higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

REFRIGERATION TRADE THEORY N3

14 April 2021

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 1.1.1 C✓ (Gauge pressure = Absolute pressure – atmospheric pressure
= 1000 – 101,4
= 898,6 K Pa✓)

1.1.2 C✓ (Absolute pressure = Gauge pressure + atmospheric pressure
= 700 + 101,4
= 801,4 K Pa✓)

1.1.3 D✓ (K = ℃ + 273
= 25 + 273
= 298 K✓)

1.1.4 B ✓ (Vo/To= Vn /Tn)
= 40x308/276
=44,64 litres✓)

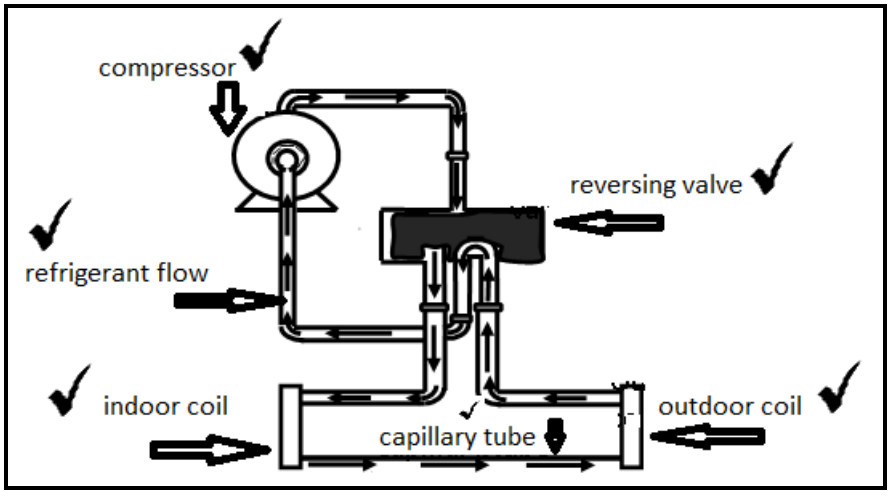
1.1.5 C✓ (℃ = $K - 273$
= 340 – 273
= 67 ℃ ✓)

(5 × 2) (10)

1.2 1.2.1 A saturated vapour is in such a condition that if little heat is removed from it, some of the vapour will condense.
OR
If any compression of its volume at constant temperature causes it to condense to liquid. (2)

1.2.2 The specific heat capacity is the heat required to raise the temperature of a unit mass (a kg) with 1 unit (1 ℃ or 1 K). (2)

1.3



(6)
[20]

QUESTION 2

2.1 2.1.1
- It ensures that the entire evaporator is used at full and part loading conditions.✓✓
- It stops liquid carry- over to the compressor✓✓
- It responds quickly to wide and frequent load variations.✓✓

(3 × 2) (6)

2.1.2 It regulates the rate of flow of liquid refrigerant in proportion✓ to the rate of evaporation in the evaporator.✓
Connected between condenser✓and evaporator✓ (4)

2.2
- An automatic expansion valve maintains a constant pressure✓ in the evaporator✓, while the thermostatic expansion valve maintains a constant degree of suction superheat✓ at the evaporator outlet✓. (4)

2.3 Miscellaneous heat load includes all sources of heat not calculated by heat leakage✓, product cooling or respiration load✓. (2)

2.4
- People
- Sun heat
- Lights
- Electric motors
- Defrosting heat sources (Any other 4 × 1) (4)

[20]

QUESTION 3

3.1
3.1.1 D
3.1.2 C
3.1.3 A
3.1.4 E
3.1.5 B

(5 × 1) (5)

3.2 Advantages

- The system operates very economically due to the low condensing temperature possible.
- Lower initial cost due to the elimination of the water-cooled condenser.
- Less space requirements.
- Suitable for indoor location

(Any 3x1) (3)

Disadvantages

- Problems might be experienced with corrosion, scale and slime formation in the sump which can block the nozzles.
- Higher maintenance costs than air-cooled condensers but lower than cooling towers.
- Location problems are similar to those for air-cooled condenser.

(Any 3x1) (3)

3.3 Water is pumped from the sump of the evaporative condenser✓ and is distributed over the exterior of the condensing coil.✓ A fan forces air through the falling water✓ and over the coil surface. (3)

3.4

- To supply✓ a steady flow of gas to the burner✓.
- Without a regulating valve, the flame✓ would change and might be extinguished✓ when the burner gas pressure changes.
- The pressure regulator reduces✓ the pressure and provides a constant gas pressure✓.
- Liquid petroleum (LP) ✓ gases do not need a pressure regulator at the refrigerator✓
- because the pressure regulator mounted on the LP✓ cylinder performs the same duty✓. (Any other 3 × 2) (6)

[20]

QUESTION 4

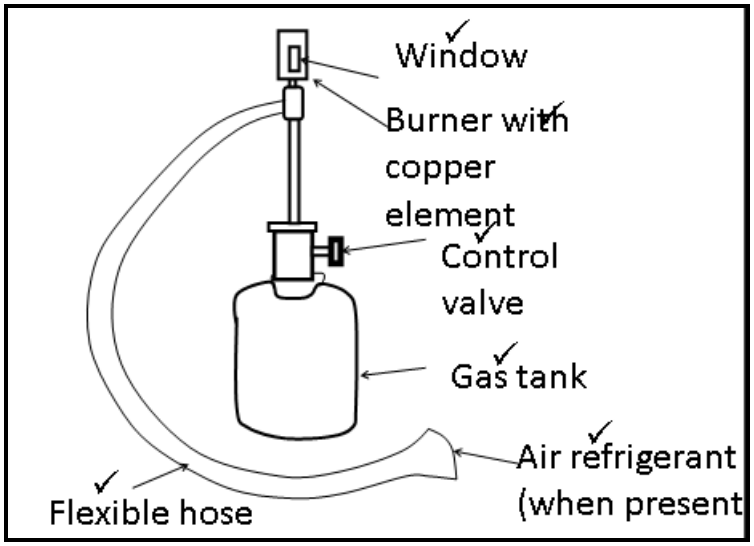
4.1 4.1.1 Determine the cause and repair

4.1.2 Charge plant with correct amount of refrigerant

4.1.3 Check thermostat setting

4.1.4 Replace filter (4 × 1) (4)

4.2



(6)

4.3

$$V = \frac{\pi \times D^2 \times L \times N \times n}{4} \times \eta_v$$

$$= \frac{\frac{\pi \times D^3 \times Nn}{4}}{1} \times \frac{\eta_v}{1} \checkmark$$

$$D^3 = \frac{V \times 4}{\pi \times Nn} \times \frac{1}{\eta_v} \checkmark$$

$$D^3 = \frac{0{,}1356 \times 4}{3{,}142 \times 1000 \times 2} \times \frac{1}{0{,}75} \checkmark$$

$$D^3 = 0{,}0000863 \times \frac{1}{0{,}75} \checkmark$$

$$D^3 = 0{,}000115 \checkmark$$

$$D = \sqrt[3]{0{,}000115} \checkmark$$

$$= 0.0486\ m \checkmark$$

$$= 48{,}6\ mm \checkmark$$

(8)

4.4
- No maintenance needed
- Can easily be replaced
- Do not damage the shaft

(Any other 2 × 1) (2)

[20]

QUESTION 5

5.1
- Time
- Temperature difference
- Thickness of insulation materials
- Type of insulation
- External surface of the cabinet (Any 4 × 1) (4)

5.2
A – Cabinet GRD
B – System GRD
C – Door frame heater
D – Lamp
E – Door switch
F – Evaporator door switch
G – Relay
H – Motor terminals
I – Overload protector (9)

5.3
- When the compressor is operated, it bypasses✓ the defrost element of the evaporator.
- When the temperature of the cabinet✓ is within an acceptable level
- the thermostat connects✓ the defrost element of the evaporator
- and ensures that defrosting occurs. ✓ (4)

5.4 Resistive load (1)

5.5 Current draw on switch-on equals running current (2)
[20]

TOTAL: 100

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