higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

4 July 2022

This marking guideline consists of 7 pages.

SECTION A

QUESTION 1: OCCUPATINAL SAFETY

NOTE: Candidates need to answer only QUESTION 1.1 **OR** QUESTION 1.2

1.1
- Provide maximum positive protection
- Block access to danger zones during operations
- Must be corrosion and fire resistant
- Easily repairable
- Must be free from hazards such as splinters and pinch points
- It should be a permanent part of the machine
- Efficient operation of the machine should not be affected by the guard
- It should be strong and long lasting
- All guards should be manufactured according to the requirements of the OHS Acts and the Department of Labour
- It should be hinged to allow for servicing of the machine (Any 5 × 1) (5)

OR

1.2
- All persons under the age of 50 years must be in possession of a valid first aid certificate.
- Every person in charge of more than 300 workmen must be in possession of a valid first aid certificate.
- All employees working near machinery on the surface must be in possession of a valid first aid certificate.
- Every person on a mine must obtain a first aid certificate within a period of one year of their appointment.
- First aid certificates shall be renewed at intervals of not more than three years. (5)

[5]

QUESTION 2: COUPLINGS

2.1
- Flange coupling
- Chain coupling
- Marine coupling
- Gear coupling
- Fluid coupling (Any 4 × 1) (4)

2.2 In the case of a coupling, the shafts must be stationary before the coupling can be engaged or disengaged ✓ while a clutch must be engaged or disengaged while one or both of the shafts are rotating. ✓ (2)

[6]

QUESTION 3: LIMITS AND FITS

3.1
3.1.1 Transition
3.1.2 Clearance
3.1.3 Clearance
3.1.4 Interference
3.1.5 Clearance (5 × 1) (5)

3.2 3.2.1 Unilateral tolerance: This is when the tolerance range is allowed on one side of the basic size only

3.2.2 Bilateral tolerance: This is when the tolerance range is allowed on both sides of the basic size

(2 × 1) (2)
[7]

QUESTION 4: BEARINGS

A – Ball roller
B – Spherical roller or barrel roller
C – Cylindrical roller
D – Needle roller
E – Tapered roller **[5]**

QUESTION 5: LUBRICATION AND VALVES

5.1 The temperature at which a lubricant, when heated, will give off enough vapour to 'flash' momentarily when exposed to a small flame. (1)

5.2
- It must maintain its firm thickness
- It must not gum up or lose its fluidity.
- It should not be acid to avoid corrosion of the bearing surfaces
- It must not offer too much resistance against motion
- It should have a high flash point
- It must have good adhesive properties (Any 4 × 1) (4)

5.3
- Stauffer grease cup
- Tell-tale grease lubricator
- Grease gun
- Oil gun (Any 1 × 1) (1)

[6]

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

6.1 A – Gland/Neck bush
B – Shaft
C – Adjusting nuts/Bolt & nuts
D – Packing/Packing rings/Soft packing
E – Pump casing stuffing box (5)

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

6.3
- Control the energy flow or flow of fluid
- Open and close the path of flow
- Direct the flow of fluid
- Regulate the pressure of the fluid (Any 2 × 1) (2)

[9]

QUESTION 7: PUMPS

7.1 A piston pump has a piston which is smaller in length than the stroke of the pump whereas a plunger pump has a piston longer than the stroke the pump. (2)

7.2
7.2.1 Stuffing box
7.2.2 Positive
7.2.3 Vacuum
7.2.4 Pressure (4 × 1) (4)
[6]

QUESTION 8: COMPRESSORS.

8.1 True
8.2 False
8.3 False
8.4 True (4 × 1) **[4]**

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

9.1
- Sag is destructive to the chain (shorter life span)
- Sag is detrimental to smooth running (low efficiency)
- Sag causes whipping and vibration (could derail)
- Damages the drive and driven sprockets (Any 3 × 1) (3)

9.2
- Circular pitch
- Module (2)

9.3
- They are used to change the direction of rotation of the driven gear so that it runs in the same direction as the drive gear
- They allow the centre distance between the driver and driven gears to be changed accordingly (2)

9.4
9.4.1 Centre distance: This is the distance from the centre of the drive pulley the centre of driven pulley

9.4.2 Driven pulley: This pulley is attached to the shaft of the machine to be driven and is the larger pulley in the belt drive

9.4.3 Idler pulley: A guide pulley that keeps the tension of the belt constant. OR It increases the arc of contact. (3 × 1) (3)

9.5 A – Single reduction gearing
B – Double reduction gearing (2)
[12]

TOTAL SECTION A: 60

SECTION B

NOTE: Candidates need to answer only TWO questions from SECTION B

QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1
- Power transmission
- Lubrication
- Cooling
- Removes dirt
- Prevents corrosion (Any 3 × 1) (3)

10.2
10.2.1 The pressure relief valve protects the system from excessive pressure.

10.2.2 Provides mechanical energy to the hydraulic fluid

10.2.3 Non-return valve prevents the reversal flow of oil in a hydraulic system

10.2.4 The directional control valve controls the direction of flow of oil

10.2.5 The reservoir stores the hydraulic fluid in the system until it is required. (5 × 1) (5)

10.3
- Check compressor oil level
- Inspect receiver for air leaks
- Ensure air supply is clean and cool
- Check gauge pressure does not exceed maximum working pressure
- Clean intake filter
- Open drain valve to remove moisture
- Check hoses and fittings for leaks, kinks and perished rubber
- Document checks and inspections in the log book
- Change the oil and filter at prescribed intervals (Any 5 × 1) (5)

10.4
- Oil is the working medium in hydraulics,✓ whereas air is the working medium in pneumatics.✓
- Unused oil is returned to the reservoir in hydraulics✓ whereas the unused air is exhausted to atmosphere in pneumatics.✓ (Any 1 × 2) (2)

10.5
- Compressed air supply is readily available.
- They are reliable and durable.
- They are easily adaptable.
- They are safe.
- Reciprocating motion is easily and cheaply achieved.
- Variable speeds and power can be obtained.
- They are economical as they have low set-up and maintenance costs.
- They can operate in adverse/harsh conditions. (Any 5 x 1) (5)

[20]

QUESTION 11 CENTRE LATHES

11.1
- Material type
- Stock length
- Information from a drawing
- Operating sequence
- Tooling required
- Dwell time
- Coolant application
- Sizes according to dimensioning position

(Any 5 × 1) (5)

11.2 The travelling lathe steady is fitted to the carriage and travels along with the tool ✓ whereas the fixed lathe steady which is fixed to the lathe bed and remains stationery.✓ (2)

11.3 $$\text{Set-over} = \frac{\text{Length of Workpiece x ratio}}{2} \checkmark$$
$$= \frac{280}{2} \times \frac{1}{14} \checkmark$$
$$= 10 \text{ mm} \checkmark$$ (3)

11.4 11.4.1
$$\text{Lead} = \text{Number of starts} \times \text{pitch of thread}$$
$$= 3 \times 7$$
$$= 21 \text{ mm} \checkmark$$

$$\tan\theta = \frac{\text{Lead}}{\pi \times Dm}$$
$$= \frac{21}{\pi \times 90} \checkmark$$
$$= 0{,}0742 \checkmark$$
$$\theta = 4{,}25° \checkmark$$ (4)

11.4.2 Leading angle = 90°- (helix angle + clearance angle)
= 90°- (4,25°+ 3°) ✓
= 82,75º ✓ (2)

11.4.3 Following angle = 90°+ (helix angle - clearance angle)
= 90°+ (4,25 - 3°) ✓
= 91,25º ✓ (2)

11.5 11.5.1 Incremental – the distance from one point to the second point is given without referring to a common reference point.

11.5.2 Absolute – all points taken from a common reference point

(2 × 1) (2)

[20]

QUESTION 12 MILLING MACHINES AND SURFACE GRINDERS

12.1 12.1.1

A – Slitting saw
B – Side and face cutter
C – Slot drill
D – End mill (4)

12.1.2

A – Cutting material to the length/cutting narrow grooves or slots.
B – Cut steps/cutting slots
C – Cutting keyways/cutting blind slots
D – Milling slots/cutting profiles/facing narrow surfaces. (4)

12.2 12.2.1

$$\frac{40}{N}$$
$$= \frac{40}{58} \checkmark$$
$$= \frac{20}{29} \checkmark$$

Use plate 2 – 20 holes on a 29 hole circle ✓ (3)

12.2.2

$$\frac{N}{9^\circ}$$
$$= \frac{45}{9} \checkmark$$
$$= 5 \checkmark$$

5 full turns of the crank handle ✓ (3)

12.3

- Vitrified
- Resin
- Rubber
- Shellac
- Silicate

(Any 2 × 1) (2)

12.4

- Amount of material to be ground
- Hardness of the material
- Wet or dry grinding
- Surface area
- Degree of precision required
- Machine capacity

(Any 4 × 1) (4)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100