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## Overview

This standard identifies the competences you need to produce composite mouldings (such as moulds, components, splashes, 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 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.

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## 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. complete and store all relevant documentation in accordance with organisational procedures 9. deal promptly and effectively with problems within your control and report those that cannot be solved 10. leave the work area in a safe and appropriate condition on completion of the activities

## Knowledge and understanding

### *You need to know and understand:*

1. the health and safety precautions to be taken, and procedures used, when working with composite materials, consumables, tools and equipment in the specific work area 2. 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 3. the protective equipment (PPE) that is needed for personal protection and, where required, the protection of others 4. the specific environmental conditions that must be observed when producing composite mouldings (such as temperature, humidity, styrene levels to threshold limits, fume/dust extraction systems and equipment) 5. how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate standards) in relation to work undertaken 6. how to interpret first and third angle drawings/lay-up manuals, imperial and metric systems of measurement, workpiece reference/datum points and system of tolerancing 7. the quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification) and the completion of such documents 8. the 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) 9. the different types of resin systems, fibres, reinforcements and their applications 10. how to build up laminates (including orientation and balance of plies) to minimise spring and distortion in composite mouldings 11. the different core, insert and filler materials, and their applications 12. the visual identification of both raw and finished composite materials 13. the identification of materials by product codes 14. different types of production tooling used for producing composite mouldings, and their applications 15. the identification and rectification of defects in production 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 of storage and handling of ancillary and consumable materials 20. the 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) 21. the tools and equipment used in the pre-preg laminating activities, and 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 such as 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 production tooling 27. the identification of defects in the composite moulding (such as de-lamination, voids, contaminants) 28. the care and safe handling of production 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

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Producing composite mouldings using pre-preg laminating techniques



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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, 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 pre-preg laminating 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 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 in accordance with approved procedures 8. leave the work area in a safe and appropriate condition on completion of the activities

2. Carry out all of the following activities when preparing production tooling: 1. check that tooling is correct and complete 2. correctly apply sealers/release agents 3. clean tooling and remove resin build-ups 4. clean and store tooling suitably after use 5. check for surface defects 3. Carry out all of the following activities to prepare materials for production: 1. obtain correct materials for the activity 2. check availability of ancillary materials required 3. thaw material in accordance with approved procedures 4. cut materials to correct shape and orientation 5. identifying defects in pre-preg materials 6. check materials when provided in kit form 7. check that materials are fit for purpose and in life 8. identify and protect materials in the work area

4. Produce a range of mouldings, using techniques for four of the following types of production tool: 1. metal 2. tooling block 3. glass pre-preg 4. carbon pre-preg 5. female tooling 6. male tooling 7. multi-part tools 8. matched tooling 9. wet lay-up 10. closed tooling 11. other specific type

5. Produce a range of mouldings incorporating two of the following in the lay-up: 1. butt joints 2. overlap joints 3. staggered joints 4. orientated plies 5. inverted plies 6. inserts 7. other specific item

6. Produce a range of mouldings incorporating five of the following shape features: 1. internal corners 2. external corners 3. double curvature 4. concave surface 5. convex surfaces 6. return surfaces 7. joggle details 8. nett edges 9. other specific feature

7. Produce a range of mouldings using four of the following methods: 1. production of ply templates 2. nesting of ply templates 3. shaped locators 4. joining boards 5. loose tooling 6. intensifiers 7. vacuum de-bulk 8. pressure de-bulk 9. other specific method

8. Produce a range of mouldings using techniques for one type of resin from: 1. epoxy 2. phenolic 3. bismaleimide 4. cyanate ester 5. other specific resin

9. Produce a range of mouldings using techniques for two types of fibre from: 1. polyethylene 2. glass 3. aramid 4. carbon 5. other specific fibre

10. Produce a range of mouldings using two types of reinforcement from: 1. continuous 2. uni-directional 3. tapes 4. woven 5. braids 6. multi-axis 7. other specific type

11. Produce a range of mouldings using two types of core material: 1. wood 2. expanding core 3. nomex honeycomb 4. aluminium honeycomb 5. foam 6. syntactic core 7. other specific material

12. Use three of the following methods when using core materials: 1. core templates 2. pre-shaping core 3. core chamfers 4. core splicing 5. peel plies 6. edge filling 7. adhesive/resin films 8. single stage curing 9. multi-stage curing 10. other specific method

13. Use one of the following for applying temperature during the cure cycle: 1. oven 2. autoclave 3. heated tools/moulds 4. heated press 5. other specific method

14. Use one of the following for applying pressure during the cure cycle: 1. vacuum bags 2. pressure bags 3. thermal mould expansion 4. fibre tensioning 5. other specific method

15. Use four of the following processes/methods where vacuum bags are used: 1. check vacuum integrity 2. surface bagging 3. envelope bagging 4.

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multi-part envelope bags 5. internal bagging 6. through-tube bagging 7. pleats and tucks 8. reusable bagging 9. use of vacuum fittings 10. other specific process/method 16. Produce a range of mouldings which comply with all of the following quality and accuracy standards: 1. meets company standards and procedures 2. dimensionally accurate with specification tolerances 3. has an appropriate surface finish and is free from defects or surface blemishes

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