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**Overview**

This standard is about diagnosing faults occurring in the e-cycle system, including the motor, controller, sensors and wiring. It is also about removing and replacing units and components, including after-market upgrades/enhancements, and evaluating the performance of the rectified system.

In this standard the term 'e-cycle' includes vehicles with two, three or four wheels that are pedal-assisted:

- Road legal up to 15.5 mph with a motor with an output of up to 250w
- E-cycles used for other purposes

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## Performance

### criteria

- You must be able to:
- P1 use suitable personal protective equipment and cycle coverings (where applicable) when using diagnostic methods and carrying out removal and replacement activities
  - P2 ensure e-cycle and the work area is safe prior to commencing with any diagnostic, remove or replace activity
  - P3 support the identification of faults by reviewing cycle:
    - P3.1 technical data
    - P3.2 appropriate diagnostic test procedures
    - P3.3 legal requirements
  - P4 prepare and check all the required equipment following manufacturer's instructions prior to use
  - P5 use diagnostic methods which are relevant to the symptoms presented
  - P6 collect sufficient diagnostic information in a systematic way to enable an accurate diagnosis of e-cycle system faults
  - P7 correctly interpret test results from e-cycle systems
  - P8 accurately identify and record any system deviation from acceptable limits
  - P9 ensure your assessment of removed units and components accurately identifies their condition and suitability for repair or replacement
  - P10 promptly inform the relevant person(s) where repairs are uneconomic or unsatisfactory to perform
  - P11 use the equipment required, correctly and safely throughout all diagnostic methods and remove or replace activities
  - P12 carry out all activities following:
    - P12.1 manufacturer's instructions
    - P12.2 industry recognised methods
    - P12.3 your workplace procedures
    - P12.4 health, safety and environmental requirements
  - P13 work in a way which minimises the risk of:
    - P13.1 damage to other cycle systems, units and components
    - P13.2 contact with leakage and hazardous substances
    - P13.3 damage to your working environment
    - P13.4 injury to self and others

- P14 ensure components returned to manufacturer or supplier are packaged and transported in line with legislation and manufacturer's guidance
- P15 ensure all replaced units and components conform to the e-cycle operating specification and any legal requirements
- P16 record and report any e-cycle systems that do not conform to legal requirements
- P17 correctly adjust units and components to ensure that they operate to meet system requirements, when necessary
- P18 promptly record and report any additional faults you notice during the course of work
- P19 use testing methods which are appropriate for assessing the performance of the rectified system
- P20 ensure the rectified e-cycle system and any other system that might have been affected by the work carried out, perform to the cycle operating specification and any legal requirements prior to return to the customer
- P21 ensure your records are accurate, complete and promptly passed to the relevant person(s) in the format required
- P22 complete all system diagnostic and removal and replacement activities within the agreed timescale
- P23 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 health and safety legislation environmental requirements and workplace procedures relevant to workshop practices and personal and cycle protection when diagnosing e-cycle faults
- K2 legal requirements relating to the e-cycle (including road safety and environmental requirements)
- K3 your workplace procedures for:
  - K3.1 recording diagnostic and removal and replacement information
  - K3.2 the referral of problems
  - K3.3 reporting delays to the completion of work
- K4 the importance of documenting diagnostic and rectification information
- K5 the importance of working to agreed timescales and keeping others informed of progress
- K6 the relationship between time, costs and productivity
- K7 the importance of promptly reporting anticipated delays to the relevant person(s)
- K8 the implications on warranty where adjustments or replacements fall outside of acceptable parameters
- K9 how to package and transport e-cycle units and components in line with legislation and manufacturer's guidance

You need to know and understand:

**Use of technical information**

- K10 how to find, interpret and use sources of information applicable to e-cycle component removal and replacement
- K11 the importance of using the appropriate sources of technical information
- K12 how to find, interpret and use sources of information on e-cycle electrical and electronic operating specifications, diagnostic test procedures, repair procedures and legal requirements

You need to know and understand:

**E-cycle system operation and construction**

- K13 how e-cycle systems and their related units and components are constructed and their operation

- K14 electrical and electronic principles associated with e-cycle systems, including types of sensors and actuators, their application and operation
- K15 how e-cycle systems and their related units and components are dismantled and reassembled for the types of cycle on which you work
- K16 how to remove and replace e-cycle system mechanical and electrical units and components for the types of motorcycle on which you work
- K17 how e-cycle systems and components interlink, including multiplexing
- K18 how adjustments made to the e-cycle system might affect how other systems or units operate

You need to know  
and understand:

#### **Equipment**

- K19 how to prepare, check and use all the removal and replacement equipment required
- K20 how to prepare and confirm the accuracy of diagnostic testing equipment

You need to know  
and understand:

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

- K21 electrical and electronic principles associated with e-cycle systems, including types of sensors and actuators, their application and operation
- K22 types of circuit protection and why they are necessary
- K23 how electrical and electronic systems operate, including electrical component function, electrical inputs, outputs, voltages, oscilloscope patterns and digital principles
- K24 the interaction between electrical, electronic and mechanical components within e-cycle system
- K25 electrical symbols, units and terms
- K26 electrical safety procedures
- K27 the hazards associated with working on or near high voltage electrical systems and components

You need to know  
and understand:

#### **E-cycle system faults, their diagnosis and correction**

- K28 the types and causes of e-cycle system unit and component faults and failures
- K29 e-cycle system unit and component replacement procedures, the circumstances which will necessitate replacement and other possible courses of action

- K30 cycle operating specifications for limits, fits and tolerances relating to e-cycle systems for the types of e-cycle on which you work
- K31 how to select and carry out the correct diagnostic testing method
- K32 how to assess and interpret results of the condition of components
- K33 how to make cost effective recommendations for rectification
- K34 how to carry out system rectification activities in order to correct faults in the e-cycle system
- K35 the relationship between test methodology and the faults rectified – the use of appropriate testing methods
- K36 how to ensure all cycle systems operate correctly following rectification activities

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**Scope/range**

1. **E-cycle systems** are:
  - 1.1. mechanical systems
  - 1.2. electrical systems
  - 1.3. electronic systems
  
2. **Units and components** are:
  - 2.1. Batteries
  - 2.2. motors
  - 2.3. controllers
  - 2.4. sensors
  - 2.5. actuators
  - 2.6. ecu
  - 2.7. wiring
  
3. **Diagnostic and testing methods** are:
  - 3.1. sensory
  - 3.2. functional
  - 3.3. measurement
  
4. **Tools and equipment** include:
  - 4.1. hand tools
  - 4.2. special workshop tools
  - 4.3. general workshop equipment
  - 4.4. electrical and electronic testing equipment
  - 4.5. diagnostic and rectification equipment for e-cycle systems

**5. Rectification activities are:**

- 5.1. dismantling
- 5.2. replacement of units and components
- 5.3. adjustment of units and components
- 5.4. repairs to wiring and connectors
- 5.5. re-programming e-cycle systems
- 5.6. updating operating software
- 5.7. reassembly
- 5.8. functional testing

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**Additional  
information**

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

**Glossary****Agreed timescales**

Examples include job times set by your company or agreed with a specific customer.

**Diagnostic information – see Performance Criteria P6**

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**

**Dismantled**

For this standard, components will not be dismantled for overhaul purposes. However systems will be dismantled for components to be inspected and potentially returned to the manufacturer/supplier.

**Functional diagnostic methods**

Examples include: to include performance testing and road testing where relevant

**E-cycles**

In this standard the term 'e-cycle' includes vehicles with two, three or four wheels that are pedal-assisted:

- Road legal up to 15.5 mph with a motor with an output of up to 250w
- E-cycles used for other purposes

**Recommendations**

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

**Sensory diagnostic methods**

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

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**Relevant occupations** E-cycle Technician

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**Suite** Cycle? Micro mobility?

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**Key words** xx