

Assessment Requirements

Unit HV02.1K – Knowledge of Heavy Vehicle Engine Mechanical, Lubrication, and Cooling System Units and Components

Content:

Engines

- a. Engine types and configurations:
 - i. inline
 - ii. flat
 - iii. vee
 - iv. four-stroke cycle for compression ignition engines
 - v. naturally aspirated, turbo-charged and turbo-charged aftercooled engines
 - vi. alternative fuel engines
 - vii. hybrid arrangements where applicable
- b. Key engineering principles related to engine mechanical systems
 - i. compression ratios
 - ii. volumetric efficiency
 - iii. cylinder capacity
 - iv. power
 - v. torque
- c. Terms used in engine mechanical systems
 - i. tdc
 - ii. bdc
 - iii. stroke
 - iv. bore
- i. Relative advantages and disadvantages of different engine types and configurations.
- ii. Engine components and layouts:
 - i. side camshaft and overhead camshaft
 - ii. single and multi cylinder
 - iii. wet and dry liners
 - iv. crankshaft dampers
- d. Cylinder head layout and design, combustion chamber and piston design.
- e. Calculate compression ratios from given data.
- f. The procedures used when inspecting engines
- g. The procedures to assess:
 - i. serviceability
 - ii. wear
 - iii. condition
 - iv. clearances
 - v. settings
 - vi. linkages
 - vii. joints
 - viii. fluid systems
 - ix. adjustments
 - x. operation and functionality
 - xi. security
- h. Symptoms and faults associated with mechanical engine operation:
 - i. poor performance
 - ii. abnormal or excessive mechanical noise
 - iii. erratic running

- iv. low power
- v. exhaust emissions
- vi. abnormal exhaust smoke
- vii. unable to start
- viii. exhaust gas leaks to cooling system
- ix. exhaust gas leaks

Lubrication

- a. Key engineering principles relating to lubrication systems
 - x. classification of lubricants
 - xi. properties of lubricants
 - xii. methods of reducing friction
- b. The advantages and disadvantages of wet and dry systems.
- c. Engine lubrication system:
 - i. splash and pressurised systems
 - ii. pumps
 - iii. pressure relief valve
 - iv. filters
 - v. oil ways
 - vi. oil coolers
- d. Terms associated with lubrication and engine oil:
 - i. full-flow
 - ii. hydrodynamic
 - iii. boundary
 - iv. viscosity
 - v. multi-grade
 - vi. natural and synthetic oil
 - vii. viscosity index
 - viii. multi-grade
- e. The requirements and features of engine oil:
 - i. operating temperatures
 - ii. pressures
 - iii. lubricant grades
 - iv. viscosity
 - v. multi-grade oil
 - vi. additives (detergents, dispersants, anti-oxidants inhibitors, anti-foaming agents, anti-wear)
 - vii. synthetic oils
 - viii. organic oils
 - ix. mineral oils
- f. Symptoms and faults associated with lubrication system
 - i. excessive oil consumption
 - ii. oil leaks
 - iii. oil in water
 - iv. low or excessive pressure
 - v. oil contamination
- g. The procedures used when inspecting lubrication system
- h. The construction and operation of heavy vehicle engine lubrication systems and components, to include:
 - i. full flow
 - ii. by pass
 - iii. wet sump
 - iv. dry sump

Cooling, Heating and Ventilation

- a. Key engineering principles relating to engine cooling, heating and ventilation systems
 - i. heat transfer
 - ii. linear and cubical expansion
 - iii. specific heat capacity
 - iv. boiling point of liquids
- b. Procedures used to remove, replace and adjust cooling system components
 - i. cooling fans and control devices
 - ii. header tanks, radiators and pressure caps
 - iii. coolant filters
 - iv. heater matrix's and temperature control systems
 - v. expansion tanks hoses, clips and pipes
 - vi. thermostats impellers and coolant
 - vii. ventilation systems
- c. The preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement
 - i. system pressure testers
 - ii. pressure cap testers
 - iii. anti-freeze testing equipment
 - iv. chemical tests for the detection of combustion gas
 - v. supplementary coolant additive
- d. The layout and construction of internal heater systems.
- e. The controls and connections within internal heater system.
- f. Symptoms and faults associated with cooling systems:
 - i. water leaks
 - ii. water in oil
 - iii. internal heating system: efficiency, operation, leaks, controls, air filtration, air leaks and contamination
 - iv. excessively low or high coolant temperature
- g. The procedures used when inspecting
 - i. internal heating system
 - ii. cooling system

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;
 - i. cleanliness of vehicle interior and exterior
 - ii. security of components and fittings
 - iii. re-instatement of components and fittings