

Assessment Requirements

Unit AE01K – Knowledge of Locating and Correcting Simple Electrical Faults in the Automotive Workplace

Content:

Basic electrical principles

- a. Explain the direction of current flow and electron flow.
- b. These principles must include:
 - i. volts
 - ii. amps
 - iii. ohms
 - iv. power
 - v. AC/DC
 - vi. magnetism
 - vii. electromagnetism
 - viii. electromotive force
 - ix. electromagnetic induction
 - x. electrical heating effect
- c. The terms used within these principles:
 - i. volt (electrical pressure)
 - ii. ampere (electrical current)
 - iii. ohm (electrical resistance)
 - iv. watt (power)
- d. Calculations for the basic principles:
 - i. amps
 - ii. Ohms
 - iii. volts
 - iv. watts
- e. Circuit principles to include:
 - i. series circuits
 - ii. parallel circuits
 - iii. current flow
 - iv. voltage of components
 - v. volt drop
 - vi. resistance
 - vii. the effect on circuit operation of open circuit component(s)
- f. Earth and insulated return systems.
- g. Cable sizes and colour codes.
- h. Different types of connectors, terminals and circuit protection devices.
- i. Meaning of and checks for:
 - i. short circuit
 - ii. open circuit
 - iii. bad earth
 - iv. high resistance
 - v. security
 - vi. functionality
 - vii. performance to specific

Vehicle and electrical unit wiring diagrams

- a. Describe and identify vehicle and unit electrical symbols

- b. Interpret information from vehicle wiring diagrams.
 - i. vehicle systems
 - ii. electrical units
 - iii. wire colour and size
 - iv. earth locations
 - v. wiring junction locations
 - vi. fuse size and location
 - vii. connection pin numbers

Safety procedures and precautions when working on electrical and electronic systems

- a. Safety precautions when working on electrical and electronic systems to include:
 - i. avoidance of short circuits
 - ii. power surges
 - iii. prevention of electric shock
 - iv. protection of electrical and electronic components.
 - v. protection of circuits from overload or damage

Electrical test equipment, its function and correct use

- a. Equipment to include:
 - i. voltmeters
 - ii. ammeters
 - iii. ohmmeters
 - iv. lock torque testers
 - v. regulator testers
 - vi. insulation testers
 - vii. oscilloscopes
 - viii. specialist test equipment

Different types of Batteries

- a. Identify various types
 - i. lead acid – conventional
 - ii. maintenance free
 - iii. gel
 - iv. alkaline
 - v. sodium.

Battery structure and chemical composition

- a. Lead-acid and alkaline batteries:
 - i. construction
 - ii. capacity
 - iii. rating
 - iv. reserve capacity
 - v. cranking rating
 - vi. polarity
 - vii. electrochemical action
 - viii. electrolyte type

Battery maintenance and charging

- a. Maintenance including:
 - i. cleaning terminals and battery tops
 - ii. protecting terminals
 - iii. cell top-up for non-sealed units
 - iv. securing to the vehicle
 - v. removal and refitting procedures
- b. Charging to include:

- i. trickle charging
- ii. boost charging
- iii. charging rates
- iv. safe charging techniques
- v. charging equipment

Lead-acid battery testing techniques and identify basic battery faults

- a Testing techniques for:
 - i. testing of electrolyte
 - ii. high rate discharge testing
 - iii. testing equipment.
- b Faults including:
 - i. low charge
 - ii. battery not holding charge
 - iii. sulphating
 - iv. battery voltage drop during different component operation
 - v. damaged plates and insulators

Different types of generators

- a. Dynamos and regulators.
- b. Alternators with internal and external regulators.

Charging principles and function of generators

- a Charging principles:
 - i. supply current demands
 - ii. battery charging
 - iii. constant voltage at different engine speeds

Components of generators

- a Dynamo and alternator components:
 - i. field coils
 - ii. armature
 - iii. brush assemblies
 - iv. alternator stator
 - v. rotor
 - vi. slip rings
 - vii. rectifier
 - viii. end frame packs
 - ix. bearings
 - x. regulator
 - xi. drive system

Basic testing procedures and identify charging system faults

- a Basic test procedures:
 - i. testing of generator outputs (under and off load)
 - ii. testing for rectification and regulation
 - iii. removal and fitting procedure
 - iv. bench testing
 - v. vehicle testing
- a. Faults to include:
 - i. slipping drive belt
 - ii. corroded or loose connections
 - iii. secure mounting
 - iv. not charging
 - v. noisy operation

Types, structure and operating principles of starter motors

- a Starter motor types:
 - i. pre-engaged
 - ii. permanent magnet for heavy and diesel vehicles.
 - iii. Add gear reduction to starter motor types
- b Components to include:
 - i. solenoid
 - ii. armature
 - iii. commutator
 - iv. brush assemblies
 - v. drive systems
 - vi. ignition switches

Basic common faults and testing procedures for starter motors

- a Basic test to include:
 - i. pre-engaged
 - ii. permanent magnet for heavy and diesel vehicles and light vehicle
 - iii. gear reduction starters
 - iv. wiring related to the circuits
 - v. ignition switches
 - vi. removal and refitting procedures
- a. Faults to include:
 - i. starter not engaging
 - ii. slow engine cranking speed
 - iii. insecure mounting

Types of ignition systems and ignition fundamentals

- a Ignition system types:
 - i. conventional
 - ii. electronic
 - iii. programmed
 - iv. distributorless
- b. Ignition system functional requirements.

The function of ignition components

- a Components to include:
 - i. ignition switch
 - ii. coil
 - iii. distributor
 - iv. spark plugs
 - v. leads
 - vi. ballast resistor
 - vii. contact breakers
 - viii. condenser
 - ix. electronic systems

Testing procedures and basic common faults relating to the ignition system

- a. Testing procedures relating to the ignition system and components including:
 - i. wiring
 - ii. connections
 - iii. switching of the primary circuit
 - iv. removal and refitting procedures.
- b. Failing to start and running erratic

The operating principles of the fuel system

Different fuel types and the relevant combustion process.

- a. Fuel and air mix
- b. Compression ratios
- c. Exhaust emissions.

The different types of fuel system and components

- a. Petrol fuel systems and components:
 - i. Carburettor
 - ii. Choke
 - iii. fuel cut off
 - iv. stepper motors
 - v. sensors
 - vi. injectors
 - vii. fuel pumps
 - viii. relays
 - ix. cold start
 - x. anti run on solenoid
 - xi. lambda sensors
 - xii. idle control actuators
 - xiii. single and multipoint injection systems
- b. Compression ignition systems:
 - i. engine stop solenoid
 - ii. injectors
 - iii. fuel pumps
 - iv. relays
 - v. heater plugs
 - vi. injection pumps
 - vii. filters

Test procedures and basic common faults associated electronic elements of fuel systems and components

- a. Basic testing procedures:
 - i. diesel engine failing to start
 - ii. failing to stop when switched off
 - iii. petrol engine not starting
 - iv. difficult to start when cold

The function of the engine management system and its components

- a. Describe the engine management working processes:
- b. System component including:
 - i. pulse, hall, optimum inductive generators
 - ii. ECU
 - iii. control modules
- c. Sensors including:
 - i. crankshaft
 - ii. manifold
 - iii. temperature
 - iv. knock

Different types of components

- a. Components to include:
 - i. constant energy systems
 - ii. pulse generators
 - iii. hall effect generators

- iv. optimum inductive pulse generators
- v. modules
- vi. ECU
- vii. sensors

Basic common faults and testing methods associated with engine management systems

- a. Basic faults and tests to include:
 - i. engine fails to start
 - ii. erratic running
 - iii. poor fuel consumption
 - iv. poor connections
- b. Removal and replacement procedures.

The different lighting system components

- a. Components to include:
 - i. side and tail lights
 - ii. brake lights
 - iii. reverse lights
 - iv. rear and front fog lights
 - v. headlights
 - vi. driving lights
 - vii. spot lights
 - viii. indicators
 - ix. headlamp trim motors
 - x. index lights

The function of component parts

- a. Components to include:
 - i. lamp holders
 - ii. bulbs
 - iii. relays
 - iv. switches
 - v. warning systems
 - vi. trim motors

Basic common faults and testing methods associated with external lighting system

- a. Faults relating to:
 - i. switches
 - ii. relays
 - iii. lamp holders
 - iv. wiring
 - v. connections
 - vi. fuses and fuse ratings
 - vii. headlamp alignment

The operating principles of external lighting systems

- a. Principles including:
 - i. side and tail lights
 - ii. brake lights
 - iii. reverse lights
 - iv. rear and front fog lights
 - v. headlights
 - vi. spot lights
 - vii. indicators