SEMCOMP211

Using filament winding techniques to produce composite mouldings

Overview

This standard identifies the competences you need to produce composite mouldings using filament winding 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 filament winding production techniques.

You will be expected to set up the filament winding equipment to produce a range of mouldings incorporating a variety of winding patterns 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 filament winding 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 and madrel tooling have been set up correctly for the filament winding 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, equipment and material delivery system
7. check that the equipment is operating correctly
8. carry out the moulding activities using the correct methods and techniques
9. produce mouldings to the required specification
10. remove completed mouldings from mandrels
11. check the quality of the mouldings by visual inspection
12. deal promptly and effectively with problems within your control and report those that cannot be solved
13. complete relevant documentation
14. 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 filament winding 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/lay-up 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 filament winding techniques (such as material identification, lay-up specifications, resin/catalyst ratios, winding angle, winding tension, 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 of the machine controls and how to stop the machine in an emergency
12. the function of the main parts of the filament winding machines (such as mandrel drive; carriage drive; winding heads; controls; material delivery systems; mandrel extraction 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. the function the winding materials used and their combinations play in the production of mouldings
17. how to visually identify raw and finished composite materials
18. the type of production tooling used for producing composite mouldings
19. the identification of common defects in production tooling
20. how to prepare moulds and tooling (including the correct selection and use of release films/agents)
21. the methods used for handling, preparing and applying the reinforcing fibres and fabrics
22. the tools and equipment used in the filament winding activities and their care, preparation and safe handling
23. the common problems that can occur during the filament winding process (including defects such as contamination, exotherm, porosity, resin rich, fibre deviation, broken tows)
24. the procedures and methods used for removing mouldings from production mandrels
25. the identification of common defects in the composite mouldings (such as porosity, contaminants, fibre deviation, tension variation)
26. the care and safe handling of mandrel tooling and composite mouldings throughout the production cycle
27. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve
28. 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 laid up 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 filament winding 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 mandrel is correct, complete, clean and free from damage
2.3 the mandrel is correctly and securely mounted between the headstock and tailstock
2.4 all guards, screens and safety mechanisms are in place and in good working order
2.5 the deposition carriage operates correctly
2.6 the winding head functions correctly
2.7 the mandrel and deposition carriage settings are appropriate for the moulding being produced (such as mandrel rotational speed, carriage speed, deposition angle), including alarm conditions
2.8 all the machine controls are operational and function correctly

3.

Prepare the mandrel tooling for production, to include carrying out three of the following:

3.1 check that tooling is correct and complete
3.2 clean tooling and remove resin build-ups
3.3 check for surface defects
3.4 correctly apply release films/agents

4.

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

4.1 there is sufficient raw materials available and that they meet the component specification (such as resin, catalyst, additives, fibres)
4.2 the resin/catalyst feed and mixing systems are operating correctly (such as collection tubes, mixing heads, dispensing heads/injectors), where fitted
4.3 the correct pre-catalysed materials has been selected and defrosted where required
4.4 the fibre materials have been set up correctly on racks/creels and where appropriate spliced together
4.5 the fibres have been fed through the correct guides and winding comb/head in sequence to suit the part being produced
4.6 the correct fibre deposition rate, winding angle and tension has been set correctly prior to winding parts

5.

Produce composite mouldings using one of the following winding patterns:

5.1 hoop winding
5.2 helical winding
5.3 longitudinal winding
5.4 winding combination

6.

Produce composite mouldings, using two of the following mandrel types:

6.1 straight mandrel
6.2 multiple spindles/mandrels
6.3 circular mandrels
6.4 non-circular mandrels
6.5 split/segmented mandrels
6.6 integrated mandrels
6.7 mandrels with connections/bosses
6.8 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 chopped strand with resin spray
9.7 pre-impregnated tows/tapes
9.8 thermoplastic powder impregnated fabric
9.9 co-mingled thermoplastic fabric
9.10 other (to be specified)

10.

Use one of the following for applying temperature during the cure cycle:

10.1 room temperature
10.2 oven
10.3 heated tools/moulds
10.4 deposition head heater
10.5 curing lamps
10.6 heat mats
10.7 autoclave
10.8 other (to be specified)

11.

remove completed mouldings from mandrels using one of the following methods:

11.1 reciprocating extraction
11.2 continuous extraction
11.3 stripper plate
11.4 electric ram
11.5 pneumatic ram
11.6 hydraulic ram
11.7 anchored mandrel & part puller/lifter
11.8 mandrel segment removal
11.9 other (to be specified)

12.

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

12.1 mouldings which meet the required specification
12.2 mouldings which have defects
12.3 mouldings that require further investigation

13.

Produce composite mouldings in compliance with one of the following:

13.1 BS, ISO or BSEN standards and procedures
13.2 customer standards and requirements
13.3 company standards and procedures
13.4 recognised compliance agency/body's standards

14.

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

14.1 production documentation
14.2 quality control documentation
14.3 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

SEMCOMP211

Using filament winding techniques to produce composite mouldings

Developed by	Enginuity
Version Number	2
Date Approved	28 Feb 2018
Indicative Review Date	01 Feb 2021
Validity	Current
Status	Original
Originating Organisation	Semta
Original URN	SEMCOMP211
Relevant Occupations	Composite Fitter, Composite Technician, Laminator, Moulding Technician
Suite	Composite Engineering Suite 2
Keywords	Engineering; produce; composite; mouldings; components; laminating; resin; fibre; filament winding