SEMAUT3080

Producing motorsport composite mouldings using pre-preg laminating techniques

Overview

This standard identifies the competences you need to produce motorsport composite mouldings (such as moulds, wings, body panels, ductwork, fairings, jigs) using pre-preg laminating techniques, in accordance with approved procedures. You will be required to use appropriate drawings, specifications and documentation to produce various mouldings, using the correct pre-preg laminating production techniques.

You will be expected to prepare a range of tooling, apply appropriate release agents, and prepare the composite materials. You will produce a range of composite mouldings, incorporating a variety of features and using a range of techniques and processes. Mouldings produced will include laminates and sandwich structures, using a range of resin, fibre and core materials.

Your responsibilities will require you to comply with organisational policy and procedures for the moulding activities undertaken, and to report any problems with the moulding activities, equipment or materials that you cannot personally resolve, or that 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 pre-preg laminating techniques and procedures. You will understand the moulding techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, correcting faults, and ensuring that the work output is to the required specification.

You will understand the safety precautions required when carrying out the 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.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. follow the correct component drawing or any other related specifications for the component to be produced
3. determine what has to be done and how this will be achieved
4. obtain and prepare the appropriate tools, equipment and materials
5. carry out the moulding or laying-up activities using the correct methods and techniques
6. produce components to the required specification
7. check that all the required operations have been completed to specification
8. deal promptly and effectively with problems within your control and report those that cannot be solved
9. ensure that work records are completed, stored securely and available to others, as per organisational requirements
10. leave the work area in a safe condition on completion of the activities, as per organisational and legal requirements

Knowledge and understanding

You need to know and understand:

1. the specific safety precautions to be taken whilst carrying out the activities (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)
2. the health and safety requirements of the work area and the activities, and the responsibility these requirements place on you
3. the hazards associated with the activities, and how to minimise them and reduce risks
4. the personal protective equipment and clothing (PPE) to be worn during the activities
5. how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to current industry standards and codes of practice)
6. how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
7. quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification), and the completion of such documents
8. conventions and terminology used for pre-preg laminating techniques (material orientation, material identification, material templates, ply lay-up, pressure plates, vacuum bagging, cure cycles, exotherm)
9. different types of resin systems, fibres, reinforcements, and their applications
10. building up laminates, including orientation and balance of plies to minimise spring and distortion in composite mouldings
11. different core, insert and filler materials, and their applications
12. the visual identification of both raw and finished composite materials
13. identification of materials by product codes
14. different types of mould tooling used for producing composite mouldings, and their merits
15. the identification and rectification of defects in mould tooling
16. methods of preparation for patterns, moulds and tooling, including the correct selection and use of surface sealers and release agents
17. the correct methods of storage, thawing and handling of pre-preg materials, including monitoring temperature, storage life and out-life

18. methods used in the application of pre-preg materials to tooling surfaces, including methods of tailoring and cutting
19. correct methods for storage and handling of ancillary and consumable materials
20. selection and use of ancillary and consumable materials (such as release films, breather fabrics, bagging films, tapes) to meet performance requirements (temperature and compatibility)
21. tools and equipment used in the pre-preg laminating activities; their care, preparation and control procedures
22. the problems that can occur during the lay-up process, including modifications to the ply lay-up, and defects (contamination and distortion)
23. how modifications and defects can be overcome during the pre-preg laminating activity
24. cure cycles, including temperature and pressure ramps, dwell times, post curing
25. the need for monitoring the cure cycle using thermocouples, probes, chart recorders and data logs
26. procedures and methods used for removing mouldings from tooling
27. the identification of defects in the composite moulding (de-lamination, voids, contaminants and distortion)
28. the care and safe handling of mould tooling and composite mouldings throughout the production cycle
29. the production controls used in the work area, and actions to be taken for unaccounted items
30. how the composite moulding relates to its own quality documents, and the production tooling used
31. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve
32. how to access, use and maintain information to comply with organisational requirements and legislation

Scope/range related to performance criteria

1.

Carry out all of the following during the moulding activities:

1.1 obtain and use the appropriate documentation (such as job instructions, drawings, material data sheets, planning and quality control documentation, material data sheets, specifications)
1.2 adhere to procedures or systems in place for risk assessment, hazardous materials, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
1.3 provide and maintain a safe working environment for the pre-preg laminating activities
1.4 obtain the correct tools and equipment for the activity, and check that they are in a safe, tested and usable condition
1.5 follow safe practice/approved pre-preg laminating techniques and procedures at all times
1.6 return all tools and equipment to the correct location on completion of the pre-preg laminating activities
1.7 dispose of waste materials in accordance with approved procedures
1.8 leave the work area in a safe and appropriate condition on completion of the 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 correctly apply sealers/release agents
2.3 clean tooling and remove resin build-ups
2.4 clean and store tooling suitably after use
2.5 check for surface defects

3.

Prepare the materials for production, to include carrying out all of the following:

3.1 obtain correct materials for the activity
3.2 check availability of ancillary materials required
3.3 thaw material removed from freezer storage
3.4 cut materials to correct shape and orientation
3.5 identifying defects in pre-preg materials
3.6 check materials when provided in kit form
3.7 check materials are fit for purpose and in life
3.8 identify and protect materials in the work area

4.

Produce motorsport composite mouldings using pre-preg laminating techniques, to include:

Either four of the following:

1. tub/monocoque
2. wheels
3. nose cones
4. wishbones
5. floor/diffuser
6. wings
7. crash structures

OR ten of the following:

8. splitters
9. floor trays
10. air intakes
11. seats
12. body panels
13. fuel tank housings
14. radiator ducts
15. exhausts
16. side pods
17. wing endplates
18. dash panels
19. trim panels
20. engine covers
21. bumpers
22. fairings/shrouds
23. electrical boxes
24. pedal boxes
25. brake ducts
26. moulds/jigs

1.

Produce motorsport composite mouldings, using techniques for four of the following types of mould tool:

1.1 metal
1.2 glass pre-preg
1.3 carbon pre-preg
1.4 male tooling
1.5 matched tooling
1.6 wet lay-up
1.7 tooling block
1.8 female tooling

1.9 multi-part tools
1.10 closed tooling

2.

Produce motorsport composite mouldings incorporating three of the following in the lay-up:

2.1 butt joins
2.2 staggered joins
2.3 inverted plies
2.4 overlap joins
2.5 orientated plies
2.6 inserts

3.

Produce motorsport composite mouldings incorporating five of the following shape features:

3.1 internal corners
3.2 double curvature
3.3 convex surfaces
3.4 joggle details
3.5 external corners
3.6 concave surface
3.7 return surfaces
3.8 nett edges

4.

Produce motorsport composite mouldings using four of the following methods:

4.1 production of ply templates
4.2 pressure de-bulk
4.3 joining boards
4.4 nesting of ply templates
4.5 intensifiers
4.6 loose tooling
4.7 vacuum de-bulk
4.8 shaped locators
4.9 other specific method

5.

Produce motorsport composite mouldings using techniques for one type of resin from:

5.1 epoxy
5.2 phenolic
5.3 bismaleimide
5.4 cyanate ester

6.

Produce motorsport composite mouldings using techniques for two types of fibre from:

6.1 polyethylene
6.2 glass
6.3 aramid
6.4 carbon
6.5 hybrid

7.

Produce motorsport composite mouldings using techniques for two types of reinforcement from:

7.1 continuous
7.2 uni-directional
7.3 braids
7.4 woven
7.5 multi-axis
7.6 tapes

8.

Produce motorsport composite mouldings using techniques for two types of core materials from:

8.1 wood
8.2 expanding core
8.3 nomex honeycomb
8.4 aluminium honeycomb
8.5 syntactic core
8.6 foam

9.

When using core materials, use four of the following methods:

9.1 core templates
9.2 peel plies
9.3 core splicing
9.4 single stage curing
9.5 pre-shaping core
9.6 adhesive/resin films
9.7 edge filling
9.8 multi-stage curing
9.9 core chamfers
9.10 bonding paste

10.

Use one of the following for applying temperature during the cure cycle:

10.1 oven
10.2 heated tools/moulds
10.3 autoclave
10.4 heated press

11.

Use one of the following for applying pressure during the cure cycle:

11.1 pressure bags

11.2 vacuum bags
11.3 thermal mould expansion
11.4 fibre tensioning

12.

Where vacuum bags are used, use four of the following processes/methods:

12.1 check vacuum integrity
12.2 envelope bagging
12.3 internal bagging
12.4 use of vacuum fittings
12.5 pleats and tucks
12.6 through-tube bagging
12.7 surface bagging
12.8 multi-part envelope bags
12.9 reusable bagging

13.

Check motorsport composite mouldings comply with one of the following:

13.1 industry standards, codes of practice and legislation
13.2 customer standards and requirements
13.3 company standards and procedures
13.4 recognised compliance agency/body standards

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