



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

1 AUGUST 2019

This marking guideline consists of 9 pages.

QUESTION 1: OCCUPATIONAL SAFETY

- | | | |
|-----|-------|---|
| 1.1 | 1.1.1 | D |
| | 1.1.2 | E |
| | 1.1.3 | A |
| | 1.1.4 | B |
| | 1.1.5 | C |

(5 × 1)

OR

- | | | |
|-----|-------|---|
| 1.2 | 1.2.1 | F |
| | 1.2.2 | D |
| | 1.2.3 | B |
| | 1.2.4 | A |
| | 1.2.5 | C |

(5 × 1)

[5]**QUESTION 2: COUPLINGS**

- | | | |
|-----|-------|---|
| 2.1 | 2.1.1 | Permanent/Fixed/Rigid coupling |
| | 2.1.2 | Flexible or self-aligning couplings |
| 2.2 | 2.2.1 | Fluid drive coupling |
| | 2.2.2 | Permanent/Fixed/Rigid coupling |
| | 2.2.3 | A – driving member (pump/impeller)
B – driven member (turbine) |

(2 × 1)

(2)

(1)

(1)

(2)

[6]**QUESTION 3: LIMITS AND FITS**

- | | | |
|-----|---|-----|
| 3.1 | 40,030 mm | (1) |
| 3.2 | 40,035 mm | (1) |
| 3.3 | 39,980 mm | (1) |
| 3.4 | Maximum allowance = $(40 + 0,035 \text{ mm}) - (40 - 0,020 \text{ mm})$
= 40,035 – 39,98✓
= 0,055 mm✓ | (2) |
| 3.5 | Minimum allowance = $(40 + 0,030 \text{ mm}) - (40 - 0,010 \text{ mm})$
= 40,030 – 39,99✓
= 0,04 mm✓ | (2) |

[7]

QUESTION 4: BEARINGS

- 4.1 A bearing is a device designed to reduce friction between two parts of a machine, one stationary and the other rotating. (1)
- 4.2
- White metal
 - Cast iron
 - Bronze
 - Nylon
 - Teflon
- (Any 4 × 1) (4)
[5]

QUESTION 5 : LUBRICATION AND VALVES

- 5.1
- Siphon-wick lubricator
 - Sight-feed lubricator
 - Needle lubricator
- (3 × 1) (3)
- 5.2 When a fluid flows through a foot valve, the flap of the foot valve opens ✓ and allows the fluid to flow. ✓ If the flow of the fluid is reversed, the flap closes and does not allow the fluid to flow back. ✓ (3)
[6]

QUESTION 6: PACKING, STUFFING BOXES, JOINTS AND WATER PIPE SYSTEMS

- 6.1
- Pressure within the pipe
 - Nature of fluid medium
 - Temperature of fluid
 - Environmental conditions
- (4 × 1) (4)
- 6.2 The wedge design prevents steam from escaping by applying a light pressure on the piston rod. (1)
- 6.3
- Plastic piping is relatively cheap
 - Easy to handle due to its light weight
 - No machining required
 - Good insulator when used with electricity
 - Combining pipes is very easy
 - Corrosion resistant
- (Any 4 × 1) (4)
[9]

QUESTION 7: PUMPS

- | | | | | |
|-----|--|--------------------|-------------|------------|
| 7.1 | 7.1.1 | Single acting pump | | |
| | 7.1.2 | Double acting pump | | |
| | 7.1.3 | Piston pump | (3 × 1) | (3) |
| 7.2 | <ul style="list-style-type: none"> • Gear pump • Helical screw gear pump • Vane type pump • Flexible impeller pump | | (Any 3 × 1) | (3) |
| | | | | [6] |

QUESTION 8: COMPRESSORS


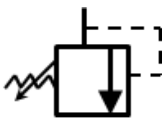

- | | | | |
|-------------------|--|---------|------------|
| A – Air intake | | | |
| B – Diffuser ring | | | |
| C – Volute casing | | | |
| D – Impeller eye | | | |
| | | (4 × 1) | [4] |

QUESTION 9: V-BELTS, GEAR DRIVES, CHAIN DRIVES AND REDUCTION GEARBOXES

- | | | | |
|-----|--|---|-------------|
| 9.1 | <ul style="list-style-type: none"> • Chain drives • Gear drives • Belt drives | (Any 2 × 1) | (2) |
| 9.2 | The deflection should be 16 mm for every meter of span. | | (1) |
| 9.3 | <ul style="list-style-type: none"> • To transmit high power • To increase speed and reduce torque or vice versa • To change the direction of drive • When space is limited | (Any 3 × 1) | (3) |
| 9.4 | 9.4.1 | Ensure that bearings are well lubricated. | (1) |
| | 9.4.2 | Measure the sag and adjust if it is too large | (1) |
| 9.5 | <ul style="list-style-type: none"> • The speed of the motor would be too fast. • The heavy load put onto the motor would cause the motor to stop rotating. | | (2) |
| 9.6 | <ul style="list-style-type: none"> • Single-reduction gearbox • Double-reduction gearbox • Worm and worm-wheel gearbox | (Any 2 × 1) | (2) |
| | | | [12] |

TOTAL SECTION A: 60

SECTION B (Any TWO answers)**QUESTION 10: HYDRAULICS AND PNEUMATICS**

- 10.1
- Power transmission
 - Lubrication
 - Cooling
 - Prevents corrosion
 - Removes dirt
- (Any 3 × 1) (3)
- 10.2
- 10.2.1
- 
- 10.2.2
- 
- 10.2.3
- 
- (3 × 1) (3)
- 10.3
- 10.3.1 Provides mechanical energy to the hydraulic fluid.
- 10.3.2 It protects the system from experiencing excessive pressure.
- 10.3.3 Stores hydraulic fluid until it is required.
- (3 × 1) (3)
- 10.4 Control valve (1)
- 10.5
- 10.5.1 Non-return valve
- 10.5.2 Compressor
- 10.5.3 Pneumatic motor
- 10.5.4 Pressurised receiver
- 10.5.5 Single acting cylinder or cylinder
- (5 × 1) (5)
- 10.6
- 10.6.1 False
- 10.6.2 True
- 10.6.3 True
- (3 × 1) (3)
- 10.7
- Not affected by dust or corrosive atmospheres
 - Can be used in damp and inflammable conditions
- (2)
- [20]**

QUESTION 11: CENTRE LATHES

- 11.1
- Used to support long work pieces on a centre lathe
 - Used for turning long, small diameter shafts on a centre lathe
 - Used to support a square bar on the centre lathe (Any 2 x 1) (2)
- 11.2
- 11.2.1 Travelling steady
- 11.2.2 Fixed steady (2 × 1) (2)
- 11.3 Angle that the thread makes with a line perpendicular to the axis of the thread (1)
- 11.4
- 11.4.1 $Lead = No. of starts \times Pitch of thread$
 $= 3 \times 10$
 $= 30 \text{ mm} \checkmark$
- $$\tan \theta = \frac{Lead}{\pi D m}$$
- $$= \frac{30}{\pi \times 155} \checkmark$$
- $$= 0,0616$$
- $$\theta = 3^\circ 31' \checkmark \quad (3)$$
- 11.4.2 $Leading \text{ tool angle} = 90^\circ - (Helix \text{ angle} + Clearance \text{ angle})$
 $= 90^\circ - (3^\circ 31' + 3^\circ) \checkmark$
 $= 90^\circ - (6^\circ 31')$
 $= 83^\circ 29' \checkmark \quad (2)$
- 11.4.3 $Following \text{ tool angle}$
 $= 90^\circ + (Helix \text{ angle} - Clearance \text{ angle})$
 $= 90^\circ + (3^\circ 31' - 3^\circ) \checkmark$
 $= 90^\circ + (0^\circ 31')$
 $= 90^\circ 31' \checkmark \quad (2)$

- 11.5 $N = 24 \text{ r/sec}$
 $N = 24 \times 60$
 $N = 1\,440 \text{ r/min}$ ✓
- $V = \pi DN$
 $= \pi \times 0,02 \times 1440$ ✓
 $N = 90,478 \text{ m/min}$ ✓ (3)
- 11.6 $L = f \times N \times t$
- $f = \frac{L}{N \times t}$ ✓
- $= \frac{700}{130 \times 15}$ ✓
- $f = 0,36 \text{ mm/rev}$ ✓ (3)
- 11.7 11.7.1 G-commands
 11.7.2 M-commands
- (2 × 1) (2)
[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 Used to indicate the fraction of a turn in the holes on a specific hole-circle. (1)

12.2 The Cincinnati index plate has holes on both sides so it is reversible ✓
whereas the Brown and Sharp system has three loose plates with different
hole-circles on each plate. ✓ (2)

12.3 Slab milling cutter or rose cutter (1)

12.4 $42^{\circ} 45'$

$$= 42 \frac{45}{60}$$

$$= 42 \frac{3}{4} \checkmark$$

$$\text{Indexing} = \frac{N}{9^{\circ}}$$

$$= \frac{42 \frac{3}{4}}{9}$$

$$= \frac{171}{4 \times 9} \checkmark$$

$$= \frac{19}{4}$$

$$= 4 \frac{3}{4} \checkmark$$

$$= 4 \left[\frac{3}{4} \times \frac{4}{4} \right] \checkmark \quad \text{OR} \quad 4 \left[\frac{3}{4} \times \frac{5}{5} \right]$$

$$= 4 \frac{12}{16} \checkmark \quad \quad \quad = 4 \frac{15}{20} \checkmark$$

Indexing = 4 full turns of the crank handle and 12 holes in a 16-hole circle OR
4 full turns of the crank handle and 15 holes in a 20-hole circle

(7)

12.5	<ul style="list-style-type: none"> • Prevents the continuous forming of shavings • Helps in the removal of shavings • Reduces chattering • Easier flow of coolant • Improves the finish on the workpiece • Provides a better cutting action • More economical on power consumptions 	(Any 4 × 1)	(4)
12.6	12.6.1	Grit size refers to the actual size of the abrasive particles	
	12.6.2	Grade of the grinding wheel refers to the strength of the bond which holds the abrasive grains in place	
	12.6.3	The structure of the wheel refers to the spacing of the grit in the wheel	
	12.6.4	The structure number indicates the structure of the grinding wheel	
)4 × 1)	(4)
12.7	Produces a flat surface which is smooth and accurate		(1)
			[20]
TOTAL SECTION B:			40
GRAND TOTAL:			100