



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

METAL WORKERS' THEORY N1

28 November 2023

This marking guideline consists of 7 pages.

QUESTION 1: SAFETY AND HOUSEKEEPING

- 1.1 Occupational Health and Safety Act (2)
- 1.2 Horseplay (1)
- 1.3 This will ensure that the whole scaffold remains level for its full height and length. (1)
- 1.4 Full body harness with double lanyard (safety harness) or similar (1)
(5 × 1) **[5]**

QUESTION 2: CARE AND USE OF TOOLS

- 2.1 They are used to shape metals✓ and do work in confined spaces.✓ (2)
- 2.2 That the jaws are in full contact with the nut or bolt head
OR
That the nut or bolt head fits snug between the jaws of the spanner (1)
- 2.3 It is used to check the squareness of small jobs. (1)
- 2.4
- Podger spanner
 - Box spanner
 - Ring spanner
 - Flat spanner
 - Ratchet spanner
 - Adjustable spanner
 - Wrench (Any 3 × 1) (3)
- 2.5 To measure an angle, take the measurement (angle required) on the line of chords✓ and open the legs of the ruler so that the points of the dividers are exactly in the dots. The legs of the ruler will be at the required angle.✓ (2)
- 2.6 $H^2 = X^2 + Y^2$
 $H^2 = (2,5)^2 + (1,5)^2$ ✓
 $H = \sqrt{6,25 + 2,25}$ ✓
 $Y = 2,916$ m✓ (3)
[12]

Engineering Studies (11022061)

QUESTION 3: DEVELOPMENTS

- 3.1 See Addendum A (2)
- 3.2 See Addendum A (2)
- 3.3 Circumference = 3,142 × diameter
3,142 × 40 mm✓
157,0796 mm✓ (2)
- 3.4 See ADDENDUM A (4)
- [10]**

QUESTION 4: METALS AND PLATES AND SECTIONS

- 4.1 4.1.1
- Corrosion-resistant
 - High tensile strength
 - Durable
 - Ductile
 - Temperature-resistant (cannot be heat-treated)
 - Impact-resistant
 - Abrasion-resistant (Any 2 × 1) (2)
- 4.1.2 It is very light,✓ tough,✓ malleable,✓ ductile and corrosion-resistant,✓ and is a good conductor of heat and electricity.✓ (Any 2 × 1) (2)
- 4.2 4.2.1 It refers to the material's ability to withstand impact✓ or hammering loads without cracking or breaking.✓ (1)
- 4.2.2 It refers to the ability of metal to return to its original shape after being stretched, bent, compressed or deformed. (1)
- 4.2.3 Metal can be hammered into shape without cracking. (1)
- 4.3 4.3.1 Centre line
4.3.2 Other side up
4.3.3 Mild steel plate (3 × 1) (3)
- 4.4 A Angle iron
B Diamond mesh sheet
C I-beam
D Checked plate (4 × 1) (4)
- [14]**

QUESTION 5: MACHINES

- 5.1 5.1.1 It is used for drilling holes in steel plates, flat bars, etc. (up to 13-mm shank diameter).
- 5.1.2 It is used to bend steel plates or flat bars into various angles.
- 5.1.3 It is used to roll steel plates into circular shapes.
- 5.1.4 It is used to shear steel plates (long or short lengths).
- 5.1.5 It is used to cut various steel sections using a rotating blade. (5 × 1) (5)
- 5.2
 - Check the grinding wheels for cracks.
 - Wear safety goggles.
 - Ensure that the machine guards are in position.
 - Only one person may operate the machine.
 - Wear ear protection.
 - Ensure that the work rest is set at a suitable distance.
 - Set the machine at the correct working speed.
 - Do not overload the machine.
 - Do not grind on the side of the wheel.(Any 5 × 1) (5)
- [10]**

QUESTION 6: JOINTS AND BOLTED JOINTS

- 6.1
 - Black bolt
 - Machined bolt
 - Countersunk bolt
 - Huck bolt(4)
- 6.2 Total length = total material thickness + washer thickness + nut height + two threads✓
 = Mt + W + N + S
 = (10 + 10) + 3 + 12 + 4✓
 = 39 mm✓
 The standard length of the bolt closest to that is 40 mm.✓
(4)
- 6.3 They are used in general steel work and structures in direct bearing situations where bolt shearing is minimal✓ and where hole clearance is not a problem (up to 2-mm clearance between hole and bolt can be found).✓
(2)
- [10]**

QUESTION 7: ARC WELDING

- 7.1
- Leather apron✓ – Protects the body against burns from sparks, drops of molten metal and radiation✓
 - Leather spats✓ – Cover the shoes, protecting the feet from any molten metal or sparks✓
 - Leather gloves✓ – Protect the hands and arms from burns, cuts and scratches✓
 - Welding cap✓ – Protects the head from welding sparks✓
 - Leather yoke✓ – Protects the chest and arms from welding sparks and molten droplets, especially when doing overhead welding✓
 - Safety boots✓ – Prevent injury to feet due to falling objects or sharp metal edges✓
 - Overall✓ – Must provide sufficient coverage to prevent burns caused from sparks, spatter or radiation✓ (Any 5 × 2) (10)
- 7.2
- The DC welding machine has a lower operating efficiency than the AC welding machine.
 - Maintenance costs are much higher on the DC welding machine than on the AC welding machine.
 - The DC welding machine is initially more expensive than an AC welding machine of the same size.
 - There is no arc blow with an AC welding machine. Above 200 amperes, the magnetic effect of the electric arc created by the direct current causes arc blow.
 - The DC welding machine is noisier than the AC welding machine (Any 4 × 1) (4)
- [14]**

QUESTION 8: OXYACETYLENE AND LPG CUTTING AND WELDING

- 8.1
- Tinted safety goggles
 - Leather gloves
 - Leather spats
 - Leather apron
 - Full body overall
 - Safety shoes (Any 5 × 1) (5)
- 8.2
- Incorrect regulator pressure (pressure too low)✓ – Ensure that the regulator pressure is correctly set before lighting the torch.✓
 - The nozzle is too close to the material✓ – Lift the nozzle and ensure that it does not get closer than 3 mm from the inner to the metal.✓
 - The nozzle is blocked or dirty✓ – Clean the nozzle or replace it if it cannot be cleaned properly.✓

- Attempting to light the torch with a mixture of fuel and oxygen ✓ – Light the torch with only the fuel open. ✓
- The nozzle is overheated ✓ – Replace the nozzle. ✓
- The hoses were not purged before lighting the torch ✓ – Purge the hoses properly. ✓ (Any 4 × 2) (8)

8.3 An approved leak detecting fluid ✓ that must be applied at all joints ✓ (2)
[15]

QUESTION 9: CALCULATIONS AND PLANNING

Calculation of half circle:

$$\begin{aligned} \text{Half circle length} &= (\text{mean diameter} \times \pi) \div 2 \checkmark \quad \text{or} \quad (\text{radius} + \frac{1}{2} \text{ thickness}) \times \pi \\ &= ([310 + 6] \times \pi) \div 2 &= (155 + 3) \times \pi \\ &= (316 \times \pi) \div 2 &= 158 \times \pi \\ &= 980,177 \div 2 &= 496,372 \text{ mm} \\ &= 496,372 \text{ mm} \checkmark \end{aligned}$$

Calculation of long leg length:

$$\begin{aligned} \text{Leg length} &= \text{leg length} - \text{plate thickness} \checkmark \\ &= 175 - 6 \\ &= 169 \text{ mm} \checkmark \end{aligned}$$

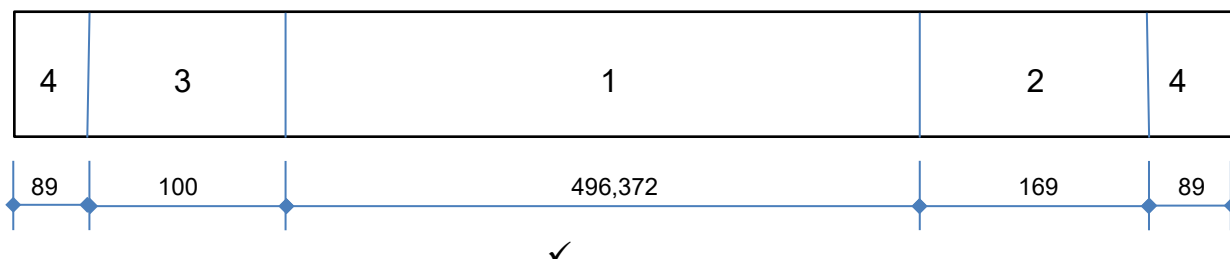
Calculation of short leg length:

$$\text{Leg length} = 100 \text{ given} \checkmark$$

Calculation of foot length:

$$\begin{aligned} \text{Foot length} &= \text{foot length} - \text{plate thickness} \checkmark \\ &= 95 - 6 \\ &= 89 \text{ mm} \checkmark \end{aligned}$$

$$\begin{aligned} \text{Total length of bracket} &= \text{half circle} + (2 \times \text{leg length}) + (2 \times \text{foot length}) \checkmark \\ &= 496,372 + (169 + 100) + (2 \times 89) \\ &= 943,372 \text{ mm} \checkmark \end{aligned}$$



[10]

TOTAL: 100

