

## Assessment Requirements

### Unit HV13K – Knowledge of Diagnosis and Rectification of Heavy Transmission and Driveline Faults

#### Content:

#### The construction and operation of transmission and driveline systems

##### a. Including::

- i. friction clutches
- ii. fluid couplings
- iii. multi-speed gearboxes
- iv. fully automatic - including electronic control
- v. electronically controlled gearshift systems
- vi. hub reduction
- vii. final drive units
- viii. hubs & shafts

##### a. Key principles relating to heavy vehicle transmission and driveline systems

- ix. friction
- x. torque transmission
- xi. materials
- xii. fluids & energy
- xiii. potential & kinetic energy

#### Electrical and electronic principles related to heavy vehicle transmission systems

- a. The operation of electrical and electronic systems and components related to heavy vehicle transmission systems including:
  - i. ECU
  - ii. sensors and actuators
  - iii. electrical inputs & outputs
  - iv. voltages
  - v. oscilloscope patterns
  - vi. digital and fibre optic principles
- b. The interaction between the electrical/electronic system, hydraulic system and mechanical components of the transmission systems.
- c. Electronic and electrical safety procedures.

#### The operation heavy vehicle clutches and fluid couplings

- a. The construction and operation of friction clutches (coil spring, diaphragm) including single and twin clutch designs.
- b. The construction and operation of fluid couplings including:
  - i. fluid flywheel
  - ii. torque converter (torque multiplication, efficiency)
  - iii. benefits of fluid couplings
  - iv. benefits of torque converter over fluid flywheel

#### The operation of heavy vehicle transmissions and driveline systems

- a. The construction and operation of manual gearboxes:
  - i. multi-speed gearboxes
  - ii. gear arrangements
  - iii. shaft and bearing arrangements
  - iv. synchromesh devices

- v. interlock mechanisms
- vi. linkages
- vii. overdrive
- viii. lubrication
- b. The construction and operation of automatic gearboxes including hydraulic and electronic control systems: operations of epicyclic gears (sun, planet, annulus and carrier), method for achieving different gear ratios using epicyclic gearing; hydraulic control systems, components and operation; electronic control system, components and operation.
- c. The construction and operation of the electronically controlled gearshift systems
- d. The construction and operation of final drive systems including:
  - i. crown wheel and pinion
  - ii. differential gears
  - iii. differential lock
- e. The construction and operation of heavy vehicle tandem drive systems including third differential and differential locks.
- f. The operation of heavy vehicle traction control systems and launch control.
- g. The construction and operation of heavy vehicle hub arrangements.
- h. The construction and operation of:
  - i. drive shafts
  - ii. prop shafts including flexible joints and couplings
  - iii. universal joints
  - iv. constant velocity joints
  - v. sliding joints

### **Symptoms and faults in heavy vehicle transmissions and drive-line systems**

- a. Clutch and coupling faults:
  - i. abnormal noises
  - ii. vibrations
  - iii. fluid leaks
  - iv. slip
  - v. judder
  - vi. grab
  - vii. failure to release
- b. Gearbox faults:
  - i. abnormal noises
  - ii. vibrations
  - iii. loss of drive
  - iv. difficulty engaging or disengaging gears
  - v. abnormal noises
  - vi. vibrations
  - vii. loss of drive
  - viii. failure to engage gear
  - ix. failure to disengage gear
  - x. leaks
  - xi. failure to operate
  - xii. incorrect shift patterns
  - xiii. electrical and electronic faults
- c. Final drive faults:
  - i. abnormal noises
  - ii. vibrations
  - iii. loss of drive
  - iv. oil leaks
  - v. failure to operate
  - vi. electrical and electronic faults
- d. Drive-lines and couplings:

- i. abnormal noises
- ii. vibrations
- iii. loss of drive

### **Faults in heavy vehicle transmission systems**

- a. Interpret information for diagnostic tests, vehicle and equipment specifications, use of equipment, testing procedures, test plans, fault codes and legal requirements.
- b. How to prepare equipment for use in diagnostic testing.
- c. How to conduct systematic testing and inspection of transmission system, mechanical, hydraulic, electrical and electronic systems using appropriate tools and equipment including, multimeter, oscilloscope and pressure gauges.
- d. How to carry out workshop based and road testing of vehicle and transmission system.
- e. Evaluate and interpret test results from diagnostic and/or road testing.
- f. Compare test result and values with vehicle manufacturer's specifications and settings.
- g. How to dismantle, components and systems using appropriate equipment and procedures.
- h. Assess, examine and evaluate the operation, settings, values, condition and performance of components and systems.
- i. Probable faults, malfunctions and incorrect settings.
- j. Rectification or replacement procedures.
- k. Operation of systems following diagnosis and repair to confirm operation and performance.

### **Transmission units and components**

- a. Friction clutches
- b. Fluid couplings
- c. Multi speed gearboxes
- d. Fully automatic - including electronic control
- e. Electronically controlled gearshift systems
- f. Hub reduction
- g. Final drive units
- h. Hubs & shafts

### **Measurements and settings**

- a. Settings
- b. Input and output values
- c. Voltages
- d. Current consumption
- e. Resistance
- f. Output patterns with oscilloscope
- g. Pressures
- h. Condition
- i. Wear and performance