SEMAE3203

Producing aircraft composite mouldings using wet lay-up laminating techniques

Overview

This standard identifies the competences you need to produce aircraft composite mouldings (such as moulds, components, splashes, jigs) using wet lay-up laminating techniques, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft mouldings. You will be required to use appropriate drawings, specifications and documentation to produce various mouldings using the correct wet lay-up laminating production techniques.

You will be expected to prepare a range of tooling, apply release agents and prepare composite materials. You will produce a range of composite mouldings, incorporating a range of features and using a range of application methods. 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 production activities undertaken, and to report any problems with the production activities, equipment or materials that you cannot personally resolve, or 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 wet lay-up laminating techniques and procedures. You will understand the production techniques used, and their application, in adequate depth to provide a sound basis for carrying out the activities, correcting faults, and ensuring the work output is produced 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.

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 activities using the correct methods and techniques
6. produce mouldings 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. leave the work area in a safe and appropriate condition on completion of the activities
10. complete the relevant documentation, in accordance with organisational requirements

Knowledge and understanding

You need to know and understand:

1. health and safety precautions to be taken and procedures used when working with aircraft composite materials, consumables, tools and equipment in the specific work area
2. the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
3. 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
4. protective equipment (PPE) that is needed for personal protection and, where required, the protection of others
5. the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables
6. the specific environmental conditions the must be observed when producing composite mouldings (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment)
7. 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
8. how to interpret drawings/lay up manuals, imperial and metric systems of measurement, workpiece reference/datum points and system of tolerancing
9. quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification) and the completion of such documents
10. 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)
11. the different types of resins, reinforcement, catalysts, accelerators and additives used, and their applications
12. the different types of fibre materials, fabrics, orientations, their combinations and applications
13. different core, insert and filler materials, and their applications
14. the visual identification of both raw and finished composite materials
15. different types of production tooling used for producing composite mouldings,

and their applications
16. the identification and rectification of defects in production tooling
17. methods of preparation for patterns, moulds and tooling (including the correct use of surface sealers and release agents)
18. methods for handling and preparing the reinforcing fibres
19. how to estimate/calculate resin volume/weight required to wet-out the reinforcing fibres
20. mixing ratios for gel coats, resins, accelerators and catalysts, and the associated working times
21. the methods used in the application of the resin/fibre during the lay-up activity
22. tools and equipment used in the lay-up activities and their care, preparation and control procedures
23. why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
24. problems that can occur during the lay-up process (including defects such as contamination, resin/fibre rich areas, and distortion)
25. how defects can be overcome during the lay-up activity
26. the different methods and techniques used to cure composite mouldings including cure cycles and the need for monitoring
27. the methods and techniques used to trim mouldings prior to release (green trimming)
28. procedures and methods used for removing mouldings from production tooling
29. the identification of defects in the composite moulding (such as de-lamination, voids, contaminants)
30. the care and safe handling of production tooling and composite mouldings throughout the production cycle
31. the production controls used in the work area, and actions to be taken for unaccounted items
32. how the composite moulding relates to its own quality documents and the production tooling used
33. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

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, specifications, planning and quality control documentation)
1.2 adhere to procedures or systems in place for risk assessment, COSHH, 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 moulding activities
1.4 obtain and check that all tools and equipment to be used are correct for the operation to be carried out and are in a safe, tested and usable condition
1.5 follow safe practice/approved moulding techniques at all times
1.6 return all tools and equipment to the correct location on completion of the moulding activities
1.7 segregate and dispose of waste materials using the correct procedure

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 four 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

5.

Produce a range of mouldings using three 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 four 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 seven 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 two types 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 two types 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 techniques for four types 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 two types 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.

Use four of the following methods/processes when using core materials:

- 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 single stage curing
- 12.10 multi stage curing

13.

Produce mouldings which comply with one of the following standards:

13.1 Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
13.2 Ministry of Defence (MoD)
13.3 Military Aviation Authority (MAA)
13.4 Federal Aviation Authority (FAA)
13.5 Aerospace Quality Management Standards (AS)
13.6 BS, ISO or BSEN standards and procedures
13.7 customer standards and requirements
13.8 company standards and procedures
13.9 manufacturers standards and procedures

14.

Complete the relevant paperwork, to include one from the following and pass it to the appropriate people:

14.1 build records
14.2 job cards
14.3 log cards
14.4 aircraft log
14.5 other specific recording method

Behaviours

You will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as:

- strong work ethic
- positive attitude
- team player
- dependability
- responsibility
- honesty
- integrity
- motivation
- commitment

SEMAE3203

Producing aircraft composite mouldings using wet lay-up laminating techniques

Developed by	Enginuity
Version Number	3
Date Approved	30 Mar 2021
Indicative Review Date	01 Mar 2024
Validity	Current
Status	Original
Originating Organisation	Enginuity
Original URN	SEMAE3203
Relevant Occupations	Engineer, Engineering, Engineering and Manufacturing Technologies, Engineering Technicians
Suite	Aeronautical Engineering Suite 3
Keywords	Engineering; aeronautical; produce; composite; mouldings; components; laminating; resin; fibre; wet-lay up