
Overview

This standard identifies the competences you need to produce composite mouldings (such as moulds, components, splashes, jigs) using automated tape laying (ATL) and automated fibre placement (AFP) 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 ATL/AFP laminating production techniques.

You will be expected to prepare a range of tooling, apply release agents, and prepare composite materials. You will be expected to setup the ATL/AFP equipment to produce a range of mouldings incorporating a variety of features. Mouldings produced will include laminates using a range of resin and fibres.

Your responsibilities will require you to comply with organisational policy and procedures for the setup and production activities undertaken, and to report any problems with the equipment setup, production activities 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 ATL/AFP laminating techniques and procedures. You will understand the setup and 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 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. determine what processing operations are to be performed and how the equipment will be prepared and set up to achieve this
3. set the equipment operating parameters required for the ATL/AFP moulding operation
4. check that all safety mechanisms are in place and operate correctly
5. follow the correct component drawing or any other related specifications for the component to be produced
6. obtain and prepare the appropriate tools, equipment and materials
7. carry out the moulding activities using the correct methods and techniques
8. check that the equipment operates within the operating parameters set
9. produce mouldings to the required specification
10. check that all the required operations have been completed to specification
11. complete relevant documentation
12. deal promptly and effectively with problems within your control and report those that cannot be solved
13. 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 ATL/AFP 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 application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables
5. the specific environmental conditions that must be observed when producing composite mouldings (such as temperature, humidity, fume/dust extraction systems and equipment)
6. 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
7. how to interpret drawings/lay-up manuals, imperial and metric systems of measurement, workpiece reference/datum points and system of tolerancing
8. the quality procedures used in the workplace to ensure production control (in relation to currency, issue, meeting specification) and the completion of such documents
9. the conventions and terminology used for ATL/AFP laminating techniques (such as material orientation, material identification, ply lay-up, deposition rate, de-bulk factors, bandwidth, tow steering, tensioners, vacuum bagging, cure cycles, exotherm)
10. the safety mechanisms on the ATL/AFP machine, and the procedure for checking that they function correctly
11. operation of the machine controls, and how to stop the machine in an emergency
12. the parts and functions of the ATL/AFP machine (to include machine controls; hydraulic, pneumatic and electricity supplies; drive gear & tracks; deposition heads; material delivery systems)
13. the various machine operating parameters that may require adjusting prior to ATL/AFP laminating activities (such as heater

- temperatures, feed rates, deposition rates, fibre tension, fibre angle, placement tolerances, mould tool positioning), and how these are achieved
14. the effects that changes to these settings will have on the quality of the components produced
 15. the different types of resins used, and their applications
 16. the different types of fibre materials, fabrics, orientations, their combinations and applications
 17. different core, insert and filler materials, and their applications
 18. the visual identification of both raw and finished composite materials
 19. the identification of materials by product codes
 20. the identification and rectification of defects in production tooling
 21. methods of preparation for patterns, moulds and tooling, including the correct selection and use of surface sealers and release agents
 22. the correct methods of storage, thawing and handling of pre-preg materials (including monitoring temperature, storage life and out-life)
 23. the correct methods of storage and handling of ancillary and consumable materials
 24. how to select and use ancillary and consumable materials (such as release films, breather fabrics, bagging films, tapes) to meet performance requirements (such as temperature and compatibility)
 25. tools and equipment used in the ATL/AFP laminating activities, and their care, preparation and control procedures
 26. the 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 ATL/AFP 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 de-lamination, voids, contaminants)

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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

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, equipment setting-up documentation ,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 setting and 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 and usable condition
 5. ensure that there are appropriate facilities for storing the completed mouldings (where applicable)
 6. follow safe practice/approved setting and moulding techniques at all times
 7. ensure moulding materials are prepared, loaded and laid up according to the part specification
 8. return all tools and equipment to the correct location on completion of the setting and moulding activities
 9. segregate and dispose of waste materials using the correct procedure

2. Prepare the ATL/AFP equipment for use, to include carrying out all of the following where applicable:
 1. ensure all services are connected and operational (such as electrical, hydraulic, pneumatic, vacuum)
 2. check the mould tools are correct, complete, clean and free from damage
 3. ensure the mould tools are correct and securely mounted
 4. ensure that all guards, screens and safety mechanisms are in place and in good working order
 5. ensure the equipment tracks are clear and equipment axis move and operate correctly
 6. ensure the deposition head operates correctly
 7. set up the equipment operating conditions to suit the moulding being produced (such as deposition rates, feed rates, heater temperatures, tooling datums, end stop

- positions, selection of the correct CNC programme), including alarm conditions
8. check that all the machine controls are operational and function correctly
3. Prepare the material delivery systems, to include carrying out all of the following where applicable:
1. ensure there are sufficient raw materials available and that they meet the component specification (such as resin, fibre, tape/tow width)
 2. set and check that the tape/tow feed systems are operating correctly (such creels, tensioners, guides, sensors, clamps, cutting heads, compaction rollers, take up reels), where fitted
 3. correctly select, remove from freezer and defrost pre-catalysed materials where required
 4. correctly set up tape/tow materials on reels/creels as required
 5. feed the pre-preg tape/tow materials through the correct guides in sequence to suit the part being produced
 6. ensure the loaded material feed system operates correctly prior to moulding the production part
4. 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
5. 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. identify and protect materials in the work area

6. Produce a range of mouldings incorporating a number of the following shape features (six for ATL / ten for AFP):
 1. butt joins
 2. overlap joins
 3. staggered joins
 4. localised build-ups
 5. localised cut-outs
 6. joggle details
 7. nett edges
 8. tapered surfaces
 9. single curvature
 10. tubular mouldings
 11. double curvature
 12. female tooling
 13. male tooling
 14. concave surface
 15. convex surfaces
 16. single tow deposition
 17. group tow deposition
 18. variable tow bandwidth
 19. tow steering
 20. other specific feature

7. Produce a range of mouldings using one type of resin from:
 1. bio resin
 2. thermoplastic
 3. epoxy
 4. phenolic
 5. bismaleimide
 6. cyanate ester
 7. vinyl ester
 8. other (to be specified)

8. Produce a range of mouldings using techniques for one type of fibre from:
 1. natural fibre
 2. thermoplastic
 3. glass
 4. aramid
 5. carbon

6. hybrid
 7. other (to be specified)
9. Produce a range of mouldings using four types of reinforcement from:
1. uni-directional tows
 2. unidirectional tapes
 3. woven tapes
 4. multi-axis tapes
 5. thermoplastic powder impregnated fabric
 6. co-mingled thermoplastic fabric
 7. other (to be specified)
10. Produce a range of mouldings using two types of core material (where applicable):
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)
11. Use three of the following methods when using core materials (where applicable):
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. single stage curing
 10. multi-stage curing
12. 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)
13. Prepare 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
14. 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
15. Visually inspect a number of mouldings, and identify two of the following:
1. mouldings which meet the required specification
 2. mouldings which have defects
 3. mouldings that require further investigation

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16. Produce a range of mouldings which comply with one of the following standards:
 1. BS, ISO or BSEN standards and procedures
 2. customer standards and requirements
 3. company standards and procedures
 4. recognised compliance agency/body standards

 17. Complete the relevant documentation, to include one of the following:
 1. production documentation
 2. quality control documentation
 3. job cards

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

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