higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

3 APRIL 2019

This marking guideline consists of 8 pages.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

1.1 1.1.1 True
1.1.2 False
1.1.3 True
1.1.4 False
1.1.5 True

(5 × 1) **[5]**

OR

1.2 1.2.1 False
1.2.2 True
1.2.3 True
1.2.4 False
1.2.5 True

(5 × 1) **[5]**

QUESTION 2: COUPLINGS

2.1 A coupling connects the input and output shafts ✓ permanently.✓ (2)

2.2 2.2.1 Flexible coupling
2.2.2 Permanent/fixed coupling
2.2.3 Self-aligning coupling
2.2.4 Flexible coupling

(4 × 1) (4)
[6]

QUESTION 3: LIMITS AND FITS

3.1
- Provides standardisation and interchangeability of parts and is practical for economic purposes
- Allows for the acceptance of faulty machining and workmanship through certain limits
- Accelerates production and manufacturing
- Cuts production costs and delivery times

(4 × 1) (4)

3.2 3.2.1 85,10 mm
3.2.2 85, 10 mm
3.2.3 0,15 mm

(3 × 1) (3)
[7]

QUESTION 4: BEARINGS

4.1
- Point contact
- Line contact

(2 × 1) (2)

4.2 A – Radial load
B – Combined load/Angular load
C – Axial load/Thrust load

(3 × 1) (3)
[5]

QUESTION 5: LUBRICATION AND VALVES

5.1
- Solids
- Liquids
- Semi-solids (grease)

(3 × 1) (3)

5.2
- To control direction
- To control pressure

(2 × 1) (2)

5.3 Safety valves protect the system from overload (1)
[6]

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

6.1
Step 1: Measure the circumference of the shaft and cut packing rings to size.
Step 2: Remove the gland lock.
Step 3: Dip the packing rings into oil.
Step 4: Insert one packing at a time, push into place and ensure the edges are staggered at 120° to each other.
Step 5: Replace gland and tighten gland nuts evenly, ensuring straightness and that the packing is gripped by the shaft.

(5 × 1) (5)

6.2
- They are not very stable.
- They become brittle and damaged when exposed to UV rays.
- They cannot be used with all types of acids.
- They cannot withstand high temperatures.

(4 × 1) (4)
[9]

QUESTION 7: PUMPS

7.1 As the plunger lifts, the inlet valve opens, ✓ the outlet valve closes and water is drawn into the cylinder.✓
As the plunger moves down, the inlet valve closes, the outlet valve opens✓ and the liquid is forced into the delivery pipe. ✓ (4)

7.2 Positive displacement (1)

7.3 With each stroke of the plunger, a fixed amount of liquid is displaced. (1)
[6]

QUESTION 8: COMPRESSORS

8.1
- Single-stage compressor
- Multi-stage compressor
- Single-acting compressor
- Double-acting compressor

(Any 2 × 1) (2)

8.2 The intercooler cools the air✓ between the different stages in a multi-stage compressor.✓ (2)
[4]

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

9.1 A – Hard rubber outer casing
B – Cords
C – Soft rubber (3 × 1) (3)

9.2
- Guards should be fitted around gear drives.
- Machine must be switched off before working on gear drives.
- Ensure that gears mesh accurately.
- Ensure that gears are properly fixed to the shaft.
- Position gears in a way that makes replacement of parts easy.

(Any 3 × 1) (3)

9.3
- It is suitable for short and long centre distance drives with light or heavy loads at low or high speeds.
- Maintenance can be done without disturbing other components.
- It has multiple drives on one chain. (3 × 1) (3)

9.4 9.4.1 To eliminate the use of very small gears

9.4.2 To eliminate the use of very large gears

(2 × 1) (2)

9.5 Drive gear (1)
[12]

TOTAL SECTION A: 60

SECTION B

QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1 10.1.1 Pressure build-up in a fluid gives energy to the fluid which is then transferred to the system.

10.1.2 Mechanical components are lubricated by hydraulic oil passing through it.

10.1.3 Through the circulation of hydraulic fluid heat is dissipated.

(3 × 1) (3)

10.2 10.2.1 Reservoir
10.2.2 Hydraulic pump
10.2.3 Check valve
10.2.4 Hydraulic motor
10.2.5 Line/piping

(5 × 1) (5)

10.3 10.3.1 It protects the system from excessive pressure.

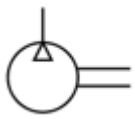
10.3.2 It alerts, generates or cancels signals for sensing, processing and controlling.

(2 × 1) (2)

10.4
- Pressure
- Volume/Area

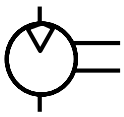
(2 × 1) (2)

10.5 10.5.1



10.5.2

10.5.3



(3 × 1) (3)

10.6 A hydraulic system operates with oil ✓ whereas a pneumatic system operates with air. ✓ (2)

10.7
- Check for leaks/cracks.
- Check for kinks.
- Check for perished rubber.

(3 × 1) (3)

[20]

QUESTION 11: CENTRE LATHES

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

11.2
- Under its own weight
- The pressure of the cutting tool (2 × 1) (2)

11.3
- Set over of the tailstock
- Set over of the compound slide
- Use the taper turning attachment (Any 2 × 1) (2)

11.4 11.4.1

$$Lead = No.of\ starts \times Pitch\ of\ thread$$
$$= 2 \times 12$$
$$\underline{Lead = 24\ mm}\checkmark$$ (1)

11.4.2

$$Depth = \frac{Pitch}{2}$$
$$= \frac{12}{2}$$
$$\underline{Depth\ = 6\ mm}\checkmark$$

$$Mean\ diameter\ (Dm) = Outside\ diamter - Depth$$
$$= 85 - 6$$
$$\underline{Mean\ diameter\ (Dm) = 79\ mm}\checkmark$$ (2)

11.4.3

$$\tan\theta = \frac{Lead}{\pi Dm}$$
$$= \frac{24}{\pi \times 79}\ \checkmark$$
$$= 0{,}0967$$
$$\underline{\theta = 5{,}523°\ \ OR\ \ 5°\ 31'}\ \checkmark$$ (2)

11.5 $S = \pi DN$

$$N = \frac{S}{\pi D}\ \checkmark$$
$$= \frac{22}{\pi \times 0{,}065}\ \checkmark$$
$$\underline{N = 107{,}735\ r/min}\checkmark$$ (3)

11.6 $S = 36\ m/min$

$= \frac{36}{60}$

$\underline{S = 0{,}6\ m/sec}$ ✓

$S = \frac{\pi DN}{60}$

$N = \frac{S \times 60}{\pi D}$ ✓

$= \frac{0{,}6 \times 60}{\pi \times 0{,}09}$

$\underline{S = 127{,}324\ r/min}$ ✓

$T = \frac{L}{f \times N}$

$= \frac{600}{0{,}75 \times 127{,}324}$ ✓

$= 6{,}283\ min$

$\underline{T = 6\ min\ 16\ sec}$ ✓ (5)

11.7
- Absolute dimensioning
- Incremental dimensioning

(2 × 1) (2)
[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1
12.1.1 Plain helical slab cutter
12.1.2 Side and face cutter
12.1.3 Dovetail cutter
12.1.4 T-slot cutter
12.1.5 End milling cutter

(5 × 1) (5)

12.2 $Indexing = \frac{40}{N}$

$= \frac{40}{12}$

$= 3\frac{4}{12}$ ✓

$= 3\left[\frac{1}{3} \times \frac{17}{17}\right]$ ✓ OR $3\left[\frac{1}{3} \times \frac{18}{18}\right]$ OR $3\left[\frac{1}{3} \times \frac{19}{19}\right]$ OR $3\left[\frac{1}{3} \times \frac{22}{22}\right]$

$= 3\frac{17}{51}$ ✓ OR $= 3\frac{18}{54}$ OR $= 3\frac{19}{57}$ OR $= 3\frac{22}{66}$

✓ ✓

$Indexing = 3\ full\ turns\ of\ the\ crank\ handle\ and\ 17\ holes\ in\ a\ 51\ hole\ plate.$

Other possible answers:
$Indexing = 3\ full\ turns\ of\ the\ crank\ handle\ and\ 18\ holes\ in\ a\ 54\ hole\ plate.$
$Indexing = 3\ full\ turns\ of\ the\ crank\ handle\ and\ 19\ holes\ in\ a\ 57\ hole\ plate.$
$Indexing = 3\ full\ turns\ of\ the\ crank\ handle\ and\ 22\ holes\ in\ a\ 66\ hole\ plate.$ (5)

12.3 $V = \pi DN$

$N = \frac{V}{\pi D}$ ✓

$= \frac{35}{\pi \times 0{,}060}$ ✓

$\underline{N = 185{,}681\ r/min}$ ✓

$f = f_t \times T \times N$

$= 0{,}09 \times 12 \times 185{,}681$ ✓

$\underline{f = 200{,}54\ mm/min}$ ✓ (5)

12.4 12.4.1 Surface grinder (1)

12.4.2 A – Workpiece
B – Horizontal spindle
C – Magnetic table
D – Grinding wheel

(4 × 1) (4)
[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100