

SEMPEO2-45 - SQA Unit Code FP44 04

Producing Composite Mouldings using Resin Flow Infusion Techniques



Overview

This standard covers a broad range of basic competences that you need to produce composite mouldings using resin flow infusion 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 resin flow infusion activities by obtaining all necessary information, documentation, materials, tools and equipment, and to plan how you intend to carry out the required activities and the sequence of operations you intend to use.

You will be expected to prepare the tooling, apply release agents and to prepare the composite materials. You will produce composite mouldings, which will incorporate a range of features. 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 resin flow infusion 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, will enable you to apply appropriate composite moulding resin flow infusion techniques and procedures safely. You will understand the moulding procedure, and its application, and will know about the equipment, materials and consumables, to the required 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 resin flow infusion 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 resin flow infusion 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 6.

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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 resin infusion activities before you start them
 - P3 prepare the moulds, jigs or formers ready for the manufacturing operations
 - P4 check materials are fit for purpose and in life
 - P5 carry out the resin flow infusion activities, using the correct methods and techniques
 - P6 remove the mouldings correctly 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 assembly 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 resin flow infusion techniques, and with the composite materials, consumables, tools and equipment used, and how to minimise these and reduce any risks in the work area
- 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 workshop environmental conditions that must be observed when producing composite mouldings using resin flow infusion techniques (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 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 resin flow infusion techniques (such as material orientation, material identification, distribution media, resin viscosity, flow paths, ply lay-up, vacuum bagging, resin and fibre weights/volumes, 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 and insert materials, and their merits
- K13 Different types of resin distribution media, and their merits
- K14 The visual identification of both raw and finished composite materials
- K15 Different types of production tooling used for producing composite mouldings, and their applications
- K16 The identification and rectification of defects in production tooling
- K17 Building up laminates (including orientation and balance of plies), to minimise spring and distortion in composite mouldings
- K18 Methods of preparation for patterns, moulds and tooling (including the correct selection and use of surface sealers and release agents)
- K19 Methods for handling, preparation and application of the reinforcing fibres and fabrics
- K20 Correct methods of storage and handling of ancillary and consumable materials
- K21 The methods used in the positioning and application of the resin

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- distribution media
- K22 How to estimate/calculate resin volume/weight required to saturate the reinforcing fibres
- K23 Mixing ratios for gel coats, resins and catalysts, and the associated working times
- K24 The tools and equipment used in the resin flow infusion activities, and their care, preparation and control procedures
- K25 The operation and importance of a vacuum check before the infusion starts
- K26 The problems that can occur during the resin flow infusion process (including defects such as contamination, incomplete wet out, vacuum leaks, flow restrictions)
- K27 The different methods and techniques used to cure composite mouldings including cure cycles and the need for monitoring
- K28 Procedures and methods used for removing mouldings from production tooling
- K29 The identification of defects in the composite mouldings (such as delamination, voids, contaminants)
- K30 The care and safe handling of production tooling and composite mouldings throughout the production cycle
- K31 The production controls used in the work area, and actions to be taken for unaccounted items
- K32 How the composite component relates to its own quality documents and the production tooling used
- K33 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/laminating 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 activities
- 2 Prepare the tooling for production, to include carrying out **all** of the following:
 - 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 Prepare the materials for production, to include carrying out **all** of the following:
 - 3.1. obtain the correct materials for the activity
 - 3.2. check that materials are fit for purpose and in life
 - 3.3. cut materials to the correct size, shape and orientation
 - 3.4. calculate the correct resin to fibre ratios
 - 3.5. check correct quantity of resin is available
 - 3.6. check the availability of required ancillary materials
 - 3.7. identify and protect materials in the work area
 - 3.8. obtain the correct infusion media and layout for the activity
- 4 Produce composite mouldings, using **one** of the following:
 - 4.1. test panel trials/tracking
 - 4.2. partial trial runs/tracking
 - 4.3. full scale trial runs/tracking
 - 4.4. production runs
 - 4.5. staged resin entry
 - 4.6. dry area rectification
 - 4.7. vacuum regulation
 - 4.8. resin flow regulation
- 5 Produce composite mouldings incorporating **two** of the following:

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- 5.1. butt joins
 - 5.2. overlap joins
 - 5.3. staggered joins
 - 5.4. feathered joins
 - 5.5. orientated plies
 - 5.6. inverted plies
 - 5.7. balancing plies
 - 5.8. inserts
 - 5.9. fixtures
- 6 Produce composite mouldings incorporating **four** of the following shape features:
- 6.1. internal corners
 - 6.2. external corners
 - 6.3. horizontal surface
 - 6.4. vertical surface
 - 6.5. double curvature
 - 6.6. concave surface
 - 6.7. convex surfaces
 - 6.8. return surfaces
 - 6.9. joggle details
 - 6.10. nett edges
- 7 Produce composite mouldings, using techniques for **one** type of resin from:
- 7.1. bio resin
 - 7.2. acrylic
 - 7.3. polyester
 - 7.4. vinyl ester
 - 7.5. epoxy
 - 7.6. phenolic
 - 7.7. other (to be specified)
- 8 Produce composite mouldings, using techniques for **one** type of fibre from:
- 8.1. natural fibre
 - 8.2. thermoplastic
 - 8.3. glass
 - 8.4. aramid
 - 8.5. carbon
 - 8.6. hybrid
 - 8.7. other (to be specified)
- 9 Produce composite mouldings, using techniques for **one** type of reinforcement from:
- 9.1. uni-directional
 - 9.2. chopped strand
 - 9.3. tissues/veils
 - 9.4. woven
 - 9.5. braids
 - 9.6. multi-axis/stitched
 - 9.7. knitted
 - 9.8. tapes
 - 9.9. other (to be specified)

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- 10 Produce composite mouldings, using techniques for **one** type of core materials from:
 - 10.1. solid timber
 - 10.2. end grain balsa
 - 10.3. coremat
 - 10.4. rigid foam
 - 10.5. expanding foam
 - 10.6. skinned honeycomb
 - 10.7. other (to be specified)

- 11 Produce composite mouldings using techniques for **three** types of resin distribution media:
 - 11.1. mould surface entry
 - 11.2. interlaminar
 - 11.3. surface meshes
 - 11.4. infusion mats/fabrics
 - 11.5. channelled core
 - 11.6. perforated core
 - 11.7. perforated hose
 - 11.8. spiral wrap
 - 11.9. peel ply
 - 11.10. braid
 - 11.11. flow channels
 - 11.12. manifolds
 - 11.13. networks
 - 11.14. bleed plies
 - 11.15. moulded vacuum bags

- 12 Use **three** of the following vacuum bagging processes/methods:
 - 12.1. check vacuum integrity
 - 12.2. surface bagging
 - 12.3. envelope bagging
 - 12.4. internal bagging
 - 12.5. pleats and tucks
 - 12.6. reusable bagging
 - 12.7. leak detection
 - 12.8. leak rectification
 - 12.9. catch pots/tanks
 - 12.10. localised resin injection
 - 12.11. use of reusable vacuum fittings

- 13 Remove the composite mouldings and carry out **all** of the following:
 - 13.1. visually check that the moulding is complete and free from defects
 - 13.2. use appropriate equipment/gauges to check for dimensional accuracy (such as overall dimensions, thickness of material/moulding, geometric features)
 - 13.3. carry out repairs (where appropriate)
 - 13.4. finish the mouldings, using appropriate tools and equipment

- 14 Produce composite mouldings in compliance with **one** of the following:
 - 14.1. components are dimensionally accurate within specification

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requirements

- 14.2. finished components meet the required shape/geometry (such as square, straight, angle, free from twists)
- 14.3. completed components are free from defects, sharp edges or slivers
- 14.4. components meet company standards and procedures

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