



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

METAL WORKERS' THEORY N1

2 AUGUST 2021

This marking guideline consists of 6 pages and 1 addendum.

QUESTION 1: SAFETY AND HOUSEKEEPING

- 1.1 The work piece can spin around and cut you.
- 1.2 The hammer head can fly off and hit your fellow workers.
- 1.3 The small particles can damage your eyes.
- 1.4 Pieces of the mushroom can break off and injure the operator/bystanders.
- 1.5 The sharp edges of the plate will injure the worker by cutting his/her hands. (5 × 1) **[5]**

QUESTION 2: CARE FOR AND USE OF TOOLS

- 2.1 2.1.1 Outside callipers
2.1.2 Inside callipers
2.1.3 Chalk line
2.1.4 Sledgehammer
2.1.5 Wrench (5 × 1) (5)
- 2.2 2.2.1 To measure long lengths
2.2.2 To measure or obtain an angle
2.2.3 To draw large circles
2.2.4 To mark the centre of a hole to be drilled
2.2.5 To determine the squareness or accuracy of a small job (5 × 1) (5)
- 2.3 $X^2 + Y^2 = R^2$
 $90 \text{ mm}^2 + 120 \text{ mm}^2 = R^2$
 $8100 + 14400 = R^2 \checkmark$
 $22500 = R^2 \checkmark$
 $150 \text{ mm} = R \checkmark$ (3)
- 2.4 2.4.1 False
2.4.2 False (2 × 1) (2) **[15]**

QUESTION 3: DEVELOPMENTS (PARALLEL LINE METHOD)

- 3.1 See the addendum attached. (2)
- 3.2 See the addendum attached. (2)
- 3.3 $C = 3,142 \times 44$
 $= 138,23 \text{ mm} \checkmark \checkmark$ (2)
- 3.4 See the addendum attached. (4) **[10]**

QUESTION 4: METALS

- | | | | | |
|-----|-------|---|-------------|-----|
| 4.1 | 4.1.1 | Stainless steel✓✓ | | |
| | 4.1.2 | Aluminium✓✓ | | |
| | | | (2 × 2) | (4) |
| 4.2 | 4.2.1 | The impact strength of a material refers to the material's ability to withstand the impact of hammering loads without cracking or breaking. | | |
| | 4.2.2 | It refers to the ability of metal to return to its original shape after being stretched, bent, compressed or deformed. | | |
| | 4.2.3 | The ability of a metal to be hammered into shape without cracking. | (3 × 1) | (3) |
| 4.3 | 4.3.1 | Drawing | | |
| | 4.3.2 | Galvanised | | |
| | | | (2 × 1) | (2) |
| 4.4 | | <ul style="list-style-type: none"> • Rolled steel joist • H-beam • Rolled steel channel • I-beam | (Any 3 × 1) | (3) |

[12]**QUESTION 5: MACHINES**

- | | | | |
|-----|---|-------------|-----|
| 5.1 | <ul style="list-style-type: none"> • Ensure that the area around the machine is clear of any tripping hazards. • Make sure that all hands or fingers are out of the way before operating the press. • Do not hold or grip the plate tightly to be bent. Merely support it, as the plate may jerk when it is bent. • Do not overload the machine by trying to bend plates thicker than the capacity of the bending machine. • Ensure the work does not fall during the bending process. • Ensure the blade and V-blocks are a set and are the correct size for the thickness of plate to be bent. • Only one person should give instructions and operate the machine. • Take note of the position of the emergency stop button or switch. • Make sure that all guards are in position and are operating correctly before using the machine. | (Any 5 × 1) | (5) |
|-----|---|-------------|-----|

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- 5.2
- Ensure that the steel section to be cut is firmly secured before cutting it.
 - Keep the area around the machine clean and tidy at all times.
 - Only one person should give instructions and operate the machine.
 - Use a paint brush, not your hands, to clean away the shavings on the machine.
 - Keep hands clear of blade and supporting cylinders (holding down clamps).
 - Wear appropriate PPE.
 - Do not leave the machine unattended at any time.
- (Any 5 × 1) (5)
[10]

QUESTION 6: JOINTS AND BOLTED JOINTS

- 6.1 6.1.1 They are used where a smooth surface is required to finish the job. ✓✓
- 6.1.2 They are used where low-stress loads are experienced. ✓✓
(2 × 2) (4)
- 6.2
- Black bolt
 - Machined bolt
 - Countersunk bolt
 - Huck bolt
- (Any 3 × 1) (3)
- 6.3 6.3.1 The distance between two rivets from centre to centre in the same row.
- 6.3.2 It is when two plates overlap with each other.
- 6.3.3 The distance from the centre of a rivet or bolt to the edge of the plate.
(3 × 1) (3)
[10]

QUESTION 7: OXYACETYLENE AND LPG CUTTING AND WELDING

- 7.1
- The torch is held in the right hand and the filler rod in the left hand.
 - The torch precedes the filler rod as the movement is from left to right.
 - The torch is held at an angle of 40° to 50° and no sideways movement is required as the flame is directed at the completed weld.
 - The filler rod is held at an angle of 30° to 40° and is moved from side to side in small circular movements.
 - The groove required is less than 80° and therefore uses less filler rod.
- (5)

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- 7.2 To test for gas leaks, you must use a soap solution.✓ Mix the soap solution properly✓ and apply to all joints of the oxyacetylene equipment by using a paint brush.✓ If there is a leak, the soap solution will start to bubble.✓ Do not continue using the equipment until the leak is repaired. Do not use matches, bodied plastic lighters or the nose to detect gas leaks.✓ (5)
- 7.3
- Welding goggles – to protect the eyes
 - Heavy leather gloves – to protect the hands
 - Heavy leather spats – to protect the feet
 - Heavy leather apron – to protect the body
 - A cap or hat – to protect the head
- (5)
[15]

QUESTION 8: METAL ARC WELDING

- 8.1
- 8.1.1 The term 'earthing' refers to the earth clamp, which is connected to the metal to be welded.
- 8.1.2 The electricity flowing through the electrode, melting the tip of the electrode.
- 8.1.3 Provides alternating current or direct current for welding.
- 8.1.4 Direction in which electrons move when an arc is struck.
- 8.1.5 A set of insulated copper welding cables to carry the current to the electrode holder and the earth clamp. (5 × 1) (5)
- 8.2
- Check that all electric connections are secure.
 - Check that electric cables are in good repair.
 - Ensure that the electrode holder and the earth clamp are in a good condition.
 - Have a fire extinguisher within easy reach.
 - Ensure there is enough ventilation for your own safety. (Any 5 × 1) (5)
- 8.3 Alternating current has no polarity✓ as the positive and negative poles reverse their polarity with each cycle of the power supply.✓ Since the flow of electrons changes direction so rapidly,✓ the heat generated by the arc is divided equally between the tip of the electrode✓ and the metal being welded.✓ (5)
[15]

QUESTION 9: CALCULATIONS

9.1 Internal stiffening ring:

$$\text{Mean diameter} = 840 \text{ mm} - (5 \text{ mm} + 5 \text{ mm})$$

$$= 830 \text{ mm}$$

$$\text{Circumference} = 3,142 \times 830 \text{ mm}$$

$$= 2607,86 \text{ mm}$$

(4)

9.2 External stiffening ring:

$$\text{Diameter} = 840 \text{ mm} + 6 \text{ mm} + 6 \text{ mm}$$

$$= 852 \text{ mm}$$

$$\text{Mean diameter} = 852 \text{ mm} + 5 \text{ mm} + 5 \text{ mm}$$

$$= 862 \text{ mm}$$

$$\text{Circumference} = 3,142 \times 862 \text{ mm}$$

$$= 2708,4 \text{ mm}$$

(4)

[8]**TOTAL: 100**

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ADDENDUM

