

SEMPEO2-43 - SQA Unit Code FP42 04

Producing Composite Mouldings using Wet Lay-up Techniques



Overview

This standard covers a broad range of basic competences that you need to produce composite mouldings using wet-lay up laminating techniques. It will prepare you for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or it will provide a basis for the development of additional skills and occupational competences in the working environment.

You will be expected to prepare for the wet-lay up moulding activities by obtaining all necessary information, documentation, materials, tools and equipment required, and to plan how you intend to carry out the moulding/laying up activities and the sequence of operations you intend to use.

You will be expected to prepare the tooling, apply release agents and prepare the composite materials. You will produce composite mouldings, which will incorporate a range of features, using a range of application methods. Mouldings produced will include laminates and sandwich structures, using suitable resin, fibre and core materials. The activities will also include making all necessary visual and dimensional checks, to ensure that the mouldings meet the required specification and have an appropriate cosmetic appearance.

Your responsibilities will require you to comply with health and safety requirements and organisational policy and procedures for the wet lay-up production activities undertaken. You will need to take account of any potential difficulties or problems that may arise with the activities, and to seek appropriate help and advice in determining and implementing a suitable solution. You will work under a high level of supervision, whilst taking responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide an understanding of your work, and will enable you to apply appropriate composite moulding wet lay-up techniques and procedures safely. You will understand the moulding/laying-up procedure, and its application, and will know about the equipment, materials and consumables, to the required depth to provide a the basis for carrying out the activities to the required specification.

You will understand the safety precautions required when carrying out the wet lay-up moulding 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.

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Specific Standard Requirements

In order to prove your ability to combine different wet lay up operations, at least one of the components produced must be of a significant nature, and must have a minimum of **three** of the features listed in scope 7.

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Performance criteria

- You must be able to:*
- P1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines
 - P2 plan the moulding/laying-up activities before you start them
 - P3 prepare the moulds, jigs or formers ready for the manufacturing operations
 - P4 mix and prepare the required materials
 - P5 carry out the moulding or laying-up activities, using the correct methods and techniques
 - P6 remove the mouldings from the formers and trim/finish them to specification
 - P7 check that all the required operations have been completed to specification
 - P8 deal promptly and effectively with problems within your control, and seek help and guidance from the relevant people if you have problems that you cannot resolve
 - P9 leave the work area in a safe and tidy condition on completion of the moulding activities

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Knowledge and understanding

You need to know and understand:

- K1 Health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area
- K2 The hazards associated with carrying out wet lay-up moulding techniques, and with the composite materials, consumables, tools and equipment used, and how to minimise these and reduce any risks
- K3 Protective equipment (PPE) that is needed for personal protection and, where required, the protection of others
- K4 The application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables
- K5 The specific environmental conditions that must be observed when producing composite mouldings (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)
- K6 How to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken
- K7 How to interpret drawings/lay up manuals, imperial and metric systems of measurement, workpiece reference/datum points and system of tolerancing
- K8 Quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification) and the completion of such documents
- K9 Conventions and terminology used for wet lay-up techniques (such as resin and fibre weights/volumes, material orientation, material identification, material tailoring, mixing ratios, gel times, exotherm, bleed plies)
- K10 The different types of resins, reinforcement, catalysts, accelerators and additives used, and their applications
- K11 The different types of fibre materials, fabrics, orientations, their combinations and applications
- K12 Different core, insert and filler materials, and their applications
- K13 The visual identification of both raw and finished composite materials
- K14 Different types of production tooling used for producing composite mouldings, and their applications
- K15 The identification and rectification of defects in production tooling
- K16 Methods of preparation for patterns, moulds and tooling (including the correct use of surface sealers and release agents)
- K17 Methods for handling and preparing the reinforcing fibres
- K18 How to estimate/calculate resin volume/weight required to wet-out the reinforcing fibres
- K19 Mixing ratios for gel coats, resins, accelerators and catalysts, and the associated working times
- K20 The methods used in the application of the resin/fibre during the lay-up activity
- K21 Tools and equipment used in the lay-up activities and their care, preparation and control procedures
- K22 The problems that can occur during the lay-up process (including defects such as contamination, resin/fibre rich areas, and distortion)

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- K23 How defects can be overcome during the lay-up activity
- K24 The different methods and techniques used to cure composite mouldings including cure cycles and the need for monitoring
- K25 The methods and techniques used to trim mouldings prior to release (green trimming)
- K26 Procedures and methods used for removing mouldings from production tooling
- K27 The identification of defects in the composite moulding (such as delamination, voids, contaminants)
- K28 The care and safe handling of production tooling and composite mouldings throughout the production cycle
- K29 The production controls used in the work area, and actions to be taken for unaccounted items
- K30 How the composite moulding relates to its own quality documents and the production tooling used
- K31 The extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

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Additional Information

Scope/range related to performance criteria

You must be able to:

- 1 Carry out **all** of the following during the moulding activities:
 - 1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
 - 1.2 follow job instructions, drawings, process specifications and moulding/lay-up procedures
 - 1.3 ensure that all equipment and tools used are in a safe and serviceable condition
 - 1.4 return all tools and equipment to the correct location on completion of the moulding/lay up activities

- 2 Carry out **all** of the following activities when preparing production tooling:
 - 2.1 check that tooling is correct and complete
 - 2.2 clean tooling and remove resin build-ups
 - 2.3 check for surface defects
 - 2.4 correctly apply sealers/release agents
 - 2.5 clean and store tooling suitably after use

- 3 Carry out **all** of the following activities to prepare materials for production:
 - 3.1 obtain correct materials for the activity
 - 3.2 check that materials are fit for purpose and in life
 - 3.3 cut materials to correct size and shape
 - 3.4 calculate the correct resin to fibre ratios
 - 3.5 check correct quantity of resin is available
 - 3.6 identify and protect materials in the work area
 - 3.7 check correct measure and mix of resin/catalyst

- 4 Produce a range of mouldings using **one** of the following types of production tool:
 - 4.1 pattern
 - 4.2 mandrel
 - 4.3 metallic
 - 4.4 tooling block
 - 4.5 wet lay-up
 - 4.6 infused mould
 - 4.7 glass pre-preg
 - 4.8 carbon pre-preg
 - 4.9 female tooling
 - 4.10 male tooling
 - 4.11 multi-part tools
 - 4.12 matched tooling
 - 4.13 closed tooling

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- 5 Produce a range of mouldings using **two** of the following application techniques:
 - 5.1 spray application of a gel coat
 - 5.2 brush application of a gel coat
 - 5.3 spray application of fibre/resin
 - 5.4 brush application of fibre/resin
 - 5.5 roller application of fibre/resin
 - 5.6 removal of voids and air pockets
 - 5.7 brush/roller consolidation
 - 5.8 use of vacuum bagging
 - 5.9 use of bleed plies

- 6 Produce a range of mouldings incorporating **two** of the following in the lay-up:
 - 6.1 butt joins
 - 6.2 overlap joins
 - 6.3 staggered joins
 - 6.4 feathered joins
 - 6.5 orientated plies
 - 6.6 inserts
 - 6.7 fixtures

- 7 Produce a range of mouldings incorporating **four** of the following shape features:
 - 7.1 internal corner
 - 7.2 external corner
 - 7.3 horizontal surface
 - 7.4 vertical surface
 - 7.5 double curvature
 - 7.6 concave surface
 - 7.7 convex surface
 - 7.8 return surfaces
 - 7.9 joggle details
 - 7.10 nett edges

- 8 Produce a range of mouldings using **one** type of resin from:
 - 8.1 bio resin
 - 8.2 acrylic
 - 8.3 polyester
 - 8.4 vinyl ester
 - 8.5 epoxy
 - 8.6 phenolic
 - 8.7 other (to be specified)

- 9 Produce a range of mouldings using techniques for **one** type of fibre from:
 - 9.1 natural fibre
 - 9.2 thermoplastic
 - 9.3 glass
 - 9.4 aramid
 - 9.5 carbon

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- 9.6 hybrid
- 9.7 other (to be specified)

- 10 Produce a range of mouldings using techniques for **two** type of reinforcement from:
 - 10.1 uni-directional
 - 10.2 roving
 - 10.3 chopped strand
 - 10.4 continuous filament
 - 10.5 tissues/veils
 - 10.6 bonded fabrics
 - 10.7 woven
 - 10.8 braids
 - 10.9 tapes
 - 10.10 multi axis/stitched
 - 10.11 other (to be specified)

- 11 Produce a range of mouldings using techniques for **one** type of core material from:
 - 11.1 solid timber
 - 11.2 end grain balsa
 - 11.3 coremat
 - 11.4 rigid foam
 - 11.5 expanding foam
 - 11.6 skinned honeycomb
 - 11.7 other (to be specified)

- 12 Remove the moulding and carry out **all** of the following:
 - 12.1 visually check that the moulding is complete and free from defects
 - 12.2 use appropriate equipment/gauges to check for dimensional accuracy (such as overall dimensions, thickness of material/moulding, geometric features)
 - 12.3 mark out the mouldings for trimming of excess material
 - 12.4 cut/trim the mouldings, using appropriate tools and equipment (such as cutting wheels/discs, routers, saws)
 - 12.5 carry out repairs (where appropriate)
 - 12.6 finish the mouldings, using appropriate tools and equipment (such as rubbing blocks, diamond files, disc or belt sanders, pencil grinders)
 - 12.7 polish the mouldings, using appropriate tools and equipment (such as wet sanding, cutting compounds)

- 13 Produce composite mouldings which comply with **one** of the following standards:
 - 13.1 components are dimensionally accurate within specification requirements
 - 13.2 finished components meet the required shape/geometry (such as squareness, straightness, angularity and being free from twists)
 - 13.3 completed components are free from defects, sharp edges or slivers
 - 13.4 components meet company standards and procedures

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