

Assessment Requirements

Unit LV02.2K – Knowledge of Light Vehicle Fuel, Ignition, Air and Exhaust System Units and Components

Content:

Fuel - Petrol

- a. The function and layout of petrol injection systems:
 - i. single and multi-point systems
 - ii. injection components
 - iii. injection pump
 - iv. pump relay
 - v. injector valve
 - vi. air flow sensor
 - vii. throttle potentiometer
 - viii. idle speed control valve
 - ix. coolant sensor
 - x. MAP and air temperature sensors
 - xi. mechanical control devices
 - xii. electronic control units
- b. The operation of single and multi-point petrol injection systems and components:
 - i. injection pump
 - ii. pump relay
 - iii. injector valve
 - iv. air flow sensor
 - v. throttle potentiometer
 - vi. idle speed control valve
 - vii. coolant sensor
 - viii. MAP and air temperature sensors
 - ix. electronic control units
 - x. fuel pressure regulators
 - xi. fuel pump relays
 - xii. lambda exhaust sensors
 - xiii. flywheel and camshaft sensors
 - xiv. air flow sensors (air flow meter and air mass meter)
 - xv. EGR valve
- c. The procedures used when inspecting petrol system

Fuel – Diesel

- a. The layout and construction of inline and rotary diesel systems.
- b. The principles and requirements of compression ignition engines
 - i. combustion chambers (direct and indirect injection)
- c. The function and operation of diesel fuel injection components:
 - i. fuel filters
 - ii. sedimenters
 - iii. injectors
 - iv. injector types (direct and indirect injection)
 - v. single
 - vi. multi-hole and pintle nozzle types
 - vii. governors
 - viii. fuel pipes
 - ix. glow plugs

- x. cold start devices
- xi. fuel cut-off solenoid
- d. The purpose and operation of:
 - i. turbochargers
 - ii. construction
 - iii. use of inter-coolers
- e Explain the procedures for injection pump timing and bleeding the system
- f The procedures used when inspecting diesel system

Fuel

- a. The meaning of terms related to:
 - i. hydro-carbon fuels
 - ii. volatility
 - iii. calorific value
 - iv. flash point
 - v. octane value
 - vi. cetane value
- b. The composition of hydro-carbon fuels:
 - i. % hydrogen and carbon in petrol and diesel fuels
- c. The composition of air (% nitrogen, oxygen), % of oxygen.
- d. The chemically correct air/fuel ratio for petrol engines as 14.7:1 (lambda 1, stoichiometric ratio).
- e. Weak and rich air/fuel ratios for petrol engines.
- f. Exhaust composition and by-products for chemically correct, rich and weak air/fuel ratios of petrol engines:
 - i. water vapour (H₂O)
 - ii. nitrogen (N)
 - iii. carbon monoxide (CO)
 - iv. carbon dioxide (CO₂)
 - v. carbon (C)
 - vi. hydrocarbon (HC)
 - vii. oxides of nitrogen (NO_x, NO₂, NO) and particulates
- g. The relative advantages and disadvantages of diesel and petrol engines.
- h. Symptoms and faults associated with fuel systems
 - i. diesel fuel system: air in fuel system, water in fuel, filter blockage, leaks, difficult starting, erratic running, excessive smoke (black, blue, white), engine knock, turbocharger faults
 - ii. petrol injection system: leaks, erratic running, excessive smoke, poor starting, poor performance, poor fuel economy, failure to start, exhaust emissions, running-on, excessive fuel consumption and surging

Ignition

- a. The layout of electronic ignition systems, advantages over conventional systems (points).
- b. Electronic ignition circuits and components:
 - i. LT Circuit
 - ii. battery
 - iii. ignition switch
 - iv. electronic trigger devices
 - v. capacitor
 - vi. HT Circuit
 - vii. spark plugs (reach, heat range, electrode features and electrode polarity)
 - viii. rotor arm
 - ix. distributor (if applicable)
 - x. distributor cap
 - xi. ignition leads
 - xii. ignition coil
 - xiii. ignition timing advance system
- c. The operation electronic system components:

- i. amplifiers
- ii. triggering systems
- iii. inductive pick-ups
- iv. hall generators
- v. optical pulse generators
- vi. control units
- d. The operation of amplifier units.
- e. Ignition terminology:
 - i. dwell angle
 - ii. dwell time
 - iii. dwell variations
 - iv. advance and retard of ignition timing
 - v. static and dynamic ignition timing
- f. The operation of electronic ignition systems under various conditions and loads to include:
 - i. engine idling
 - ii. during acceleration
 - iii. under full load
 - iv. cruising
 - v. overrun
 - vi. cold starting
- g. The principles of engine management systems:
 - i. closed loop system
 - ii. integrated ignition
 - iii. injection systems
 - iv. sensors
- h. The procedures used when inspecting
 - i. ignition system
 - ii. engine management
 - iii. sensors
- I. Symptoms and faults associated with ignition system operation
 - i. failure to start hot or cold, erratic running, poor performance, misfire, exhaust emissions misfiring and ignition noise (pinking)

Air supply and exhaust systems

- a. The construction and purpose of air filtration systems.
- b. The operating principles of air filtration systems.
- c. The construction and purpose of the exhaust systems.
- d. The operating principles of the systems.
- e. Exhaust system design to include silencers and catalytic converters.
- f. The procedures used when inspecting induction, air filtration and exhaust systems
- g. Symptoms and faults associated with air and exhaust systems
 - i. exhaust gas leaks
 - ii. air leaks

General

- a. The preparation, testing and use of tools and equipment used for:
 - i. dismantling
 - ii. removal and replacement of engine units and components
- b. Appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removal and replacing engine units and components
- c. The importance of logical and systematic processes.
- d. The inspection and testing of engine units and components.
- e. The preparation of replacement units for re-fitting or replacement.

- f. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance and safety requirements.
- g. Refitting procedures.
- h. The inspection and testing of units and system to ensure compliance with manufacturer's, legal and performance requirements.
 - i. The inspection and re-instatement of the vehicle following repair to ensure customer satisfaction;
 - ii. cleanliness of vehicle interior and exterior
 - iii. security of components and fittings
 - iv. re-instatement of components and fittings