higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

4 April 2023

This marking guideline consists of 9 pages.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

1.1
- Disconnect the power supply.
- Lock the switch in the 'Off' position.
- Place warning signs that indicate the supply voltage on the electrical switch distribution boards.
- Mark the power supply DC or AC.
- Put 'Danger' or 'Do not switch on' sign boards on the stop/start controls of the machine you are working on.
- Label circuit-breaker switches to indicate which machine they serve.
- Label the main switch in such a way that it stands out from the rest of the switches on the distribution board.
- Faulty portable electrical equipment must never be used. Always check its condition before use.
- Ideally, records of regular monthly checks listing appropriate action to rectify faulty equipment should be kept.   (Any 5 × 1)   (5)

OR

1.2
- No person should place, throw or leave any naked light or flame on or near any combustible material or inflammable substances.
- No combustible waste material shall be stored anywhere in quantity sufficient to create a fire hazard.
- No combustible waste material shall be stored or kept in the immediate vicinity where any electrical apparatus or heating apparatus is installed.
- No welding, flame cutting or flame heating shall take place unless adequate means to extinguish the fire immediately is available.
- No person shall smoke or carry an open light in any cage, skip or other conveyance in any shaft or winch or in any elevator car in a hatchway.
- Calcium carbide is not to be taken underground unless it is in a lamp provided by the manager or in a water-tight container approved by the regional manager.
- All machinery must be constructed, installed, operated and maintained so as to prevent any dangerous heating.   (Any 5 × 1)   (5)

                                                   [5]

QUESTION 2: COUPLINGS

2.1
- Rigid/Permanent/Fixed coupling
- Flexible coupling
- Self-aligning coupling   (3)

2.2
- Axial misalignment
- Radial misalignment
- Angular misalignment

                                                   (3 × 1)   (3)

                                                   [6]

QUESTION 3: LIMITS AND FITS

3.1	3.1.1	0,04 mm		
	3.1.2	Unilateral tolerance		
	3.1.3	Unilateral tolerance		

                                               (3 × 1)   (3)

3.2	3.2.1	Tolerance of the hole		
	3.2.2	The degree of tolerance on the hole		
	3.2.3	Tolerance of the shaft		
	3.2.4	The degree of tolerance on the shaft		

                                               (4 × 1)   (4)
                                                       [7]

QUESTION 4: BEARINGS

- Excessive load on bearing
- Lack of or inadequate supply of lubrication
- Dirty oil causing friction
- Uneven bearing surfaces
- Bearing not seated properly
- Bearing and shaft out of line
- Eccentric shaft
- Incorrect grade of oil
- Bearing halves pulled up too tight   (Any 5 × 1)   **[5]**

QUESTION 5: LUBRICATION AND VALVES

5.1
- Siphon-wick lubricator
- Sight-feed lubricator
- Needle lubricator
- Drip-feed lubricator   (Any 3 × 1)   (3)

5.2   It is the temperature at which oil gives off vapour to burn continuously when ignited.   (1)

5.3
- They control the direction of flow.
- They control the pressure of flow.   (2)
                                                      [6]

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

6.1
- Pressure within the pipe
- Nature of fluid medium
- Temperature of fluid
- Environmental conditions   (Any 2 x 1)   (2)

6.2
- Clean all surfaces thoroughly
- Ensure no damage to the oil ring
- Use the correct seal
- Lubricate the seal before fitting
- Protective sheath to be used when fitting a ring seal or O-ring over a sharp ridge or threaded section
- Tighten up lightly ensuring that the ring seal fits squarely   (Any 3 × 1)   (3)

6.3
- Plastic piping is relatively cheap
- Easy to handle due to its light weight
- No machining required
- Good insulator when used with electricity
- Combining pipes is very easy
- Corrosion resistant   (Any 4 x 1)
                                                                                (4)
                                                                                [9]

QUESTION 7: PUMPS

7.1   A pump is a mechanical device used to transport a fluid from one location to another location.   (1)

7.2   7.2.1   A – Outlet / High pressure
                    B – Inlet / low pressure
                    C – Gear
                    D – Casing
                                                              (4 × 1)   (4)

         7.2.2   Positive displacement   (1)
                                                                            [6]

QUESTION 8: COMPRESSORS

When the piston moves outwards, air is sucked into the cylinder through the inlet valve✓ while the outlet valve will close.✓ With the inward movement of the piston, the inlet will close✓ and the compressed air will be forced out through the outlet valve.✓   **[4]**

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

9.1
- Ensure that the safety guards are present.
- The machine must be switched off when replacing belts.
- Use the correct size V-belt.
- Ensure that the belt is not slack.
- Never adjust V-belts while the machine is running.
- Prevent dirt and oil from getting onto a V-belt.
- Ensure that the pulleys are tightly fitted onto the shafts.
- Ensure that pulleys are properly aligned.   (Any 2 × 1)   (2)

9.2   Drive pulley / Driving pulley   (1)

9.3
- Compact and can be used in confined spaces
- Provides a direct drive
- Positive drive/No slip takes place
- Lasts longer / more durable
- Can deal with high torque   (Any 3 × 1)   (3)

9.4
- Wear causes elongation of chains
- Cannot operate at high speeds
- Breaks without warning
- Noisy during operation
- Flexible in one plane only
- Sprockets need replacing due to wear   (Any 4 × 1)   (4)

9.5   Reduction gearing means the speed of power drives are reduced drastically,✓
        but at the same time heavier work can be done without the load stopping the
        motor.✓   (2)
                                                                              [12]

                                                        TOTAL SECTION A: 60

SECTION B

Answer only TWO questions from this section.

QUESTION 10: PNEUMATICS AND HYDRAULICS

10.1   •   Pressure
         •   Volume/Area   (2)

10.2   10.2.1   Reservoir
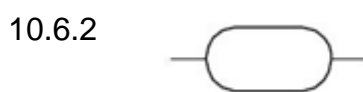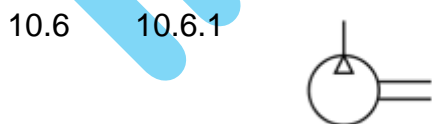
        10.2.2   Hydraulic pump

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

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

        10.4.3   Through the circulation of hydraulic fluid heat is dissipated.
                                                        (3 × 1)   (3)

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

10.6   10.6.1

        10.6.2

        10.6.3

                                                             (3 × 1)   (3)

                                                        Please turn over

10.7 • Check for leaks/cracks.
   • Check for kinks.
   • Check for perished rubber   (3)
                                                                              [20]

QUESTION 11: CENTRE LATHE

11.1 • Travelling steady
   • Fixed steady   (2)

11.2 11.2.1 • Short tapers can be cut to any angle.
            • It is simple to operate and calculate.
            • Internal and external tapers can be turned.   (3)

      11.2.2 • It is not accurate.
            • The length of the taper is limited to the travel of the compound
              slide.
            • It can only be fed by hand causing fatigue to the operator and
              inaccurate surface finish of the workpiece.   (3)

11.3 11.3.1 This type of programming allows each tool movement to be made
             with reference to the prior movement.

      11.3.2 This system of programming measures all tool movement from fixed
             point, origin or zero.

      11.3.3 These are code commands for the machine to prepare for a specific
             machining cycle

      11.3.4 These commands are specific instructions for the machine, e.g.,
             machine stop, machine start, coolant on, coolant off, spindle stop,
             etc.
                                                              (4×1) (4)

11.4 11.4.1 $\text{Lead} = \text{Number of starts } \times \text{pitch of thread}$
                   $= 2 \times 6$
                   $= 12 \text{ mm}\checkmark$

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

              $\qquad = \dfrac{12}{\pi \times 90} \; \checkmark$

              $\qquad = 0{,}04 \; \checkmark$

              $\theta = 2{,}29° \; \checkmark$ (4)

11.4.2   Leading angle = 90 - (helix angle + clearance angle)
                        = 90 - (2,29 + 4°) ✓
                        = 83,71°✓   (2)

11.4.3   Following angle = 90 + (helix angle - clearance angle)
                        = 90 + (2,29 - 4°) ✓
                        = 88,29°✓   (2)

[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDING

12.1   12.1.1   Up-cut milling
        12.1.2   Gang milling
        12.1.3   Straddle milling
        12.1.4   Slab milling
        12.1.5   Down-cut milling

                                                           (5 × 1)   (5)

12.2 $S = \pi DN$

        $= \pi \times 0,04 \times 320$ ✓

        $= 40,21 \text{ m/min}$ ✓   (2)

12.3   12.3.1

Rapid Indexing $= \dfrac{24}{N}$ ✓

$= \dfrac{24}{6}$ ✓

$= 4$ holes ✓   (3)

12.3.2

Simple Indexing $= \dfrac{40}{N}$

$= \dfrac{40}{6}$ ✓

$= 6\dfrac{2}{3}$ ✓

$= 6\left[\dfrac{2}{3} \times \dfrac{13}{13}\right]$ ✓

$= 6\ \dfrac{26}{39}$ ✓

Indexing = 6 full turns of the crank handle and 26 holes in a 39-hole circle.✓   (5)

12.4
- Machine vibration
- Worn or insufficiently lubricated wheel spindles
- Out of balance wheel
- Wheel not true
- Wheel too hard
- Foundation not solid
- Other machine vibrations   (Any 4 × 1)   (4)

12.5   The actual size of the abrasive particles is called the grit or grain size.   (1)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100