



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE MECHANOTECHNOLOGY N3

12 APRIL 2021

This marking guideline consists of 6 pages.

QUESTION 1: POWER TRANSMISSION, CLUTCHES AND COUPLING OF SHAFTS

- 1.1 1.1.1 $N(RATIO) = \frac{N(MOTOR)}{N(BELT)}$
 $N(RATIO) = \frac{1\ 250}{650} \quad \checkmark$
 $N(RATIO) = 1,923$
 $N(RATIO) = 1,923 : 1 \quad \checkmark \quad (2)$
- 1.1.2 Type of start vs Duty class vs Operational hours
 $SF = 1.3 \quad \checkmark \checkmark \quad (2)$
- 1.1.3 $P(DESIGN) = P(MOTOR) \times SF$
 $P(DESIGN) = 40 \times 1,3 \quad \checkmark$
 $P = 52 \text{ kW} \quad \checkmark \quad (2)$
- 1.1.4 $D(APPROXIMATE)$ vs $N(MOTOR)$
52 kW vs 1 250 r/min
 $D(APPROXIMATE) = 180 \text{ mm} \quad \checkmark \checkmark \quad (2)$
- 1.1.5 $P(MOTOR) = \frac{2\pi NT}{60}$
 $T = \frac{40\ 000 \times 60 \checkmark}{2\pi \times 1\ 250 \checkmark}$
 $T = 305,577 \checkmark \frac{1}{2} \text{ Nm} \checkmark \frac{1}{2} \quad (3)$
- 1.2 1.2.1 Centre distance: the distance from the centre of the driving pulley/sprocket to the centre of the driven pulley/sprocket
- 1.2.2 Belt deflection: the amount of movement on the belt resulting from its slackness
- 1.2.3 A machine part that connects a drive shaft with a driven shaft in such a way that the connection can easily be disengaged.
- 1.2.4 A part of the machine that is used to join one or more shafts to provide single shaft of required length.

(4 × 2) (8)
[19]

QUESTION 2: BRAKES

- 2.1 2.1.1 C
 2.1.2 D
(2 × 1) (2)
- 2.2 • It is easily repairable because of its simplicity.
 • The wheels are coupled separately/independently, hence breaking of a single cable or rod will not affect the entire system.
 • Power failure has no effect on the functionality of this braking system.
(Any 2 × 1) (2)
- 2.3 • The system depends on the flow of the electric current.
 • The system depends on electric power.
 • The system will be ineffective due to power failure.
(Any 2 × 1) (2)
- [6]**

QUESTION 3: BEARINGS

- 3.1 Part bearings – support radial loads in housings
- 3.2 Solid bearings – support radial loads in generators, motor starters and idler pulleys
- 3.3 Split bearings – support radial loads in reciprocating engines and gear shafts
- 3.4 Thrust bearings – support axial/thrust loads in one direction as they are placed on thrust collars
- 3.5 Guide bearings – support sliding, and reciprocating movement as found in centre lathes and pump assemblies
(5 × 2) [10]

QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION

- 4.1 • To minimise chances of explosion
 • To maintain the correct viscosity of the lubricant
 • For the pressure tank to store more air
 • To maintain lubrication of parts
(4)
- 4.2 • Liquid – oil
 • Semi-solid – grease
 • Solid – graphite, boron nitrate
(3 × 2) (6)
- 4.3 • Open-vane impeller
 • Semi-open or ribbed impeller
 • Enclosed or shrouded impeller
(3)
- [13]**

QUESTION 5: HYDRAULIC AND PNEUMATIC

5.1 5.1.1 $A = \frac{\pi d^2}{4}$

$$d = \sqrt{\frac{0,00163 \times 4}{3,1416}} \quad \checkmark$$

$$d = 0,045556 \text{ m}$$

$$d = 45,556 \sqrt{1/2} \text{ mm} \sqrt{1/2}$$

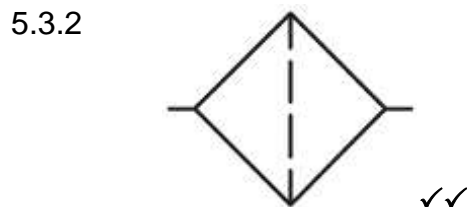
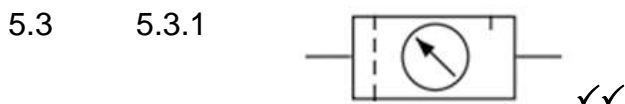
5.1.2 $p = \frac{F}{A}$

$$F = 420 \times 10^3 \times 0,00163 \quad \checkmark$$

$$F = 684,6 \sqrt{1/2} \text{ N} \quad \checkmark$$

(2 × 2) (4)

5.2 When pressure is exerted on the surfaces of a liquid in an enclosed system, the pressure is transmitted with equal force in all directions. (2)

(2 × 2) (4)
[10]**QUESTION 6: INTERNAL COMBUSTION ENGINES**

6.1 A – spark plug
B – combustion chamber
C – piston
D – connecting rod (conrod)
E – displacement volume (5)

6.2 • Compression stroke
• Power stroke
• Exhaust stroke (3)
[8]

QUESTION 7: CRANES AND LIFTING MACHINES

- 7.1
- The cost of building, dismantling, and transporting components is very high.
 - The crane has limitations of functionality as it is static on site.
 - The crane's ability to operate is limited to its radius.
 - The covering area of the crane is limited because it is fixed in one position. (4)

- 7.2
- A – trolley/hoisting drum
B – rail
C – hook (3)
[7]

QUESTION 8: MATERIAL AND MATERIAL PROCESSES

- 8.1
- 8.1.1
- Overheating causes sagging and collapsing.
 - There is no colour change when heated.
 - Heat tends to soften the metal. (3)

- 8.1.2
- Serious reduction of corrosion-resisting properties due to heat
 - Distortion and grain growth (2)

8.2

8.2.1 Nylon becomes stiff.

- 8.2.2 Perspex becomes rigid. (2 × 1) (2)
[7]

QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING

- 9.1
- To promote good working relations in the workplace.
 - To prevent worker grievances/dissatisfaction from accumulating unattended by supervisors
 - A means for management to know about the working conditions and relations between employees
 - A means of internal dispute resolution (4)
- 9.2
- Accurate
 - Objective
 - Clear
 - Brief
 - Insightful
 - Open-minded (Any 5 x 1) (5)
- 9.3
- The quantity of the items needed
 - When the items are needed
 - By whom the request is being made (3)
- [12]**

QUESTION 10: ENTREPRENEURSHIP

- 10.1
- Good organisers
 - Good managers
 - Directors and controllers of activities designed to achieve pre-established goal.
 - Combine the qualities of entrepreneurship with a sound business idea (4)
- 10.2
- Competition
 - Expansion potential
 - Business service
 - Nature of the business product
 - Symbiosis
 - Convenience and accessibility
 - The size of the business (Any 4 x 1) (4)
- [8]**
- TOTAL: 100**