higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

REFRIGERATION TRADE THEORY N3

30 November 2023

This marking guideline consists of 5 pages.

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QUESTION 1

1.1
- Centrifugal fans or radial flow fans or squirrel fans.
- Axial fans or propeller fans
- Crossflow fans or tangential flow fans (3)

1.2 1.2.1 Superheated vapour is vapour in such a condition that if some heat is removed from it the volume and/or pressure of the vapour will decrease but there will be no condensation, or any vapour heated above its saturation temperature.

1.2.2 Saturated vapour is a vapour in such a condition that if little heat is removed from it some of the vapour will condense or any vapour at its saturation temperature.

1.2.3 Specific heat capacity of a substance is the amount of heat required to raise the temperature of a unit mass of 1 kg by 1 °C.

1.2.4 Latent heat is the heat added or removed from a substance in order to change the phase of the substance without a change in the temperature of the substance.

1.2.5 Set point is the required or ideal value of a controlled variable.

1.2.6 The enthalpy of a given mass of a substance at any given state is the total amount of energy supplied to bring it to that state from some initial state.

(6 × 2) (12)

1.3
- Capillary tube
- Automatic expansion valve
- Thermostatic expansion valve
- Low-side float
- High-side float (5)

[20]

QUESTION 2

2.1 These are all the sources of heat calculated by heat leakage, product cooling and respiration load. (2)

2.2
- Lights
- Electric motors
- People
- Defrosting heat sources
- Sun heat (Any 4 × 1) (4)

2.3 2.3.1 A valve is a mechanical device that blocks a pipe, either partially or completely, to change the amount of fluid that passes through it.

2.3.2 A strainer is a mechanical device designed to help protect the system from the harmful or undesirable effects of both solid and fluid impurities. A strainer filters out solid debris in the water system.

2.3.3 A pipe union is a secure and semi-permanent connection between two pipes or is used to connect two pipes together semi-permanently.

(3 × 2) (6)

2.4
- The pressure regulator operates about the same as a refrigerant expansion valve.✓
- The outlet pressure presses against the diaphragm.✓
- When the pressure drops, the diaphragm will move, open the gas valve and allow more gas to flow.✓
- The increased gas flow✓
- will press the diaphragm up and will tend to close the valve.✓ (5)

2.5
- Thermostatic expansion valve
- Automatic expansion valve
- Capillary tube
- High-level float valve
- Low-level float valve
- Hand expansion valve (Any 3 × 1) (3)

[20]

QUESTION 3

3.1
- Starting and stopping the compressor
- Changing the speed of the compressor
- Lifting the suction valves
- Hot-gas bypass
- Regulating the suction pressure
- Regulating the discharge pressure (Any 4 × 2) (8)

3.2
- No shaft seal is required.
- Compressor mounting is easy.
- No shaft-alignment problems.
- Correct amount of lubricating oil in compressor. (Any 3 × 1) (3)

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3.3 $$VP = \frac{\Pi D^2 S N R}{4}$$

$$VP = \frac{3{,}142 \times (0{,}07)^2 \times 0{,}08 \times 8 \times 12}{4} \checkmark$$

$$VP = 0{,}02955\, m^3/s \rightarrow \checkmark$$

$$\eta = \frac{V}{VP}$$

$$\eta = \frac{0{,}0225}{0{,}02955} \times \frac{100}{1} \checkmark\checkmark$$

$$\eta = 76{,}1\% \rightarrow \checkmark \textbf{ OR } 76{,}13\%$$ (5)

3.4

COMPRESSION SYSTEM	ABSORPTION SYSTEM
• Uses mechanical energy • Uses an electrical motor • Motor has moving parts • Motor is sometimes not quiet • Must have an electricity supply	• Uses heat energy • Uses a gas or heating element • Minimum moving parts • Quiet while in operation • Operates on a small gas cylinder

(Any 3 × 2) (6)

3.5
- Splashed feed
- Pump-forced feed (Any 1 × 1) (1)

3.6
- To crack a service valve means the valve is front-seated ✓ and then turned back a quarter of a turn.
- When the valve is back-seated it is the same procedure. ✓ (2 × 1) (2)

[25]

QUESTION 4

4.1
- Shell and tube
- Tube within a tube type (2)

4.2
- Time/Duration
- Temperature difference
- Thickness of insulation materials
- Type of insulation
- External surface of the cabinet (Any 4 × 1) (4)

4.3 The prime function of an oil separator is to separate oil from the refrigerant✓ and return it to the compressor crankcase.✓ (2)

4.4
- The accumulator is a safety device✓
- that prevents liquid refrigerant from flowing into the suction line and into the compressor.✓
- It is installed between the evaporator and the compressor.✓ (3)

4.5
- Chill room
- Processing room
- Quick-freezer room
- Locker room (4)

[15]

QUESTION 5

5.1 **NOTE**: Sequence must be followed.
- Shut the service valve.
- Connect the system analyser with the blue on the low-pressure side and the red on the high-pressure side.
- Block the high- and low-pressure connections.
- Crack the suction valve and switch on the compressor.
- If pressure on the high side is too low then allow gas to flow into the low side of the compressor and switch off.
- Check for leaks on the high side as well as the low side.
- Allow the gas to escape and repeat step 5.
- Note the reading and switch off the compressor.
- Check readings again after 15 minutes.
- If readings are still the same it can be assumed that the compressor is 100% efficient.
- If there is a difference of more than 30%, the compressor is not suitable.
- The cause is normally leaky valves which must be repaired. (12 × 1) (12)

5.2
- Pipes must be clean.
- All joints must be free of leaks.
- Run all pipelines in as simple and direct manner as possible.
- Use the minimum number of fittings.
- Pitch the horizontal lines in the direction of the refrigerant flow.
- The pitch should be 15 mm per 3 m of run. (Any 5 × 1) (5)

5.3
- The filter drier consists of a cylinder filled with a chemical✓
- which absorbs the moisture from the refrigerant✓
- flowing through it and catches up impurities, and it is fitted in the liquid line.✓ (3)

[20]

TOTAL: 100

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