higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

REFRIGERATION PRACTICE
NQF LEVEL 3

7 December 2020

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 N
1.2 H
1.3 F
1.4 A
1.5 G

(5 × 1) **[5]**

QUESTION 2

2.1 $pV = mRT$

$$V = \frac{mRT}{p} \checkmark$$

$$= \frac{5 \times 287(273+25)}{101325} \checkmark$$

= 4.22 m^3✓ (3)

2.2 $$V_2 = V_1 \times \frac{T_2}{T_1} \checkmark$$

$$= 0.75 \times \frac{273+90}{273+20}$$ (temperatures to the nearest K)✓

= 0.93 m^3✓ (3)

2.3 Specific gravity of oil = 0.9
Depth of oil in the tube, *h* = 120 cm = 1.2 m✓

Gauge pressure = *wh*
= p.*g*.*h* , p being the mass density
= (0.9p_w) × *g* × *h* , p_w being mass density of water
[Specific gravity = p/p_w]
= 0.9 × 1000 × 9.81 × 1.2N/m^2✓
= 105944.82N/m^2✓
= 10.595kN/m^2✓ (4)

2.4 Diameter of the piston *d* = 10cm = 0.1m✓
Force applied on the piston, *F* = 1000N✓

Therefore, pressure on the piston, $p = \frac{Force}{Area} = \frac{F}{A} = \frac{1000}{\pi/4 \times (0.1)^2}$ ✓

= 127307 N/m^2✓
= 127.307 kN/m^2✓ (5)

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2.5 When the valve is opened, the two vessels shall be connected through the pipe and the transfer of air shall take place in order to attain a state of equilibrium. After the attainment of equilibrium, the total mass of air shall be 24 kg.

Final volume = 2 × 2 = 4 m^3✓
Using perfect gas equation, $pV = mRT$

$$p = \frac{mRT}{V} \checkmark$$

For air, R = 287J/kg K

Substituting values, $$p = \frac{24 \times 287 \times 300}{4} \checkmark$$

= 516600 N/m^2✓

Final pressure = 516.6 kPa✓ (5)

[20]

QUESTION 3

3.1 Electrical earthing means providing an alternative path for dangerous currents to flow so that accidents due to electric shock and damage to the equipment can be avoided. (2)

3.2
- It keeps people safe by preventing electric shocks.
- It avoids damage to electrical appliances and devices by preventing excessive current from running through the circuit.
- It prevents the risk of fire that could be caused by a current leakage. (3)

3.3 Step 1: Switch off the main switch, earth leakage unit and all the circuit breakers. Unplug everything and switch off the isolators.

Step 2: Switch on the earth leakage unit first. Then switch on the main switch. If the earth leakage trips, the chances are that you have a neutral fault. If the earth leakage unit stays up/on, go to step 3.

Step 3: Switch on one circuit breaker at a time and wait for a second or two. If the earth leakage trips as you switch on a circuit breaker, leave the circuit breaker down/off and switch on the next circuit breaker. If the rest of the circuit breakers are reset without tripping the earth leakage unit, then you have identified the circuit. Now you can plug the appliance in and switch on the isolators.

Step 4: Start plugging in appliances and switch on isolators one at a time until the cable or appliance trips the earth leakage. Unplug the appliance which trips the earth leakage and leave it unplugged. You have identified the problem. (4)

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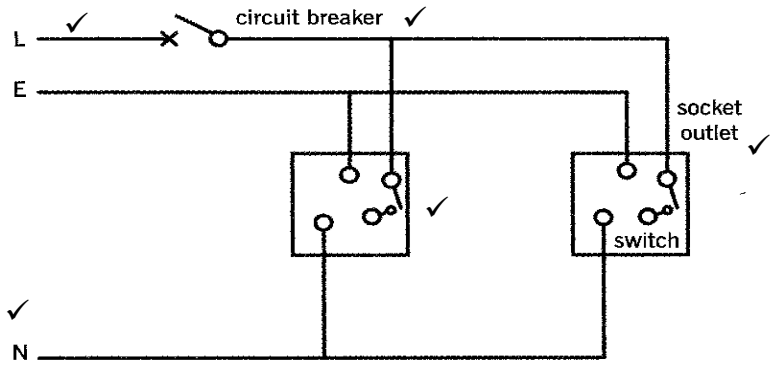
3.4 3.4.1 Shaft
3.4.2 End bell
3.4.3 Windings
3.4.4 Rotor
3.4.5 Base

(5 × 1) (5)

3.5
- 5 A circuit breaker
- 1 mm^2 cable (red, black and green/yellow)
- 20 mm PVC conduit
- 20 mm saddles
- 20 mm couplings
- 20 mm inspection bends (6)

3.6



(5)
[25]

QUESTION 4

4.1 4.1.1 Capillary tube cutter
4.1.2 Deburrer
4.1.3 Pinch-off plier
4.1.4 Telescope inspection mirror
4.1.5 Fire extinguisher
4.1.6 Digital multimeter

(6 × 1) (6)

4.2 4.2.1 If the voltage is too low, the amperage increases. This may result in the components melting down or may cause the appliance to malfunction. (2)

4.2.2 If the voltage is too high, this will cause appliances to run too fast and too high, which will shorten their service life. (2)

4.3 The defrost mechanism in a refrigerator heats the cooling element (evaporator coil)✓ for a short period of time and melts the frost that has formed on it.✓ The resulting water drains through a duct at the back of the unit. ✓ Defrosting is controlled by an electric or electronic timer✓ :For every 6,

8, 10, 12 or 24 hours of compressor operation it turns on a defrost heater for 15 minutes to half an hour.✓ (5)

4.4 Step 1: Stop the compressor.
Step 2: Remove the remote bulb from the suction line.
Step 3: Place bulb in a container of ice water.
Step 4: Start the compressor.
Step 5: Remove the bulb from the ice water and warm in hand. At the same time, check the temperature of the suction line at the evaporator. If a rapid reduction in temperature is noted, the element works properly. (5 × 2) (10)

[25]

QUESTION 5

5.1 To regulate the operation and construction of refrigeration and air-conditioning plants in South Africa. (2)

5.2 5.2.1 A competent person is an employee who is able to recognise hazards associated with a particular task and mitigate those hazards.

5.2.2 A fusible plug is a threaded metal cylinder, usually made of bronze, brass or gunmetal, with a tapered hole drilled through its entire length.

5.2.3 A pressure relief valve is a type of safety valve used to control or limit the pressure in a system. Pressure might otherwise build up and create a process upset, instrument or equipment failure, or fire. (3 × 2) (6)

5.3
- Read the identification on the container
- Look at the colour of the container
- Measure the refrigerant temperature and pressure
- Take a sample for laboratory analysis (4)

5.4 An oblique sketch puts more focus on the face or front of an object✓✓ whereas an isometric sketch puts more focus on the edge of an object.✓✓
Oblique sketches are drawn using a 45-degree angle to render the third dimension✓✓ whereas isometric sketches are drawn using a 30-degree angle.✓✓ (Any 2 × 2) (4)

5.5 5.5.1 Condenser
5.5.2 Low-pressure gas
5.5.3 Accumulator
5.5.4 Low-pressure liquid
5.5.5 Expansion device
5.5.6 Suction line
5.5.7 Filter drier
5.5.8 Compressor
5.5.9 Discharge line

(9 × 1) (9)

[25]

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TOTAL: 100

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