SEMAUT3089

# Installing cableforms and looms in motorsport vehicles

## Overview

This standard identifies the competences you need to install and secure cableforms and looms in motorsport vehicles, in accordance with approved procedures. You will be required to use appropriate cable installation drawings, specifications and documentation to install the various types of cabling. You will install the appropriate cable forms which will include positioning and securing these in the correct locations, applying appropriate screening techniques, using the specified/appropriate techniques for bulkhead/body panel penetration and the use of appropriate fastening devices. The circuitry will include vehicle system cable assemblies for power supply (such as charging, starting and ignition); lighting (such as internal, external and instrumentation/display); data acquisition, control and communication systems. You will be expected to terminate these cables to the relevant circuit breaker panels, distribution panels and relay panels.

Your responsibilities will require you to comply with organisational policy and procedures for the cable installation activities undertaken, and to report any problems with these activities that you cannot personally resolve, or that 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 appropriate electrical cable installation techniques and procedures on motorsport vehicles. You will understand the circuits being installed, and their application, and will know about the installation methods, tools and techniques used, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the completed installation is to the required specification.

You will understand the safety precautions required when carrying out the cable installations. 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 all relevant drawings and specifications for the installation being carried out
3. use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
4. install, position and secure the cabling and components in accordance with the specification
5. check that all necessary connections and terminations are complete and components are fit for purpose
6. deal promptly and effectively with problems within your control and report those that cannot be solved
7. ensure that work records are completed, stored securely and available to others, as per organisational requirements
8. leave the work area in a safe condition on completion of the activities, as per organisational and legal requirements

## Knowledge and understanding

*You need to know and understand:*

1. the specific safety precautions to be taken whilst carrying out the activities (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)
2. the health and safety requirements of the work area and the activities, and the responsibility these requirements place on you
3. the hazards associated with the activities, and how to minimise them and reduce risks
4. the personal protective equipment and clothing (PPE) to be worn during the activities
5. the precautions to be taken to prevent electrostatic discharge (ESD) damage to circuits and sensitive components (use of earthed wrist straps)
6. how to obtain and interpret drawings, circuit and physical layouts, charts, specifications, vehicle manuals, wiring regulations and other documentation used during the installation process (including current industry standard and code of practice schematics, symbols and terminology)
7. how to carry out currency/issue checks on the specifications you are working with
8. the cableforms and looms to be installed, and their function within the particular system
9. the assembly and installation techniques to be used, and the importance of adhering to these procedures
10. the different types of cabling (multicore cables, single-core cables, screened cables, multiplex), terminations and their application
11. how to correctly align and position the cableforms and looms according to their use
12. the importance of correct routeing and securing of cableforms and looms
13. the different types of electrical components to be installed (relay panels, control panels, circuit breakers/fuse panels)
14. the techniques used to position, align, support, secure and distribute the cabling through the vehicle
15. how to extract and insert cables through bulkhead penetration without causing damage to cables or components

16. the methods and techniques to be used for soldering and de-soldering, and the importance of adhering to these procedures
17. the methods and techniques to be used for crimping and heat-shrinking, and the importance of adhering to these procedures
18. types of fastening methods to be used such as adhesive, cable ties and mechanical fasteners
19. the use of anti-vibration mountings
20. the importance of ensuring that the completed installation is free from damage and of ensuring that any exposed components are protected
21. the quality control procedures to be followed during the installation operations
22. how to conduct any necessary checks to ensure that the completed wiring complies with all required standards
23. the importance of safe storage of components prior to assembly and installation
24. the importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components, looms and wiring are correctly covered/protected
25. the procedures for ensuring that you have the correct tools, equipment, components and fasteners for the activities
26. why electrical bonding is critical, and why it must be both mechanically and electrically secure
27. the procedure for the safe disposal of waste materials
28. the tools and equipment used in the installation activities, and their calibration/care and control procedures
29. 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
30. problems with assembly and installation of motorsport vehicle cableforms and wiring looms, and the importance of informing the appropriate people of non-conformances
31. the problems that can occur with the electrical wiring installation operations, and how these can be overcome
32. the recording documentation to be completed for the activities undertaken
33. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve
34. how to access, use and maintain information to comply with organisational requirements and legislation

## Scope/range related to performance criteria

1.

Carry out all of the following during the electrical cable installation activities:

1.1 obtain clearance to work on the vehicle, and observe all relevant isolation and safety procedures
1.2 obtain and use the appropriate documentation (such as job instructions, installation drawings, vehicle manuals, specifications, quality control documentation)
1.3 adhere to procedures or systems in place for risk assessment, hazardous substances, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
1.4 provide safe access and working arrangements for the work area, and ensure that any appropriate environmental conditions can be met
1.5 use approved installation techniques and procedures at all times
1.6 where appropriate, apply electrostatic discharge (ESD) protection procedures
1.7 ensure components and surrounding structures are maintained free from damage and foreign objects
1.8 return all tools and equipment to the correct location on completion of the activities
1.9 dispose of waste items in a safe and environmentally acceptable manner
1.10 leave the vehicle cableforms in a safe condition and ready for testing
1.11 leave the vehicle and work area in a safe and appropriate condition and free from foreign object debris

2.

Install vehicle cableforms and looms in one of the following types of motorsport vehicle:

2.1 single seater
2.2 kart
2.3 rallying
2.4 historic
2.5 sports car
2.6 other specific approved competition vehicle

3.

Install five of the following types of motorsport vehicle cableforms/looms:

3.1 control system
3.2 power supply system
3.3 ignition system
3.4 lighting system
3.5 charging/starting system
3.6 visual display system
3.7 communication system

3.8 data acquisition system
3.9 safety system

4.

Apply ten of the following installation methods and techniques:

4.1 routeing cableforms and looms to avoid damage or chafing
4.2 grouping appropriate cables and applying suitable tape/covering/cable lacing
4.3 drilling/preparing holes for cable fixing devices
4.4 drilling/preparing holes for bulkhead/body panel penetration
4.5 positioning and securing cables using appropriate cable fixing devices
4.6 stripping cable insulation
4.7 soldering cables and cable end fittings
4.8 crimping cable fittings
4.9 earth bonding
4.10 heat shrinking
4.11 screening appropriate cables
4.12 sealing and protecting cable connections
4.13 taking electrostatic discharge (ESD) precautions
4.14 applying cable code identification
4.15 checking cables for continuity
4.16 applying protective edging materials (such as rayrim)

5.

Install cableforms/loom components to include four of the following:

5.1 circuit breaker/fuse panels
5.2 relay panel
5.3 cable protection
5.4 control panels
5.5 terminal blocks
5.6 power supply (batteries)
5.7 module blocks

6.

Make six of the following types of electrical connection:

6.1 module blocks
6.2 free plugs and sockets
6.3 terminal blocks
6.4 tray-mount sockets
6.5 earth bonding points
6.6 overall screened
6.7 soldered connections
6.8 fibre-optic terminations
6.9 multi-pin plugs and sockets
6.10 armoured (SWA) cable terminations
6.11 crimped connections
6.12 mineral insulated (MI) cable terminations
6.13 co-axial cable

7.

Check installed cableforms and looms comply with one of the following:

7.1 race associations
7.2 current legislation, industry standards, codes of practice and procedures
7.3 vehicle manufacturers specification
7.4 customer standards and requirements
7.5 team/company standards and procedures
7.6 specific vehicle requirements

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