
Overview

This standard identifies the competences you need to produce aircraft composite mouldings (such as moulds, components, splashes, jigs) using pre-preg 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 pre-preg 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 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 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 pre-preg 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 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 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 pre-preg laminating 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 that must be observed when producing composite mouldings (such as temperature, humidity, 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 pre-preg laminating techniques (such as material orientation, material identification, material templates, ply lay-up, pressure plates, vacuum bagging, cure cycles, exotherm)
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. building up laminates (including orientation and balance of plies) to minimise spring and distortion in composite mouldings
14. different core, insert and filler materials, and their applications
15. the visual identification of both raw and finished composite materials
16. identification of materials by product codes
17. different types of production tooling used for producing composite mouldings, and their applications

18. the identification and rectification of defects in production tooling
19. methods of preparation for patterns, moulds and tooling, including the correct selection and use of surface sealers and release agents
20. the correct methods of storage, thawing and handling of pre-preg materials (including monitoring temperature, storage life and out-life)
21. methods used in the application of pre-preg materials to tooling surfaces (including methods of tailoring and cutting)
22. correct methods of storage and handling of ancillary and consumable materials
23. 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)
24. tools and equipment used in the pre-preg laminating activities, and their care, preparation and control procedures
25. 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
26. problems that can occur during the lay-up process (including modifications to the ply lay-up, and defects such as contamination and distortion)
27. how modifications and defects can be overcome during the pre-preg laminating activity
28. cure cycles (including temperature and pressure ramps, dwell times, post curing)
29. the need for monitoring the cure cycle (using thermocouples, probes, chart recorders and data logs)
30. procedures and methods used for removing mouldings from production tooling
31. the identification of defects in the composite moulding (such as delamination, voids, contaminants)
32. the care and safe handling of production tooling and composite mouldings throughout the production cycle
33. the production controls used in the work area, and actions to be taken for unaccounted items
34. how the composite moulding relates to its own quality documents, and the production tooling used
35. 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. obtain and use the appropriate documentation (such as job instructions, drawings, material data sheets, specifications, planning and quality control documentation)
 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
 3. provide and maintain a safe working environment for the moulding activities
 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
 5. follow safe practice/approved moulding techniques at all times
 6. return all tools and equipment to the correct location on completion of the moulding activities
 7. segregate and dispose of waste materials using the correct procedure
2. Carry out all of the following activities when preparing production tooling:
 1. check that tooling is correct and complete
 2. clean tooling and remove resin build-ups
 3. check for surface defects
 4. correctly apply sealers/release agents
 5. clean and store tooling suitably after use
3. Carry out all of the following activities to prepare materials for production:
 1. obtain correct materials for the activity
 2. thaw material removed from freezer storage
 3. identifying defects in pre-preg materials
 4. check that materials are fit for purpose and in life
 5. check availability of ancillary materials required
 6. cut materials to correct shape and orientation
 7. check materials when provided in kit form
 8. identify and protect materials in the work area
4. Produce a range of mouldings, using four of the following types of production tool:
 1. pattern
 2. mandrels

-
3. metal
 4. tooling block
 5. glass pre-preg
 6. carbon pre-preg
 7. female tooling
 8. male tooling
 9. multi-part tools
 10. matched tooling
 11. closed tooling
5. Produce a range of mouldings incorporating five of the following in the lay-up:
1. butt joins
 2. overlap joins
 3. staggered joins
 4. orientated plies
 5. inverted plies
 6. balancing plies
 7. inserts
 8. fixtures
6. Produce a range of mouldings incorporating seven of the following shape features:
1. internal corners
 2. external corners
 3. horizontal surface
 4. vertical surface
 5. double curvature
 6. concave surface
 7. convex surfaces
 8. return surfaces
 9. joggle details
 10. nett edges
7. Produce a range of mouldings using six of the following methods:
1. production of ply templates
 2. nesting of ply templates
 3. material cutting & kitting
 4. shaped locators
 5. joining boards
 6. loose tooling
 7. intensifiers
 8. vacuum de-bulk
 9. hot de-bulk
 10. pressure de-bulk
 11. moulded datum features

-
12. placement jigs
 13. laser projection placement
 14. video feedback placement
8. Produce a range of mouldings using two types of resin from:
 1. bio resin
 2. thermoplastic
 3. epoxy
 4. phenolic
 5. bismaleimide
 6. cyanate ester
 7. other (to be specified)
 9. Produce a range of mouldings using techniques for two types of fibre from:
 1. natural fibre
 2. thermoplastic
 3. glass
 4. aramid
 5. carbon
 6. hybrid
 7. other (to be specified)
 10. Produce a range of mouldings using two types of reinforcement from:
 1. continuous
 2. uni-directional
 3. tapes
 4. tissues/veils
 5. woven
 6. braids
 7. multi-axis
 11. Produce a range of mouldings using three types of core material (where applicable to the Sector or process):
 1. solid timber
 2. end grain balsa
 3. thermoplastic core
 4. rigid foam
 5. syntactic core
 6. expanding core
 7. fibrous honeycomb
 8. aluminium honeycomb
 9. other (to be specified)

12. Use three of the following methods when using core materials (where applicable to the Sector or process):

1. core templates
2. pre-shaping core
3. core chamfers
4. core splicing
5. peel plies
6. bonding paste
7. edge filling
8. adhesive/resin films
9. potting/filler compound
10. single stage curing
11. multi-stage curing

13. Prepare the moulding for temperature curing using two of the following methods:

1. oven
2. autoclave
3. heated tools/moulds
4. heat mats
5. heated press
6. curing lamps
7. infrared heating
8. UV curing
9. electro-magnetic inductance
10. micro-wave
11. other (to be specified)

14. Preparing the moulding for pressure consolidation using two of the following methods:

1. vacuum bags
2. hot de-bulk
3. pressure de-bulk
4. pressure bags
5. thermal mould expansion
6. fibre tensioning
7. press
8. autoclave

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

1. check vacuum integrity
2. surface bagging
3. envelope bagging

-
4. multi-part envelope bags
 5. internal bagging
 6. through-tube bagging
 7. pleats and tucks
 8. reusable bagging
 9. use of reusable vacuum fittings
16. Produce mouldings which comply with one of the following standards:
1. Civil Aviation Authority (CAA)/European Aviation Safety Agency (EASA)
 2. Ministry of Defence (MoD)
 3. Military Aviation Authority (MAA)
 4. Federal Aviation Authority (FAA)
 5. Aerospace Quality Management Standards (AS)
 6. BS, ISO or BSEN standards and procedures
 7. customer standards and requirements
 8. company standards and procedures
 9. manufacturers standards and procedures
17. Complete the relevant paperwork, to include one from the following and pass it to the appropriate people:
1. build records
 2. job cards
 3. log cards
 4. aircraft log
 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

SEMAE3202

Producing aircraft composite mouldings using pre-preg 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	SEMAE3202
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; pre-preg laminating
