**Overview**

This standard covers a broad range of basic competences that you need to produce composite mouldings using pre-preg 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 pre-preg laminating 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 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 pre-preg laminating 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 pre-preg laminating techniques and procedures safely. You will understand the moulding/laminating 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 pre-preg laminating 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.
Specific Standard Requirements

In order to prove your ability to combine different pre-preg laminating 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.
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/laminating 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/laminating 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
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 Pre-preg laminating 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, 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 pre-preg laminating 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 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 pre-preg materials (including monitoring temperature, storage life and out-life)
K20 Methods used in the application of pre-preg 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
1. Performance requirements (such as temperature and compatibility)

2. The tools and equipment used in the pre-preg laminating activities, and their care, preparation and control procedures

3. The problems that can occur during the lay-up process (including modifications to the ply lay-up, and defects such as contamination and distortion)

4. The cure cycles (including temperature and pressure ramps, dwell times, post curing)

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

6. Procedures and methods used for removing mouldings from production tooling

7. The identification of defects in the composite moulding (such as delamination, voids, contaminants)

8. The care and safe handling of production tooling and composite mouldings throughout the production cycle

9. The production controls used in the work area, and actions to be taken for unaccounted items

10. How the composite moulding relates to its own quality documents, and the production tooling used

11. The extent of your own responsibility and to whom you should report 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 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/laminating 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 pre-preg 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 production tool:
   4.1. pattern
   4.2. mandrels
   4.3. metal
   4.4. tooling block
   4.5. glass pre-preg
   4.6. carbon pre-preg
   4.7. female tooling
   4.8. male tooling
   4.9. multi-part tools
   4.10. matched tooling
   4.11. closed tooling

5. Produce a range of mouldings incorporating two of the following in the lay-
Producing Composite Mouldings using Pre-Preg Techniques

5.1. butt joins
5.2. overlap joins
5.3. staggered joins
5.4. orientated plies
5.5. inverted plies
5.6. balancing plies
5.7. inserts
5.8. fixtures

6 Produce a range of 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 a range of mouldings using **one** type of resin from:
7.1. bio resin
7.2. thermoplastic
7.3. epoxy
7.4. phenolic
7.5. bismaleimide
7.6. cyanate ester
7.7. other (to be specified)

8 Produce a range of 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 a range of mouldings using **one** type of reinforcement from:
9.1. continuous
9.2. uni-directional
9.3. tapes
9.4. tissues/veils
9.5. woven
9.6. braids
9.7. multi-axis

10 Produce a range of mouldings using **one** type of core material (**where applicable to the Sector or process**):
10.1. solid timber
10.2. end grain balsa
10.3. thermoplastic core
10.4. rigid foam
10.5. syntactic core
10.6. expanding core
10.7. fibrous honeycomb
10.8. aluminium honeycomb
10.9. other (to be specified)

11 Use one of the following methods when using core materials (where applicable to the Sector or process):
11.1. core templates
11.2. pre-shaping core
11.3. core chamfers
11.4. core splicing
11.5. peel plies
11.6. bonding paste
11.7. edge filling
11.8. adhesive/resin films
11.9. potting/filler compound
11.10. single stage curing
11.11. multi-stage curing

12 Prepare the moulding for temperature curing using one of the following methods:
12.1. oven
12.2. autoclave
12.3. heated tools/moulds
12.4. heat mats
12.5. heated press
12.6. curing lamps
12.7. infrared heating
12.8. UV curing
12.9. electro-magnetic inductance
12.10. micro-wave
12.11. other (to be specified)

13 Preparing the moulding for pressure consolidation using one of the following methods:
13.1. vacuum bags
13.2. hot de-bulk
13.3. pressure de-bulk
13.4. pressure bags
13.5. thermal mould expansion
13.6. fibre tensioning
13.7. press
13.8. autoclave

14 Remove composite moulding and carryout all of the following:
14.1. visually check that the moulding is complete and free from defects
14.2. use appropriate equipment/gauges to check for dimensional accuracy
14.3. mark out the mouldings for trimming of excess material
14.4. cut/trim the mouldings using appropriate tools and equipment (such as cutting wheels/discs, routers, saws)
14.5. carry out repairs (where appropriate)
14.6. finish the mouldings, using appropriate tools and equipment (such as rubbing blocks, diamond files, disc or belt sanders, pencil grinders)
14.7. polish the mouldings using appropriate tools and equipment (such as wet sanding, cutting compounds)

15 Produce mouldings which comply with one of the following standards:
15.1. components are dimensionally accurate, within specification requirements
15.2. finished components meet the required shape/geometry (such as square, straight, angle, free from twists)
15.3. completed components are free from defects, sharp edges or slivers
15.4. components meet company standards and procedures
## SEMPEO2-44 - SQA Unit Code H2M2 04
Producing Composite Mouldings using Pre-Preg Techniques

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