higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

DIESEL TRADE THEORY N3

3 AUGUST 2018

This marking guideline consists of 6 pages.

QUESTION 1

1.1 $Vs = \frac{\pi d^2}{4} \times Ls$

$= \frac{\pi \times 81^2}{4} \times 88$ ✓

$= 453\,463{,}767 \text{ mm}^3$ ✓✓

$Vc = \frac{Vs}{Cr - 1}$

$= \frac{453463{,}767}{13 - 1}$ ✓

$= 37\,788{,}647 \text{ mm}^3$ ✓✓ (6)

1.2 Volume removed $= \frac{\pi d^2}{4} \times h$

$= \frac{\pi \times 81^2}{4} \times 1{,}56$ ✓

$= 8\,038{,}676 \text{ mm}^3$ ✓

New clearance volume = 37 788,647 – 8 038,676 ✓

$= 29\,749{,}971 \text{ mm}^3$ ✓

$Cr = \frac{Vs - Vv}{Vv}$

$= \frac{453463{,}767 \quad 29749{,}971}{29749{,}971}$ ✓

$= 14{,}242 : 1$ ✓ (6)

1.3 When increasing the compression ratio of an engine beyond the manufacturers specifications increased bearing pressure √ and increased thrust on the cylinder walls √ will require improve lubrication √. Due to the higher ratio to which the air and fuel mixture is compressed √ there will be an increase of the initial temperature which will ignite the fuel √ as the detonation temperature is reached. Due to this increases temperature, the engine could knock √, if special fuels are not used √. The Cooling capacity of the engine must be increased due to higher temperatures at which the engine will operate at. √ (8)

[20]

QUESTION 2

2.1 2.1.1 A – Valve Spring
B – Valve Seat
C – Relief Piston
D – Fluted Guides
E – Valve Body (5)

2.1.2 The valve spring keeps the delivery valve on its seat. As the plunger moves upward and closes the inlet and spill port. The fuel pressure rises rapidly. The increase in the fuel pressure will cause the valve to move upward against the spring pressure. The relief piston leaves its bore. Fuel is forced past the relief piston into the fuel line and injection takes place. (6)

2.2
- Delivery Pressure
- Transfer Pressure
- Metering Pressure
- Injection Pressure
- Unloading Pressure. (4)

2.3
- A speed governor controls the maximum speed of an engine.
- It also controls the engine speed according to the engine load.
- It ensures engine idling. (2)

2.4
- The DPA pump can operate reliably at higher speeds.
- It is lighter in construction.
- Due to the simple construction it is cheaper to manufacture.
- Due to only one pumping element, no calibration is required.
- An automatic injection timing control can be incorporated. (3)

[20]

QUESTION 3

3.1 3.1.1 A – Ring gear or annulus
B – Output Shaft
C – Sun Gear
D – Brake Band
E - Input Shaft
F – Planet Gear (6)

3.1.2
- The set is compact and small.
- It is light in weight.
- The Epicyclic set provides numerous gear ratios.
- The gear set changes gears smoothly and silently.
- Constant mesh reduces wear on gear teeth.
- Gear change takes place automatically. (Any 3 × 1) (3)

3.2 3.2.1 A – High throttle pressure
B – Line Pressure
C – Low Governor Pressure (3)

3.2.2 The sift control valve controls the sifting between 1st and 2nd gears or 2nd and 3rd gears. The gear selected is determined by the governor and throttle pressure. When the governor pressure is low, the vehicle speed is low. The control valve is pushed down by the throttle pressure. When the governor pressure is high, the vehicle speed is high. The Control valve is pushed up by the governor pressure and the circuit to the 2nd gear clutch is opened. Transmission will shift into second gear. (8)
[20]

QUESTION 4

4.1
- The limited slip differential has two cross pins and four planet gears.
- The limited slip differential has cross pins mounted at right angles to each other, but do not make contact at their intersection.
- Tips of the planetary shaft are angular
- Carrier has angular slots for the planetary shaft (4)

4.2
- The steering pump belt slips or is broken.
- The steering pump is worn or broken.
- The power steering fluid level is too low.
- The steering system leaks oil.
- The shuttle valve is faulty.
- The relief valve was adjusted incorrectly and the pressure is too low.
- The front tyre is deflated.
- The steering cylinder seized. (Any 3 × 1) (3)

4.3 4.3.1 A – Sun gear
B – Cone Clutch
C – One Way Clutch
D – Annulus / Ring Gear
E – Planetary Gear (5)

4.3.2 Spring pressure pushes the cone clutch to connect the sun gear to the annulus locking the complete gear assembly. Drive from the engine is taken through the unit. (2)

4.3.3
- The main shaft drives the planetary carrier.
- The planetary gears run around the stationary sun gear and drive the ring gear faster. (2)

4.4 Connect a pressure gauge and shut off valve into the high pressure hose. To check the system pressure, close the test valve and compare the readings to the specifications. To check the action of the power piston, control valve and hoses, measure the system pressure as you turn the steering wheel right to left with the test valve open. (4)
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QUESTION 5

5.1 Engagement of the differential lock is obtained when the sleeve slides over the splines of the side shaft. The side gear mesh with the corresponding dog teeth clutch member fixed to the differential housing. One side gear is locked to the differential housing preventing the planet pinions from revolving within the diff housing. The side shaft and housing will revolve with the final drive and crown wheel as one. (4)

5.2
- Time, date and place of the accident.
- A description of the injury.
- Is the injury considered serious or not?
- Was the injured sent to the hospital, treated by a doctor or treated at the work place.
- Was the injury purely accidental.
- Names of witnesses if any.
- How the injury occurred. (3)

5.3
- The receptionist
- Workshop manager
- Mechanic
- Parts department
- Accounting department (4)

5.4
- The amount of capital available to start the business.
- The type of land tenure.
- Are there adequate roads near the site?
- Is access to and from the site easy with no blind corners.
- Is there existing competition.
- Is it near an industrial are for expansion. (3)

5.5
- Brake drum micrometre
- Calliper to measure brake lining thickness.
- Cooling system pressure tester.
- Torque wrenches
- Gas analysers.
- Diagnostic scanners. (3)

5.6
- Prevent theft
- Ensure that necessary tools are ordered
- Broken tools are repaired or replaced (3)

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TOTAL: 100