higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

9 APRIL 2021

This marking guideline consists of 9 pages.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

NOTE: Candidates need answer only QUESTION 1.1 or QUESTION 1.2.

1.1 1.1.1 False
1.1.2 False
1.1.3 True
1.1.4 True
1.1.5 False

(5 × 1) **[5]**

OR

1.2. 1.2.1 True
1.2.2 False
1.2.3 True
1.2.4 False
1.2.5 True

(5 × 1) **[5]**

QUESTION 2: COUPLINGS

2.1 2.1.1 Metal disc coupling

2.1.2 Flexible couplings

2.1.3 Floating disc

(3 × 1) (3)

2.2 2.2.1 Permanent coupling

2.2.2 Flexible coupling

2.2.3 Self-aligning coupling

(3 × 1) (3)
[6]

QUESTION 3: LIMITS AND FITS

3.1 3.1.1 Push fit – parts will move relative to each other when slight hand pressure is applied to move the two parts.

3.1.2 Running fit – The two mating parts fit into each other smoothly but not loosely.

3.1.3 Sliding fit – The two parts slide freely relative to each other.

3.1.4 Press fit – Pressure is applied mechanically or hydraulically to fit the one part tightly into the other.

(4 × 1) (4)

3.2 3.2.1 Bilateral tolerance – The limits of a dimension are on both sides of the basic size.

3.2.2 Unilateral tolerance –The limits of a dimension are only on one side of the basic size.

3.2.3 High limit – Is the maximum permissible size allowed relative to the basic size of the work-piece.

(3 × 1) (3)
[7]

QUESTION 4: BEARINGS

4.1
- Insufficient lubrication
- Contamination in the bearing
- Bearing slipping in the housing or on the shaft
- Flattened roller or ball
- Different sizes of rollers or balls
- Indentation of races

(Any 3 × 1) (3)

4.2
- They cannot be repaired
- They are noisy in operation at high speeds
- Less capacity to withstand shock
- High initial costs

(Any 2 × 1) (2)
[5]

QUESTION 5: LUBRICATION AND VALVES

5.1 5.1.1 Rubbing speed – It is the speed at which a shaft turns inside a bearing.

5.1.2 Adhesion – It is the ability a substance has to cling to another material or substance.

5.1.3 Viscosity – The speed of flow or resistance to flow or thickness of the liquid.

(3 × 1) (3)

5.2 When the pressure in a system exceeds the spring tension of the valve, ✓ the valve opens and allows fluid to flow.✓ When the pressure drops below the spring tension, the valve closes ✓ and stops the flow of fluid. (3)
[6]

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

6.1
- To prevent heat loss due to radiation
- To prevent or minimise condensation in the pipelines
- To minimise hammer shocks in the system
- To have more accurate gauge readings
- To prevent water entering reciprocating machines
- Saves energy
- Prevents water pipes from freezing in winter (Any 5 × 1) (5)

6.2
- Bell-and-spigot
- Welded
- Soldered or brazed
- Screwed (threaded)
- Flanged
- Butt-and-strap
- Fillet welding (Any 4 × 1) (4)

[9]

QUESTION 7: PUMPS

7.1 7.1.1 A – Piston pump
B – Plunger pump (2)

7.1.2 Reciprocating pumps (1)

7.1.3 Positive displacement (1)

7.2
- To slow the liquid down
- To increase the pressure energy
- To prevent overloading of the impeller motor (Any 2 × 1) (2)

[6]

QUESTION 8: COMPRESSORS

8.1 Air filter – It prevents dust and foreign matter in the air from entering the cylinder.

8.2 High pressure cylinder – It compresses the air to the required pressure.

8.3 Drain valve – It is used to drain all the water in the air receiver.

8.4 Cotter – It tightens up the bearing holes as wear takes place between the bearing halves and the crank.

(4 × 1) **[4]**

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

9.1 The main function of a V-belt is to transfer driving motion from one shaft to another. (1)

9.2 9.2.1 Arc of contact – It is the portion of the pulley that is in contact with the V-belt along its circumference.

9.2.2 Driven pulley – It is the pulley that is attached to the working part of the machine.

(2 × 1) (2)

9.3
- They are expensive to manufacture
- They are not repairable
- They require constant lubrication
- The drive and driven shafts need to be close together
- If anything goes wrong, slippage does not occur to prevent damage to the machine (Any 3 × 1) (3)

9.4 9.4.1 To transmit power from one shaft to another when the distance between shafts is too large to use gears.

9.4.2 Used when positive transmission is desired (i.e., no slippage).

(2 × 1) (2)

9.5
- They are relatively noisy
- Wear causes elongation of the chain
- The sprockets need replacing due to wear
- They have speed limitations
- They break without warning (Any 2 ×1) (2)

9.6
- Ensure bearings are lubricated with grease.
- Check bearings for wear by listening for excessive noise. (2)

[12]

TOTAL SECTION A: 60

SECTION B

NOTE: Candidates need answer only TWO of the following questions

QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1 10.1.1 C
10.1.2 A
10.1.3 E
10.1.4 B
10.1.5 D

(5 × 1) (5)

10.2 10.2.1 Double acting cylinder or cylinder
10.2.2 Spring loaded non-return valve or non-return valve
10.2.3 Throttle valve
10.2.4 Sequence valve
10.2.5 Air receiver

(5 × 1) (5)

10.3

HYDRAULIC SYSTEM	PNEUMATIC SYSTEM
Uses hydraulic oil	Uses air
Uses a pump to generate power	Uses a compressor to generate power
Closed circuit – oil returns to the tank	Open circuit – air is released to the atmosphere
Higher system pressure	Lower system pressure
Slower operation	Faster operation
Minimum power loss	Power loss occurs over long distances
Higher operating costs	Lower operating costs
Self-lubricating	Requires lubrication

(Any 3 × 2) (6)

10.4 Positive displacement pumps are used in hydraulics. (1)

10.5
- Power transmission
- Lubrication
- Cooling

(3)
[20]

QUESTION 11: CENTRE LATHES

11.1
- Plain or solid mandrels
- Cone mandrels
- Screw mandrels
- Expanding mandrels (4)

11.2
- Only external tapers can be turned
- Due to centres being misaligned, uneven wear takes place on the centres and centre holes (2)

11.3 $S = \pi \mathrm{DN}$

$$N = \frac{S}{\pi \mathrm{D}}$$

$$= \frac{45}{\pi \times 0.085} \quad \checkmark$$

$\underline{N = 168.517\ r/min}$ ✓

$L = f \times N \times t$
$= 0.8 \times 168.517 \times 5$ ✓
$\underline{L = 674.068\ mm}$ ✓ (4)

11.4 11.4.1 $$Set - over = \frac{D - d}{2} \times \frac{length\ of\ workpiece}{length\ of\ taper}$$

$$= \frac{95-60}{2} \times \frac{500}{330} \quad \checkmark$$

$$= 17.5 \times 1.52$$
$Set - over = 26.515$ mm ✓ (2)

11.4.2 $$\tan \frac{\theta}{2} = \frac{X}{L}$$

$$\tan \frac{\theta}{2} = \frac{17.5}{330}$$

$\tan \frac{\theta}{2} = 0.053$ ✓

$\theta = \tan^{-1} 0.053 \times 2$ ✓
$\theta = 6.068°$
$\theta = 6° 04'$ ✓ (3)

11.5
- Material type
- Tooling required
- Dwell time
- Stock length
- Coolant application
- Cutting speed
- Information from a drawing
- Operating sequence
- Sizes according to dimensioning sizes

(Any 5 × 1) (5)
[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 12.1.1 Dovetail cutter – Is used to manufacture dovetail slides that are used on various machines.

12.1.2 Slotting cutter – It is used only for cutting slots, grooves and keyways.

12.1.3 End mill cutter – It is used for milling slots, cutting profiles and facing narrow surfaces.

12.1.4 Slot drill – It is used to cut keyways and blind slots

(4 × 1) (4)

12.2
- It prevents the continuous forming of shavings
- It reduces chattering
- It helps in the removal of shavings
- It gives a better cutting action
- It is more economical in terms of power consumption
- It allows an easier flow of coolant
- It improves the finish on the work-piece

(Any 3 × 1) (3)

12.3 $Indexing = \frac{N}{9°}$

$= \frac{37}{9}$ ✓

$= 4\frac{1}{9}$

$= 4\left[\frac{1}{9} \times \frac{2}{2}\right]$ ✓

$= 4\frac{2}{18}$ ✓

$Indexing$
$= 4\ full\ turns\ of\ the\ crank\ handle$ ✓ $and\ 2\ holes\ in\ a\ 18\ hole\ plate$ ✓ (5)

12.4 $D = \frac{90}{1000}$

$\underline{D = 0.09\ m}$

$S = \pi DN$

$N = \frac{S}{\pi D}$ ✓

$= \frac{23}{\pi \times 0.09}$ ✓

$\underline{N = 81.346\ r/min}$ ✓ (3)

12.5 12.5.1 Grit size – It is the actual size of the abrasive particles on a grinding wheel.

12.5.2 Grade – It is the hardness of the wheel or the strength of the bond holding the abrasive particles in place.

12.5.3 Structure – It is the spacing of the grit in the wheel.

(3 × 1) (3)

12.6
- Use coarser grit wheels
- Use an open structure wheel
- Use a softer grade wheel
- Increase work speed

(Any 2 × 1) (2)
[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100