



**higher education  
& training**

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

# **MARKING GUIDELINE**

**NATIONAL CERTIFICATE**

**MECHANOTECHNOLOGY N3**

**7 April 2020**

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

**QUESTION 1: POWER TRANSMISSION; COUPLING OF SHAFTS AND CLUTCHES**

- 1.1 
$$P = \frac{2\pi NT}{60}$$
  

$$T = \frac{4500 \times 60 \checkmark}{2 \times \pi \times 2800 \checkmark}$$
  

$$= 15,347 Nm \checkmark^{1/2}$$
 (3)
- 1.2
- To provide a semi-permanent connection.
  - To promote drive/rotation in both directions.
  - To do effective maintenance when uncoupling for repairs.
  - Long shafts are more difficult and expensive to manufacture to the right specification
  - Long heavy shafts are more difficult to transport
  - It is difficult to handle and install long shafts in the workshops and factories. (Any 2 × 1) (2)
- 1.3
- 1.3.1 A – Flange  
B – Gear (2)
- 1.3.2 Internal gear coupling (1)
- 1.4
- Natural rubber
  - Chloroprene (2)
- 1.5
- Must have correct viscosity.
  - Must prevent mixing with water (emulsion).
  - Must resist foaming.
  - Must serve as an effective lubricator.
  - Must prevent corrosion. (5)
- 1.6
- 1.6.1 
$$\text{Speed Ratio} = \frac{\text{Speed of the faster pulley}}{\text{Speed of the slower pulley}}$$
- 1.6.2 
$$\text{Number of belts} = \frac{\text{Design power}}{\text{Corrected power per belt}}$$
- 1.6.3 
$$\text{Belt length} = [(D + d) \times 1,57] + (2 \times \text{centre distance})$$
 (3 × 2) (6)
- [21]**

**QUESTION 2: BRAKES**

- A – Fluid reservoir  
 B – Master cylinder  
 C – Rear flexible hose/T-piece connection  
 D – Rigid pipes/hydraulic fluid pipes  
 E – Pedal

**[5]****QUESTION 3: BEARINGS**

- 3.1
- Taper rollers
  - Cylindrical rollers
  - Spherical rollers
  - Ball rollers
  - Needle rollers
- (Any 4 × 1) (4)
- 3.2
- Nominal outside diameter
  - Nominal bore diameter
  - Width of the bearing
  - Bearing number
  - Basic dynamic load
  - Basic static load

(6)  
**[10]****QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION**

- 4.1
- 4.1.1
- A – Pump casing
  - B – Piston rod/shaft
  - C – Soft packing/asbestos
- (3)
- 4.1.2
- Stuffing box with soft packings (1)
- 4.2
- The purpose of a mechanical seal is to prevent fluid from leaking out of the pump. (1)
- 4.3
- An oil filter is a device used to retain insoluble contaminants in a fluid by using a porous medium. (2)
- 4.4
- To extend the oil life
  - To remove oil deterioration products
  - To prevent excessive wear on moving parts
  - To prevent clogging and sticking of control valves and pistons (Any 3 × 1) (3)
- 4.5
- A large volume of water is needed because of the slow circulation of water.
  - The radiator is very large and has to extend above the cylinder head.
  - The system can only operate if it completely filled with water.
  - If there is no circulation water starts to boil in the water jackets.

(4)  
**[14]**

**QUESTION 5: HYDRAULICS AND PNEUMATICS**

5.1      5.1.1       $A = \frac{\pi d^2}{4}$   
 $d = \sqrt{\frac{4 \times 0,18}{\pi}} \checkmark$   
 $d = 0,479m \text{ OR } 478,731mm \checkmark^{1/2}$  (2)

5.1.2       $P_B = \frac{F_B}{A_B}$   
 $= \frac{1000}{0,18} \checkmark^{1/2}$   
 $= 5555,556 Pa \checkmark^{1/2}$   
 $F_A = p_A \times A_A$   
 $= 5555,556 \times 0,02 \checkmark^{1/2}$   
 $= 111,111 N \checkmark^{1/2}$   

Alternatively (2)

$$\frac{F_A}{A_A} = \frac{F_B}{A_B}$$

$$F_A = \frac{1000 \times 0,02}{0,18} \checkmark$$

$$= 111,111 N \checkmark$$

5.1.3       $F_A \times \text{Stroke Length} = W \times \text{height lifted}$

$$\text{Stroke Length} = \frac{1000 \times 10 \times 10^{-3}}{111,111} \checkmark$$

$$= 90 mm \checkmark$$
 (2)

- 5.2
- To transfer hydraulic power
  - To maintain suitable viscosity
  - To have the ability to lubricate moving parts
  - To be resistant to oxidation
  - To resist foaming
  - To resist emulsification
  - To resist corrosion
- (Any 5 × 1) (5)  
**[11]**

**QUESTION 6: INTERNAL COMBUSTION ENGINE**

- 6.1
- It has a lower power output.
  - It has high manufacturing costs.
  - It causes more pollution.
  - It is much noisier.
- (4)
- 6.2
- It combines gasoline and air creating a highly combustible mixture.
  - It regulates the ratio of air and fuel.
  - It controls the engine's speed.
- (Any 2 X 1) (2)
- [6]**

**QUESTION 7: CRANES AND LIFTING MACHINES**

- 7.1
- A – Rail
  - B – Tower
  - C – Tower base
  - D – Ballast on base
  - E – Bogie
- (5)
- 7.2
- The mass that has to be handled by the steel rope
  - The number of steel drops the rope makes
  - The size of the pulley grooves
  - The maximum velocity of the rope
  - Diameter of the hoisting drum
  - Diameter of the pulley
  - The rope's ability to resist abrasion
  - The rope's ability to withstand distortion
  - The rope's ability to withstand corrosion
- (Any 2 × 1) (2)
- [7]**

**QUESTION 8: MATERIAL AND MATERIAL PROCESSES**

- 8.1
- 8.1.1
- To remove stresses and strains induced by hardening
  - To reduce brittleness
  - To increase toughness
- (Any 2 × 1) (2)
- 8.1.2
- To harden the steel
  - To enable the steel to resist wear
  - To enable the steel to cut other steel
- (Any 2 × 1) (2)
- 8.2
- It is a process whereby the physical properties of a metal are changed by heating metal up to a certain temperature and then cooling it down.
- (3)
- [7]**

**QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING**

- |     |  |  |         |             |
|-----|--|--|---------|-------------|
| 9.1 | 9.1.1  | Communication that flows from management to subordinates   |         |             |
|     | 9.1.2  | The flow of information from subordinates to management  |         |             |
|     | 9.1.3  | When employees on the same level communicate with one another  |         |             |
|     | 9.1.4  | When authorised paths of communication are not being followed, in other words the hierarchy of communication is neglected. | (4 × 2) | (8)         |
| 9.2 | Capital budget is a long-term plan for investment in property, equipment and other physical facilities in order to improve the organisation's production capacity. |  |         | (3)         |
|     |  |  |         | <b>[11]</b> |

**QUESTION 10: ENTREPRENEURSHIP**

- |      |  |         |                   |
|------|--|---------|-------------------|
| 10.1 | The ability to function with direction in all tasks for extended periods in order to address customer needs.           |         |                   |
| 10.2 | Being optimistic and positive in spite of difficulty/opposition while growing the business.                            |         |                   |
| 10.3 | To possess self-imposed standards and principles, with an internal drive to change one's own and other people's lives. |         |                   |
| 10.4 | An entrepreneur's ability to trust his/her own abilities and judgement in starting and maintaining his/her business.   | (4 × 2) | <b>[8]</b>        |
|      |  |         | <b>TOTAL: 100</b> |