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

28 November 2023

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 1.1.1 False
1.1.2 True
1.1.3 False
1.1.4 False
1.1.5 True

(5 × 1 (5)

1.2
- Diameter of the pipe
- Length of the pipe
- Fluid density
- Velocity of the fluid (4)

1.3 1.3.1 $M_a = \frac{Q}{v}$ ✓

$= \frac{39,6}{0,872}$ ✓

= 45,41 kg dry air /min ✓ (3)

1.3.2 $h_1 - h_2 = \frac{Q}{m}$ ✓

$= \frac{12,5 \times 60}{45,41}$ ✓

= 16,52 kJ/kg dry air. ✓ (3)

1.3.3 $h_2 = 52,5 - 16,52$ ✓

= 35,98 kJ/kg dry air. ✓

(2)

1.3.4 $\frac{h2 - hs}{h1 - hs} = \frac{\omega 2 - \omega s}{\omega 1 - \omega s}$ ✓

$\frac{35.98 - 17.7}{52,5 - 17.7} = \frac{\omega 2 - 5.25}{8,2 - 5,25}$ ✓

ω_2 = 6,8 g. /kg of dry air. ✓ (4)

[20]

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QUESTION 2

2.1 2.1.1

- Refrigerant super-heated at entry to compressor.
- Refrigerant super-heated after compression
- Refrigerant just dry at entry to the compressor.
- The refrigerant under cooled after condensation.

Any three (3x1)

2.1.2

- Chemical processing
- Cryogenic refrigeration
- Medical refrigeration
- Commercial refrigeration
- Electronic cooling
- Cold storage

Any two(2x1) (3) (2)

2.2 2.2.1 It is the process of treating air✓ to control simultaneously its temperature, humidity, cleanliness and distribution to meet the requirements of the conditioned space.✓

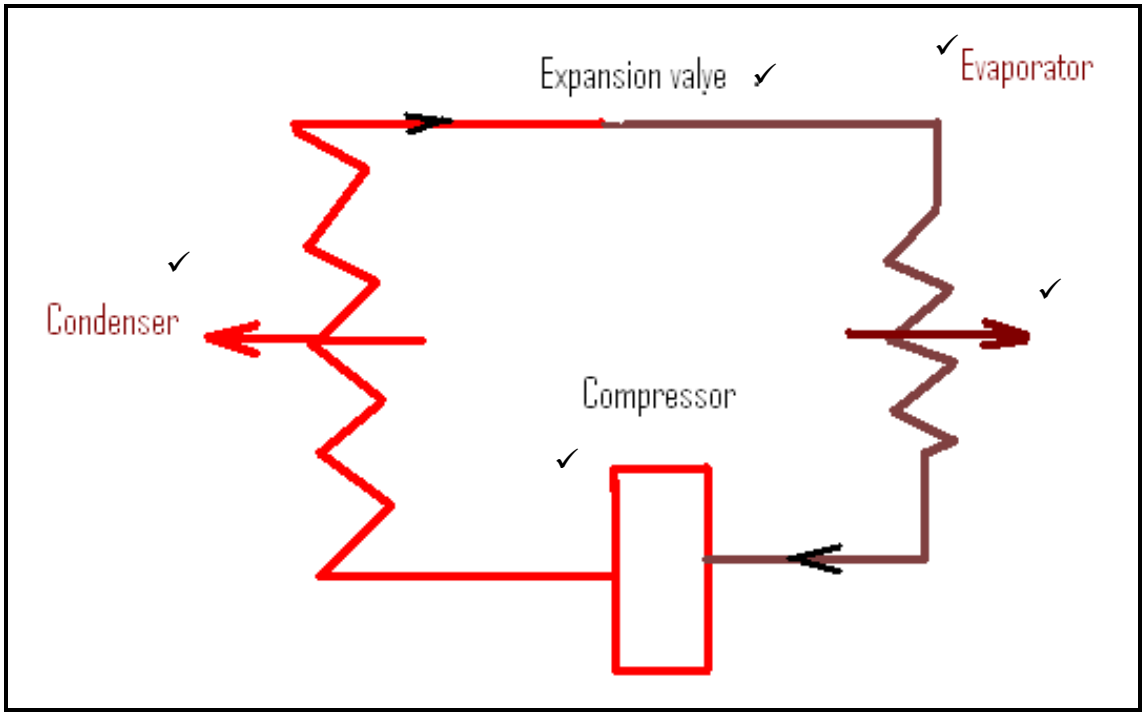
2.2.2 An adiabatic process is a process that takes place without adding or removing heat.✓✓

(2 × 2) (4)

2.3

- It provides cooling during summer.
- It provides heating during winter. (2)

2.4



(5)

2.5 2.5.1 ADVANTAGES

- Adaptable to multiple zoning
- Adaptable to seasonal changeover

2.5.2 DISADVANTAGES

- Larger distribution system than all-water systems
- Air distribution and performance are difficult to balance

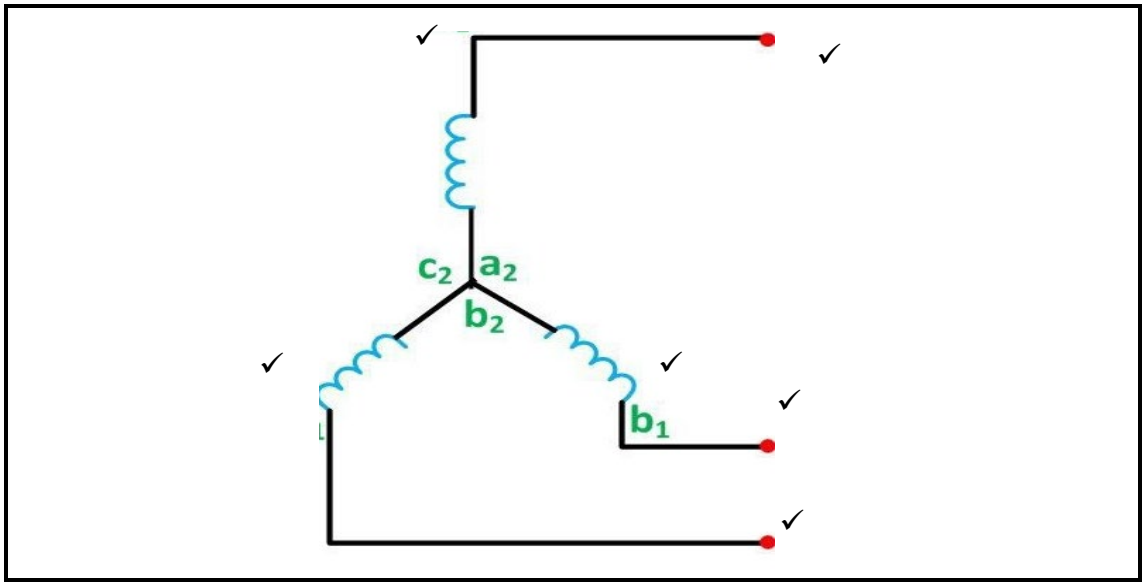
(2 × 2) (4)

[20]

QUESTION 3

3.1
- The torque is lower.✓
- The starting current is reduced.✓ (2)

3.2 Star connection



(Correctness of drawing ✓✓) (8)

3.3 3.3.1
- Main contactor✓
- Star contactor✓
- Delta contactor✓ (3)

3.3.2 The function of the timer is to facilitate the switch-over✓ from star to delta once the motor has gained about 80%✓ of the full speed. (2)

3.3.3 The function of the overload relay is to protect the windings from over currents and short circuits in the internal windings. (1)

3.3.4
- The start button✓: It is a NO (normally open) type✓.
- The stop button✓: It's a NC (normally closed) type ✓ (4)

[20]

QUESTION 4

4.1 4.1.1 Flow switch
4.1.2 Pressurestat
4.1.3 Room thermostat
(3 × 1) (3)

4.2
- Temperature
- Pressure
- Humidity of air (3)

4.3
- The amount of ice on the evaporator
- The amount of heat supplied to the evaporator (2)

4.4
- Run the system✓
- with the discharge valve closed for a few seconds✓
- and close the suction valve.✓
- Recover the remaining refrigerant using the recovery unit.✓ (4)

4.5 It ensures that all the ice formed in the system is melted,✓ thereby avoiding a blockage that will restrict the flow of the refrigerant in the pipe.✓ (2)

4.6 The refrigerating effects are increased.✓✓ (2)

4.7 It is a manual that guides the operating team in the startup, shutdown, troubleshooting and optimisation of the plant.✓✓ (2)

4.8 It is the set of conditions for operating a particular system or plant.✓✓ (2)
[20]

QUESTION 5

5.1 5.1.1 B
5.1.2 C
5.1.3 A
5.1.4 A
(4 × 1) (4)

5.2
- Default design
- Mechanical fault
- Operational fault
- Electrical fault (4)

5.3 The plant should be inspected regularly✓✓ (2)

5.4 It can result in high superheat✓ at the compressor suction.✓ (2)

5.5 It will result in broken valves✓ and damage to bearings due to bad lubrication.✓ (2)

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5.6
- Halide torch
- Electronic leak detectors
- Soap bubbles
- Ultrasonic leak detectors
- Oil spot (Any 2 × 1) (2)

5.7
- Power failure
- Isolator switched off
- Operational fault
- Electrical fault (4)

[20]

TOTAL: 100

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