higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

27 November 2023

This marking guideline consists of 9 pages

Copyright reserved

SECTION A: ALL QUESTIONS ARE TO BE MARKED IN THIS SECTION.

QUESTION 1: OCCUPATIONAL SAFETY

NOTE: Candidates need to answer ONLY QUESTION 1.1 OR QUESTION 1.2

1.1
- Provide maximum positive protection.
- It must not block access to other areas.
- 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. (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
- Axial misalignment
- Radial misalignment
- Angular misalignment (3)

2.2 2.2.1 Nylon Sleeve Coupling

2.2.2 Flexible Coupling

2.2.3 Nylon Sleeve

(3 × 1) (3)

[6]

QUESTION 3: LIMITS AND FITS

3.1
- Clearance fits
- Interference fits
- Transition fits

(3 × 1) (3)

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.

3.2.3 Tolerance is the range covered between the high limit and low limit of size.

3.2.4 Basic size is the dimension to which a part should ideally be manufactured.

(4 × 1) (4)
[7]

QUESTION 4: BEARINGS

4.1
- Radial load
- Axial or thrust load
- Combined load (radial and axial) or angular load

(3 × 1) (3)

4.2
- Faulty maintenance and assembly
- Insufficient lubricant
- Incorrect lubricant
- Dirt or grit in the lubricant
- High operating temperature
- Wear/fatigue of bearing material
- Faulty design
- Corrosion of the bearing material
- Water contamination

(Any 2 × 1) (2)
[5]

QUESTION 5: LUBRICANTION AND VALVES

5.1 5.1.1 Liquid

5.1.2 Semi-solid

5.1.3 Liquid

(3 × 1) (3)

Copyright reserved

5.2 5.2.1 True

5.2.2 False

5.2.3 False

(3 × 1) (3)
[6]

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

6.1 6.1.1 False
6.1.2 True
6.1.3 False
6.1.4 True
6.1.5 True

(5 × 1) (5)

6.2
- Bell-and-spigot
- Welded
- Soldered or brazed
- Screwed (threaded)
- Flanged

(Any 4 × 1) (4)
[9]

QUESTION 7: PUMPS

7.1
- A pump is a mechanical device used to move fluid from one location to another location
- To impart energy to a fluid. (2)

7.2 In piston pumps, the piston is smaller/shorter than the stroke of the pump,✓ whereas, in plunger pumps, the piston length is bigger than the stroke of the pump✓ (2)

7.3
- It means that a fixed amount of liquid ✓ cannot be constantly delivered.✓
- It means that liquid is displaced towards the outlet of the pump ✓ by centrifugal force not by the action of the plunger or piston.✓ (Any 1 × 2) (2)

[6]

QUESTION 8: COMPRESSORS

A – Outlet / Outlet valve / Discharge
B – Air receiver / Tank / Reservoir
C – Inlet / Inlet valve / Suction
D – Piston
E – Connecting rod

(5 × 1) **[5]**

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

9.1 9.1.1 Caused by excessive heat or chemical fumes

9.1.2 Caused by fluid contaminating the belt

9.1.3 Caused by improper installation

(3 × 1) (3)

9.2
- Cycloid gear tooth profile
- Involute gear tooth profile

(2 × 1) (2)

9.3
- Single-strand or multiple-strand roller chains
- Silent chains
- Leaf chains
- Double-pitch roller chain

(4 × 1) (4)

9.4
- To reduce the speed
- To increase the torque
- To transmit power

(Any 2 × 1) (2)

[11]

TOTAL SECTION A: 60

SECTION B

QUESTION 10: PNEUMATICS AND HYDRAULICS

10.1 A: Double-acting cylinder / Cylinder / Actuator
B: Directional control valve / Control valve
C: Pressure relief valve
D: Reservoir

(4 × 1) (4)

10.2
- 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)

10.3 10.3.1 The pressure relief valve protects the system from excessive pressure.

10.3.2 The reservoir stores the hydraulic fluid until it is required.

10.3.3 The hydraulic pump provides mechanical energy to the hydraulic fluid.

10.3.4 The water trap is used to trap the water particles in the air and prevents them from re-entering the air system.

10.3.5 A compressor compresses the air and delivers it at a higher pressure.

(5 × 1) (5)

10.4
- Directional control valves
- Pressure relief valves/Safety valve
- Sequence valve
- Non-return valve/check valve
- Flow control valve (Any 3 × 1) (3)

10.5
- 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 3 × 1) (3)

[20]

QUESTION 11: CENTRE LATHES

11.1 It is used for holding work pieces that have been already bored or reamed, for further machining. (1)

11.2
- No setting up is required
- Work pieces are easily mounted and dismounted
- Setting is simple
- External turning is true to internal turning
- Can accommodate a large variety of work pieces
- Production of large quantities of similar work pieces is made easier

(Any 4 × 1) (4)

11.3 11.3.1
- Long tapers can be turned.
- Cross-slide can be fed automatically.

(2 × 1) (2)

11.3.2
- Only external tapers can be turned.
- Due to centres being misaligned, uneven wear takes place on the centres and centre holes.

(2 × 1) (2)

11.4
$$Set-over = \frac{D-d}{2} \times \frac{\text{length of workpiece}}{\text{length of taper}}$$
$$= \frac{90-60}{2} \checkmark \times \frac{500}{300} \checkmark$$
$$= 25 \text{ mm} \checkmark$$
(3)

11.5
$$S = \pi DN$$
$$N = \frac{S}{\pi \times D} \checkmark$$
$$= \frac{20}{\pi \times 0{,}060} \checkmark$$
$$N = 106{,}1 \text{ r/min} \checkmark$$
(3)

11.6
$$\text{Lead} = \text{Number of starts} \times \text{pitch of thread}$$
$$= 2 \times 14$$
$$= 28 \text{ mm} \checkmark$$
$$Dm = OD - \frac{1}{2} \times \text{Pitch}$$
$$= 77 - \frac{1}{2} \times 14$$
$$= 70 \text{ mm} \checkmark$$

$$\tan\theta = \frac{\text{Lead}}{\pi \times Dm}$$
$$= \frac{28}{\pi \times 70}$$
$$= 0{,}13 \checkmark$$

$$\Theta = \tan^{-1} 0{,}13 \checkmark$$
$$= 7{,}41° \checkmark$$
(5)

[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 × 1) (2)

12.2 12.2.1 A – End Milling cutter
B – Slitting Saw
C – Slab Milling cutter

(3 × 1) (3)

12.3 $\text{Indexing} = \frac{40}{N}$

$= \frac{40}{18}$ ✓

$= 2\frac{4}{18}$ ✓

$= 2\left[\frac{4}{18} \times \frac{3}{3}\right]$ ✓

$= 3\ \frac{12}{54}$ ✓

$= 3$ turns of crank and 12 holes in a 54– hole circle ✓ (5)

12.4 $V = \pi DN$

$N = \frac{V}{\pi D}$ ✓

$= \frac{30}{\pi \times 0{,}085}$ ✓

$\underline{N = 112{,}34\ r/min}$ ✓

$f = f_t \times T \times N$

$= 0{,}08 \times 15 \times 112{,}34$ ✓

$\underline{f = 134{,}81\ mm/min}$ ✓ (5)

12.5 Produces a flat surface which is smooth and accurate (1)

12.6
- Off-hand grinding is a manual (hand held) grinding process ✓ whereas precision grinding is done on a surface grinder . ✓
- The surface finish In off-hand grinding is poor ✓ whereas the surface finish is smoother in precision grinding ✓
- In off-hand grinding the tolerances are large ✓ whereas in precision grinding the tolerances are small ✓. (Any 1 × 2) (2)

12.7
- Plain disc wheel / Disc grinding wheel / Straight wheel
- Cup grinding wheels / Straight cup grinding wheel
- Flared cup grinding wheel
- Double cup grinding wheel (Any 2 × 1) (2)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100

Copyright reserved