SEMPEO2-73 - SQA Unit Code H2CC 04
Producing Composite Mouldings using Resin Film Infusion Techniques

Overview

This standard covers a broad range of basic competences that you need to produce composite mouldings using resin film 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 film 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 sealer/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 film 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 and, will enable you to apply appropriate composite moulding resin film 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 film 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 film 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 film 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 film infusion 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 the must be observed when producing composite mouldings (such as temperature, humidity, 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 resin film infusion techniques (such as material orientation, material identification, material templates, ply lay-up, pressure plates, vacuum bagging, cure cycles, exotherm)
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 Building up laminates (including orientation and balance of plies) to minimise spring and distortion in composite mouldings
K13 Different core, insert and filler materials, and their applications
K14 The visual identification of both raw and finished composite materials
K15 The identification of materials by product codes
K16 Different types of production tooling used for producing composite mouldings, and their applications
K17 The identification and rectification of defects in production tooling
K18 Methods of preparation for patterns, moulds and tooling, including the correct selection and use of surface sealers and release agents
K19 The correct methods of storage, thawing and handling of resin film infusion materials (including monitoring temperature, storage life and out-life)
K20 Methods used in the application of resin film infusion materials to tooling surfaces (including methods of tailoring and cutting)
K21 Correct methods of storage and handling of ancillary and consumable materials
K22 Selection and use of ancillary and consumable materials (such as

release films, breather fabrics, bagging films, tapes) to meet performance requirements (such as temperature and compatibility)

K23 The tools and equipment used in the resin film infusion activities, and their care, preparation and control procedures

K24 Problems that can occur during the lay-up process (including modifications to the ply lay-up, and defects such as contamination and distortion)

K25 How modifications and defects can be overcome during the resin film infusion activity

K26 Cure cycles (including temperature and pressure ramps, dwell times, post curing)

K27 The need for monitoring the cure cycle (using thermocouples, probes, chart recorders and data logs)

K28 Procedures and methods used for removing mouldings from production tooling

K29 The identification of defects in the composite moulding (such as de-lamination, 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 moulding 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 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. thaw material removed from freezer storage
- 3.3. identifying defects in resin film materials
- 3.4. check that materials are fit for purpose and in life
- 3.5. check availability of ancillary materials required
- 3.6. cut materials to correct shape and orientation
- 3.7. check materials when provided in kit form
- 3.8. identify and protect materials in the work area

4 Produce a range of mouldings, using **one** of the following types of tooling:
- 4.1. pattern
- 4.2. mandrels
- 4.3. metal
- 4.4. tooling block
- 4.5. wet lay-up
- 4.6. infused tooling
- 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

5 Produce a range of mouldings incorporating **two** of the following:
- 5.1. butt joins
- 5.2. overlap joins
- 5.3. staggered joins
- 5.4. orientated plies
- 5.5. inverted plies
- 5.6. inserts
- 5.7. balancing plies
- 5.8. fixtures

6 Produce a range of mouldings incorporating **three** of the following shape features:
- 6.1. internal corners
- 6.2. external corners
- 6.3. vertical surface
- 6.4. double curvature
- 6.5. concave surface
- 6.6. horizontal surface
- 6.7. convex surfaces
- 6.8. return surfaces
- 6.9. joggle details
- 6.10. nett edges

7 Produce a range of mouldings using **two** of the following methods:
- 7.1. production of ply templates
- 7.2. nesting of ply templates
- 7.3. material cutting & kitting
- 7.4. shaped locators
- 7.5. joining boards
- 7.6. loose tooling
- 7.7. intensifiers
- 7.8. vacuum de-bulk
- 7.9. moulded datum features
- 7.10. placement jigs
- 7.11. laser projection placement
- 7.12. video feedback placement

8 Produce a range of mouldings using **one** type of resin from:
- 8.1. bio resin
- 8.2. thermoplastic
- 8.3. epoxy
- 8.4. phenolic
- 8.5. bismaleimide
- 8.6. cyanate ester
- 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

9.6. hybrid
9.7. other (to be specified)

10 Produce a range of mouldings using **one** type of reinforcement from:
10.1. continuous
10.2. uni-directional
10.3. tapes
10.4. tissues/veils
10.5. woven
10.6. braids
10.7. multi-axis

11 Produce a range of mouldings using **one** type of core material **(where applicable to the Sector or process):**
11.1. solid timber
11.2. end grain balsa
11.3. thermoplastic core
11.4. syntactic core
11.5. rigid foam
11.6. expanding core
11.7. fibrous honeycomb
11.8. aluminium honeycomb
11.9. other (to be specified)

12 Use **one** of the following methods when using core materials **(where applicable to the Sector or process)**::
12.1. core templates
12.2. pre-shaping core
12.3. core chamfers
12.4. core splicing
12.5. peel plies
12.6. bonding paste
12.7. edge filling
12.8. adhesive/resin films
12.9. potting/filler compound
12.10. single stage curing
12.11. multi-stage curing

13 Using **one** of the following for applying temperature during the cure cycle:
13.1. oven
13.2. autoclave
13.3. heated tools/moulds
13.4. heat mats
13.5. heated press
13.6. curing lamps
13.7. infrared heating
13.8. electro-magnetic inductance
13.9. micro-wave
13.10. other (to be specified)

14 Using **one** of the following for applying pressure to consolidate the moulding:

14.1. vacuum bags
14.2. pressure bags
14.3. thermal mould expansion
14.4. fibre tensioning
14.5. press
14.6. autoclave

15 Where vacuum bags are used, use **two** of the following processes/methods:
15.1. check vacuum integrity
15.2. surface bagging
15.3. envelope bagging
15.4. multi-part envelope bags
15.5. internal bagging
15.6. through-tube bagging
15.7. pleats and tucks
15.8. reusable bagging
15.9. use of reusable vacuum fittings

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

17 Produce a range of mouldings which comply with **one** of the following standards:
17.1. components are dimensionally accurate within specification requirements
17.2. finished components meet the required shape/geometry (such as square, straight, angle, free from twists)
17.3. completed components are free from defects, sharp edges or slivers
17.4. components meet company standards and procedures

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