

**higher education  
& training**

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

# **MARKING GUIDELINE**

**NATIONAL CERTIFICATE  
APRIL EXAMINATION  
FITTING AND MACHINING THEORY N2**

**25 MARCH 2013**

**This marking guideline consists of 8 pages.**

**SECTION A: COMPULSORY****QUESTION 1: OCCUPATIONAL SAFETY**

- Resolutions per minute (rpm) must be clearly visible
- CANNOT fit a grinding wheel unless the rpm is marked clearly on wheel
- Speed of spindle must not exceed the manufacturers' rated wheel speed
- Damaged wheel or a wheel not dressed should not be used
- A grinding wheel must be mounted on spindle between two strong flanges - diameter of flange must be 1/3 size of wheel diameter
- Paper washers to be fitted to prevent metal-on-metal contact
- Adequate guards
- Tool rest must have a maximum gap of 3 mm from grinding wheel
- Goggles must be used

(Any 5 × 1) [5]

**QUESTION 2: COUPLINGS**

2.1 False

2.2 True

2.3 True

2.4 False

2.5 True

(5 × 1) [5]

**QUESTION 3: LIMITS AND FITS**

3.1 3.1.1 Unilateral tolerance (1)

3.1.2 Bilateral tolerance (1)

3.2 3.2.1 Interference

3.2.2 Transition

3.2.3 Clearance (3 × 1) (3)

3.3 3.3.1 Interference (1)

3.3.2 Clearance fit (1)

[7]

**QUESTION 4: BEARINGS**

- 4.1
  - Distribution – must be over as wide an area as possible
  - Adequate cooling must be provided
  - Oil-groove should not be cut over the entire length
  - Clean up raised or sharp edges
  - Entry point for fluid should be at a low pressure area
  - Spiral grooves to be cut against the direction of rotation
  - Vertical bearings – spiral groove to force oil upward
  - Guide bearings should be accommodated with a cross pattern of grooves

(Any 5 × 1) (5)

- 4.2
  - Screw puller
  - Impact puller (Slide-hammer)
  - Hydraulic puller
  - Puller plates
  - Hydraulic press

(Any 3 × 1) (3)  
[8]

**QUESTION 5: LUBRICATION AND VALVES**

- 5.1
  - Stauffer cup
  - Tell-tale lubricator
  - Grease applicator gun
  - Oil pump

(Any 3 × 1) (3)

5.2 **COLD POINT**  
The lowest temperature at which a lubricant ceases to flow (1)

- 5.3
  - A Globe
  - B Gate
  - C Diaphragm

(3 × 1) (3)  
[7]

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

- 6.1
  - Nature of fluid medium
  - Pressure within
  - Environment
  - Operating temperature
  - Temperature

(Any 4 × 1) (4)

- 6.2
  - Retains heat
  - Prevents heat loss
  - Prevents condensation/water forming in pipes
  - Prevents water-hammer

(Any 3 × 1) (3)

- 6.3 - Yes (2)  
 - This is the only way you are able to eliminate leakage without over-tightening the gland. [9]

**QUESTION 7: PUMPS**

- 7.1 inlet valve and outlet valve (2)  
 7.2 longer and shorter (2)  
 7.3 positive (1)  
 7.4 rotor (1)  
 [6]

**QUESTION 8: COMPRESSORS**

- A Low pressure cylinder  
 B Intercooler  
 C High-pressure cylinder  
 D Receiver  
 E Filter  
 (5 × 1) [5]

**QUESTION 9: V-BELT, GEAR AND CHAIN DRIVES**

- 9.1 9.1.1 Chain pitch – the centre distance of one roller to the same point on the next roller (1)  
 9.1.2 Drive sprocket – the sprocket connected to the drive motor (1)  
 9.2 - Protect persons  
 - Contain lubrication  
 - Protect machinery (Chain breakage)  
 - Keeping dirt out (Any 2 × 1) (2)  
 9.3 - Manual  
 - Drip  
 - Oil stream  
 - Bath  
 - Disc (Any 2 × 1) (2)

- 9.4 - Single and multi-strand roller
- Double pitch roller chain
- Silent
- Leaf

(Any 2 × 1) (2)  
[8]

**TOTAL SECTION A: 60**

**SECTION B**

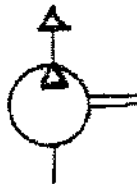
Candidates need only to answer TWO questions in this section.

**QUESTION 10: HYDRAULICS AND PNEUMATICS**

- 10.1 - Converts mechanical energy into pressure energy
- Transports fluid from the reservoir or tank to the hydraulic circuit

(Any 1 × 1) (1)

10.2 10.2.1



(1)

10.2.2



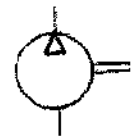
(1)

10.2.3



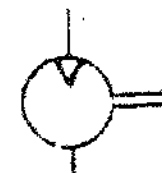
(1)

10.2.4



(1)

10.2.5



(1)

- 10.3
- Electric motor
  - Pump
  - Reservoir
  - Actuator
  - Check valve
  - Directional control valve
  - Pressure relief valve
  - Throttle valve
  - Accumulator
  - Pressure gauge
  - Pipes
  - Pressure sensor
  - Filters
- (Any 5 × 1) (5)
- 10.4
- Check **oil-level in crankcase**
  - **Belt-tension** of motor to pulley drive
  - **Pressure regulator cut-out of pressure** on pressure gauge
  - **Drain air receiver**
  - Check **filter element**
  - Check **hoses and fittings**
  - **Check service unit**
  - Check for **air receiver leaks**
- (Any 6 × 1) (6)
- 10.5
- Transmits **hydraulic energy**
  - **Lubricates** components
  - Prevents **corrosion**
  - **Removes dirt**
  - Dissipates heat **or cools**
- (Any 3 × 1) (3)
- [20]**

### QUESTION 11: CENTRE LATHES

- 11.1
- Expanding mandrel
  - Plain mandrel
  - Screw mandrel
  - Cone mandrel
- (4 × 1) (4)
- 11.2
- No setting-up of work-piece is needed.
  - Work-pieces are easily mounted and dismantled.
- (2)
- 11.3
- G – command is the code for the CNC lathe to prepare for a specific cycle  
 M – command is the on and off functions of the CNC lathe  
 X- and Y- shaft movement is the movement along the x- and y-axis
- (3)

- 11.4 Absolute dimensioning means the reference is taken from a common reference point.  
Incremental dimensioning is the distance from one point to a second point on a work piece without referring to a common reference point (2)

- 11.5 OD = 100 mm 2 Start thread

Pitch = 5 mm

Lead = No of starts x pitch = 2 x 5 = 10 mm

Pitch diameter = (OD - ½ pitch) = 100 - 2,5 = 97,5 mm

Pitch circumference =  $\pi$  x pitch diameter =  $\pi$  x 97,5 = 306,3 mm

- 11.5.1 **To find helix angle  $\phi$**

$$\begin{aligned}\tan \phi &= \frac{\text{Lead}}{\text{Pitch circumference}} = \frac{10}{306,3} \\ &= 0,0326\end{aligned}$$

$$\text{Therefore: } \phi = \tan^{-1} 0,0326 = 1,867^\circ = 1^\circ 52' \quad (3)$$

- 11.5.2 Lead angle:  $90^\circ - (\text{Helix angle} + \text{Clearance angle})$   
 $= 90^\circ - (3^\circ + 1^\circ 52')$   
 $= 90^\circ - 4^\circ 52'$   
 $= 85^\circ 48'$

$$\begin{aligned}\text{Following angle: } &= 90^\circ + (\text{Helix angle} - \text{Clearance angle}) \\ &= 90^\circ + (3^\circ - 1^\circ 52') \\ &= 90^\circ + 1^\circ 48' \\ &= 91^\circ 48' \quad (2)\end{aligned}$$

- 11.6 To prevent a long shaft from bending under its own weight when it is machined. (2)

- 11.7 Advantage  
 – long tapers can be turned.  
 – cross slide can be fed automatically

(any one)

- Disadvantage  
 – only external tapers can be turned.  
 – uneven wear takes place on the centres and centre holes.

(any one) (2)

[20]

**QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS**

12.1	12.1.1	Slab milling		
	12.1.2	Gang milling		
	12.1.3	Straddle milling		(3)
12.2	-	Index plate		
	-	Crank pin		
	-	Single-start worm		
	-	Worm wheel	(4 × 1)	(4)
12.3	-	Too slow a speed		
	-	Metal clogging the space between abrasive particles/Wheel clogged		
	-	Wrong wheel		
	-	Wheel too hard		
	-	Insufficient coolant/Disruption in coolant supply	(Any 3 × 1)	(3)
12.4	-	Abrasive type		
	-	Grade		
	-	Bonding material		
	-	Grain size		
	-	Structure		(5)
12.5	-	Power consumption is reduced		
	-	Chattering is reduced		
	-	Shavings are broken up and evacuated easily		
	-	Much better cutting action		
	-	Surface finish is improved	(Any 4 × 1)	(4)
12.6		Slotting cutter/Slotting/Slot drill		(1)
				<b>[20]</b>
			<b>TOTAL SECTION B:</b>	<b>40</b>
			<b>GRAND TOTAL:</b>	<b>100</b>