Assessment Requirements

Unit HV04K – Knowledge of Heavy Vehicle Chassis Units and Components

Content:

Chassis layouts

i. types of chassis
ii. axle configurations
iii. rear steered axles
iv. self-steered axles

1.3 describe how to remove and replace

Steering

a. Key engineering principles related to steering:
   i. geometry
   ii. angles
   iii. damping
   iv. stress and strain
b. The construction and operation of steering systems
   i. power and non-assisted steering
   ii. multi axle steering arrangements
   iii. heavy vehicle steering units and components
c. The action and purpose of steering geometry:
   v. castor angle
   vi. camber angle
   vii. kingpin or swivel pin inclination
   viii. negative offset
   ix. wheel alignment (tracking) (toe in and toe out)
   x. toe out on turns
   xi. steered wheel geometry
   xii. multi axle steered wheel geometry
d. The following terms associated with steering:
   i. Ackerman principle
   ii. slip angles
   iii. self-aligning torque oversteer and understeer
   iv. neutral steer
   v. rear steer
   vi. self-steer
e. The components and layout of hydraulic power assisted steering systems:
   i. piston and power cylinders
   ii. drive belts and pumps
   iii. control valve (rotary, spool and flapper type)
   iv. hydraulic fluid
f. The advantages of power assisted steering.
g. The operation of hydraulic power assisted steering.
h. The principles of electronic power steering systems.
i. The procedures used for inspecting the serviceability and condition of:
   i. manual steering
   ii. power assisted steering

h. Steering system defects to include:
   i. uneven tyre wear
   ii. wear on outer edge of tyre
   iii. wear on inner edge of tyre
   iv. uneven wear
   v. flats on tread
   vi. steering vibrations
   vii. wear in linkage
   viii. damaged linkage
   ix. incorrect wheel alignment
   x. incorrect steering geometry

Suspension

a. Types of suspension
   i. non independent suspension
   ii. independent suspension
   iii. air suspension
   iv. electronically controlled air suspension (ECAS)
   v. steel suspension
   vi. lifting axles

b. The layout and components of suspension systems:
   i. non-independent suspensions
   ii. independent front suspension (IFS)
   iii. air suspension
   iv. electronically controlled air suspension (ECAS)
   v. rubber suspension
   vi. tandem axle suspension
   vii. lifting axles

b. The operation of suspension systems and components:
   i. leaf and coil springs
   ii. torsion bar
   iii. air springs
   iv. air suspension levelling mechanism (mechanical and electronic)
   v. dampers
   vi. trailing arms
   vii. ball joints
   viii. bump stops
   ix. anti-roll bars
   x. stabiliser bars
   xi. swinging arms
   xii. parallel link
   xiii. transverse link
   xiv. “A” frame axle location
   xv. suspension damping
   xvi. stress and strain

c. The advantages of different systems including:
   i. non-independent
   ii. independent suspension (IFS)
   iii. air suspension (mechanical)
   iv. air suspension (electronically controlled)
   v. lifting axles

d. The principles of electronically controlled air suspensions systems.
e. The forces acting on suspension systems during braking, driving and cornering.
f. The methods of locating the road wheels against braking, driving and cornering forces.

g. The methods of controlling cornering forces by fitting anti-roll torsion members
h. Suspension terms:
    i. rebound
    ii. bump
    iii. yaw
    iv. dive
    v. pitch
    vi. roll
    vii. compliance
i. The procedures used for inspecting the serviceability and condition of the suspension system
j. Suspension system defects:
    i. wheel hop
    ii. ride height (unequal and low)
    iii. wear
    iv. noises under operation
    v. fluid leakage
    vi. excessive travel
    vii. excessive tyre wear
    viii. bounce
    ix. poor vehicle handling
    x. worn dampers
    xi. worn joints/damaged linkages
    xii. vehicle “crabbing”

Brakes

a. Key principles relating to braking systems:
    i. laws of friction
    ii. hydraulics
    iii. pneumatics
    iv. properties of fluids
    v. properties of air
    vi. braking efficiency
b. The construction and operation of braking systems:
    i. air brakes
    ii. air-over-hydraulic brakes
    iii. electronic brakes including Anti-lock Braking Systems and Anti-Slip Regulation
    iv. endurance (retarding) systems
c. The construction and operation of drum brakes:
    i. leading and trailing shoe construction
    ii. self-servo action
    iii. slack adjusters
    iv. cam expanders
    v. wedge expanders
    vi. automatic adjusters
    vii. backing plates
    viii. parking brake system
    ix. wear indicators and warning lamps
d. The construction and operation of disc brakes:
    i. disc pads
    ii. caliper
    iii. brake disc
    iv. ventilated disc
    v. disc pad retraction
    vi. parking brake system
    vii. wear indicators and warning lamps

e. The construction and operation of the hydraulic braking system:
   i. line layout
   ii. master cylinders
   iii. wheel cylinders
   iv. disc brake callipers & pistons
   v. brake pipe
   vi. brake servo
   vii. warning lights
   viii. parking brakes
   ix. equalising valves
f. The construction and operation of the air braking system
   i. air compressors
   ii. air dryers
   iii. air processing units
   iv. pressure regulating valves
   v. circuit protection valves
   vi. air reservoirs
   vii. control valves (foot, park and hand)
   viii. relay valves
   ix. load sensing valves (mechanical and automatic)
   x. brake actuators
   xi. parking brake mechanisms
   xii. trailer control valves
   xiii. two-line trailer brake system
   xiv. warning light/buzzer systems
   xv. air pipes
   xvi. valve port numbering
g. The construction and operation of the air-over-hydraulic braking system
   i. air supply and storage
   ii. air control valves
   iii. conversion from pneumatic pressure to hydraulic pressure
   iv. hydraulic control valves
h. The requirements and hazards of brake fluid:
   i. boiling point
   ii. hygroscopic action
   iii. manufacturer's change periods
   iv. fluid classification and rating
   v. potential to damage paint surfaces
i. Terms associated with braking systems:
   i. braking efficiency
   ii. brake fade
   iii. brake balance
j. The procedures used for inspecting the serviceability and condition of the braking system
h. Braking system defects:
   i. worn shoes or pads
   ii. worn or scored brake surfaces
   iii. abnormal brake noises
   iv. brake judder
   v. fluid contamination of brake surfaces
   vi. fluid/air leaks
   vii. pulling to one side
   viii. poor braking efficiency
   ix. lack of assistance
   x. loss of air pressure
   xi. brake drag

xii. brake grab
xii brake fade

Endurance Brakes

a. The construction and operation of heavy vehicle endurance (retarder) brakes:
- i. exhaust brake
- ii. compression (engine) brake
- iii. hydraulic retarder
- iv. electro-magnetic retarder

ABS and ASR

a. The construction and operation of heavy vehicle ABS systems
- i. category one (2S/2M)
- ii. category two (2S/1M)
- iii. category three (1S/1M)
- iv. wheel speed sensors
- v. modulators
- vi. electronic control unit

Terms associated with ABS systems
- i. individual control
- ii. modified individual control
- iii. select low

The construction and operation of heavy vehicle ASR systems
The procedures used for inspecting the serviceability and condition of the ABS/ASR system

Wheel and Tyres

a. The engineering principles for wheels and tyres
- i. Friction
- ii. un-sprung weight
- iii. dynamic and static balance

b. The construction of different types of tyre:
- i. radial
- ii. cross ply
- iii. bias belted
- iv. tread patterns
- v. tyre mixing regulations
- vi. tyre applications
- vii. tyre markings
- viii. wheel construction
- ix.

c. Tyre markings:
- i. tyre and wheel size markings
- ii. speed rating
- iii. direction of rotation
- iv. profile
- v. load rating
- vi. ply rating
- vii. tread-wear indicators

d. Wheel construction:
- i. alloy
- ii. pressed steel
- iii. one-piece rims

iv. two-piece rims
v. three-piece rims

e. Wheel retention
i. conical seating
ii. spherical seating
iii. spigot mounted

f. Types of wheel bearing arrangements:
i. non-driving and driven wheels
ii. fully floating
iii. three quarter floating

g. Types of bearing used for wheel bearing arrangements and their adjustment:
i. taper roller
ii. angular contact ball
iii. integrated

h. The procedures used for inspecting the serviceability and condition of:
iii. tyres & wheels
iv. bearings

i. The defects associated with tyres and wheels:

i. abnormal tyre wear
ii. cuts
iii. side wall damage
iv. wheel vibrations
v. loose wheel retainers
vi. tyre over heating
vii. tread separation

j. Hazards when loading heavy vehicles

i. flammable liquids
ii. Gases that are lighter than air and heavier than air
iii. increased vehicle mass
iv. raised tipper bodies
v. raised centre of gravity
vi. working at heights

General

The procedures for dismantling, removal and replacement of chassis system components

a. The preparation:
i. testing and use of tools and equipment
ii. electrical meters and equipment used for dismantling
iii. removing and replacing chassis systems and components

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

c. The importance of logical and systematic processes.
d. The inspection and testing of chassis systems and components.
e. The preparation of replacement units for re-fitting or replacement of chassis systems or components.
f. Identify 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.

h. The inspection and testing of units and systems 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