



**higher education  
& training**

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)

$$\begin{aligned} 1.1.2 \quad NR &= \frac{N_{motor}}{N_{belt}} \\ &= \frac{1350}{800} \checkmark \\ &= 1,69 \checkmark \end{aligned} \quad (2)$$

1.1.3 From table 3, the nearest center distance = 1779 mm ✓  
From there to the top you can read the belt length of 4560 mm ✓

### Alternatively

$$\begin{aligned} L &= [(D + d) \times 1,57] + 2 \times C \\ &= [(400 + 236) \times 1,57] + 2 \times 1700 \checkmark \\ &= 4398,52 \text{ mm } \checkmark \end{aligned} \quad (2)$$

1.1.4 CF = 1,05 (Table 3) (1)

- |     |  |             |     |
|-----|--|-------------|-----|
| 1.2 | <ul style="list-style-type: none"> <li>• The number of teeth on the sprocket</li> <li>• Centre distance between sprockets</li> <li>• Position of the drive (vertical/horizontal)</li> <li>• The length of the chain link/pitch</li> <li>• Operational speed</li> <li>• Operational condition/s</li> <li>• Size of the chain</li> <li>• Size of the load</li> <li>• Ratio between load magnitude and chain size</li> <li>• The power to be transmitted</li> <li>• The torque to be transmitted</li> <li>• Type/nature of unit to be driven</li> <li>• Method of lubrication to be applied on the chain</li> </ul> | (Any 5 × 1) | (5) |
| 1.3 | <ul style="list-style-type: none"> <li>• Axial alignment</li> <li>• Radial alignment</li> <li>• Combined load</li> </ul>   | (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)

$$\begin{aligned}
 5.1.3 \quad P &= \frac{F}{A} \\
 &= \frac{40 \times 10^3}{448,55 \times 10^{-6}} \checkmark \\
 &= 89,176 \text{ MPa} \checkmark
 \end{aligned}$$

(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**