higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

WELDERS' THEORY N2

9 APRIL 2013

This marking guideline consists of 8 pages.

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QUESTION 1: MACHINES

1.1 Safety precautions – Angle grinding machine

- Wear safety goggles.
- Make sure there is a screen between you and workers nearby.
- Never use the machine without the guard.
- Ensure that the electric cord and the grinding disc are in good condition.
- Do not jam the disc in the work piece.
- When you put the machine down, ensure the disc stopped rotating.
- When changing discs, take the plug out of the wall socket.
- Keep fingers away from moving disc.
- Before grinding or cutting allow the wheel to reach the maximum speed.

(ANY THREE) (3)

1.2 Bending rolls machine

A End post
B Adjustable top roller
C Bottom rollers
D Power point (4)

1.3 Working principle - Guillotine

The top blade is angled in relation to the bottom blade which is fixed horizontally. The plate is inserted between the two blades. The machine automatically holds the plate down. The top blade moves parallel to the bottom blade to make the cut. (3)

[10]

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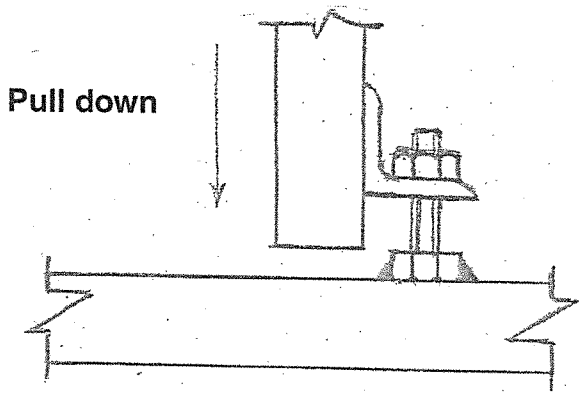
QUESTION 2: JOINING OF ROLLED STEEL SECTIONS

2.1 A *jig* is a device which holds different parts together in their proper relation to each other for tacking or welding. (2)

2.2 Tighten the nut until the plates align.



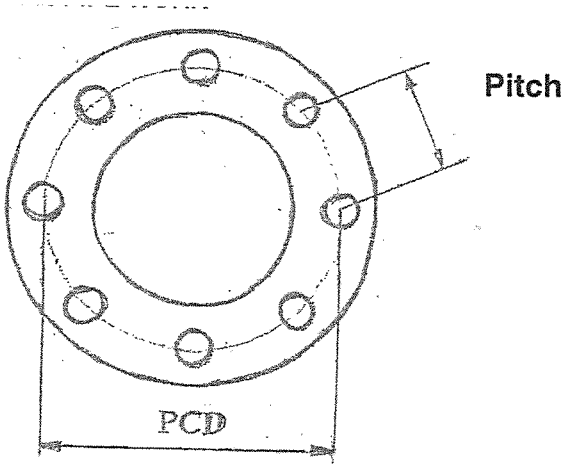
(3)

2.3 Notching

The cutting out of a part of a steel profile for bending purposes or to fit in other steel profiles. (2)
[7]

QUESTION 3: GENERAL PIPE WORK

3.1 Pipe Flange



(4)

3.2 Length of 45° bend $= \frac{45° \times 2 \times \pi \times R}{360°}$

$= \frac{45° \times 6{,}283 \times 230}{360°}$

$= 180{,}6$ mm

Length of bend = 180,6 mm (4)
[8]

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QUESTION 4: DEVELOPMENT

Radial line method
Square-to-square hood

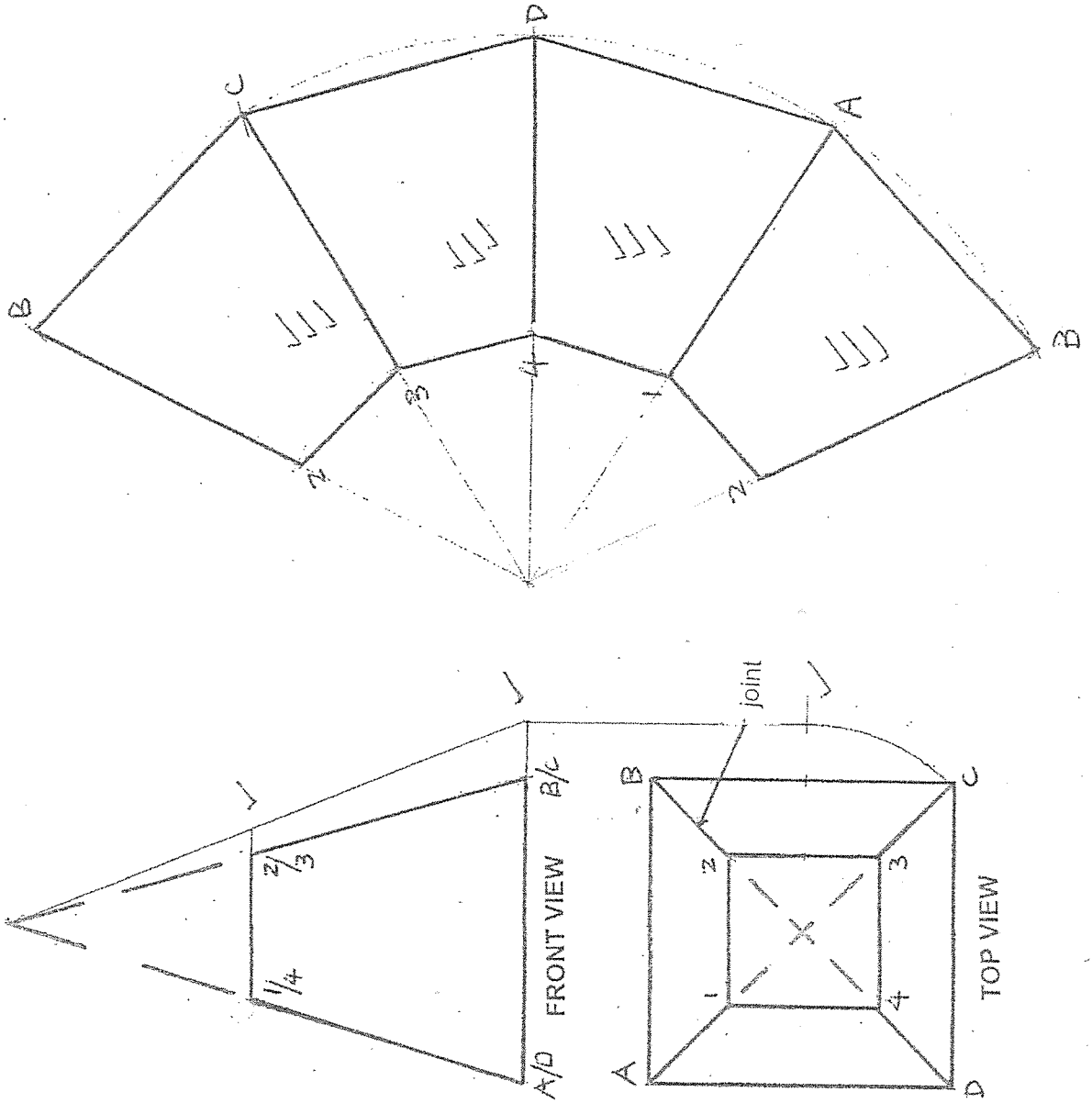

FIGURE 3 **[15]**

QUESTION 5: STEEL STRUCTURES

Length of rafter $= \sqrt{9^2 + 3^2}$

$= \sqrt{81 + 9}$

$= \sqrt{90}$

$= 9{,}48$ m **[5]**

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QUESTION 6: METALS

6.1
- Engine blocks
- Ornaments
- Machine slides and beds
- Bearings
- Stoves

(ANY TWO) (2)

6.2 V-angle is 60°–70° (2)

6.3 Components of stainless steel

- Iron
- Carbon
- Chrome
- Nickel

(4)

6.4 6.4.1 Carbon
Hardens the steel and it becomes iron carbide. When more carbon is added it is a cementite structure, which is even harder. (3)

6.4.2 Manganese
- Improves hardness
- Improves strength
- Provides a non-shrinking steel

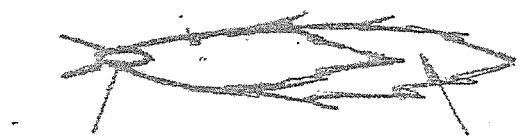
(ANY TWO) (2)

6.4.3 Vanadium
- Refines the structure of steel
- Increases resistance to wear
- Has great endurance under repeated loading

(ANY TWO) (2)
[15]

QUESTION 7: GAS WELDING

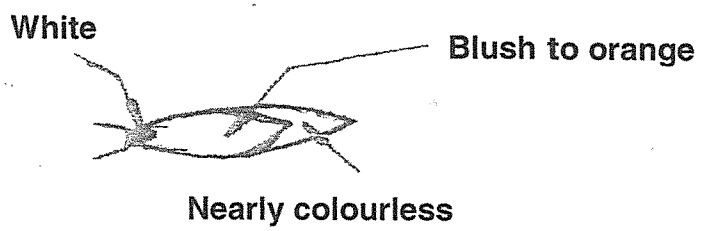
7.1 The carbonising flame is recognised by the feathery edge of the white cone.



Intense white with feathery edge **Light orange**

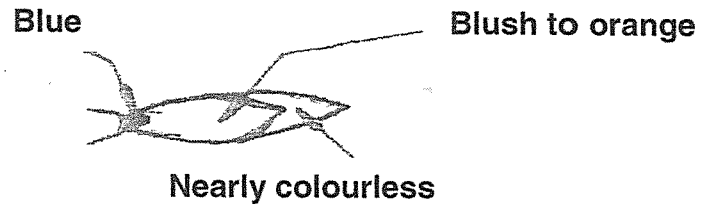
(1)

The neutral flame is recognised by a well-defined white cone surrounded by a colourless outer flame.



(1)

The oxidizing flame recognised by a small pointed blue cone surrounded by a shorter flame.



(1)

7.2 High-pressure system
Low-pressure acetylene and high-pressure oxygen are supplied from cylinders where gasses are stored in compressed form. The pressure is controlled by cylinder gauges. (2)

Low-pressure system
Low pressure acetylene is supplied from a generator. It is purified, dried and then passed to the blow torch. The oxygen is supplied from high-pressure cylinders with control gauges. The blow torch is designed for high-pressure oxygen to inject low-pressure acetylene into the nozzle. (2)

7.3 Porous material such as fuller's earth or wood pulp, acetone (2)

7.4 Safety precautions: Oxy-acetylene welding

- When working on galvanised or painted plates, work in a well-ventilated area or wear an approved respirator.
- Safety clothing and equipment must be used at all times.
- Suitable fire-fighting equipment must be readily available.
- Cylinders must be secured in an upright position away from sparks and flames.
- Open valves slowly to prevent damage to the regulators.
- Do not work on tanks that may have an explosive substance, without taking the necessary safety measures.
- When working in a tank or in a confined space, cylinders must be left outside and the torch lit and then passed in. An assistant must be stationed outside.

(ANY THREE) (3)
[12]

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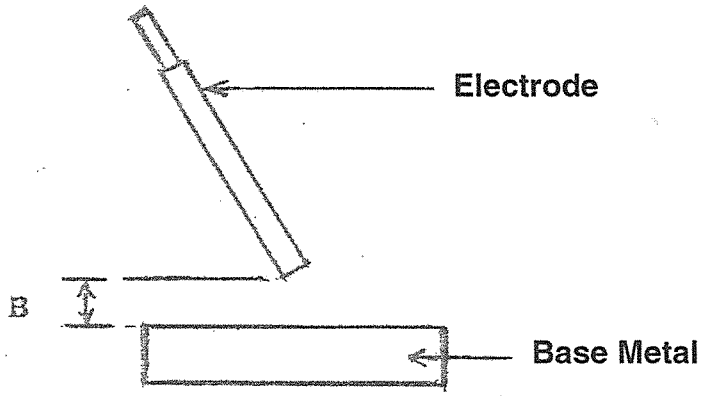
QUESTION 8: ARC WELDING

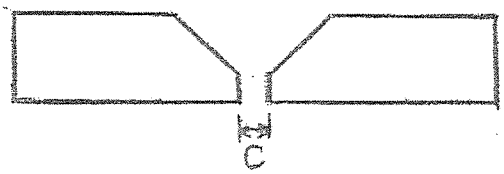
8.1 8.1.1 Arc length

B = Arc length – distance from the base metal to the tip of the electrode



(2)

8.1.2 C = Gap – distance between the parts to be welded together



(2)

8.2 The foot control is fitted to the TIG welding machine to regulate the current while welding. This allows the welder to continue welding without adjusting the setting of the machine when the base metal heats up. (2)

8.3 Components – MIG welding machine

- Gas supply
- Wire reel
- Central control system
- Wire feed unit
- Power source
- Gun control
- Workpiece

(ANY FIVE) (5)

8.4 Straight polarity - The workpiece is connected to the positive side of the supply current and the electrode to the negative side. (2)

8.5 Operation – gas feed unit – MIG

The gas flow from the gun to the workpiece is controlled by the trigger on the welding gun. It is designed to release gas just before the electrode, so that when the arc begins there is already shielding gas. (2)

[15]

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QUESTION 9: WELD TESTING

9.1 Defects: X-ray testing

- Porosity
- Slag inclusion
- Cracks
- Lack of side wall fusion
- Lack of root penetration

(ANY THREE) (3)

9.2 Types of iron particles

- In the form of dry powder
- Suspended in liquid

(2)
[5]

QUESTION 10: HEAT TREATMENT

10.1 Pearlite structure of steel

Consists of layers of ferrite and cementite. Cementite is the carbon found in steel. Pearlite contains 0,83% carbon and is formed when the steel drops below 695 °C during the cooling process, from molten iron. The pearlite composition is made up of 87% ferrite and 13% cementite. (4)

10.2 Precautions – hardening steel

- Steel must not be over-heated
- Steel must be heated at a uniform rate
- Steel must be heated thoroughly
- Do not quench at higher temperatures than those specified

(ANY TWO) (2)

10.3 Post heating – is applying heat after welding to remove stresses. (2)
[8]

TOTAL: 100

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