SEMCOMP212

Using pultrusion techniques to produce composite mouldings

Overview

This standard identifies the competences you need to produce composite mouldings using pultrusion moulding techniques, in accordance with approved procedures. You will be required to use appropriate drawings, specifications and documentation to produce various mouldings, using the approved pultrusion production techniques.

You will be expected to produce a range of mouldings incorporating a variety of materials and moulded 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 production activities undertaken and to report any problems with the equipment setup, production activities or materials that you cannot personally resolve, or that are outside your permitted authority, to the relevant people. You will be expected to work to instructions under 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 pultrusion 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 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, environmental and other relevant regulations, directives and guidelines
2. confirm what has to be produced and how this will be achieved
3. confirm the equipment has been set up correctly for the pultrusion moulding operation
4. check that all safety mechanisms are in place and operate correctly
5. follow the correct component drawing or any other related documentation for the component to be produced
6. carry out any preparation activities required on the tooling, die heating equipment and materials
7. check that the equipment is operating correctly
8. carry out the moulding activities using the correct heating source, methods and techniques
9. produce mouldings to the required specification
10. check the quality of the mouldings by visual inspection
11. deal promptly and effectively with problems within your control and report those that cannot be solved
12. complete relevant documentation
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 pultrusion techniques and with the composite materials, consumables, tools and equipment used and how to minimise these and reduce any risks in the work area
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 the must be observed when producing composite mouldings (such as temperature, humidity, fume extraction systems and equipment)
6. how to identify 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/layup manuals, systems of measurement, workpiece reference 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 basic conventions and terminology used for pultrusion techniques (such as material identification, pultrusion specifications, resin/catalyst ratios, accelerators, curing temperature, gel time, cure time, exotherm)
10. the safety mechanisms on the machine and the procedure for checking that they function correctly
11. how to operate the machine controls, and how to stop the machine in an emergency
12. the function of the main parts of the pultrusion machine (such as machine controls; die heaters; pulling equipment; cut-off saws; material delivery systems)
13. the common machine settings that may require adjusting to achieve the required specification

14. the effects that changes to theses settings will have on the quality of the components produced
15. the function resins, reinforcement, catalysts, accelerators and additives play in the production of mouldings
16. how to visually identify raw and finished composite materials
17. the identification of common defects in production tooling
18. the methods used for handling, preparation and application of the reinforcing fibres and fabrics
19. the tools and equipment used in the pultrusion activities and their care, preparation and safe handling
20. the common problems that can occur during the pultrusion process (including defects such as contamination, exotherm, resin rich, dry fibres, broken tows, incomplete curing)
21. the identification of common defects in the composite mouldings (such as porosity, contaminants, dry fibres, tension variation, fibre separation)
22. the care and safe handling of mandrel tooling and composite mouldings throughout the production cycle
23. the actions to be taken for unaccounted items
24. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve
25. the documentation to be completed during and/or on completion of the moulding activity

Scope/range related to performance criteria

1.

Carry out all of the following during the moulding activities:

1.1 use the appropriate documentation (such as job instructions, drawings, material data sheets, specifications, equipment setting-up documentation, 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 maintain a safe working environment for the setting and moulding activities
1.4 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
1.5 confirm that there are appropriate facilities for storing the completed mouldings (where applicable)
1.6 follow safe practice/approved setting and moulding techniques at all times
1.7 ensure moulding materials are prepared and in sequence according to the part specification
1.8 return all tools and equipment to the correct location on completion of the setting and moulding activities
1.9 segregate and dispose of waste materials using the correct procedure

2.

Confirm that the pultrusion machine has been set up correctly to include all of the following:

2.1 all services are connected and operational (such as electrical, hydraulic, pneumatic)
2.2 the moulding dies are correct, complete, clean and free from damage
2.3 the moulding dies are correct and securely mounted
2.4 all guards, screens and safety mechanisms are in place and in good working order
2.5 the profile pullers operate correctly
2.6 the flying cut-off saw operates correctly
2.7 the profile pullers and cut-off saw settings are appropriate for the profile being produced (such as linear speeds, transverse speeds, end stop positions), including alarm conditions
2.8 all the machine controls are operational and function correctly

3.

Confirm the material system has been set up correctly, to include all of the following as applicable to the system being used:

3.1 there are sufficient raw materials available and that they meet the component specification (such as resin, catalyst, additives, fibres)
3.2 that the resin/catalyst feed and mixing systems are operating correctly (such as collection tubes, mixing heads, dispensing heads/injectors), where

fitted
3.3
the correct pre-catalysed materials has been selected and defrosted where required
3.4 the fibre materials have been set up correctly on racks/creels and where appropriate spliced together
3.5 the fibres have been fed through the correct guides in sequence to suit the part being produced

4.

Confirm the die heating equipment has been set up for use, to include all of the following:

4.1 the heating services are connected and operational (such as electrical, fluids, steam)
4.2 the process heating conditions suit the moulding being produced (such as zones, temperature, pressure, rates), including alarm conditions
4.3 check the heating controls are operational and function correctly

5.

Use one of the following heating sources:

5.1 heated platterns
5.2 in-mould heating
5.3 electric heating
5.4 water heating
5.5 steam heating
5.6 oil heating
5.7 electro-magnetic inductance
5.8 micro-wave
5.9 other (to be specified)

6.

Produce composite mouldings using three of the following features:

6.1 sharp corners
6.2 radius corners
6.3 horizontal surfaces
6.4 vertical surfaces
6.5 curved surfaces
6.6 corrugated surfaces
6.7 solid section
6.8 hollow section
6.9 longitudinal recesses
6.10 longitudinal webs/ribs
6.11 undercuts
6.12 longitudinal inserts
6.13 other (to be specified)

7.

Produce composite mouldings, using one type of resin from:

7.1 bio resin

7.2 thermoplastic
7.3 polyester
7.4 vinyl ester
7.5 epoxy
7.6 phenolic
7.7 other (to be specified)

8.

Produce composite mouldings, using one type of fibre from:

8.1 natural fibre
8.2 thermoplastic
8.3 glass
8.4 aramid
8.5 carbon
8.6 hybrid
8.7 other (to be specified)

9.

Produce a range of mouldings using two types of reinforcement from:

9.1 uni-directional tows
9.2 unidirectional tapes
9.3 tissues/veils
9.4 woven fabrics
9.5 multi-axis fabrics
9.6 pre-impregnated tows/tapes
9.7 thermoplastic powder impregnated fabric
9.8 co-mingled thermoplastic fabric
9.9 fabric preform
9.10 other (to be specified)

10.

Visually inspect a number of sample or trial mouldings and identify two of the following:

10.1 mouldings which meet the required specification
10.2 mouldings which have defects
10.3 mouldings that require further investigation

11.

Produce composite mouldings in compliance with one of the following:

11.1 BS, ISO or BSEN standards and procedures
11.2 customer standards and requirements
11.3 company standards and procedures
11.4 recognised compliance agency/body's standards

12.

Complete the relevant documentation, to include one of the following:

12.1 production documentation
12.2 quality control documentation
12.3 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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