higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

FITTING AND MACHINING THEORY N2

30 MARCH 2016

This marking guideline consists of 9 pages.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

1.1
- Must be strong and long lasting
- Must not interfere with the operation of the machine
- Must be easy to repair
- Must be corrosion and fire resistant
- Must provide maximum protection
- Must not block access to other areas
- Must block access to danger zones during operation
- Must be free from hazards such as splinters and pinch points
- Should be a permanent part of the machine
- Effective operation of the machine should not be affected by the guard

(Any 5 x 1) **[5]**

OR

1.2 1.2.1 Area to be sufficiently illuminated so that moving parts can be clearly seen.

1.2.2 No light or lamp is allowed inside a mine unless the director general of mines approves it.

1.2.3 Safety valves must be tested regularly to ensure opening at authorised gauge pressure.

1.2.4 No cables to be placed or suspended in an unprotected manner. They must be laid in such a way that damage is avoided.

1.2.5 No person is allowed to work in and un-illuminated part of a mine unless they carry a light.

(5 x 1) **[5]**

QUESTION 2: COUPLINGS

- Easier to handle short shafts than long shafts
- Easier to transport short shafts than long shafts
- Maintenance is easier on short shafts than on long shafts
- Cheaper to manufacture short shafts than long shafts
- Manpower is reduced during maintenance
- Shorts shafts do not bend as much as long shafts

(Any 5 x 1) **[5]**

QUESTION 3: LIMITS AND FITS

3.1 3.1.1 The hole basis system is used when a shaft is machined within limits to fit a standard existing hole.

3.1.2
- Minimum allowance is the smallest distance between the smallest hole size and the largest shaft size.
- Minimum allowance is the smallest allowable distance between two mating components. (Any 1 x 1)

3.1.3 Bilateral tolerance is when the tolerance range is allowed on both sides of the basic size.

3.1.4 Transition fit is a fit in which the shaft may be slightly larger or smaller in diameter than the hole and still remain within limits.

(4 x 1) (4)

3.2 Minimum allowance = smallest hole size – largest shaft size ✓
= (30 - 0,015) – (30 - 0,025) ✓
= 0,01 mm ✓ (3)
[7]

QUESTION 4: BEARINGS

4.1
- The operation is quiet
- Low cost
- Great rigidity
- Can be replaced when worn
- Life is not limited by fatigue
- Easy to manufacture

(Any 4 x 1) (4)

4.2
- Screw puller
- Hydraulic puller
- Puller plates
- Impact puller
- Hydraulic press
- Bearing induction heater
- Heated oil bath
- Heating lamps
- Wheel puller (Any 3 x 1) (3)

[7]

QUESTION 5: LUBRICATION AND VALVES

5.1
- Ball valve
- Gate valve
- Globe valve
- Diaphragm valve

(Any 2 x 1) (2)

5.2 Normally open valves are designed to be opened when in use ✓ whereas a normally closed valve is closed during normal use ✓ (2)

5.3
5.3.1 Stauffer grease lubricator
5.3.2 Wick-feed lubricator
5.3.3 Hand-operated grease pump
5.3.4 Grease gun

(4 x 1) (4)
[8]

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

6.1
- Asbestos
- Cotton
- Nylon
- Rubber
- Neoprene
- Teflon
- Graphite
- Aluminium
- Babbit or white metal
- Cork

(Any 4 x 1) (4)

6.2
- Prevent heat loss as the pipeline carries steam or hot water from one place to another.
- To prevent condensation or water forming in a steam pipeline
- To prevent water hammer in steam pipelines
- For more accurate gauge readings
- To prevent water entering the machine

(Any 3 x 1) (3)
[7]

QUESTION 7: PUMPS

7.1
- Centrifugal pump
- Reciprocating pump
- Rotary pump (3 x 1) (3)

7.2 As water circulates inside the casing a vortex is created at the centre, which causes a vacuum. ✓ This vacuum allows more water to be drawn into the casing. ✓ A centrifugal force causes the water at the outside circumference of the casing to be forced through the delivery outlet. ✓ (3)

[6]

QUESTION 8: COMPRESSORS

8.1 Lubricator
8.2 Sheave
8.3 Piston
8.4 Connecting rod
8.5 Cotter **[5]**

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

9.1 9.1.1 Chain pitch is the distance from the centre of one pin to the centre of the next pin.

9.1.2 The drive sprocket is the sprocket that is attached to the motor from which the driving motion is performed.

(2 x 1) (2)

9.2
- Protect persons working in close proximity to a chain drive, in case of chain breakage.
- Protect machinery, in case of chain breakage.
- Houses the lubrication system. (Any 2 x 1) (2)

9.3
- Always make sure that the V-belt drive has a guard around it
- Make sure that the machine is switched off when replacing V-belts
- Never adjust the slack of a V-belt while the machine is in motion
- Use tensioning pulleys to adjust the slack of the belt
- Use the correct size V-belt for the pulley and type of drive
- Keep dirt and oil off the drive to prevent slip
- Make sure that the pulleys are tightly fitted onto the shafts
- Ensure that the pulleys are in line with each other
- Always keep spare V-belts so that broken ones can be replaced immediately. (Any 3 x 1) (3)

9.4
- Unlike V-belt and chain drives, gear drives are positive drive, that is, no slip is possible ✓
- Gear drives can be used in confined spaces whereas V-belt and chain drives are used over longer distances ✓
- Gear drives can deal with higher torque than V-belt and chain drives ✓
- Gear drives are more durable than V-belt and chain drives (Any 3 x 1) (3)

[10]

TOTAL SECTION A: 60

SECTION B

Candidates must answer only TWO questions in this section.

QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1
10.1.1 Air dryer
10.1.2 Filter with manual drain
10.1.3 Filter with automatic drain
10.1.4 Filter or regulator
10.1.5 Single-acting cylinder with spring return
(5 x 1) (5)

10.2
- In hydraulic systems, oil is the working medium ✓ whereas in pneumatics systems, air is the working medium. ✓
- In hydraulic systems, the excess oil is returned to the reservoir ✓ whereas in pneumatic systems, the excess air is exhausted to the atmosphere. ✓ (Any 1 x 2) (2)

10.3
- Manually
- Electrically
- By fluid pressure (pilot pressure) (3 x 1) (3)

10.4
10.4.1 Hydraulic motor is a hydraulic source of rotary power, which drives components

10.4.2 Tank/Reservoir is a storage container for hydraulic oil which is to be used in the system and acts as return station.

10.4.3 Pressure-relief valve regulates the system pressure, keeping it at a fixed pressure for end use.
(3 x 1) (3)

10.5
- Controls energy flow
- Opens or closes the path of flow
- Directs the flow
- Regulates the flow (Any 2 x 1) (2)

10.6
10.6.1 Pump
10.6.2 Single-acting cylinder
10.6.3 Check valve
10.6.4 4/3 way directional control valve
10.6.5 Tank/Reservoir
(5 x 1) (5)
[20]

QUESTION 11: CENTRE LATHES

11.1 11.1.1 The fixed cone holds the work in position ✓ while the sliding cone can be tightened onto the workpiece by means of a fastening nut on the back end. ✓

11.1.2 A split tapered bush fits over a tapered shaft. ✓ By driving the shaft into the bush, the bush opens up to accommodate workpieces of various hole sizes. ✓

(2 x 2) (4)

11.2 11.2.1
- Time saving
- Concentricity is guaranteed
- Simplicity of operation and calculations
- Internal and external tapers can be turned
- Short tapers can be turned to any angle (Any 2 x 1) (2)

11.2.2
- The length of the taper is limited to the length of the travel of the compound slide.
- No automatic feed, only by hand
- Not very accurate angle (set by eye judgement) (Any 2 x 1) (2)

11.3
- The dial test indicator method
- The graduated sleeve method (2)

11.4 The travelling steady is fitted to the carriage of the lathe and travels along with the tool ✓ whereas the fixed steady is clamped on the slideway of the lathe and does not move with the tool. ✓ (2)

11.5
$$\text{Tailstock set-over} = \frac{\text{Length of workpiece}}{2} \times \text{Ratio} \quad ✓$$
$$= \frac{280}{2} \times \frac{1}{40} \quad ✓$$
$$= 3{,}5 \text{ mm} ✓$$
(3)

11.6
$$\text{Lead} = \text{No. of starts} \times \text{Pitch} = 2 \times 10 = 20 \text{ mm} \quad ✓$$

$$\text{Mean diameter} = \text{OD} - \frac{\text{Pitch}}{2} = 45 - \frac{10}{2} = 40 \text{ mm} \quad ✓$$

$$\tan\theta = \frac{\text{Lead}}{\text{Mean Circumference}} = \frac{20}{\pi \times 40} = 0{,}159 \quad ✓ \quad ✓$$

$$\theta = \tan^{-1} 0{,}159 = 9{,}043° ✓$$

(5)

[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 12.1.1 Ball-nose cutter
12.1.2 T-slot cutter
12.1.3 Dove-tail cutter

(3 x 1) (3)

12.2
- Rapid index plate
- Index plate for simple indexing
- Angular head with degrees on
- Spindle
- Crank handle
- Single-start worm
- Worm wheel
- Sector arms

(Any 4 x 1) (4)

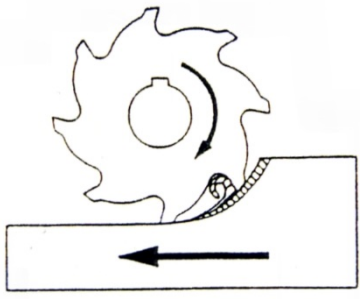
12.3
- Too slow a speed
- Metal clogging the space between abrasive particles/wheel clogged
- Wrong wheel/wheel too hard
- Insufficient coolant/disruption in coolant supply

(Any 3 x 1) (3)

12.4 $S = \pi D N$ ✓
$= \pi \times 0{,}04 \times 302$ ✓
$= 37{,}95$ m/min ✓

(3)

12.5 12.5.1



✓✓ (for drawing)

The teeth cuts from top to bottom. ✓ The direction of cutter and feed ✓ is in the same. ✓ (5)

12.5.2
- Deeper cuts can be taken
- A finer finish is obtained

(2)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100