

Carrying out fault diagnosis on experimental vehicles

Overview

This standard identifies the competences you need to carry out fault diagnosis on experimental vehicles, in accordance with approved procedures. You will be required to diagnose faults on experimental vehicles, which will involve mechanical equipment, electrical/electronic systems/equipment, steering and suspension equipment, braking systems and components, engine/power units, fuel systems, gearbox and transmission systems, exhaust emission and control systems, cooling and heating systems, and vehicle process controller, at sub-assembly or component level, as applicable. You will be expected to use a variety of fault diagnosis methods and techniques, and to utilise a number of diagnostic aids and equipment. From the evidence gained, you will be expected to identify the fault and its probable cause, and suggest appropriate action to remedy the problem.

Your responsibilities will require you to comply with organisational policy and procedures for the fault diagnostic activities undertaken, and to report any problems with these activities or the tools and equipment used, 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 fault diagnosis procedures to experimental vehicles. You will understand the various fault diagnosis methods and techniques used, and their application. You will know how to apply and interpret information obtained from diagnostic aids and equipment, in adequate depth to provide a sound basis for carrying out the activities and identifying faults or conditions that are outside the required specification. You will know about the interaction of the other associated integrated technologies, and will have adequate knowledge to carry out effective fault diagnosis of the complete vehicle.

You will understand the safety precautions required when carrying out the fault diagnosis activities, especially those for isolating specific components, the use of lifting and handling equipment, and for taking the necessary safeguards to protect yourself and others in the workplace. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

Carrying out fault diagnosis on experimental vehicles

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. review and use all relevant information on the symptoms and problems associated with the products or assets
3. investigate and establish the most likely causes of the faults
4. select, use and apply diagnostic techniques, tools and aids to locate faults
5. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
6. determine the implications of faults for other work and for safety considerations
7. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
8. ensure that work records are completed, stored securely and available to others as per organisational requirements
9. leave the work area in a safe condition on completion of the activities, as per organisational and legal requirements

Carrying out fault diagnosis on experimental vehicles

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. where to obtain and how to interpret drawings, circuit diagrams, specifications, vehicle/manufacturers' manuals and other information needed in the fault diagnosis process
6. the basic principles of how the vehicle systems function and the working purpose of the various integrated components
7. the various fault finding techniques that can be used, and how they are applied (such as half-split, input/output, emergent problem sequence, six point technique, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)
8. how to evaluate the various types of information available for fault diagnosis (such as customer/development personnel reports, monitoring equipment, sensory inputs, history records, and condition of the end product)
9. how to evaluate sensory conditions by sight, sound, smell, touch
10. the procedures to be followed to investigate faults and how to deal with intermittent conditions
11. how to use the various aids and reports available for fault diagnosis
12. the type of equipment that can be used to aid fault diagnosis, and how to check that it is calibrated or configured correctly for the intended use and that it is free from damage and defects (such as mechanical measuring instruments, electrical measuring instruments, test rigs and pressure and flow devices)
13. how to select and apply fault finding methods and techniques to solve problems
14. how to analyse and evaluate possible characteristics and causes of specific faults/problems
15. how to relate previous reports/records of similar fault conditions
16. how to evaluate the likely risk of running the vehicle with the displayed fault, and the effects the fault could have on the overall performance of the vehicle
17. the extent of your own authority and to whom you should report if you have problems that you cannot resolve
18. how to access, use and maintain information to comply with

Scope/range related to performance criteria

1. Carry out all of the following during the fault diagnostic activities:
 1. obtain and use the appropriate documentation (such as job instructions, assembly drawings, vehicle documentation, quality control documentation)
 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
 3. provide and maintain safe access and working arrangements for undertaking the vehicle diagnostics
 4. obtain the correct tools and equipment for the activity and check they are in a safe, tested and usable condition
 5. follow safe practice/approved diagnostic techniques and procedures at all times
 6. collect vehicle fault diagnostic evidence from running and static vehicle systems
 7. disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis
 8. identify the fault and determine appropriate corrective action
 9. return all tools and equipment to the correct location on completion of the diagnostic activities
 10. leave the work area in a safe condition on completion of the activities
2. Carry out fault diagnosis, on two of the following, to sub-assembly/component level:
 1. vehicle mechanical equipment
 2. vehicle electrical/electronic systems
 3. vehicle braking systems
 4. vehicle process controllers
 5. prototype engine/power unit
 6. prototype engine test controller
 7. gearbox and transmission
 8. suspension system
 9. steering system
 10. cooling and heating system
 11. exhaust emission control system

Carrying out fault diagnosis on experimental vehicles

12. fuel system

3. Collect evidence about the fault from four of the following sources:
 1. development personnel or customer who reported the fault
 2. sensory (such as sight, sound, smell, touch)
 3. monitoring equipment or gauges
 4. vehicle/manufacturer's records/history
 5. recording devices
 6. condition of the end product
4. Use a range of fault diagnostic techniques, to include two of the following:
 1. half-split technique
 2. emergent problem sequence
 3. unit substitution
 4. function/performance testing
 5. six point
 6. computer-aided diagnostics
 7. input/output
 8. injection and sampling
 9. unit substitution
5. Use a variety of diagnostic aids and equipment, to include two of the following:
 1. manufacturer's/vehicle manual
 2. logic diagrams
 3. algorithms
 4. flow charts
 5. probability charts/reports
 6. fault analysis charts (such as fault trees)
 7. equipment self-diagnostics
 8. troubleshooting guides
 9. circuit diagrams/specifications
 10. prototype engine test schedule
6. Use two of the following types of test equipment in the fault diagnosis:
 1. mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
 2. electrical/electronic measuring instruments (such as multimeters, logic probes)
 3. fluid power test equipment (such as test rigs, flow meters, pressure gauges)
 4. computer programmed self-assessment systems
 5. prototype engine test controllers

Carrying out fault diagnosis on experimental vehicles

7. Find faults that have resulted in two of the following conditions:

1. intermittent failures
2. partial failure or reduced performance/out-of-specification products
3. complete breakdowns
4. incomplete or incorrect test results

8. Check diagnostic activities comply with one of the following standards:

1. company standards and procedures
2. equipment manufacturer's specifications
3. customer standards and requirements
4. specific system requirements

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