
Overview

This standard is about diagnosing and rectifying faults occurring in the vehicle combustion engine's mechanical, electrical, hydraulic and fluid systems.

Performance criteria

- You must be able to:
- P1 use suitable personal and vehicle protective equipment when using **diagnostic methods** and carrying out rectification activities
 - P2 support the identification of **faults**, by reviewing vehicle:
 - P2.1 technical data
 - P2.2 diagnostic test procedures
 - P3 prepare the vehicle systems and work area for safe working procedures as appropriate to the vehicle
 - P4 prepare, check and use all the required **equipment** following manufacturers' instructions
 - P5 use **diagnostic methods** which are relevant to the symptoms presented
 - P6 collect sufficient diagnostic information in a logical and systematic way to enable an accurate diagnosis of engine system **faults**
 - P7 accurately identify and record any system deviation from manufacturer's tolerances
 - P8 ensure your assessment of dismantled sub-assemblies, units and components identifies their condition and suitability for repair or replacement
 - P9 promptly inform the relevant person(s) where repairs are uneconomic or unsatisfactory to perform
 - P10 carry out all diagnostic and rectification activities following:
 - P10.1 manufacturers' instructions
 - P10.2 recognised repair methods
 - P10.3 your workplace procedures
 - P10.4 health, safety and environmental requirements
 - P11 work in a way which minimises the risk of:
 - P11.1 damage to other vehicle systems
 - P11.2 damage to other components and units
 - P11.3 contact with leakages
 - P11.4 contact with hazardous substances
 - P12 ensure all repaired and replacement components and units conform to the vehicle operating specification and any legal requirements
 - P13 adjust components and units, when necessary, correctly to ensure that they operate to meet system requirements

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- P14 promptly record and report any additional **faults** you notice during the course of work
 - P15 use testing methods which are suitable for assessing the performance of the system rectified
 - P16 ensure the rectified engine system performs to the vehicle operating specification and any legal requirements prior to return to the customer
 - P17 ensure your records are accurate, complete and passed to the relevant person(s) within the agreed timescale and in the format required
 - P18 complete all system diagnostic activities within the agreed timescale
 - P19 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 the importance of working to recognised diagnostic and rectification procedures and processes and obtaining the correct information for diagnostic and rectification activities to proceed
- K5 the importance of recording 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)

Electrical and electronic principles

- K9 electrical and electronic principles associated with engine systems, including types of sensors and actuators, their application and operation
- K10 how electrical and electronic engine systems operate, including electrical component function, electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics principles
- K11 the interaction between electrical, electronic and mechanical components within vehicle engine systems
- K12 how engine electrical systems interlink and interact, including multiplexing
- K13 electrical symbols, unit and terms
- K14 electrical safety procedures

K15 the hazards associated with working on or near high energy electrical vehicle components

Use of diagnostic and rectification equipment

K16 how to prepare and check the accuracy of diagnostic testing **equipment**

K17 how to use diagnostic and rectification **equipment** for engine mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems; specialist engine repair tools and general workshop equipment

Combustion engine electrical faults, their diagnosis and rectification

K18 how engine mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems are constructed and operate

K19 how engine mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems are dismantled, reassembled and adjusted to manufacturers' specifications

K20 the types and causes of engine mechanical, electrical, electronic, hydraulic/pneumatic and fluid system, component and unit **faults** and failures

K21 engine mechanical, electrical, electronic, hydraulic/pneumatic and fluid component unit and replacement procedures, the circumstances which will necessitate replacement and other possible courses of action

K22 how to find, interpret and use sources of information on engine electrical and electronic operating specifications, diagnostic test procedures, repair procedures and legal requirements

K23 vehicle operating specifications for manufacturer's tolerances relating to engine mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems for the vehicle(s) on which you work

K24 how to select the most appropriate **diagnostic testing** method for the symptoms presented

K25 how to carry out systematic **diagnostic testing** of engine mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems using prescribed processes or formats

K26 how to assess the condition of mechanical, electrical, electronic, hydraulic/pneumatic and fluid components and units

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- K27 how to interpret test results and vehicle data in order to identify the location and cause of engine system **faults**
 - K28 how to carry out the rectification activities in order to correct **faults** in the engine mechanical, electrical, electronic, hydraulic/pneumatic and fluid systems
 - K29 the relationship between test methodology and the **faults** repaired – the use of appropriate testing methods
 - K30 how to make cost effective recommendations for rectification

Scope/range

- 1. Faults** occur within
 - 1.1. the engine mechanical system
 - 1.2. the engine electrical and electronic systems
 - 1.3. the engine hydraulic and fluid systems

- 2. Diagnostic methods** are
 - 2.1. measurement
 - 2.2. functional testing
 - 2.3. electrical and electronic systems testing

- 3. Diagnostic testing** is defined as:
 - 3.1. Verify the fault
 - 3.2. Collect further information
 - 3.3. Evaluate the evidence
 - 3.4. Carry out further tests in a logical sequence
 - 3.5. Rectify the problem
 - 3.6. Check all systems

- 4. Equipment** is
 - 4.1. diagnostic and rectification equipment for engine mechanical systems
 - 4.2. diagnostic and rectification equipment for engine electrical systems
 - 4.3. diagnostic and rectification equipment for engine hydraulic/pneumatic and fluid systems
 - 4.4. specialist repair tools
 - 4.5. general workshop equipment

**Additional
Information****Glossary**

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

Agreed timescales

Examples include: manufacturer's recommended work times, job times set by your company or a job time agreed with a specific customer.

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.

Electrical systems

Excluding high voltage system

Diagnostic information

This relates to mechanical condition, including wear, run out, pressures and compressions, flow, leakage and electrical measurements such as voltage and pulse displays, electronic systems data, including fault codes, sensor measurements and control unit outputs and/or signals.

Engine area

Engine mechanical, cooling systems, electronic ignition, petrol fuel injection, diesel fuel injection, lubrication, engine management systems, exhaust emission reduction systems and pressure charged induction systems and starting/charging.

Engine and component faults

These are faults that require a multistage inspection and a series of test results to identify the cause.

Functional testing

Examples include: compression testing, performance testing and road testing where relevant.

Hydraulic and fluid systems

These are fuels, oil, lubrication, cooling, air conditioning.

Recommendations

Examples include: servicing, dismantling for further inspection and test, repair and replacement.

Rectification activities

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

Vehicles

These can be any of the following types of light vehicle: SI, CI, Hybrid, Electric or Alternative fuel vehicles.

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