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## Overview

This standard identifies the competences you need to repair composite mouldings, such as cured panels, moulds, components and jigs, in accordance with approved procedures. You will be required to use appropriate drawings, specifications and repair documentation, and to extract the relevant information in order to carry out the necessary repairs to the components or assemblies.

You will be expected to identify the method of repair to be used and to select suitable repair materials. You will repair a range of composite mouldings, with various defects, using a range of methods. Mouldings repaired will include a range of resin and fibre materials.

Your responsibilities will require you to comply with organisational policy and procedures for the repair activities undertaken, and to report any problems with the activities, equipment or materials that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying composite moulding repair procedures. You will understand the repair techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

You will understand the safety precautions required when carrying out the repair activities, and when using the associated tools and equipment. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

**Performance  
criteria**

*You must be able to:*

- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
- P2 follow the relevant specifications for the component to be repaired
- P3 prepare the component for repair
- P4 carry out the repairs within agreed timescale using approved materials and components and methods and procedures
- P5 ensure that the repaired component meets the specified operating conditions
- P6 produce accurate and complete records of all repair work carried out

## Knowledge and understanding

*You need to know and understand:*

- K1 health and safety precautions to be taken, and procedures to be used when working with composite materials, consumables, tools and equipment in the specific work area
- K2 how to recognise and deal with emergencies and the procedures to be followed (such as methods of safely evacuating and closing down of compartments in the case of fire or other major incident, first aid, fire fighting and resuscitation of personnel)
- K3 the hazards associated with composite materials, consumables, tools and equipment, and how to minimise these in the work area
- K4 the protective equipment (PPE) that is needed for personal protection and, where required, the protection of others
- K5 the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables
- K6 the specific workshop environmental conditions that must be observed when repairing marine mouldings (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)
- K7 how to use and extract information from drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken
- K8 how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
- K9 quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification), and the completion of appropriate documents
- K10 conventions and terminology used when repairing composite mouldings (such as disbonds, de-lamination, resin injection, resin voids, core potting, repair patches)
- K11 the different forms of damage or defect that can occur in the mouldings, and how this affects the type of repair selected
- K12 how to assess the damage or defect in the mouldings, and how to determine the most suitable type of repair
- K13 the importance of ensuring that the repair conforms to the repair specification
- K14 failure modes for various composite mouldings, and what can contribute to these
- K15 different types of composite resin systems, fibres and reinforcements, and the types of defect that might be present
- K16 different methods of production for composite mouldings, and the sorts of defect that might be caused
- K17 different bonding agents, methods used, and the sorts of defect that might be present in the bond

- K18 the various methods that can be used to help identify whether defects are present in the mouldings (to include visual inspection, touch, sound, measurement, mechanical and non-destructive tests)
- K19 correct methods of storage and handling of composite materials
- K20 tools and equipment used for various activities associated with composite mouldings
- K21 the extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Additional Information

### Scope/range related to performance criteria

- You must be able to:*
1. Carry out **all** of the following during the composite repair activities:
    - 1.1 use the correct issue of documentation (such as drawings, manuals, specifications, job cards)
    - 1.2 use relevant health and safety documentation (such as material data sheets, COSHH sheets, risk assessments)
    - 1.3 use the correct tools and equipment for the activity, and ensure that they are safe to use and suitably stored
    - 1.4 keep the work area in a safe and tidy condition
  2. Carry out **all** of the following when preparing for the repair activity:
    - 2.1 identify what needs to be repaired
    - 2.2 select the correct equipment for the activity
    - 2.3 assess the extent of the damage to be repaired
    - 2.4 check that the equipment is suitable for use
    - 2.5 identify the method of repair to be used
    - 2.6 check the availability of ancillary materials required
    - 2.7 identify and protect the moulding and repair materials in the work area
  3. Carry out **three** of the following types of composite repair:
    - 3.1 cosmetic which can be filled
    - 3.2 hole damage with access from both sides
    - 3.3 surface damage where laminate needs replacing
    - 3.4 hole damage with external access only
    - 3.5 internal damage where laminate needs replacing
    - 3.6 requiring temporary mould manufacture
  4. Carry out repairs to marine composite components, to include the following: Either **one** of the following:
    - 4.1 hull
    - 4.2 superstructure
    - 4.3 masts and spars
    - 4.4 cabins or wheel houses
    - 4.5 bulkheadOr **four** of the following:
    - 4.6 rudders
    - 4.7 berths
    - 4.8 skegs

- 4.9 radar/navigational domes
  - 4.10 air intakes/vents
  - 4.11 tanks
  - 4.12 steering equipment (wheel, tiller)
  - 4.13 fairings
  - 4.14 davits
  - 4.15 consoles
  - 4.16 hatches
  - 4.17 seats
  - 4.18 casings and covers
  - 4.19 shower units
  - 4.20 vanity units
  - 4.21 other specific marine component
5. Repair defects in composite mouldings, using **four** of the following methods:
- 5.1 localised curing
  - 5.2 relieving distortion
  - 5.3 resin injection
  - 5.4 core patching
  - 5.5 fettling
  - 5.6 separation of bonds
  - 5.7 wet-lay patching
  - 5.8 insert/core potting
  - 5.9 surface filling
  - 5.10 bonding
  - 5.11 pre-preg patching
  - 5.12 repair patches/kits
  - 5.13 colour matching
  - 5.14 polishing
  - 5.15 osmosis
  - 5.16 laminating
6. Repair defects, using techniques/materials applicable to **two** of the following resins types:
- 6.1 polyester
  - 6.2 bismaleimide
  - 6.3 acrylic resin
  - 6.4 cyanate ester
  - 6.5 phenolic resin
  - 6.6 vinyl ester
  - 6.7 epoxy resin
7. Repair defects, using techniques/materials applicable to **two** of the following fibre types:

- 7.1 polyethylene
  - 7.2 carbon
  - 7.3 glass
  - 7.4 hybrid
  - 7.5 aramid
8. Repair **eight** of the following types of defect in marine composite mouldings:
- 8.1 incomplete curing
  - 8.2 de-lamination
  - 8.3 fractures
  - 8.4 dimensional
  - 8.5 broken fibres
  - 8.6 gouges
  - 8.7 tolerances
  - 8.8 holes
  - 8.9 damaged cores
  - 8.10 surface finish
  - 8.11 water ingress
  - 8.12 wrong inserts
  - 8.13 distortion
  - 8.14 voids
  - 8.15 insert positions
  - 8.16 fire damage
  - 8.17 disbonds
  - 8.18 impact damage
  - 8.19 blisters
  - 8.20 dents or `dings`
  - 8.21 abrasion/erosion
  - 8.22 bridging
  - 8.23 excessive adhesive
9. Repair a range of mouldings which comply with **one** of the following standards:
- 9.1 BS, ISO or BSEN standards and procedures
  - 9.2 customer (contractual) standards and requirements
  - 9.3 company standards and procedures
  - 9.4 recognised compliance agency/body's standards
10. Complete the relevant paperwork, to include **one** from the following and pass it to the appropriate people:
- 10.1 repair records
  - 10.2 quality/acceptance documentation
  - 10.3 system log
  - 10.4 job cards

10.5 work authorisation documents

10.6 other specific reporting method



## SEMME3150 – HY1G 04

### Repairing marine composite components and assemblies

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