higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

25 November 2024

This marking guideline consists of 8 pages.

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SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

Candidates should 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 False ✓
1.2.2 False ✓
1.2.3 False ✓
1.2.4 True ✓
1.2.5 False ✓

(5 × 1) **[5]**

QUESTION 2: COUPLINGS

2.1
- Fixed/Permanent/Rigid couplings ✓
- Flexible couplings ✓
- Self-aligning couplings ✓

(3 × 1) (3)

2.2
- Nylon sleeve couplings ✓
- Pin and rubber bush couplings ✓
- Raffard couplings ✓
- Metal disc couplings ✓
- Spider couplings ✓
- Rubber belt couplings ✓
- Resilient (Bibby) couplings ✓

(Any 3 × 1) (3)
[6]

QUESTION 3: LIMITS AND FITS

3.1
3.1.1 This is when the tolerance range is allowed on both sides of the basic size. ✓

3.1.2 This is when the tolerance range is allowed on one side of the basic size. ✓

3.1.3 This is the range covered between high limit and low limit. ✓

3.1.4 This is the size to which a part should ideally be manufactured. ✓

3.1.5 This refers to the maximum permissible size allowed relative to the basic size. ✓

(5 × 1) (5)

3.2 3.2.1 Hole basis system – the size of the hole is kept standard and the required fit is obtained by varying the size of the shaft. ✓

3.2.2 Shaft basis system – the size of the shaft is kept standard and the fit is obtained by varying the size of the hole. ✓

(2 × 1) (2)
[7]

QUESTION 4: BEARINGS

4.1
- Heated oil bath ✓
- Heating lamps ✓
- Bearing induction heater/Bearing heaters ✓ (Any 2 × 1) (2)

4.2
- Quiet operation ✓
- Low cost ✓
- Great rigidity ✓
- Can be replaced when worn ✓
- Life is not limited by fatigue ✓ (Any 3 × 1) (3)

[5]

QUESTION 5: LUBRICATION AND VALVES

5.1 5.1.1 Cold point - It is the lowest temperature at which a lubricant will pour or flow at an adequate rate to fulfil its function. ✓

5.1.2 Rubbing pressure - It is the pressure that is generated between a bearing and a shaft. ✓

5.1.3 Adhesion - It is the ability a substance has to cling to another material or substance. ✓

(3 × 1) (3)

5.2 5.2.1 Foot/Flap valve ✓ (1)

5.2.2 A – Clack/Plate ✓
B – Seat ✓ (2)
[6]

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

6.1
- The flange nuts and bolts are not tight enough ✓
- The packing between the flanges are damaged ✓
- The flanges are cracked or corroded ✓
- The joints are damaged due to vibration, expansion or contraction ✓
- Flanges are not parallel during assembly ✓
- The surface finish on the flanges are poor ✓ (Any 3 × 1) (3)

6.2 Yes. ✓
This is the only way you are able to eliminate leakage without over-tightening the gland. ✓ (2 × 1) (2)

6.3
- It is not very stable. ✓
- It becomes brittle when exposed to open air. ✓
- It cannot withstand high temperatures. ✓
- It cannot be used with all types of acids. ✓ (4 × 1) (4)

[9]

QUESTION 7: PUMPS

7.1
- Piston pumps ✓
- Plunger pumps ✓
- Simplex and duplex pumps ✓
- Single-acting and double-acting pumps ✓ (Any 2 × 1) (2)

7.2
7.2.1 Impeller ✓
7.2.2 Discharge/Outlet/Exit ✓
7.2.3 Eye/Centre of the impeller ✓
7.2.4 Inlet/Intake ✓

(4 × 1) (4)

[6]

QUESTION 8: COMPRESSORS

8.1 The inter-cooler cools the air after compression in the low pressure cylinder ✓ whereas the after-cooler cools the air after compression in the high pressure cylinder.✓ (2)

8.2
- Reciprocating compressors ✓
- Rotary compressors ✓ (2 × 1) (2)

[4]

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

9.1 9.1.1 The portion of the pulley that is in contact with the belt along its circumference. ✓

9.1.2 A guide pulley that keeps the tension of the belt constant./ It increases the arc of contact. ✓

9.1.3 Distance between the centres of the drive and driven pulleys. ✓

(3 × 1) (3)

9.2
- Construct fences and guards around gear drives for protection. ✓
- Always isolate the gear drive electrically before starting to do anywork on the drive. ✓
- Never lubricate the machine while in operation or motion. ✓
- Ensure that the gears are fitted properly. ✓
- Ensure that the gears mesh accurately. ✓
- Avoid using loose clothing that can come in contact with rotating components of the gears. ✓

(Any 3 × 1) (3)

9.3
- Single-reduction gearbox ✓
- Double-reduction gearbox ✓
- Worm and worm-wheel gearbox ✓

(3 × 1) (3)

9.4 9.4.1 Chain pitch is the distance measured from the centre of one pin to the centre of the next pin. ✓

9.4.2 The centre distance between the sprockets is the distance measured from the centre of the driven sprocket to the centre of the driving sprocket. ✓

9.4.3 The driver sprocket is the sprocket that is attached to the motor which provides driving motion. ✓

(3 × 1) (3)

[12]

TOTAL SECTION A: 60

SECTION B

Answer only TWO of the three questions in SECTION B.

QUESTION 10: PNUEMATICS AND HYDRAULICS

10.1
- Pressure ✓
- Volume/Area ✓ (2 × 1) (2)

10.2 10.2.1 The pressure-relief valve releases air when the system exceeds safe limits. ✓

10.2.2 Non-return valve prevents the reverse flow of air in a pneumatic system. ✓

10.2.3 The directional control valve controls the direction of air flow. ✓
(3 × 1) (3)

10.3
- Pump ✓
- Reservoir ✓
- Piping ✓
- Valves ✓
- Actuating unit ✓

(5 × 1) (5)

10.4 10.4.1 C ✓
10.4.2 A ✓
10.4.3 F ✓
10.4.4 B ✓
10.4.5 D ✓
(5 × 1) (5)

10.5 10.5.1 Non-return valve ✓
10.5.2 Compressor ✓
10.5.3 Pneumatic motor ✓
10.5.4 Air receiver/Tank ✓
10.5.5 Single acting cylinder or cylinder ✓
(5 × 1) (5)
[20]

QUESTION 11: CENTRE LATHES

11.1
- Supporting long, slender work pieces between centres ✓
- Maintaining concentricity of long work pieces while machining ✓
- Reducing vibration or chatter, ensuring a better finish of the workpiece ✓
- Supporting work pieces against the pressure of heavy machining ✓

(Any 3 × 1) (3)

11.2
- Long tapers can be turned. ✓
- A cross-slide can be automatically fed. ✓ (2 × 1) (2)

11.3 Set-over = $\frac{\text{Length of workpiece}}{2}$ x ratio ✓

$= \frac{300}{2} \times \frac{1}{15}$ ✓

= 10 mm ✓ (3)

11.4 11.4.1 $\text{Lead} = \text{Number of starts} \times \text{pitch of thread}$

$= 2 \times 12$

$= 24 \text{ mm}$ ✓

$\tan\theta = \frac{\text{Lead}}{\pi \times \text{Dm}}$

$= \frac{24}{\pi \times 66}$ ✓

$= 0{,}116$ ✓

$\theta = 6{,}6°$ ✓ (4)

11.4.2 Leading angle = 90°- (helix angle + clearance angle)
= 90°- (6,6°+ 3°) ✓
= 80,4º ✓ (2)

11.4.3 Following angle = 90°+ (helix angle - clearance angle)
= 90°+ (6,6 - 3°) ✓
= 93,6º ✓ (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 are taken from a common reference point. ✓
(2 × 1) (2)

11.6
- No part of the tool besides the actual cutting edge can touch the work ✓
- Stops tool rubbing ✓
- Minimises pressure against the cutting tool ✓
- Minimises friction and heat ✓ (Any 2 × 1) (2)

[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1
- The dividing head divides the circumference of a workpiece equally into several parts. ✓
- The dividing head holds the workpiece in the required position while work is done. ✓ (2)

12.2 12.2.1 Dovetail cutter – Is used to manufacture dovetail slides that are used on various machines. ✓

12.2.2 Slotting cutter – It is used for cutting slots, grooves and keyways. ✓

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

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

(4 × 1) (4)

12.3
- 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)

12.4 12.4.1 Indexing = $\frac{40}{N}$

$= \frac{40}{58}$ ✓

$= \frac{20}{29}$ ✓

Indexing = 0 turns of the crank handle and 20 holes in an 29-hole circle (Plate 2) ✓ (3)

12.4.2 Indexing = $\frac{N}{9}$

$= \frac{54}{9}$ ✓

$= 6$ ✓

Indexing = 6 turns of the crank handle ✓ (3)

12.3 Resinoid or synthetic ✓
Rubber bonding ✓
Shellac ✓
Silicates ✓
Vitrified ✓ (Any 2 × 1) (2)

12.4
- Grit too fine ✓
- Wheel too hard ✓
- Table speed too slow ✓
- Feed is too light ✓ (Any 3 × 1) (3)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100

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