SEMAUT3067

Carrying out fault diagnosis and rectification activities on motorsport vehicles during a competition

Overview

This standard identifies the competences you need to carry out the diagnosis and rectification of faults on motorsport vehicle systems, in a fast and efficient manner, during a race meeting or competition. This will involve the application of a range of fault diagnostic techniques, tools and equipment, and the diagnosis and location of the faults to their unit and/or component parts on a range of systems such as engines, transmission, chassis, wheel braking, suspension, steering, fuel, lubrication, cooling and electrical, in accordance with approved procedures.

It covers a range of motorsport vehicles such as single seater, rallying, sports cars, karts, historic and other specific approved competition vehicles. The diagnostic and rectification methods and techniques will include using jigs, fixtures, hand tools, specialist tools, voltmeters, ammeters, ohmmeters, measuring equipment, dismantling the equipment to sub-assembly and component level, protecting exposed components, checking components for serviceability, making mechanical and electrical connections, setting, aligning and adjusting refitted components, tightening fasteners to the required torque, and replenishing oils, greases and fluids.

On completion of the diagnostic and rectification activities, you will be required to carry out a range of final checks, tests and adjustments such as pressure testing systems for potential leaks, checking electrical circuit continuity, checking electrical charging systems, carrying out movement checks (such as travel, clearance or operation of levers and links), functional testing of rectified systems, visual examinations and other specific tests to ensure that the system meets the required specification.

Your responsibilities will require you to comply with organisational policy and procedures for the diagnosis and rectification 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 must ensure that all tools, equipment, and materials used are correctly accounted for on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work as a member of a team, 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. Where team working is involved, you must demonstrate a significant personal contribution during the team activities in order to satisfy the requirements of the standard, and competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying the appropriate diagnostic and rectification techniques and procedures to motorsport vehicles. You will understand the diagnostic and rectification methods and procedures used, and their application. You will know how the equipment functions, the common problems that can occur, the purpose of the individual components and associated defects, in adequate depth to provide a sound basis for carrying out the diagnostic and rectification activities, correcting faults and ensuring that the equipment is replaced to the required standard. You will also have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out the rectification activities.

You will understand the safety precautions required when carrying out the fault diagnosis, adjustments and the component removal and replacement activities, especially those for lifting and supporting the equipment. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect 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. obtain and use all the relevant information on the symptoms and problems associated with the fault
3. investigate and establish the most likely causes of the fault
4. select and apply appropriate diagnostic techniques, tools and aids to locate the fault
5. determine which components or units need adjusting, repairing or replacing
6. ensure that any stored energy or substances are released safely and correctly
7. remove, replace or refit the required components, using approved tools and techniques without causing damage to components or surrounding areas
8. deal with problems during the fault location, rectification and testing activities
9. report any instances where the removal and replacement activities cannot be fully met, or where there are identified defects outside the planned activities
10. ensure that work records are completed, stored securely and available to others as per organisational requirements
11. 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 extract and use information from the relevant areas to assist in the diagnosis and rectification of the fault on the motorsport vehicle (from the driver, rider or team member, telemetry data, engineer's records, set-up sheets and inspection reports)
6. the techniques used to diagnose the faults (sensory information - sight, sound, smell, touch; half-split, six point technique, checking inputs and outputs, component substitution, aural, visual and functional checks, taking measurements and use of equipment self-diagnostics)
7. how to use a range of fault diagnostic equipment to investigate the problem (multimeters, pressure gauges, thermal measuring equipment, verniers, micrometers and other specialised tools)
8. how to evaluate the likely risk of running the vehicle with the known fault, and the effects the fault could have on health and safety, and on the overall vehicle performance
9. how to remove components from vehicle systems without damage to the components or surrounding structure (such as release of spring pressures/force, draining of fluids, proof marking, extraction of components) and the need to protect the circuit integrity by fitting blanking plugs to exposed pipes
10. how to use a range of hand tools (spanners, sockets, screwdrivers, pliers, cutters, punches) to remove a range of components, and using release agents to help free joined parts where seizure or crash damage may have occurred
11. how to check that the tools and equipment to be used are correctly calibrated, and are in a safe, tested and serviceable condition.

12. the various mechanical fasteners that will need to be removed and replaced (threaded fasteners and special securing devices), and their methods of removal and replacement
13. why securing devices need to be tightened to the correct torque, locked, and the different methods that are used
14. the use of torque wrenches, and the importance of ensuring that they are adjusted to the required settings
15. why you need to be methodical and lay the removed components out in a logical sequence to aid re-assembly, and methods that can be used to keep component parts together or in the order that they were removed
16. methods of inspecting removed components, and the awareness of what to look for with regard to damage and wear
17. the equipment used in the rectification operations (alignment tools, torque wrenches, presses)
18. how to rectify the fault using methods such as component replacement, adjustments, repair and refitting techniques
19. the importance of ensuring that all sealants and lubricants used are of the correct specification for the vehicle
20. how to select and carry out visual, aural, functional and measurement tests to ensure the correct operation of the component or system
21. the expected outcomes of the tests being conducted
22. the importance of working to the critical timescales relevant to the motorsport industry
23. the problems with the diagnosis and rectification operations, and the importance of informing appropriate people of non-conformances
24. the importance of ensuring that all tools are used correctly, checked and stored after use
25. the extent of your own authority and to whom you should report if you have problems that you cannot resolve

Scope/range related to performance criteria

1.

Carry out all of the following during the fault diagnosis and rectification activities:

1.1 obtain and use the appropriate documentation (such as job instructions, manuals, fault location documentation)
1.2 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
1.3 position and secure the vehicle, using the correct equipment
1.4 carry out all preparatory work (such as removal of bodywork, fairings and covers, removing excessive dust, grease and dirt)
1.5 check for obvious signs of damage (such as impact damage, broken parts)
1.6 check for excessive wear or play (such as on shafts, bearings, spherical joints and drive shafts)
1.7 check for leaks on seals, gaskets, bushes, controls and pipe fittings
1.8 check the condition and security of suspension and drive components
1.9 check the condition of tyres (such as damage, wear, pressures, security)

2.

Carry out fault diagnosis on one of the following types of motorsport vehicle:

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

3.

Locate faults that have resulted in all of the following breakdown categories:

3.1 intermittent problem
3.2 partial failure (where vehicle is able to return to the `pit' area under power)
3.3 complete breakdown (where vehicle is unable to return to the `pit' area under power)

4.

Collect evidence regarding the fault from five of the following sources:

4.1 system diagrams
4.2 maintenance/history records
4.3 vehicle/equipment manuals
4.4 discussion with user/team member
4.5 data logging
4.6 monitoring equipment (such as gauges recording devices)
4.7 test instruments
4.8 fault analysis charts (such as flow charts)
4.9 equipment self-diagnostics

4.10 troubleshooting guides

5.

Apply two of the following fault diagnostic techniques:

5.1 function testing
5.2 taking measurements and readings
5.3 sensory input (such as sight, sound, smell, touch)
5.4 unit substitution
5.5 half-split
5.6 input/output
5.7 six point technique

6.

Use four of the following during the fault diagnosis and rectification activities:

6.1 jigs
6.2 specialist tools
6.3 alignment devices
6.4 fixtures
6.5 voltmeter/ammeter/ohmmeter
6.6 pressure gauges
6.7 hand tools
6.8 measuring equipment
6.9 data acquisition

7.

Rectify faults in five of the following motor sport vehicle major assemblies or systems:

7.1 engine
7.2 steering
7.3 transmission
7.4 fuel
7.5 chassis
7.6 lubrication
7.7 wheel braking
7.8 cooling
7.9 suspension
7.10 electrical

8.

Use a variety of rectification activities, to include eight of the following:

8.1 removing and replacing electrical connections (such as plugs, sockets, earth straps)
8.2 removing and replacing mechanical fasteners (such as threaded fasteners, circlips, quick release fasteners, rivets)
8.3 removing and replacing hoses and pipes
8.4 tightening fastenings to the required torque
8.5 replacing faulty and or worn components with new or reconditioned components
8.6 adjusting components (for such as travel, working clearance, torque,

electrical values)
8.7 realignment of components
8.8 repairing components (such as brackets, mountings, panels)
8.9 refitting loose/dislodged components
8.10 making temporary repairs, to an acceptable standard
8.11 replenishing oils, greases or fluids

9.

Carry out six of the following monitoring or testing procedures to help diagnose and check that the fault has been rectified:

9.1 pressure testing (such as cylinder pressure, hydraulic or pneumatic pressures)
9.2 electrical checks (such as Voltage, Amperage, continuity checks)
9.3 checking data acquisition for fault rectification and correctly installing sensor parameters
9.4 checking all systems and components are free from foreign objects, dirt or other contamination
9.5 measuring for correct dimensions
9.6 testing noise intensity
9.7 exhaust gas analysis
9.8 thermal checks (such as bearings, friction surfaces)
9.9 movement checks (such as travel, clearance, operation of levers and links, torque)
9.10 vibration analysis
9.11 functional testing of rectified systems
9.12 visual examination to required standard
9.13 other specific test

10.

Check that fault diagnosis and rectification complies with one of the following:

10.1 race associations
10.2 vehicle manufacturer's specification
10.3 team/company standards and procedures
10.4 specific vehicle requirements

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