SEMPEO258

Diagnosing and rectifying faults on motorsport vehicle systems (during competition)

Overview

This standard identifies the basic competences that you need to diagnose and rectify motorsport vehicle system faults, in a fast and efficient manner, during a race meeting or competition. It will prepare you for entry into the motorsport sector, creating a progression between education and employment, or it will provide a basis for the development of additional skills and occupational competences in the working environment.

The activities 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 engine, transmission, chassis, wheel braking, suspension, steering, fuel, lubrication, cooling and electrical. You will be expected to remove the relevant components, to inspect the parts for wear or damage, to determine which (if any) parts need replacing and then to reassemble them for further use.

The removal and replacement activities will include carrying out all necessary safety activities, to lift and support the vehicle and its components, lifting and removing engine and transmission systems, breaking into hydraulic and fuel system circuits, removing and replacing faulty equipment at component or unit level, replenishing fluids, and setting and adjusting the completed system. You will also be expected to carry out routine testing and functional checks of the rebuilt components to determine that the equipment performs to the specified requirements.

Your responsibilities will require you to comply with recognised procedures for the fault diagnosis and removal and replacement activities undertaken, to take account of any potential difficulties or problems that may arise, and seek appropriate help and advice in determining and implementing a suitable solution. You will be expected to work with either a high level of supervision or as a member of a team. 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.

You must ensure that you remove all tools and equipment from the vehicle and work area on completion of the activities, complete all necessary job/task documentation accurately and legibly, and maintain the work area to a standard that will reflect the professional image of the team.

Your underpinning knowledge will be sufficient to provide a broad understanding of your work, and will enable you to apply the appropriate fault diagnosis and rectification techniques and procedures. You will know how the equipment functions, the common faults that can occur, the purpose of the individual components and associated defects, in adequate depth to carry out the fault diagnostic activities, correct faults and ensure that the equipment is replaced and functions to the required standard.

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 legislation, regulations, directives and other relevant guidelines
2. obtain and use all the relevant information on the symptoms and problems associated with the vehicle
3. assist in the investigation and help establish the most likely causes of the faults
4. assist in the selection and use of appropriate diagnostic techniques, tools and aids to locate the fault
5. assist in determining which components or units need adjusting or replacing
6. where appropriate, 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, within the limits of your personal authority and without causing damage to components or surrounding areas
8. deal with any difficulties 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. complete the relevant documentation, in accordance with organisational requirements
11. clean the work area and dispose of waste materials and defective components, in accordance with safe working practices and approved procedures

Knowledge and understanding

You need to know and understand:

1. the health and safety requirements of the area in which you are carrying out the fault diagnostic activities, and the responsibility these requirements place on you
2. the specific safety precautions to be taken when carrying out fault diagnosis on motorsport vehicles
3. the importance of wearing protective clothing and other appropriate safety equipment (PPE) during the fault diagnosis and rectification activities, and of good personal presentation to ensure quality representation of the team or organisation
4. the hazards associated with diagnosing and rectifying motorsport vehicle faults, and with the tools and equipment used (such as moving vehicles in a race environment; the safe support of the vehicle at the correct working height and position; hot vehicle components; the safe release of fuel and other liquids; stored pressure/force; handling and using release agents, sealants and adhesives; misuse of tools), and how they can be minimised
5. how to extract and use information from the relevant areas to assist in the diagnosis and rectification of the fault on the motorsport vehicles (such as 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 (such as sensory information (sight, sound, smell, touch); half-split, six point technique, checking inputs and outputs, component substitution, aural, visual, functional, taking measurements and use of equipment self-diagnostics)
7. how to use a range of fault diagnostic equipment to investigate the problem (such as 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 that 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 (such as spanners, sockets, screwdrivers, pliers, cutters, punches) to remove a range of components, and how to use release

agents to help free joined parts where seizure or crash damage may have occurred
11. the various mechanical fasteners to be removed and replaced, and their method of removal and replacement (such as threaded fasteners and special securing devices)
12. why securing devices need to be tightened to the correct torque and locked, and the different methods used
13. 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 in the order they were removed
14. methods of inspecting removed components, and the awareness of what to look for with regard to damage and wear
15. the equipment used in the rectification operations (such as alignment tools, torque wrenches, presses)
16. how to rectify the fault using methods such as component replacement, adjustments, repair and refitting techniques
17. how to select and carry out visual, aural, functional and measurement tests to ensure the correct operation of the component or system
18. the expected outcomes of the tests being conducted
19. the importance of working to the critical timescales relevant to the motorsport industry
20. how to deal with problems (such as what to do when components do not come apart as readily as expected)
21. when to act on your own initiative and when to seek help and advice from others
22. the importance of leaving the work area and vehicle in a safe and clean condition on completion of the activities (such as returning tools and equipment to the designated location, cleaning the work area, and removing and disposing of waste)

Scope/range related to performance criteria

1.

Carry out **all** of the following during the fault diagnostic activities:

1.1 carry out all preparatory work (such as removal of bodywork, fairings and covers, removing excessive dust, grease and dirt)
1.2 check for obvious signs of damage (such as impact damage, broken parts)
1.3 check for excessive wear or play (such as on shafts, bearings, spherical joints and drive shafts)
1.4 check for leaks on seals, gaskets, bushes, controls and pipe fittings
1.5 check the condition and security of suspension and drive components
1.6 check the condition of tyres (such as damage, wear, pressures, security)
1.7 check for metallic particles in lubricants

2.

Assist in diagnosing faults on **one** of the following types of motorsport vehicle:

2.1 single seater
2.2 karts
2.3 motorcycles (such as circuit and off road)
2.4 rallying
2.5 historic
2.6 sports cars
2.7 other specific approved competition vehicle

3.

Assist in locating faults that have resulted in **two** of the following breakdown categories:

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

4.

Assist in the collection of evidence regarding the fault, from **three** 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.

Assist in carrying out **three** of the following fault diagnostic techniques:

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

6.

Rectify faults in **four** of the following motorsport vehicle major assemblies or systems:

6.1 engine
6.2 steering
6.3 transmission
6.4 fuel
6.5 chassis
6.6 lubrication
6.7 wheel braking
6.8 cooling
6.9 suspension
6.10 electrical

7.

Use a variety of fault rectification activities, to include **six** of the following:

7.1 removing and replacing electrical connections (such as plugs, sockets, earth straps)
7.2 removing and replacing mechanical fasteners (such as nuts, bolts, circlips, quick-release fasteners, rivets)
7.3 removing and replacing hoses and pipes
7.4 replacing faulty and or worn components with new or reconditioned components
7.5 adjusting components (such as travel, working clearance, torque, electrical values)
7.6 realignment of components
7.7 repairing components (such as brackets, mountings, panels)
7.8 refitting loose/dislodged components
7.9 making temporary repairs to an acceptable standard

8.

Assist in carrying out **four** of the following monitoring or testing procedures, to help diagnose and check that the fault has been rectified:

8.1 pressure testing (such as cylinder pressure, hydraulic or pneumatic pressures)
8.2 electrical checks (such as voltage, current, continuity checks)

8.3 noise intensity
8.4 exhaust analysis
8.5 thermal checks (such as bearings, friction surfaces)
8.6 movement checks (such as travel, clearance, operation of levers and links, torque)
8.7 vibration analysis
8.8 functional testing
8.9 visual examination to the required standard

9.

Complete the relevant paperwork, to include **one** from the following, and pass it to the appropriate people:

9.1 body sheets
9.2 computer records
9.3 vehicle log/report
9.4 corrective action report

Behaviours

Additional Information

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

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