SEMAUT3094

Modifying motorsport vehicle electrical/electronic systems

Overview

This standard identifies the competencies you need to modify motorsport vehicle electrical/electronic systems, in accordance with approved procedures. The equipment and systems to be modified may be on a bench or test rig or fitted to the motorsport vehicle. You will be required to change, modify and update electrical/electronic systems such as electrical power supply, charging/starting, lighting, indication and gauging, data acquisition communication, control and safety systems, as is applicable to the motorsport vehicle type and in accordance with modification leaflets, latest issue drawings and standards. You will be expected to remove and replace existing cables, add new cables, change breakout points and change the routing of cables. You will also be expected to change components such as, electrical and electronic modules, units and trays. You will need to show proficiency using various tools for cutting, stripping, crimping and soldering, and for the installation of the electrical/electronic systems.

Your responsibilities will require you to comply with organisational policy and procedures for the modifications undertaken, and to report any problems with the modification activities, components or equipment 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 full 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 modification procedures to motorsport vehicle electrical/electronic systems. You will understand the modifications to be carried out, and their application, and will know about the modification methods, tools and equipment to be used, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the modification is carried out to the required specification.

You will understand the safety precautions required when carrying out the modifications. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

Note: This standard is intended to cover motorsport vehicle electrical/electronic

modifications which are significant or complex. The nature of the complexity will take into account the size and timescale of the modification, the tolerances required, the variety of equipment, techniques and materials required and the difficulty of access. It should not be used solely for simple modifications such as changes to, or the addition of, a single wire/cable or termination.

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. obtain and follow the relevant modification specifications and job instructions
3. confirm and agree the modifications to be carried out to meet the specification
4. prepare the electrical/electronic system for the required modification
5. carry out the system modification using approved materials, methods and procedures
6. complete the modification within the agreed timescale
7. check the modified electrical/electronic system meets the specified operating conditions
8. deal promptly and effectively with problems within your control and report those that cannot be solved
9. ensure that work records are completed, stored securely and available to others, as per organisational requirements
10. 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 interpretation of drawings, wiring diagrams, standards, quality control procedures and specifications used for the modification of the motorsport vehicle electrical/electronic equipment (including current industry standard and code of practice schematics, wiring regulations, symbols and terminology)
6. how to carry out currency/issue checks on the specifications you are working with
7. how to identify the various motorsport vehicle electrical/electronic systems, units and components to be modified
8. the basic principles of operation of the motorsport vehicle electrical/electronic systems, components and circuits being modified, and the purpose of individual modules/components, hardware and software
9. how software can potentially affect hardware operations
10. how to identify the components to be used; component identification systems (codes and component orientation indicators)
11. preparations to be undertaken on the motorsport vehicle electrical/electronic system prior to modification
12. the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
13. the modification, assembly and installation techniques to be used, and the importance of adhering to these procedures
14. how to mark out, drill and prepare holes for mounting and securing the

components and cables including fitting cable protection devices
15. the techniques used to position, align, adjust and secure the components to the motorsport vehicle without damage and according to their use
16. the methods and techniques to be used for soldering and de-soldering, crimping and heat shrinking, the assembly of screened and unscreened plugs and sockets, and the importance of adhering to the procedures
17. the different types of cable protection, and reasons for each type
18. the various mechanical fasteners that will be used and their method of installation (rivets, threaded fasteners, adhesives and special securing devices)
19. the importance of using the specified fasteners for the modification, and why you must not use substitutes
20. the use of anti-vibration mountings.
21. the use of seals/sealant, adhesives to prevent moisture ingress, and the precautions that need to be taken
22. the different types of cabling and their application (multicore cables, single core cables, screened cables, co-axial and tri-axial cables, data/communications cables, fibre optics)
23. the importance of correct routing and securing of cables and modified electrical/electronic units
24. the quality control procedures to be followed during the modification operations
25. how to conduct any necessary checks to ensure the accuracy and quality of the modification
26. how to recognise defects (misalignment, ineffective fasteners, foreign object damage or contamination)
27. 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/
28. the tools and equipment used in the modifying activities, and their calibration and care 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. the problems that can occur with the modification operations on motorsport vehicles and the importance of informing the appropriate people of non-conformances
31. the recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation

32. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve
33. 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 modification activities:

1.1 obtain clearance to work on the motorsport vehicle electrical system, 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 modification techniques and procedures at all times
1.6 where appropriate, apply electrostatic discharge (ESD) protection procedures
1.7 ensure that 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 electrical/electronic equipment and systems in a condition ready for testing
1.11 leave the vehicle and work area in a safe condition and free from foreign object debris (where appropriate)

2.

Modify electrical/electronic systems on one of the following types of motorsport vehicle:

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

3.

Carry out modifications to five of the following motorsport vehicle electrical/electronic systems:

3.1 power supply
3.2 communications
3.3 safety systems
3.4 charging/starting
3.5 data acquisition

3.6 ignition
3.7 visual display and computer
3.8 lighting system
3.9 engine transmission control
3.10 other electrical/electronic systems (such as fuel supply, chassis control, active ride)

4.

Carry out eight of the following types of modification:

4.1 replacing cables of different size or length
4.2 changing routes of cables
4.3 changing or adding components to panels or sub-assemblies (such as meters/dash instrumentation)
4.4 adding new looms
4.5 making changes to looms
4.6 changing position or angle of cable breakout points
4.7 changing position of electrical units
4.8 making changes to components on end of cable (such as engine RPM sensor)
4.9 fitting new electrical systems (such as audio/visual)
4.10 making changes to cable termination
4.11 changing positions of plug and socket pins
4.12 removing cables
4.13 making changes to structure (such as bulkhead, trays, panels, mountings)
4.14 adding cables
4.15 updating software
4.16 changing electrical/electronic units

5.

Carry out at twelve of the following processes:

5.1 dismantling and re-assembling
5.2 sealing and protecting cable connections (such as heat shrinking, fire sleeving devices and boots)
5.3 marking out of location positions for components or modules
5.4 stripping cable insulation
5.5 drilling and preparing holes for fasteners
5.6 making mechanical/screwed/clamped connections
5.7 preparing holes in bulkheads or panels for wires/cables
5.8 crimping terminations (such as tags and pins)
5.9 terminating co-axial/tri-axial cables
5.10 soldering and de-soldering connections
5.11 carrying out stage checks of installed components (such as continuity checking)
5.12 removing and replacing loom protection (such as heat shrink, loom tape, plastic conduit)
5.13 carrying out earth bonding
5.14 positioning and securing equipment and components using mechanical fixings

5.15 attaching suitable cable identification
5.16 carrying out appropriate adjustments to modified units and components
5.17 routing and securing component wires and cables to avoid chafing and damage
5.18 installing/updating software
5.19 terminating cables to installed components using plugs and sockets
5.20 making adjustments to components and operating parameters

6.

Carry out checks on the modified electrical/electronic equipment, to include all of the following:

6.1 visual checks for completeness and freedom from damage
6.2 security of all installed components
6.3 torque setting fasteners (where appropriate)
6.4 all installed connectors are secure
6.5 integrity of earth bonding
6.6 correct polarity of all cables and connections
6.7 carrying out appropriate electrical checks (such as voltage, current, resistance and continuity)
6.8 cable routeing is correct and secure

7.

Check modified motorsport vehicle electrical/electronic systems 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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