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Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

# **MARKING GUIDELINE**

**NATIONAL CERTIFICATE  
MECHANOTECHNOLOGY N3**

**31 JULY 2018**

**This marking guideline consists of 6 pages.**

**QUESTION 1: BELTS; CHAIN DRIVES; COUPLING AND CLUTCHES**

- 1.1      1.1.1       $P_D = P_M \times SF$   
                           $= 60 \times 1,5 \checkmark$   
                           $= 90 \text{ kW} \checkmark$  (2)
- 1.1.2       $NR = \frac{N_{motor}}{N_{belt}}$   
                           $= \frac{1350}{800} \checkmark$   
                           $= 1,69 \checkmark$  (2)
- 1.1.3      From table 3, the nearest center distance = 1779 mm  $\checkmark$   
                          From there to the top you can read the belt length of 4560 mm  $\checkmark$
- Alternatively
- $L = [(D + d) \times 1,57] + 2 \times C$   
                           $= [(400 + 236) \times 1,57] + 2 \times 1700 \checkmark$   
                           $= 4398,52 \text{ mm} \checkmark$  (2)
- 1.1.4      CF = 1,05 (Table 3) (1)
- 1.2
  - The number of teeth on the sprocket
  - Centre distance between sprockets
  - Position of the drive (vertical/horizontal)
  - The length of the chain link/pitch
  - Operational speed
  - Operational condition/s
  - Size of the chain
  - Size of the load
  - Ratio between load magnitude and chain size
  - The power to be transmitted
  - The torque to be transmitted
  - Type/nature of unit to be driven
  - Method of lubrication to be applied on the chain (Any 5 × 1) (5)
- 1.3
  - Axial alignment
  - Radial alignment
  - Combined load (3 × 1) (3)

- 1.4 1.4.1 Multi-disc clutch plate (1)
- 1.4.2
- The initial cost of this clutch is high.
  - Many frictional surfaces where slip can take place.
  - Heat generation is high due to many frictional surfaces.
  - Clutch engagement is not instantaneous.
  - The coefficient of friction is low. (Any 1 × 1) (1)
- 1.5 *Centrifugal force* is an outward force that is created when an object is spinning or rotating. (1 × 2) (2)
- [19]**

**QUESTION 2: BRAKES**

- 2.1 Through the use of electric current, the electromagnetic solenoid pulls the levers apart, allowing the shaft to rotate. ✓ When the electric current stops flowing, magnetic force of the solenoid is instantly lost. ✓ This results in the springs pulling the brake shoes against the shaft to stop it. ✓ This means the brake system cannot operate without electric power. ✓ (4)
- 2.2
- It does not need electric power.
  - Wheels are coupled separately.
  - Easy to repair (Any 1 × 1) (1)
- [5]**

**QUESTION 3: BEARINGS**

- 3.1
- A. Ball roller
  - B. Spherical roller
  - C. Cylindrical roller
  - D. Needle roller
  - E. Tapered roller (5 × 1) (5)
- 3.2
- Basic static load
  - Basic dynamic load
  - Bearing number
  - Bearing width
  - Nominal bore/inside diameter
  - Nominal outside diameter (Any 3 × 1) (3)
- 3.3
- 3.3.1 Refers to the type of bearing
  - 3.3.2 Refers to the width of the bearing
  - 3.3.3 Refers to the diameter of the bearing (3 × 1) (3)

- 3.4
- Load magnitude
  - Bearing cage design
  - Installation accuracy
  - Internal clearance
  - Bearing size/type
  - Insufficient lubrication and cooling
- (Any 3 × 1) (3)  
**[14]**

**QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION**

- 4.1
- Suitable only for clean fluid
  - It is difficult to identify a leak.
  - To replace packings, you have to remove the cylinder head.
- (3 × 1) (3)
- 4.2
- 4.2.1 With a sump/reservoir, the moving parts scoop the oil when crankshaft is rotating.
- 4.2.2 The oil supply is controlled by the use of an adjustable needle valve, operated by a lever. The valve can be lifted when the oil is required, and lowered when not required.
- 4.2.3 The operator is directly responsible for the amount of lubricant to be applied.
- (3 × 2) (6)
- 4.3
- 4.3.1 False
- 4.3.2 False
- 4.3.3 True
- 4.3.4 True
- (4 × 1) (4)  
**[13]**

**QUESTION 5: HYDRAULICS AND PNEUMATICS**

- 5.1
- 5.1.1  $V = A \times L$   
 $A = \frac{5,876 \times 10^{-5}}{0,131} \checkmark$   
 $= 448,55 \text{ mm}^2 \checkmark$
- (2)
- 5.1.2  $A = \frac{\pi d^2}{4}$   
 $d = \sqrt{\frac{448,55 \times 10^{-6} \times 4}{\pi}} \checkmark$   
 $= 23,898 \text{ mm} \checkmark$
- (2)

5.1.3 
$$P = \frac{F}{A}$$

$$= \frac{40 \times 10^3}{448,55 \times 10^{-6}} \checkmark$$

$$= 89,176 \text{ MPa} \checkmark$$

(2)

- 5.2
- Regulates pressure
  - Prepare the air for use in the system.
  - Filters/clean air
  - Lubricates components
- (Any 3 × 1) (3)  
**[9]**

### QUESTION 6: INTERNAL COMBUSTION ENGINES

- 6.1.
- Induction stroke✓  
Mixture of air and fuel is sucked into the cylinder✓
  - Compression stroke✓  
Piston moves up and compresses the mixture of fuel and air to the combustion chamber✓
  - Power stroke✓  
Spark plugs ignite the mixture of fuel and air, forcing the piston to go down✓
  - Exhaust stroke✓  
Piston moves from bottom dead centre to top dead centre as it forces the exhaust gases out✓
- [8]**

### QUESTION 7: CRANES AND LIFTING MACHINES

- 7.1
- Overhead travelling cranes
  - Tower cranes
  - Wharf cranes
  - Mobile cranes
- (4 × 1) (4)
- 7.2
- A – Core
  - B – Wire
  - C – Strand
  - D – Steel/wire rope
- (4 × 1) (4)  
**[8]**

**QUESTION 8: MATERIAL AND MATERIAL PROCESSES**

- 8.1
- Sound
  - Touch
  - Surface hardness
  - Flame colour
  - Odour
- (5 × 1) (5)

- 8.2
- To refine the grain structure of steel
  - To soften the steel
  - To reduce brittleness
  - To release internal stresses
- (4 × 1) (4)  
**[9]**

**QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING**

- 9.1 Capital budget is a long-term plan for investment in business assets like property and equipment ✓ in order to expand and improve production capacity ✓. Expenditure from the capital budget will affect the business' long-term competitiveness. ✓
- (3)

- 9.2
- It is suitable for long correspondence.
  - It is controllable and lasting.
  - It is more accurate than spoken words.
  - It can be kept for an unlimited period of time.
- (4 × 1) (4)  
**[7]**

**QUESTION 10: ENTREPRENEURSHIP**

- 10.1 Symbiosis refers to the harmonious workmanship that exists between a variety of businesses, resulting in the benefit of all businesses involved. ✓  
E.g. A motor spares shop at a plaza depends on other shops to draw all kinds of customers who drive cars. ✓
- (2)

- 10.2
- Knowledge and skills.
  - Contacts and friends.
  - Finance.
- ( Any 2 × 1) (2)

- 10.3
- By shopping around
  - Through media observation
  - By considering travelling and transportation aspects
  - By observing products while on holiday
  - By identifying opportunities in entertainment, sports and people's hobbies
  - By talking to other people (networking)
  - By observing the behaviour of children and babies
  - By identifying opportunities during housekeeping activities
- ( Any 4 × 1) (4)  
**[8]**

**TOTAL: 100**