanders: orbital, DA, belt, disc
- needle gun

- jig saw
- nibbler
- reciprocating saws
- router
- grinder
- core grinder
- hammer drills
- planer
- buffer tools
- oscillating tools

(AC2.10) **HAVS**

- Control of Vibration at Work Regulations
- tool selection
- tool servicing
- tool vibration measured
- vibration calculator used (exposure action value, exposure limit value)
- trigger times controlled
- annual health screening
- reporting and documentation

(AC2.11) **Permit to work**

- to ensure controls are in place
- awareness of people who are on site and work being undertaken
- to ensure safe practices are carried out
- to ensure no unauthorised people have access to a potentially dangerous environment
- to prevent theft or malicious damage - security
- to control and manage contracts and work being undertaken
- for reasons of industrial secrecy

(AC2.12) **Who hazards should be reported to**

- safety manager/officer/adviser
- supervisors
- fire officers
- works rescue team

(AC2.13) **Situations**

- working at heights (up the mast, on stage planks)
- in close proximity to moving machinery (running engines, rotating shafts)
- when a fire risk exists, with toxic, highly flammable or explosive substances
- when working in confined spaces
- where there is a danger of falling overboard or into water
- when working in adverse weather conditions
- when working out of normal working hours
- in extreme temperatures (oven/freezer)

Learning outcome

The learner will:

- 3 Know how to plan, organise and monitor work needed to carry out marine industry activities

Assessment criteria

The learner can:

- 3.1 explain how to maximise the efficiency and effectiveness of the resources
- 3.2 explain the types of records that need to be maintained
- 3.3 explain the importance of maintaining accurate production records
- 3.4 state problems that may occur if documentation is not maintained and completed accurately
- 3.5 state the key roles in a marine industry environment
- 3.6 state the technical skills, tools and materials needed to deliver the work outcome
- 3.7 list the information sources that detail what is required to deliver work outcomes
- 3.8 state the action to be taken when required resources are unavailable
- 3.9 describe the purpose of the regulatory and compliance bodies that cover marine industry activities
- 3.10 state the checks used to ensure marine industry activities meet quality and design specifications
- 3.11 explain the considerations when planning boat construction schedules.

Range

(AC3.1) **Efficiency and effectiveness**

- adhere to LEAN principles
- employ the right staff with appropriate skills
- provide training to enable staff to undertake their role
- good planning - review and verify design and plans, finalise time and cost of work to be done, identify, source equipment, machinery tools and materials, make, produce and use jigs and templates as required, set up tools and machinery correctly for tasks
- effective time management
- correct quality and quantity of tools
- equipment and materials
- effective use of working area and facilities

(AC3.2) **Records**

- work schedule sheets
- time sheets
- requisitions sheets
- drawings and specifications
- batch numbers
- process forms
- safety data sheets
- technical data sheets
- tool records

- calibration records
- method statements
- critical path analysis charts, or other progress charts
- quality assurance certificate
- Recreational Craft Directive logs and files
- trials and equipment test records
- stock control records

(AC3.4) Problems

- work may need to be reworked
- work that should be done may be missed or not completed
- work may be done incorrectly or not up to the standard required or expected
- the true cost of the work may not be recovered
- the customer may be charged too much or too little
- difficulty tracing work that has been undertaken
- the reputation of the company may be put at risk

(AC3.5) Key roles

- Manager
- Foreman
- Charge-hand
- Store keeper
- Buyer
- Quality manager (ISO9001)
- Health and Safety and Environmental Manager (OHSAS18001, ISO14001)
- Facilities manager
- Finance manager
- Designer
- Team leader
- Sales manager
- Production manager
- Administrative support
- Skilled workers
- Training staff
- Apprentices
- Mentors

(AC3.6) Technical skills, tools and materials

- up to date and effective working methods
- highly skilled workforce
- specialist tools and equipment
- specialist services
- materials and components

(AC3.7) Information sources

- internal information – new build specifications, scantlings lists, job instructions, sheets, line plans, working drawings, time sheets, requisition sheets, test records, drawing and specifications, tool records, calibration records, application records, risk assessments, methods statements, general arrangement drawings, schematic drawings, hydraulic drawings
- external information – designer’s drawings and specifications, customer information, regulations, codes of practice, surveyor’s reports, RCD, manufacturers’ technical data

and information, safety data sheets, H&S regulations and information , compliance regulations and standards

(AC3.8) Action to be taken

- notify relevant personnel
- re-schedule work
- implement contingency plans

(AC3.9) Regulatory and compliance bodies

- Lloyds
- Recreational Craft Directive (RCD)
- BS EN and ISO standards
- Environmental Protection Act 1990
- British Waterways Board
- Boat Safety Scheme
- Marine Coastguard Agency (MCA)
- Marine Safety Agency
- Royal Institute Naval Architects (RINA)
- Bureaux Veritas
- American Bureau of Shipping (ABS)
- American Boat and Yacht Council (ABYC)
- Royal Yachting Association (RYA)
- International Marine Electrical Association
- British Marine Electrical and Electronic Association (BMEEA)
- Flag state

(AC3.10) Checks

- measurement, checking - alignment, geometric shape, calibration, compass adjust
- testing with specialised equipment - barcol hardness tester, moisture content meter, thickness gauge
- destructive testing - the ash test, tensile testing, impact testing, non-destructive testing, etch testing of welds
- testing of TIG/MIG welds
- visual inspections - appearance, blemish free, matching grain, even colour
- operations and functional testing (for example – mechanical testing by checking the correct operation of winches and windlass, electrical testing)
- commission – functionality tests such as vibration, temperature, noise, smoke, humidity
- dock side tests – pre launch tests, safety equipment tests
- sea trials - steering and manoeuvrability functions, engine start & function, navigation lights & equipment
- bonding checks

(AC3.11) Considerations

- long term capacity
- timeframes
- design specification
- resources – skill set requirements
- availability of materials
- construction and production methods required
- production costs
- customer requirements

- transport logistics
- suppliers
- payment schedules
- relevant regulations.

Learning outcome

The learner will:

- 4 Understand safe and effective production systems used in the marine industry

Assessment criteria

The learner can:

- 4.1 explain the basic components of a typical marine production system
- 4.2 describe factors that affect productivity
- 4.3 state the effect of industrial changes on productivity
- 4.4 state factors that affect marine industry trading
- 4.5 state the factors that affect good customer relations.

Range

(AC4.1) **Components of a typical production system**

- energy
- labour (person/hours)
- machinery and equipment
- materials
- land and buildings
- access to water
- available finance to cover costs

(AC4.2) **Factors that affect productivity**

- availability and cost of materials
- cost and availability of labour
- machine and equipment availability and effective use of capacity
- supplier performance
- project time constraints
- effectiveness of planning processes
- working environment
- moral and fatigue of staff
- effect on costs of - lateness and absenteeism, machinery and equipment, breakdown/failure, down time, need to rework, scrap, poor workmanship
- transport and logistics

(AC4.3) **Effect of industrial change**

- reduced demand
- increased scale of competition
- lack of competitiveness in terms of; marketing, productivity & quality, introduction of new technology

(AC4.4) **Factors that affect marine business trading**

- quality of work produced
- clean and well maintained premises
- ensuring good product service
- repairs and builds are fit for purpose
- the cost is within the quoted price including any agreed extras
- agreed delivery dates and the implications of penalty clauses
- the method of payment
- the legal standing of the designer's specification
- contract management
- motivated staff
- communication between business and customer
- robust warranties
- company reputation

(AC4.5) **Factors that affect good customer relations**

- producing good quality work
- meeting customer expectations
- ensuring the product supplied is fit for purpose
- the cost is within the quoted price including any agreed extras
- the work is finished by the agreed delivery dates
- the work is of the required quality and reliability
- handover/training
- provision of documentation
- after sales service and rectification of faults
- customer engagement
- robust warranties.

Unit 352

Principles of marine construction and components

Unit level:	Level 3
GLH:	70
Aim:	This unit is concerned with the selection and use of materials, tools and equipment and their application in marine engineering operations.
Assessment type:	Multiple choice on-line test

Learning outcome

The learner will:

- 1 Understand materials used in marine construction

Assessment criteria

The learner can:

- 1.1 describe materials and how they are used in marine construction
- 1.2 evaluate the properties of materials used in marine construction
- 1.3 describe common defects in materials
- 1.4 explain the protection methods for wood, metal and composites used in marine construction and how they are applied
- 1.5 explain the types of reinforcement and stiffening materials used in marine construction
- 1.6 explain the selection and use of fastening and joining processes for structural purposes
- 1.7 evaluate comparative holding power of adhesives
- 1.8 distinguish primary and secondary bonds when fixing FRP structures
- 1.9 explain applications of sealing and bedding compounds used in marine construction.

Range

(AC1.1) **Materials**

- bearing materials
 - acetol
 - alloys
 - tufnol
 - white metal
 - nitrile rubber
- seals
 - mechanical seals
 - rotary shaft seals/ oil seals

- bonded seals (dowty seals)
- O-rings
- Bellows
- gland packing
- ceramic
- silicon carbide
- carbon
- PTFE

- elastomers (nitrile (NBR), neoprene, silicone etc.)
- fibre
- rope
- graphite
- kevlar

- bedding and joints
 - cork
 - gland packing (rope, PTFE)
 - paper
 - polyurethane
 - PTFE
 - rubber (nitrile, neoprene, EPDN)
 - silicon
- cloth
 - fibre reinforcement
 - pre-impregnated
 - reinforcing fibres
- composites
 - fibre reinforced plastic (FRP)
 - glass reinforced plastic (GRP)
 - plastics
- filler and filler compounds
 - colloidal silica
 - glass microfibres
 - talc and calcium carbonate
- fluids
 - additives
 - coolants
 - oils
- metals
 - alloys (brass, bronze)
 - ferrous (steel)
 - non-ferrous (lead, aluminium, copper, zinc, magnesium)
- organic peroxides
 - catalyst
- resins
 - epoxy
 - polyester
 - vinylesters
- solvents
 - acetone
 - thinners
- timbers
 - o hard woods
 - o manufactured boards

- soft woods

(AC1.2) **Properties of materials**

- bearing materials
 - hardness
 - lubrication
 - wear resistance
- bedding and joints
 - adhesion
 - aerobic / anaerobic
 - chemical resistance
 - curing state
 - flexibility
 - water resistance
- cloth
 - colour
 - fibre direction
 - fibre length
 - pattern
 - weave
 - weight
- composite
 - compressive/ shear strength
 - ductility/ malleability
 - elasticity
 - hardness
 - tensile strength
 - toughness/ brittleness
- filler and filler compounds
 - size
 - viscosity
- fluids
 - anti - corrosion
 - lubrication
 - solubility
 - temperature range
 - viscosity
- metal
 - compressive/ shear strength
 - corrosion resistance
 - ductility/ malleability
 - hardness
 - tensile strength
 - toughness/ brittleness
 - heat resistance
 - conductivity
 - nobility
- pre-impregnated
 - compressive/ shear strength
 - ductility/ malleability
 - elasticity
 - hardness
 - tensile strength
 - toughness/ brittleness
- resins/ organic peroxides
 - humidity

- mix ratio (weight, volume)
- pot life
- shelf life
- temperature
- viscosity
- wood
 - compressive/ shear strength
 - durability
 - elasticity
 - erosion resistance
 - hardness
 - moisture content
 - tensile strength
 - toughness/brittleness
 - workability

(AC1.3) Defects in materials

- wood
 - infestation
 - woodworm
 - decay
 - knots
 - splits/shakes
 - distortion
 - seasoning defects
 - voids
 - water damage
 - UV reaction
 - colour changes
- metals
 - corrosion
 - oxidation
 - galvanic and electrolytic action
 - cavitation
 - fatigue
 - de-zincification
 - crevice corrosion
 - welding imperfections
 - cracks
- plastics
 - crazing
 - fibre pattern
 - resin starvation
 - resin rich laminates
 - air entrapment
 - under-cure

(AC1.4) Protection methods and their application

- wood
 - brushing and rolling – (varnishing – UV protection, painting)
 - pressure treatment
 - steeping
 - hot and cold tank dipping
 - spraying
- metal

- brushing and rollering (painting)
- spraying
- anodising
- galvanising (including Swedish/Chinese)
- sherardising
- electro plating
- hardening and tempering
- greasing
- powder coating
- sacrificial anodes
- oil blacking
- protective wrapping
- passivating
- hot zinc spray
- insulation (gaskets, sealants, nylon tophats, proprietary compounds)
- composites
 - anti-fouling
 - polishing

(AC1.5) Types of reinforcement and stiffening materials

- carbon fibre
- aramid (Kevlar)
- pre-impregnated cloths
- polyurethane foam
- PVC foam
- wood (end grain Balsa)
- metal

(AC1.6) Fastening and joining processes

- machine screws
- riveting
- riv nuts
- thread locking compounds
- bolts, e.g. high tensile
- self-tappers
- stud bars
- pins, e.g. roll pins, clevice pins, taper, split, cotter
- keys, e.g. taper, feather, woodruff, offset
- specialist bolts, e.g. gallery bolts
- welding (MIG/TIG, MMA, oxy gas, spot welding)
- brazing and soldering (soft, silver, bronze welding)
- crimping
- thermal joining (shrink fitting, limits and fits)
- taper fits (e.g. propellers)

(AC1.7) Comparative holding power adhesives

- urea formaldehyde
- resorcinol
- cyanoacrylate
- resins
- epoxy resins
- polyurethane
- PVA
- polyester resin

- mastics, e.g. polysulphide
- contact adhesive
- casein

(AC1.8) **Primary bonds and secondary bonds**

- primary bonds made between plies of resin & reinforcement laid and cured at the same time
- secondary bonds made between plies of resin and reinforcement laid after previous layers have cured

(AC1.9) **Applications of sealing and bedding compounds**

- manufacturer's guidelines
- cleanliness
- environmental conditions
- isolation of dissimilar metal

Learning outcome

The learner will:

- 2 Understand the use of drawings and specifications used in marine engineering

Assessment criteria

The learner can:

- 2.1 identify the specification authorities and regulating bodies for marine construction activities
- 2.2 explain how to use drawing scales
- 2.3 identify boat terms from drawings and specifications
- 2.4 explain how to extract information from lines plans, construction and general arrangement drawings
- 2.5 identify diagrams, schematics and symbology used in performing marine engineering activities
- 2.6 use calculations to determine common marine engineering areas, volumes, capacities from plans, drawings and specifications

Range

(AC2.1) **Specification authorities and regulating bodies**

- Lloyds
- Recreational Craft Directive (RCD)
- BS EN and ISO standards
- Environmental Protection Act 1990
- British Waterways Board
- Boat Safety Scheme
- Marine Coastguard Agency (MCA)
- Marine Safety Agency
- Royal Institute Naval Architects (RINA)
- Bureaux Veritas
- American Bureau of Shipping (ABS)
- American Boat and Yacht Council (ABYC)
- Royal Yachting Association (RYA)

- British Marine Electrical and Electronic Association (BMEEA)
- International Marine Electrical Association
- National Marine Electronics Association in America (NMEA)
- Flag state
- Canal and River Trust

(AC2.3) **Boat terms**

- port
- starboard
- forward
- aft
- midships
- bow
- stern
- outboard
- inboard
- deadweight
- bulkhead
- keel (drop, fin, watertight, bilge, long, triple)
- mast
- rudder (balanced, unbalanced, semi balanced)
- foils
- rubbing strakes
- rolling chocks
- sole boards
- bulwarks
- capping rail
- bathing platform
- transom
- chain locker
- wheel house
- engine room
- coach roof
- lazarette/tiller flat
- camber
- bilge
- bridge
- cockpit
- deckhouse
- decks
- hatches
- vents
- saloon
- cabins
- deck equipment
- winch
- fairleads
- bollards
- bow rollers
- davits
- anchor

- length
- breadth
- depth
- draught
- freeboard
- displacement
- superstructure
- frame
- tumblehome
- flare
- gas locker
- deck glands
- skin fittings
- longitudinals
- thwartships
- waterline
- coaming
- heads
- pumps
- primemovers
- generators
- tank space
- couplings
- universal joints
- power take off
- scuppers
- stern thruster
- bow thruster
- stabilisers
- gyro
- gypsy
- switchboard
- distribution boxes
- AC units
- refrigeration
- air con
- water makers (ROWM)

(AC2.5) **Schematics**

- hydraulics
- electrical (schematics, working drawings)
- welding
- pneumatics

(AC2.5) **Symbology**

- hydraulic and pneumatic symbols
 - flowlines and connections (junction, crossing, not connected, flexible line)
 - control methods (push/pull buttons, lever and pedal operated)
 - mechanical control (plunger/roller, spring and solenoid)
 - direct control (pressure direct, internal and external control)
 - directional control valves (2/2, 2/4, 3/4 and 4/4)

- hydraulic pumps (single, bi-directional and variable speed)
- linear converters (single/double acting, telescopic and rotary converters)
- non return valves (NRV) (spring loaded, pilot controlled, shuttle and priority)
- electrical symbols
 - power supplies
 - batteries
 - AC
 - fuses/MCB
 - resistors
 - capacitors
 - transistors
 - lamps
 - relay
 - motors
 - switches
 - isolators
 - bonding
 - transformers
 - diodes
 - L.E.D's
 - thermistors and buzzers
 - loudspeakers
- welding symbols
 - square
 - scarf
 - V
 - bevel
 - U
 - J
 - flare V
 - flare bevel
 - fillet
 - plug or slot
 - spot or projection
 - seam
 - back or backing
 - surfacing
 - flange edge and corner
- finishing symbols
 - chipping
 - grinding
 - machining
 - rolling
 - hammering

(AC2.6) Calculations

- quantity
- volumes (tanks, common solids, irregular volumes and areas)
- mass
- density
- surface area, i.e. anode
- torque
- simple machines (force, ratio and efficiency)
- ideal gas laws (Boyle's, Charles and Pressure Laws)
- power current and resistance calculations

Learning outcome

The learner will:

- 3 Understand marine construction techniques

Assessment criteria

The learner can:

- 3.1 explain the types of propulsion
- 3.2 describe marine construction techniques
- 3.3 explain the use of tools and equipment in marine construction
- 3.4 explain the considerations for stresses and strains when constructing a vessel

Range

(AC3.1) Type of propulsion

- sails
- oars
- paddles & paddle wheels
- inboard and outboard marine engines driving propellers with direct, Z or V drives, Jet, hydraulic, electric drives
- air driven (hover craft)
- hybrid engines

(AC3.2) Marine construction techniques

- modern wood/epoxy (strip plank, cold moulding, clinker ply, stitch and tape)
- traditional techniques (carvel, clinker, double diagonal)
- fibre reinforced plastics FRP (wet lay up, spray, resin infused, carbon fibre, Kevlar)
- metals (steel, aluminium)
- fabrics
- plug construction techniques
- ferro cement

(AC3.3) Tools

- range of common tools (e.g. spanners, sockets, screwdrivers)
- power tools (e.g. battery drill, air impact wrench)
- measuring tools (e.g. micrometer, Vernier callipers, dial test indicator, pressure gauges, inclinometer, temperature guns)
- special servicing tools (e.g. diagnostic lap tops, multimeters, insulation testers, loop testers)

(AC3.4) Considerations for stresses and strains

- pitching
- rolling
- sagging

- hogging
 - yawing
 - lifting and shoring
 - moving vessel on land
 - static stress
 - surging
 - heaving
-

Learning outcome

The learner will:

- 4 Understand the engineering systems used on boats

Assessment criteria

The learner can:

- 4.1 explain communication systems used on boats
4.2 explain the principles of engineering systems installed on boats
-

Range

(AC4.1) **Communication systems**

- radio
- navigation lights
- flags
- satellite support systems
- rockets and flares
- mobile phones
- AIS
- Inter ship tracking systems

(AC4.2) **Systems**

- heating
 - diesel fired heating
 - water heating
 - engine driven heating
 - boilers
 - heat exchangers
 - water
 - fresh water system
 - fresh and reverse osmosis water makers (ROWM)
 - standard pressurised system
 - calorifier system
 - pumps
 - filters
 - tanks
 - waste
 - grey
 - black
-

- storage
- pump
- filters
- treatment
- maceration
- condensate drains
- vacuum
- ventilation and air conditioning
 - central cold water system
 - stand alone system
 - reverse cycle system
- refrigeration
 - compressors
 - pumps
 - heat exchangers
 - dryers
- bilge
 - pipework
 - pumps
 - pick ups
 - alarms
 - size
 - valves
- fire system
 - pumps
 - pipework
 - medium
 - suppression
- fuel
 - tanks
 - storage
 - pumps
 - filters
 - valves
 - balance
 - filler breaking system
- compressed air
 - compressors
 - cylinders
 - pipework
- hydraulic
 - steering
 - thrusters
 - linear and rotary actuation
 - stabilisers
 - winches and deck gear
 - low and high pressure systems
 - trim tabs
 - pumps, valves and accumulators
 - engine driven
 - electric driven
 - stored energy
 - hoses
 - pressure and leak testing
 - filtration
 - handling of fluids

- flushing and cleaning
 - pneumatic
 - low pressure
 - high pressure
 - compressors
 - reservoirs
 - receivers
 - valves
 - electrical
 - batteries
 - canbus and other networks
 - distribution system
 - AC /DC systems
 - renewable energy (solar, wind, hydro)
 - battery charging
 - invertors
 - domestic systems
 - heating
 - water – fresh and reverse osmosis water maker (ROWM)
 - waste – grey and black
 - refrigeration
 - ventilation and air-conditioning
-

Learning outcome

The learner will:

- 5 Understand the use of fittings and components used in marine construction

Assessment criteria

The learner can:

- 5.1 explain the importance of location and purpose of fittings and components installed on boats
 - 5.2 explain the functions of different exterior fittings and components
 - 5.3 explain the importance of providing additional stiffening and support in way of fittings and components
 - 5.4 explain the application and use of different types of fastening devices for particular applications
 - 5.5 explain the reason for the use of bedding and sealing compounds in way of fittings and dissimilar metals
 - 5.6 explain the problems that can affect the work when installing equipment, fittings and components to boats
-

Range

(AC5.1) Location and purpose

- function satisfactorily
 - do not present a hazard in use
 - allow easy access and operation
 - meet operational requirements
 - meet customer requirements
-

- meet regulatory safety requirements
- maintain structural integrity

(AC5.2) Exterior fitting and components (function)

- hull fittings
 - rudders
 - rudder stops
 - rudder gland
 - skeg fittings
 - pintles and gudgeons
 - skin fittings
 - hawse pipes
 - stern tubes, stern glands and seals
 - 'A' and 'P' brackets
 - transducers
 - anodes
 - shafts and props
 - rudder tubes
- superstructure
 - hatches and skylights
 - windows
 - doors
 - vents
 - lockers
 - radar mast
 - aerials
 - upper steering position (USP)
 - seats
- deck fittings
 - grab rails
 - pulpit and pushpit
 - guard rails
 - forestay and backstay fittings
 - bow rollers
 - winches
 - windlasses
 - cleats
 - bollards
 - fairleads
 - sampson post and fairleads
 - mainsheet and headsail tracks
 - tabernacle
 - anchor stowage
 - stanchions
 - passerelle
 - davits
 - life-buoy and life-raft stowage

(AC5.4) Application and use of fastening devices

- use of locking devices and fluids
- torque loading
- tensile strength
- grades of materials
- thread identification

- specialist bolt heads: 'gallery' bolts in narrow rudders sections, barrel bolts in wooden engine beds
- use of locking devices to prevent fastenings becoming loose or undone

(AC5.6) Problems that can affect the work

- poor design
- quality of materials and components
- late delivery of materials
- environment (heat, cold, wet)
- common installation conflicts
- working practices and standard of workmanship (poor training)
 - lack of planning, preparation and resources
 - incorrect / poor use of tools
 - incorrect use of materials
 - lack of protection (surfaces)
 - poor quality control
- access to working areas
- drawings and work instructions
 - incorrect drawings
 - unclear instructions
 - superseded documentation
 - incorrect reading of drawings and not understanding the work instructions
- incorrect specification of components
- location of existing installations
- unplanned events
- customer expectations
- poor quality control

Unit 353

Installation and repair of vessel services

Unit Level:	Level 3
GLH:	100
Aim:	It is concerned with the installation of vessel service systems and carrying out inspection, fault diagnosis and repairs of marine ancillary systems.
Assessment type	Centre-devised practical assignment and short-answer questions

Learning outcome

The learner will:

- 1 Be able to describe and install vessel service systems

Assessment criteria

The learner can:

- 1.1 describe the criteria for planning and installing marine systems within a boat
- 1.2 select and use documentation necessary for planning and routing systems
- 1.3 explain the purpose of the codes of practice and regulations that relate to quality of work and the operating environment of a vessel
- 1.4 explain why it is important to configure and connect components with regard to equipment orientation and the direction of the flow
- 1.5 identify the forms of system installation problems that may occur and how to prevent them
- 1.6 explain the key criteria for planning and installing air conditioning and heating systems
- 1.7 explain why it is important to involve and communicate with other specialist trades in planning and undertaking vessel service system installation
- 1.8 install/repair a vessel's service systems
- 1.9 select and use the components of domestic service systems and describe their use
- 1.10 identify the specific tests to be carried out by appropriately qualified engineers
- 1.11 carry out inspection and testing checks that are necessary for service installation
- 1.12 explain the importance of recording test results and reporting any discrepancy to an appropriate person
- 1.13 complete all relevant documentation and reinstate the work area

Range

(AC1.1) Criteria for planning and installing marine systems

- customer requirements
- specification and layout drawings
- access for installation and maintenance
- material usage
- sufficient water pressure for the number of outlets
- tank capacity and positioning
- method and location of discharge arrangements
- black waste
 - pumps
 - tanks (polypropylene, SS, galvanised steel)
 - piping (sanitary specification)
 - skin fitting, sea cock
 - vent
 - deck pump
 - inlet/outlet
 - inlet filters
 - syphon breaks
 - vacuum
 - diveter valve
 - pipe clip and brackets
- grey waste
 - pumps
 - float switch
 - tanks (polypropylene, SS)
 - piping (PVC)
 - pipe clip and brackets
 - venting
- bilge systems
- fire systems
- hydraulic systems
 - thrusters
 - winches
 - windlass
 - mast hydraulics
 - trim tabs
 - stabilisers
- deck and cockpit water system
 - sea cocks/ball valve
 - outlet fittings
 - piping (PVC, SS, moulded)
 - pipe clip and brackets
 - crossover drainage pipes
 - deck wash
- hot and cold water systems
 - tanks
 - pumps
 - divert and shut-off valves
 - in line filters
 - calorifier
 - immersion heater
 - water maker (ROWM)
 - accumulators

- connectors (compression joints, screw joints, cemented/glued joints, soldered joints, outlet taps/ shower units)

(AC1.2) Documentation

- layout drawings
- system specifications
- general arrangement drawing
- job instructions
- component manufacturers data sheets
- installation instructions
- Bill of Materials

(AC1.3) Codes of practice and regulations

- ISO 14001
- RCD
- Lloyds
- HSE
- FGAS
- MCA, e.g. IPV
- Boat Safety Scheme

(AC1.5) System installation problems

- contaminants
- poor connections
- incorrect orientation
- positioning (valves, syphon breaks, skin fitting, filters)
- incorrect pipe runs
- pinching
- tight bends and crushing of pipes
- head of water

(AC1.6) Key criteria

- air conditioning
 - system specifications and manufacturer instructions
 - position of unit
 - pipe and outlet runs for effective operation
 - access for installation and maintenance
 - provision for waste heat removal
 - provision for waste water removal
 - relevance of standards
- heating systems (fixed and hot air)
 - specification of manufacturer instructions
 - position of units
 - heat exhaust system
 - insulation and fire resistance of the system
 - position for efficiency of heat transfer
 - relevance of standards

(AC1.9) Components

- piping
- pipe connectors

- tanks
- pumps
- valves
- drains
- skin fittings
- ancillary fittings
- heaters
- filters
- syphon breaks
- strainers
- cathodic protection (earthing and bonding)

(AC1.10) **Specific tests**

- gas safe (gas engineer)
- electronics/electrical systems (BMEA qualified engineer)
- refrigeration and air conditioning (vacuum test, leak test, pressure test, oil test) (HVAC qualified engineer)

(AC1.11) **Inspection and testing checks**

- visual checks
- audible checks
- pressure test (manometer, gauges)
- leak tests (detection spray, immersion, soapy water)
- functional tests
- association between pressure and temperature over time

Learning outcome

The learner will:

- 2 Be able to carry out an inspection, fault diagnosis and repair marine ancillary systems

Assessment criteria

The learner can:

- 2.1 identify the sources of information relating to the condition of marine ancillary systems
- 2.2 describe the range of system/services inspections and checks carried out when looking for faults
- 2.3 describe the specialist services needed for certain reinstatement work and how these services might be employed
- 2.4 describe common faults on various marine ancillary systems
- 2.5 describe safety and isolation procedures
- 2.6 undertake inspection, fault finding and testing procedures
- 2.7 identify the options available for restoration
- 2.8 identify the specification limits which will affect options for restoration
- 2.9 identify potentially defective system components
- 2.10 plan and carry out the required procedures, then undertake the system repair and reinstatement as identified

- 2.11 identify and use the tools required for the testing, repair and replacement of system components
 - 2.12 identify the common defects that may occur following a repair
 - 2.13 complete and record results of inspection and repairs carried out
 - 2.14 restore work area following completion of the repair
-

Range

(AC2.1) Sources of information

- workshop manuals
- boat data sheets
- repair history
- parts lists
- job instructions
- harbour/sea trial report
- diagnostic report

(AC2.2) Range of systems/services

- mechanical
- electrical/electronic
- domestic

(AC2.2) Inspections and checks

- visual
- functional/operational
- audible

(AC2.4) Common faults

- defective minor components and major components
- maladjusted system components
- connections
- wear
- alignment

(AC2.5) Safety and isolation

- lock out/tag out of electrical and gas supplies
- isolating/emptying of fuel tanks
- emptying waste and water tanks
- shut off and isolate valves

(AC2.6) Inspection, fault finding and testing procedures

- visual inspections
 - function test
 - operational test
 - static test
 - leak test
 - electrical tests (system dependant)
 - pressure test
-

- alignment check

(AC2.8) Specification limits

- system performance
- craft operating environment
- safety limits
- system manufacturers recommendations
- company specifications
- surveyors reports
- customer requirements
- availability of components

(AC2.10) Procedures required prior to starting a repair

- identify components
- inform management and affected personnel
- identify hazards
- identify and isolate services (lock out/tag out if required)

(AC2.10) Procedures required after reinstating a system repair

- filling system correctly with no leaks
- venting system with no leaks
- purging, attaching suitable test equipment (by qualified engineer)
- reporting
- recommissioning and functional test

(AC2.14) Restore work area

- 5s approach
- clearing away all waste and discarded materials
- cleaning tools and equipment
- returning all tools and equipment to appropriate place
- ensuring area is safe and free from dangers

Unit 354

Installation, fault diagnosis and repair of marine engines

Unit level:	Level 3
GLH:	100
Unit aim:	It is concerned with using tools, equipment and materials to diagnose and rectify faults in marine engines, systems and components. It also covers the layout, installation and operating principles of marine engines.
Assessment type	Centre-devised practical assignment and short-answer questions.

Learning outcome

The learner will:

- 1 Be able to use the tools, equipment and materials required to diagnose and rectify faults in marine engine systems and components

Assessment criteria

The learner can:

- 1.1 explain the principal differences between the construction of a CI and SI engine
- 1.2 describe the purpose and functional requirements of ancillary marine engine systems and components
- 1.3 describe and use the special purpose tools, equipment, materials and information sources needed to diagnose and rectify faults in systems and components
- 1.4 rectify faults in marine engines

Range

(AC1.1) Principal differences

- compression ignition, spark ignition engines
- need for greater strength in CI engine, differences in combustion chamber design, piston design, use of materials, combustion requirements (temperature)
- SI and CI engines incorporating fixed and variable valve lift and timing systems
 - SI engine management and fuel systems (closed and open loop systems)
 - CI engine management and fuel systems (closed and open loop systems)
- air supply and control system (crankcase emission control systems, normally aspirated, turbo charged/super charged)
- exhaust systems: catalytic converters

(AC1.2) **Ancillary engine systems and components**

- cooling systems (liquid/air)
- lubrication systems
- electrical equipment
- ignition systems
- starting systems
- charging systems
- exhaust systems (dry and wet)
- sensors
- drive shafts (dynamic dampers)

(AC1.3) **Tools, equipment, materials, information**

- strobe light
- dwell meter
- tachometer
- coolant system pressure tester
- equipment for testing thermostat
- injector pressure tester (manual)
- specialist tools specified by manufacturer
- diagnostic equipment and data
- refractometer
- borescope
- measuring equipment (dti, feeler gauges)
- smoke/emissions tester
- cylinder compression tester
- cylinder leak tester
- battery drop test
- multimeters
- manufacturers manuals and service bulletins

Learning outcome

The learner will:

- 2 Understand the layout and operating principles of marine engines, systems and components

Assessment criteria

The learner can:

- 2.1 describe the operating principles of marine engines, systems and components
- 2.2 describe systems diagnosis and rectification
- 2.3 describe how to prepare and use hand tools, special purpose tools, equipment and materials required to remove and refit systems and components
- 2.4 state the basic electrical units and relationships

Range

(AC2.1) **Operating principles of systems and components**

- SI and CI engines
 - variable valve timing
 - variable lift
 - multi-valve arrangements
- SI and CI engine management
 - control valves and relays
 - ECU/EDU
 - sensors
 - wiring systems and connections
 - break out boxes
- fuel systems
- engine lubrication systems
 - pumps
 - filters (simplex, duplex)
 - full flow and by pass valves
 - pressure relief valves
 - pressure indicating and warning systems
 - lubricants
- cooling systems
 - coolants
 - heat exchanger
 - oil coolers
 - inter coolers
 - pumps
 - temperature control systems
- air supply and control system
 - crankcase emission control systems
 - normally aspirated
 - turbo chargers
- drive shafts
 - constant velocity joints
 - dynamic dampers
 - power take offs
- seals
- electrical and electronic systems
 - starting
 - charging (batteries, Peukert's Law)
 - ancillaries

AC2.4) **Basic electrical units and relationships**

- current
- voltage
- resistance
- power
- Ohm's Law

Learning outcome

The learner will:

- 3 Be able to diagnose faulty marine engines, systems and components, including removal, rectification/refit and evaluation

Assessment criteria

The learner can:

- 3.1 describe the methods used to diagnose faulty marine engine systems and components
- 3.2 describe the methods to obtain and interpret diagnostic information
- 3.3 diagnose and rectify faulty marine engine systems and components in SI and CI engines
- 3.4 explain and carry out the method for preparing a marine engine for removal and re-installation
- 3.5 describe the requirements for disposing of waste materials during fault diagnosis and rectification in line with environmental legislation/regulations
- 3.6 evaluate the operational efficiency of the systems and components following diagnosis and rectification
- 3.7 restore work area on completion of the repair/installation activity

Range

(AC3.1) **Methods used to diagnose**

- engineering knowledge/experience
- harbour/sea trials
- simulated tests
- measurements
- fault code analysis
- interpreting data obtained from electronic system tests (manufacturer's computer diagnostics)
- sensor measurements
- control unit outputs/signals

(AC3.2) **Methods to obtain and interpret diagnostic information**

- mechanical condition
- wear
- pressures
- flow
- leakage
- efficiency

(AC3.3) **SI and CI engines**

- variable valve timing
- variable lift
- multi-valve arrangements
- cylinder blocks
- heads
- pistons

- connecting rods and gaskets
- camshafts
- valve timing
- timing belts
- chains and tensioners
- drive mechanisms for ancillary equipment
- balancers and dampers
- crankshafts and flywheels

(AC3.3) Systems

- lubrication
- pumps
- filters
- cooling
- fuel (diesel/petrol)
- engine management
- electrical

(AC3.5) Requirements for disposing of waste materials

- ISO 14001
- local legislation
- COSHH
- Hazardous Waste Regulations
- waste hierarchy
- environmental protection legislation
- licenced waste carriers
- company policies
- other applicable legislation

(AC3.7) Restore work area

- 5s approach
- clearing away all waste and discarded materials
- cleaning tools and equipment
- returning all tools and equipment to appropriate place
- ensuring area is safe and free from dangers

Unit 355

Installation and repair of marine propulsion systems

Unit level:	Level 3
GLH:	100
Unit aim:	The aim of this unit to equip candidates with the skills and knowledge needed to carry out the installation of new marine propulsion systems on a range of hull forms and the diagnosis and rectification associated with marine propulsion systems.
Assessment type	Centre devised practical assignment and short-answer questions.

Learning outcome

The learner will:

- 1 Understand the characteristics of hull forms and propulsion systems

Assessment criteria

The learner can:

- 1.1 explain the various hull forms
- 1.2 explain marine propulsion systems and components
- 1.3 explain the relationship between hull waterline length, wave making and speed (knots)
- 1.4 explain the type and positioning of the main propulsion systems and components for various hull forms
- 1.5 explain how propulsion system types and positioning affect the performance of a vessel
- 1.6 describe the factors that affect the relationship between the wetted surface area and drag

Range

(AC1.1) Hull forms

- mono hulls
 - displacement
 - semi-displacement
 - very slender vessel (VSV)
 - planing (hard-chine, deep vee)
- multi-hulls
 - catamarans
 - trimarans
- small water plane area twin hull (SWATH)
- jet skis

(AC1.4) Propulsion components

- stern tube
- stern glands
- gland packing (rope, PTFE, UHMPE)
- stern seals
- intermediate bearings
- plumber blocks
- universal joints
- flexible drives
- outdrive
- outboard
- sail drive
- water jet drive
- hydraulic drive
- electric drive
- pod drive
- surface drive
- thrusters
- A brackets
- P brackets
- cutlass bearings
- anodes
- rope cutter

(AC1.5) Factors that affect the performance of vessel

- shaft length
- shaft angle
- shaft location
- weight
- trim
- single/multi engine
- configuration
- propellers
- A brackets
- P brackets
- rudders

(AC1.6) Factors

- hull form
- shaft/s
- A brackets
- P brackets
- rudder/s
- outdrive
- jet drive
- propeller/s
- inlets/outlets
- grills/gratings
- thrusters inlets/outlets

- anodes
 - trim tabs
 - marine growth
-

Learning outcome

The learner will:

- 2 Understand the layout and operating characteristics of systems and components

Assessment criteria

The learner can:

- 2.1 describe common propulsion systems and modes of operation
 - 2.2 describe the main components of propulsion systems and auxiliaries and state the purpose and operating characteristics
 - 2.3 identify and gain access to systems
 - 2.4 describe hazards when working with marine propulsion systems and precautions to be taken
-

Range

(AC2.1) **Common propulsion systems**

- shaft/propeller
- jet drive
- sail drive
- out drive
- pod drive
- keel drive
- outboard
- hybrid
- thrusters

(AC2.2) **Components of propulsion systems and auxiliaries**

- gearbox and reduction gear
 - drive systems
 - outdrive
 - mounting
 - trimming, controls
 - kill-cords/auto-stops
 - sail drive
 - pod drive
 - hydraulic
 - electric
 - jet drive
 - steering rams
 - lubrication systems
 - pumps
 - filters
 - valves
-

- controls
 - lubricants
- cooling systems
 - wet/dry
 - coolants
 - controls
 - thermostat
- propellers
 - two/three/four bladed
 - twin screws
 - effects of diameter
 - aspect
 - folding
 - controllable pitch
 - variable pitch
 - surface piercing
 - anodes
 - feathering
- drive shafts
 - couplings
 - flange
 - universal
 - lock methods (shaft brake)
 - key ways
 - splines
 - stern tubes
 - prop shaft
 - shaft log
 - sealing arrangement (stern glands, stern seals)
 - tapers
 - cutlass bearing
 - A and P brackets
 - intermediate bearings, e.g. plumber blocks
- rudders/steering systems
- thrusters

(AC2.3) Access requirements

- afloat
- ashore
- engine room
- tiller flat
- lazarette
- interior
- exterior
- below sole boards
- lifting equipment
- engine hatch cover

(AC2.4) Hazards and precautions

- danger from power transmission systems rotating
- stored energy, e.g. hydraulics, pneumatic pressure
- Verdigris (respiratory)
- reciprocating machinery and parts

- lifting
 - manual handling
 - lubricants
 - electrical equipment and systems
 - fire risks
 - lock out / tag out
 - permit to work
 - warning signs
 - PPE
-

Learning outcome

The learner will:

- 3 Be able to diagnose faulty systems and components, including removal, rectification/refit

Assessment criteria

The learner can:

- 3.1 describe how to diagnose and rectify faults in propulsion systems and components
 - 3.2 obtain and interpret diagnostic information
 - 3.3 prepare systems for diagnosis and rectification
 - 3.4 identify and use tools and equipment required for fault diagnosis
 - 3.5 identify information required for fault diagnosis and rectification
 - 3.6 overhaul faulty systems and components using common procedures
 - 3.7 state factors which influence whether to repair or replace
 - 3.8 state procedures for disposing of waste materials
-

Range

(AC3.1) **Diagnose faults in propulsion systems**

- system and component knowledge
- collection of data
- analysis of evidence
- interpretation of tests
- functional checks
- sensory evidence (visual, sound, smell)
- dock side trials
- sea trials
- measurements
- interpreting data from system tests
- user testimony/experiences

(AC3.1) **Rectify faults in propulsion systems**

- gearboxes
 - drive systems
 - lubrication systems
 - cooling systems
-

- propellers
- rudders/steering systems

(AC3.2) Obtaining and interpreting diagnostic information

- mechanical condition
- wear
- pressures
- flow
- leakage
- efficiency
- temperature
- vibration readings
- condition of fluids

(AC3.4) Tools and equipment

- DTI
- Feeler gauges
- Vernier caliper
- Micrometer (internal / external)
- Straight edge
- Spring gauge
- Vee blocks
- Micrometer blue
- Dye penetrant
- Pressure testing equipment

(AC3.5) Information

- manufacturer and company data and information sheets
- service schedules
- parts lists
- legal and technical data reference books
- wear down reports
- straightness reports
- fit of tapers
- visual inspection
- line up reports

(AC3.7) Factors

- cost of repair/replacement
- availability of replacement parts
- time for repair
- customer requirements, e.g. timescales

Learning outcome

The learner will:

- 4 Be able to evaluate system and component performance following fault diagnosis and rectification of propulsion systems

Assessment criteria

The learner can:

- 4.1 describe the procedures for evaluating operational performance of propulsion systems and components
- 4.2 state methods of recording and reporting outcomes
- 4.3 select, prepare and use tools and equipment to evaluate system and component performance
- 4.4 state actions to be taken following evaluation of the system
- 4.5 make and record appropriate recommendations resulting from activities
- 4.6 complete schedule as appropriate and report problems to relevant persons
- 4.7 explain how to restore work area on completion of the repair/ installation activity

Range

(AC4.2) **Methods of recording and reporting**

- manufacturers' recording sheets
- company specific recording sheets
- RCD log

(AC4.4) **Actions**

- fit new components
- carry out repairs/rectification
- check to see if work is fit for purpose
- identify time used
- parts used
- component and labour costs
- report to client/relevant manager(s)/manufacturer
- complete all required documentation

(AC4.7) **Restore work area**

- 5s approach
- clearing away all waste and discarded materials
- cleaning tools and equipment
- returning all tools and equipment to appropriate place
- ensuring area is safe and free from dangers

Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on **www.cityandguilds.com**.

City & Guilds Centre Manual contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information on such things as:

- **Walled Garden:** how to register and certificate candidates on line
- **Events:** dates and information on the latest Centre events
- **Online assessment:** how to register for e-assessments.

Centre Guide – Delivering International Qualifications contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve ‘approved centre’ status, or to offer a particular qualification. Specifically, the document includes sections on:

- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

Linking to this document from web pages

We regularly update the name of documents on our website, therefore in order to prevent broken links we recommend that you link to our web page that the document resides upon, rather than linking to the document itself.

Useful contacts

UK learners

General qualification information

E: learnersupport@cityandguilds.com

International learners

General qualification information

E: intcg@cityandguilds.com

Centres

Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results

E: centresupport@cityandguilds.com

Single subject qualifications

Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change

E: singlesubjects@cityandguilds.com

International awards

Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports

E: intops@cityandguilds.com

Walled Garden

Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems

E: walledgarden@cityandguilds.com

Employer

Employer solutions including, Employer Recognition: Endorsement, Accreditation and Quality Mark, Consultancy, Mapping and Specialist Training Delivery

E: business@cityandguilds.com

Every effort has been made to ensure that the information contained in this publication is true and correct at the time of going to press. However, City & Guilds' products and services are subject to continuous development and improvement and the right is reserved to change products and services from time to time. City & Guilds cannot accept liability for loss or damage arising from the use of information in this publication.

If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: **feedbackandcomplaints@cityandguilds.com**

About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group is a leader in global skills development. Our purpose is to help people and organisations to develop their skills for personal and economic growth. Made up of City & Guilds, City & Guilds Kineo, The Oxford Group and ILM, we work with education providers, businesses and governments in over 100 countries.

Copyright

The content of this document is, unless otherwise indicated, © The City and Guilds of London Institute and may not be copied, reproduced or distributed without prior written consent. However, approved City & Guilds centres and candidates studying for City & Guilds qualifications may photocopy this document free of charge and/or include a PDF version of it on centre intranets on the following conditions:

- centre staff may copy the material only for the purpose of teaching candidates working towards a City & Guilds qualification, or for internal administration purposes
- candidates may copy the material only for their own use when working towards a City & Guilds qualification

The Standard Copying Conditions (see the City & Guilds website) also apply.

Please note: National Occupational Standards are not © The City and Guilds of London Institute. Please check the conditions upon which they may be copied with the relevant Sector Skills Council. Published by City & Guilds, a registered charity established to promote education and training

City & Guilds

1 Giltspur Street

London EC1A 9DD

www.cityandguilds.com