Overview

This standard identifies the competences you need to setup, test and adjust electrical/electronic engine/transmission control equipment, in accordance with approved procedures. The equipment and systems to be setup and tested may be on a bench or test rig or fitted to the motorsport vehicle. You will be required to use appropriate drawings, specifications, and test documentation to set up, test and adjust the various items of equipment. You will be expected to use the specified/appropriate techniques to carry out the setting-up and testing procedures in the correct sequence. The equipment to be set up and tested will include engine management, traction control and gear selection systems.

Your responsibilities will require you to comply with organisational policy and procedures for the setting-up, testing and adjusting activities undertaken, and to report any problems with the 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 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 setting-up and testing techniques and procedures to motorsport vehicle electrical/electronic engine/transmission control systems. You will understand the engine/transmission control systems being setup and tested, and their application, and will know about the testing and adjustment techniques, test equipment and methods, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the system functions to the required specification.

You will understand the safety precautions required when carrying out the setting-up and testing operations. 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 setting up and operating specifications for the products or assets being configured
3. set up the equipment ensuring that all operating parameters are achieved and defined procedures followed
4. deal promptly and effectively with problems within your control and report those that cannot be solved
5. check that the configuration is complete and that the equipment operates to specification
6. ensure that work records are completed, stored securely and available to others, as per organisational requirements
7. 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. how to obtain and interpret drawings, standards, quality control procedures and test specifications used in the setting up and testing process (including, current industry standard and code of practice schematics, symbols and terminology used for electrical/electronic engine/transmission systems)
6. how to carry out currency/issue checks on the specifications you are working with
7. the correct operating procedures of the system being set up and tested
8. the components to be set up and tested, and their function within the particular electrical/electronic engine/transmission system
9. the adjustments/corrections/tuning required to bring the equipment/system to operational standard through full range parameters
10. the quality control procedures to be followed during the setting-up and testing operations
11. electrical bonding specifications, and their importance
12. the types of test equipment to be used, and their selection for particular types of tests
13. how to calibrate the test equipment to be used; or the organisational procedures for ensuring that the test equipment is maintained and correctly calibrated
14. the importance of applying electrostatic discharge (ESD) procedures when working on sensitive equipment or devices
15. how to connect the appropriate test equipment into the circuits/equipment (for the measurement of such items as continuity, voltage checks, equipment calibration)
16. the various testing methods and procedures, as recommended in approved electrical codes of practice, and how to apply them to different operating conditions
17. how to recognise defects (under or over performance)
18. the various fault finding techniques that can be used if the system fails the test
19. how to interpret the test readings obtained, and the significance of the readings gained
20. how to analyse the test results
21. the authorisation procedures for changes to test procedures
22. the importance of ensuring that test equipment is used only for its intended purpose and within its specified range and limits
23. the potential problems or errors that could occur, and which may affect the test results, and how they can be avoided
24. the environmental control and company operating procedures relating to the testing activities
25. the procedures to be followed on completion of the tests
26. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve
27. 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 setting-up and testing activities:
   1. obtain clearance to work on the control system, and observe all relevant isolation and safety procedures
   2. use the correct issue of the agreed setting-up and testing procedures and quality documentation
   3. adhere to risk assessment, hazardous substances, personal protective equipment and other relevant safety procedures
   4. check that all tools and test equipment are within calibration dates
   5. provide safe access and working arrangements for the testing area
   6. carry out the setting-up and testing activities using safe and approved techniques and procedures
   7. where appropriate, apply electrostatic discharge protection procedures (ESD)
   8. ensure that the testing equipment is operated within its specification range
   9. ensure the vehicle and surrounding structures are maintained free from damage and foreign objects (where appropriate)
   10. return all tools and equipment to the correct location on completion of the activities
   11. leave the vehicle in a safe and clean condition (where appropriate)

2. Test engine/transmission control equipment in one of the following types of motorsport vehicle:
   1. single seater
   2. kart
   3. rallying
   4. historic
   5. sports car
   6. other specific approved competition vehicle

3. Test one of the following types of motorsport vehicle engine/transmission control systems:
   1. engine management
   2. traction control
   3. gear selection systems
4. Setup and test eight of the following motorsport vehicle engine/transmission system components:
   1. microprocessor controllers
   2. location/positioning systems
   3. control devices
   4. detectors
   5. indication/alarm devices
   6. actuators
   7. sensors
   8. cable connectors
   9. switches
   10. safety devices/overload protection devices
   11. inertial reference unit (IRUs)
   12. other specific electrical/electronic equipment

5. Carry out tests and adjustments using a range of tools and equipment, to include five of the following:
   1. dedicated test equipment
   2. oscilloscope
   3. data test sets
   4. multimeter
   5. simulators
   6. computer/test software
   7. logic/analyser probes
   8. calibration injection inputs
   9. other specific test equipment

6. Use appropriate equipment to carry out six of the following types of test:
   1. standard operational checks
   2. referencing/calibration checks
   3. voltage checks
   4. resistance
   5. continuity checks
   6. input/output
   7. other specific tests

7. Deal with two of the following levels of complexity during the setting-up and testing activities:
1. systems with no faults
2. systems with faults
3. systems with intermittent faults

8. Use four of the following fault-finding techniques during the setting-up and testing activities:
   1. six point
   2. function testing
   3. injection and sampling
   4. half-split
   5. equipment self-diagnostics
   6. unit substitution
   7. input-to-output
   8. emergent problem sequence

9. Check tested motorsport vehicle electrical/electronic engine/transmission systems comply with one of the following:
   1. race associations
   2. current legislation, industry standards, codes of practice and procedures
   3. vehicle manufacturers specification
   4. customer standards and requirements
   5. team/company standards and procedures
   6. specific vehicle requirements
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