higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

21 NOVEMBER 2019

This marking guideline consists of 10 pages.

QUESTION 1: OCCUPATIONAL SAFETY

1.1
- Check for loose parts and tighten if necessary.
- Check the strainer and clean if necessary.
- Lubricate the machine.
- Blow out the air hose to remove moisture and dirt.
- Check fittings for proper connection.
- Ensure the control valve is in the closed position.
- Check the air pressure at the tool.
- Check if the tool-retainer device is installed.
- Check if the guarding is correct.
- Close the stop valve in the air-supply line when changing tools.
- Never kink or bend the hose to cut off air supply.

(Any 5 × 1) (5)

OR

1.2 1.2.1 No person shall wear loose outer clothing when working close to moving machinery.

1.2.2 All exposed moving machinery that may cause danger to any person, must be securely fenced off.

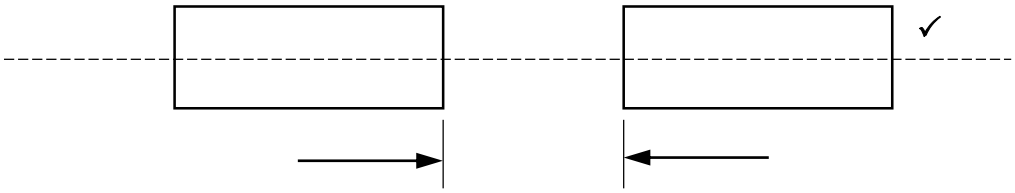
1.2.3 No person shall shift any driving belts while the belts are in motion except for light belts on coned pulleys of machine tools to change the working speed.

1.2.4 Repairing and lubricating of machinery shall be undertaken by authorised persons only.

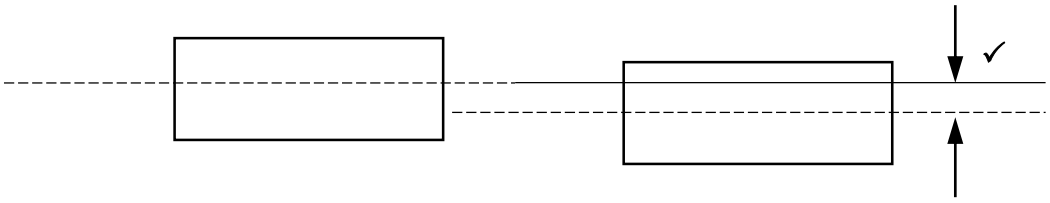
1.2.5 Every safety appliance at a mine shall be maintained in a good working order and used in the proper way.

(5 × 1) (5)
[5]

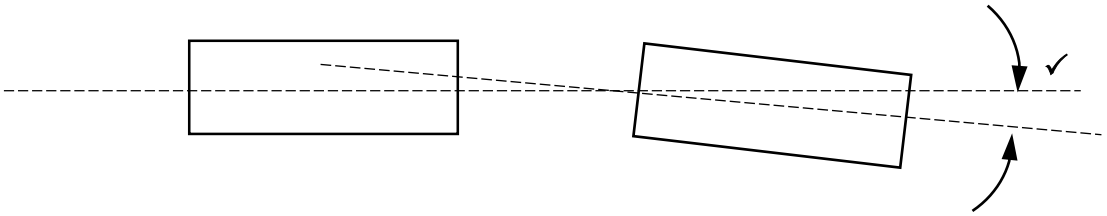
QUESTION 2: COUPLINGS



Axial misalignment ✓



Radial misalignment ✓



Angular misalignment ✓

(3 × 2) **[6]**

QUESTION 3: LIMITS AND FITS

3.1 3.1.1 Running fit

3.1.2 Drive fit

3.1.3 Press fit

3.1.4 Shrink fit

(4 × 1) (4)

3.2 3.2.1 20 mm
3.2.2 20,025 mm
3.2.3 19,995 mm

(3 × 1) (3)
[7]

QUESTION 4: BEARINGS

4.1 A – Machine slide guide bearing
B – Footstep bearing (2)

4.2 A – It allows for guided relative movement whilst carrying a load.
B – It supports shafts that rotate in a vertical position. (2)

4.3
- Centre lathe
- Milling machining
- Shaping machine (Any relevant 1 × 1) (1)

[5]

QUESTION 5: LUBRICATION AND VALVES

5.1
- Cools the work piece
- Cools the cutting tool
- Extends the cutting-tool lifespan
- Achieves higher cutting speeds
- Prevents rusting of the machine
- Achieves a better finish on the work piece
- Washes away chips and keeps cutting edge clean (Any 5 × 1) (5)

5.2 Check valve or Non-return valve. (1)

[6]

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

6.1
- Prevents heat loss
- Prevents or reduces condensation
- Minimises vibrations in the pipeline
- Stabilizes temperature in pipelines

(Any 2 × 1) (2)

6.2 The joint is normally made of compressible material so that it can take the shape of the joint ✓ and allow for any irregularity in the shape of the joint, thus preventing leakage.✓ (2)

6.3 Continuous expansion bends are used in high pressure systems in industry. (1)

6.4 6.4.1 D
6.4.2 A
6.4.3 B
6.4.4 C

(4 × 1) (4)

[9]

QUESTION 7: PUMPS

7.1 Screw pump (1)

7.2 A – Rotor/Main rotor/Power rotor
B – Stuffing box
C – Idler rotors (3)

7.3 The main rotor drives the idler rotors ✓ carrying fluid along the screws threads from the inlet towards the outlet of the pump. ✓ (2)
[6]

QUESTION 8: COMPRESSORS

8.1 Indicates the pressure of air inside the air receiver

8.2 Takes in air at a low pressure and discharges it at a higher pressure

8.3 Prevents the leakage of air between the piston and cylinder walls

8.4 Changes the straight-line (or reciprocating) motion of the piston (or crosshead) into circular motion

(4 × 1) **[4]**

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

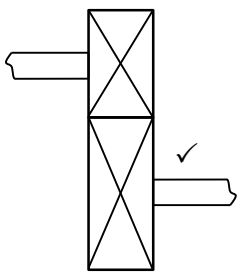
9.1 9.1.1 It is the effective diameter roughly midway between the outside of the pulley and the inside step of the pulley.

9.1.2 It is the length of the belt measured along the effective pitch line of the V-belt.

9.1.3 It is the distance between the centre of the driving pulley and the centre of the driven pulley.

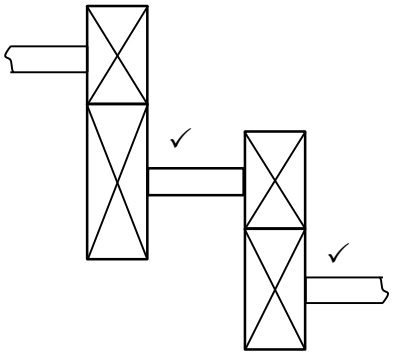
(3 × 1) (3)

9.2 9.2.1



(1)

9.2.2



(2)

9.3
- Manual lubrication
- Drip lubrication
- Oil-bath lubrication
- Oil-stream lubrication (Any 3 × 1) (3)

9.4 9.4.1 True
9.4.2 False
9.4.3 True

(3 × 1) (3)
[12]

TOTAL SECTION A: 60

SECTION B

QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1
- Pressure
- Area (2)

10.2
- Pa
- Bar (2)

10.3
- Power transmission
- Lubrication
- Cooling
- Removes dirt
- Prevents corrosion (Any 3 × 1) (3)

10.4 10.4.1 The regulator is used to regulate the pressure at a desired pressure in a hydraulic system.

10.4.2 The pressure relief valve is used to maintain a safe working pressure within a hydraulic system.

10.4.3 The directional control valve controls the direction of fluid flow.

(3 × 1) (3)

10.5 The function of a pneumatic system is to use compressed air to transmit power. (1)

10.6
A Cylinder/Double-acting cylinder/actuator
B Flow control valve/Flow-control valve with variable flow/Flow control with bypass/Throttle valve
C Pipe line/Working line
D Directional control valve (4 × 1) (4)

10.7
- 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)

[20]

QUESTION 11: CENTRE LATHES

11.1 11.1.1 Code commands for the machine to prepare for a specific machining cycle (1)

11.1.2 When all points are taken from a common reference point (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 A lathe steady. (1)

11.4
- Compound slide method
- Tailstock set-over method
- Taper-turning attachment method (3)

11.5 11.5.1

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

$$= \frac{75-50}{2} \times \frac{400}{250}\checkmark$$

$$= 12{,}5 \times 1{,}6$$

$$= 20 \text{ mm}\checkmark$$

(2)

11.5.2 $\tan \frac{\theta}{2} = \frac{X}{L}$

$\tan \frac{\theta}{2} = \frac{12,5}{250}$

$\tan \frac{\theta}{2} = 0,05$✓

$\theta = \tan^{-1} 0,05 \times 2$✓

$\theta = 5,724°$

$\theta = 5° 43'$✓ (3)

11.6 $S = \pi DN$

$N = \frac{S}{\pi \times D}$✓

$= \frac{30}{\pi \times 0,080}$✓

$N = 119,366 \text{ r/min}$✓ (3)

11.7
- 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
- Simple indexing
- Rapid indexing
- Angular indexing
- Differential indexing (4)

12.2 $11° 15'$

$= 11\frac{15}{60}$

$= 11\frac{1}{4}$ ✓

$Indexing = \frac{N}{9°}$

$= \frac{11\frac{1}{4}}{9}$

$= \frac{45}{4\times9}$ ✓

$= \frac{5}{4}$

$= 1\ \frac{1}{4}$ ✓

$= 1\left[\frac{1}{4} \times \frac{4}{4}\right]$ ✓ OR $1\left[\frac{1}{4} \times \frac{5}{5}\right]$

$= 1\ \frac{4}{16}$ ✓ $= 1\ \frac{5}{20}$

✓ ✓

Indexing = 1 full turn of the crank handle and 4 holes in a 16-hole circle OR
1 full turn of the crank handle and 5 holes in a 20-hole circle (7)

12.3
- Helps in the removal of shavings
- Reduces chattering
- Gives better cutting action
- Improves the finish on the work piece
- Coolant flows easily on the work piece
- Helical shape minimises the hammering effect experienced by parallel cutters

(Any 3 × 1) (3)

12.4 12.4.1
- Dirty coolant or loose particles of dirt can cause scratches
- Abrasive grains released from a grinding wheel that is too soft
- Incorrect wheeldressing
- Sliding the work piece off the magnetic chuck (Any 2 × 1) (2)

12.4.2
- Vibrations from the machine
- Worn or insufficiently lubricated wheel spindles
- Out of balance wheel
- Wheel too hard (Any 2 × 1) (2)

12.4.3
- Grinding wheel may be too hard
- Stopping the table while the work piece is in contact with the wheel (2)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100