Assessment Requirements

Unit HV12K – Knowledge of Heavy Vehicle Transmission and Driveline Units

Content:

Key principles related to clutch systems

a. Clutch systems to include:

i. principles of friction
ii. principle of levers
iii. torque transmission

The operation of clutch operating systems

Clutch operating mechanisms

iv. pedal and lever
v. hydraulic operated
vi. air assisted
vii. hydraulic components
viii. master cylinder
ix. slave cylinder
x. hydraulic pipes
xi. electrical and electronic components (fluid level indicators)

The operation of friction clutches

a. The reasons for fitting a clutch.

The construction and operation of:

i. coil spring clutches
ii. diaphragm spring clutches
iii. single plate clutches
iv. multi plate clutches
v. clutch/upshift brakes

Types of friction materials used in clutch construction:

i. organic
ii. ceramic

Clutch mechanisms

i. diaphragm spring clutches
ii. single plate clutches
iii. multi plate clutches
iv. air assistance
v. hydraulic operation

Gearbox systems

a. Construction and operation of gearbox systems including**:**

i. gearshift control systems
ii. manual gearbox
iii. automatic gearbox

Key principles relating to gearbox systems

i. gear ratios
ii. input and output ratios

iii. torque multiplication

The operation of manual gearboxes

a. The reasons for fitting gearboxes, to provide neutral, reverse, torque multiplication.
b. Different gearbox types:
    i. single layshaft
    ii. twin layshaft
    iii. range change
    iv. splitter
    v. twin splitter
c. The layout and construction of gears and shafts for 5, 6, 8, 12 and 16 speed gearbox designs, constant mesh and synchromesh gearboxes, reverse gear.
d. The construction and operation of:
    i. gear selection linkages
    ii. selector forks and rods
    iii. detents and interlock mechanisms
e. The construction and operation of synchromesh devices.
f. The arrangements for gearbox bearings:
    i. bushes
    ii. oil seals
    iii. gaskets
    iv. gearbox lubrication
    v. tachograph drive
g. The electrical and electronic components including reverse lamp switch.
h. Calculate gear ratios and driving torque for typical gearbox specifications.
i. The need to remove the propshaft before towing a casualty vehicle

The operation of automatic gearboxes

a. The reasons for using automatic gearboxes over manual (urban use, stop/start applications)
b. The construction and operation automatic gearboxes to include:
    i. epicyclic geartrain
    ii. brake bands
    iii. fluid couplings and torque converters
c. Properties of automatic transmission fluid

The construction and operation of driveline systems and components

a. including:
    i. universal couplings
    ii. sliding couplings
    iii. constant velocity joints
    iv. final drive units
    v. propshafts
    vi. split-propshafts
    vii. driveshafts
    viii. hub reduction
    ix. tandem drive axles
b. Key principles relating to driveline systems including:
    i. gear ratios
    ii. simple stresses

a. The layout and construction of propshafts and drive shafts used in multi-axle drive systems.
c. The reasons for using flexible couplings and sliding joints in transmissions systems.
d. The reason for using constant velocity joints in drive shafts incorporating steering mechanisms.
e. The construction and operation of:
    i. universal joints

ii. sliding couplings
iii. constant velocity joints
iv. centre bearings

f. The simple stresses applied to shafts: torsional, bending and shear.
g. The construction and operation of:
i. final drive units
ii. multi-drive axle arrangements
iii. crown wheel & pinion
iv. bevel, hypoid and helical gears
v. differential gears
vi. lubricants
vii. lubrication bearings and seals
viii. differential locks
ix. epicyclic hub reduction
h. The reasons for fitting differential/s
i. Calculate final drive gear ratios.
j. Calculate the overall gear ratio from given data (gearbox ratio x final drive ratio).

The construction and operation of gear selector systems

a. including:
i. remote linkages
ii. servo-assistance
iii. range change selection
iv. splitter selection
v. electronic gear selection
b. The layout and operation of gear selector mechanisms used on heavy vehicles:
i. manual shift using rods and levers
ii. manual shift using cables
iii. manual shift using servo assistance
iv. range change selection
1) manual switch (gearstick mounted)
2) automatic (gearbox mounted)
v. splitter selection
c. The layout and operation of electronically controlled gear selector systems:
i. clutch system
ii. gear selection
iii. gear speed synchronisation

The testing and inspection techniques used for heavy vehicle transmission systems

a. The techniques and procedures used for inspecting and testing clutches and clutch mechanisms including:
i. clearances
ii. pedal and lever settings
iii. cables & linkages
iv. hydraulic system
v. leaks (fluid and air)
vi. adjustments
vii. travel
b. The techniques and procedures used for inspecting and testing gearboxes including:
i. leaks
ii. gear selection
iii. synchromesh operation
iv. abnormal noise
c. The techniques and procedures used for inspecting and testing drive line systems (prop & drive shafts, couplings and centre bearings) including:

i. security
ii. serviceability
iii. leaks
iv. alignment
v. balance weights (where applicable)

d. The techniques used when inspecting and testing final drive systems including:
i. fluid levels
ii. leaks
iii. noise

The faults and symptoms associated with vehicle transmissions systems

a. The faults and symptoms associated with transmission systems:
i. clutch faults
ii. gearbox faults
iii. drive line faults (propshaft, drive shaft, universal and constant velocity joints)
iv. universal joint alignment
v. final drive faults
vi. gear selection faults

b. Faults and symptoms to include mechanical, electrical and hydraulic systems.

The procedures for dismantling, removal and replacement of transmission units and components

a. The preparation, testing and use of tools and equipment, electrical meters and equipment used for dismantling removing and replacing transmission systems and components.

b. Appropriate safety precautions:
i. PPE
ii. vehicle protection when dismantling
iii. removing and replacing transmission systems and components

c. The importance of logical and systematic processes.

d. The inspection and testing of transmission systems and components

e. The preparation of replacement units for re-fitting or replacement of transmission systems or components.

f. The reasons why replacement components and units must meet the original specifications (OES):
i. warranty requirements
ii. to maintain performance
iii. safety requirements

g. Refitting procedures.

j. The inspection and testing of units and system to ensure compliance with manufacturer's, legal and performance requirements.

k. 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