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## Overview

This standard is about devising and implementing strategies to diagnose faults when the application of standard manufacturer diagnostic procedures has failed to reveal the source and cause of problems. You are also required to identify the best course of action to be taken to correct problems.

## Performance criteria

### *You must be able to:*

P1 use suitable personal and vehicle protective equipment throughout all diagnostic related activities

P2 confirm with the relevant people that all standard diagnostic procedures and techniques have been systematically and correctly applied to the vehicle prior to undertaking further work

P3 prepare the vehicle systems and work area for safe working procedures as appropriate to the vehicle

P4 analyse all previous system **fault** information, diagnostic test methods and results correctly to verify the inconclusive results prior to undertaking further work

P5 liaise with the relevant manufacturer's representative to obtain up to date information, advice and guidance relevant to the identified **fault**, when necessary

P6 use **diagnostic methods** which are relevant to the symptoms presented

P7 collect diagnostic information in a logical, systematic and structured way which progressively eliminates all possible **causes** of the **fault**

P8 apply the checks and tests that are most likely to be effective in revealing the **cause** of the **fault**

P9 carry out all diagnostic activities following:

P9.1 your workplace procedures

P9.2 health, safety and environmental requirements

P10 work in a way which minimises the risk of:

P10.1 damage to other vehicle systems, units and components

P10.2 contact with leakages and hazardous substances

P10.3 contact with hazardous substances

P10.4 damage to your working environment

P10.5 injury to self and others

P11 use any **equipment** required, correctly and safely throughout all diagnostic and rectification activities

P12 collect sufficient diagnostic information to enable an accurate diagnosis of the **fault**

P13 correctly identify the **cause(s)** of the **fault**

P14 identify and record any system deviation from acceptable limits accurately

P15 accurately ensure your assessment of dismantled sub-assemblies, components and units identifies their condition and suitability for repair or replacement

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P16 make clear recommendations for a suitable course of action to rectify the **fault**

P17 promptly inform the relevant person(s) where repairs are uneconomic or unsatisfactory to perform

P18 complete all system checks and tests in the most cost and time effective way for the **fault** presented

P19 complete all system diagnostic activities within the agreed timescale

P20 ensure your records are accurate, complete and passed to the relevant person(s) within the agreed timescale and in the format required

P21 promptly report any anticipated delays in completion to the relevant person(s)

## Knowledge and understanding

### *You need to know and understand:*

#### **Legislative and organisational requirements and procedures**

K1 the legislation and workplace procedures relevant to

K1.1 health and safety

K1.2 the environment (including waste disposal)

K1.3 appropriate personal and vehicle protective equipment

K2 legal requirements relating to the vehicle (including road safety requirements)

K3 your workplace procedures for:

K3.1 recording **fault** location and correction activities

K3.2 reporting the results of tests

K3.3 the referral of problems

K3.4 reporting delays to the completion of work

K4 how to formulate and construct your own diagnostic procedures and processes in order for diagnostic activities to proceed

K5 the importance of documenting diagnostic and rectification information

K6 the importance of working to agreed timescales and keeping others informed of progress

K7 the relationship between time, costs and productivity

K8 the importance of promptly reporting anticipated delays to the relevant person(s) following your workplace procedure

#### **Electrical and electronic principles**

K9 electrical and electronic principles including types of sensors and actuators, their application and operation

K10 how electrical and electronic vehicle systems operate, including electrical component function, electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics principles

K11 the interaction between electrical, electronic, mechanical and hydraulic components and systems within a vehicle, including multiplexing

K12 electrical symbols, units and terms

K13 electrical safety procedures

K14 the hazards associated with working on or near high energy electrical vehicle components

### **Use of diagnostic and rectification equipment**

K15 how to prepare and check the accuracy of diagnostic testing **equipment**

K16 how to use diagnostic and rectification **equipment** for mechanical, electrical, hydraulic/pneumatic and fluid systems, specialist repair tools and general workshop equipment

### **Vehicle system faults, their diagnosis and correction**

K17 how vehicle mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems are constructed and operate

K18 how vehicle mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems are dismantled, reassembled and adjusted to manufacturers' specification

K19 the types and **causes** of vehicle mechanical, electrical, electronic, hydraulic/pneumatic and fluid system, unit and component **faults** and failures

K20 vehicle mechanical, electrical, electronic, hydraulic/pneumatic and fluid unit and component replacement procedures, the circumstances which will necessitate replacement and other possible courses of action

K21 how to find, interpret and use sources of information on vehicle mechanical, electrical, electronic, hydraulic/pneumatic and fluid system **operating specifications**, diagnostic test procedures, repair procedures and legal requirements

K22 how to select the most appropriate **diagnostic testing method** for the symptoms presented

K23 how to carry out systematic **diagnostic testing** of vehicle mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems

K24 how to assess the condition of the systems and components within vehicle mechanical, electrical, electronic, pneumatic, hydraulic and fluid systems

K25 how to interpret, evaluate and analyse test results and vehicle data in order to identify the location and **cause** of vehicle system **faults**

K26 how to carry out the rectification activities in order to correct **faults** in vehicle mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems

K27 your workplace procedure, policy and procedure for:

K27.1 work carried out under warranty

K27.2 liaising with manufacturers and outside agencies

K28 the relationship between test methodology and the **faults** repaired – the use of appropriate testing methods

K29 how to make cost effective recommendations for rectification

K30 the importance of inspecting the vehicle following any repairs

## Scope/range

1. **Causes** of faults are:

- 1.1. mechanical
- 1.2. electrical
- 1.3. electronic
- 1.4. hydraulic/pneumatic

2. **Faults** cover the:

- 2.1. vehicle engine area
- 2.2. transmission and driveline area
- 2.3. chassis system area
- 2.4. electrical and electronic units and components area

3. **Diagnostic methods** are:

- 3.1. sensory
- 3.2. functional
- 3.3. measurement
- 3.4. electrical and electronic systems testing

4. **Diagnostic testing** is defined as:

- 4.1. verify the fault
- 4.2. collect further information
- 4.3. evaluate the evidence
- 4.4. carry out further tests in a logical sequence
- 4.5. rectify the problem
- 4.6. check all systems

5. **Equipment** is:

- 5.1. diagnostic and rectification equipment for mechanical systems
- 5.2. diagnostic and rectification equipment for electrical and electronic systems
- 5.3. diagnostic and rectification equipment for hydraulic/pneumatic and fluid systems
- 5.4. specialist repair tools
- 5.5. general workshop equipment

6. **Operating specifications** include:

- 6.1. limits
- 6.2. fits
- 6.3. tolerances

## Glossary

*This section contains examples and explanations of some of the terms used but does not form part of the standard.*

### **Alternative Fuel**

This is defined as any type of fuel that may be used to power an internal combustion engine, examples would include LPG, bio ethanol etc.

### **Diagnostic equipment**

Examples include electronic testing equipment, brake testing equipment, steering geometry equipment, wheel balancing equipment, emission test equipment, measuring instruments, special service tools, charging service stations, noise and vibration detection equipment.

### **Recommendations**

Examples include: dismantling, return to manufacturer, repair or replacement.

### **Rectification activities**

These are a suitable repair, replacement, re-coding or re-programming that rectifies the fault(s) identified from the diagnostic activities carried out.

### **Sensory testing methods**

These may include looking, listening, smelling and touching for heat.

### **Vehicles**

Light vehicles, heavy goods and public service vehicles, motorcycles, heavy vehicle trailers and lift trucks, to include SI, CI, Hybrid, Electric or Alternative fuel vehicles.

### **VEHICLE AREAS –**

#### **Engine area:**

Engines, cooling systems, electronic ignition, petrol fuel injection, diesel fuel injection, engine management systems, starting systems, charging systems.

#### **Transmission and driveline area:**

Clutch assemblies, clutch operating systems, manual gear boxes, automatic gear boxes (including electronic control), drivelines and hubs and final drive assemblies.

#### **Chassis or Frame area:**

Suspension systems, assisted steering systems, non-assisted steering systems, braking systems, ABS/traction control, wheels and tyres, stability systems, bodywork and related areas.

#### **Electrical and electronic area:**

Body electrical systems (including wiring harnesses, lighting systems, auxiliaries, CANBUS systems, fibre optics, vehicle condition and monitoring, comfort and

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convenience, alarm systems), supplementary restraint systems (SRS), heating and air conditioning systems, climate control, communication equipment, navigation systems and entertainment equipment.

IMICA14

Diagnose faults where no prescribed process or format is available in automotive environments



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