higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

REFRIGERATION AND AIR CONDITIONING PROCESSES
NQF LEVEL 4

11 March 2020

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 1.1.1 True
1.1.2 False
1.1.3 True
1.1.4 True
1.1.5 False

(5 × 1) (5)

1.2 1.2.1 Point C
1.2.2 Between point D and A
1.2.3 Point A
1.2.4 Point B
1.2.5 Between B and C

(5 × 1) (5)

1.3
- Reduces efficiency of the system✓
- and increases superheating at the evaporator✓
- pressure drop and
- a drop in the saturation temperature (Any relevant 2 × 1) (2)

1.4 Controls the quality of air (Any relevant 1 × 2) (2)

1.5 Maintains a constant pressure in the evaporator by flooding more or less of the evaporator surface in response to the refrigeration load (2)

1.6
- Hot water is fed by sprays into the tower.
- Cold air is fed by induction of fans into the tower.
- Cold water is drawn at the bottom of the cooling tower.
- Heat is rejected to the atmosphere by hot air . (Any relevant 4 × 1) (4)

[20]

QUESTION 2

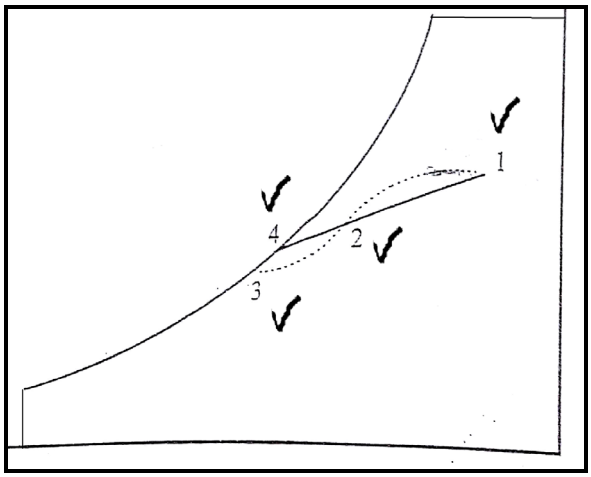
2.1 2.1.1 $m = V/U$✓
$= 1,5/1,015$
$= 1,478$ kg/s✓

$Q = m\Delta h$✓
$= 1,477 \times 21,3$✓
$= 31,5$ kW✓ (5)

2.1.2 $Q = V C_p \Delta t$✓
$V = Q/C_p \Delta t$✓

$V = 31,5/4,187 \times 10$✓
$= 0,752$ kg/s✓
$= 0,752$ ℓ/s✓ (5)

2.2



(4)

2.3 2.3.1 Volume that 1 kg of mixture will occupy

2.3.2 When an air vapour mixture is cooled at a constant pressure, the temperature at which the mixture becomes saturated and moisture starts to condense

2.3.3 Moisture content in the air

(3 × 2) (6)
[20]

QUESTION 3

3.1 3.1.1 Safety controls regulate the functions of the plant to ensure it stays within the design parameters.

3.1.2 Operational controls regulate the functions of the plant to ensure it meets the demand.

(2 × 2) (4)

3.2 It is used to cycle the compressor for capacity-control purposes or as a low-limit control. (2)

3.3
- Avoids repeated starting of the compressor if automatic
- Protects the compressor
- Allows for fault finding before starting again (3)

3.4 The automatic-reset control can start on its own after system has equalised✓✓ whereas the manual-reset control needs a technician to restart the system.✓ (3)

3.5
- Amount of ice on the evaporator
- Amount of heat supplied to the evaporator (2)

3.6 3.6.1 saturated

3.6.2 increases

3.6.3 decreases

3.6.4 drop

3.6.5 High

3.6.6 Directly (6 × 1) (6)
[20]

QUESTION 4

4.1 A: Rotor
B: Stator
C: Terminal box
D: Fan cowl (4 × 1) (4)

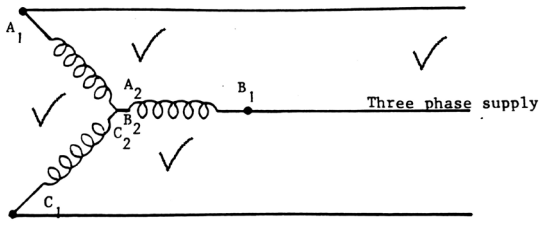
4.2 4.2.1 Illustrates all the electrical equipment and main isolator

4.2.2 Gives the installation electrician information on the location of the equipment, cable runs and numbering of terminals
(2 × 2) (4)

4.3
- Direct-on-line
- Star-delta
- Part-wind (3)

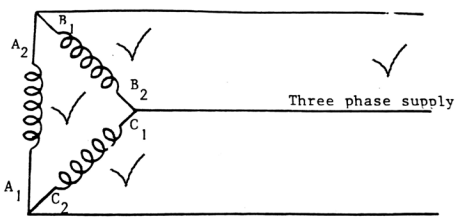
4.4 True (1)

4.5 4.5.1



(4)

4.5.2



(4)
[20]

QUESTION 5

5.1
- Design
- Mechanical
- Electrical
- Operational (Any 2 × 1) (2)

5.2
- Longer running time
- Insufficient defrost time
- Design temperature not reached
- Suction temperature higher than design
- Condensing temperature higher than design
- Excessive current drawn by the compressor (Any 2 × 2) (4)

5.3
- Shortage of refrigerant
- Cold condenser water
- Cold condenser air
- Worn compressor motor piston rings
- Leaks in the oil separator return line
- HVACR compressor motor overheating
- Inefficient compressor valve (Any 2 × 1) (2)

5.4
- Repair leak and charge.
- Regulate water flow.
- Regulate air flow.
- Replace leaky valves. (Any 2 × 1) (2)

5.5
- Understand the unit electrically.
- Understand what the unit should do.
- Understand what the unit is doing.
- Separate the electrical circuit.
- Eliminate the good circuits.
- Find the malfunctioning component. (6)

5.6 True (1)

5.7
- Soap bubbles
- Electronic leak detector
- Halide torch
- Ultraviolet
- Ultrasonic (Any 3 × 1) (3)

[20]

TOTAL: 100

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