higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

REFRIGERATION PRACTICE
NQF LEVEL 3

16 November 2022

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 Power is the rate of doing work. (2)

1.2 $F = m \times a$✓
$= 260 \times 5$
$= 1300$ N✓

$W = f \times s$✓
$= 1300 \times 5$
$= 6500$ Nm✓

$P = W / t$
$= 6500 / 2$
$= 3250$ W✓ (5)

1.3 -273,15 °C✓ (1)

1.4 Latent heat is any heat that changes its phase without a change in temperature when it is added to a body or substance. (2)

1.5 Sensible heat to be removed to reduce the vapour temperature from 390 to 345:
$Q = m \times c \times \Delta t$✓
$= 4 \times 1{,}03 \times (390 - 345)$
$= 185{,}4$ kJ✓

Latent heat to be removed to condense the vapour:
$Q = m \times hfg$✓
$= 4 \times 156$
$= 624$ kJ✓

Total heat = 185,4 + 624
= 809,4 kJ✓ (5)

1.6 Pressure is the force per unit area. ✓✓ (2)

1.7 Gauge pressure = Absolute pressure – Atmospheric pressure✓
= 350 – 101,3
= 248,7 kPa✓ (2)

1.8 $Q = m \times c \times \Delta t$✓
$= 10 \times 4{,}2 \times (35 - 15)$ ✓
= 40 kW✓ (3)

1.9 $Q = m \times c \times \Delta t$✓
$= (20 \times 3{,}6) \times 1{,}02 \times (32 - 22)$ ✓
= 734,4 kW✓ (3)
[25]

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QUESTION 2

2.1 A fusible plug is a safety device that melts at a specific temperature and allows the relief of pressure. (2)

2.2
- Short of refrigerant.
- Thermostat setting too low.
- Thermostat contact stuck.
- Excessive load.
- Ineffective compressor. (Any 3 × 1) (3)

2.3
- Check for leaks and recharge the unit.
- Readjust thermostat.
- Check heat load.
- Repair or replace thermostat.
- Check compressor valves and repair or replace. (Any 3 × 1) (3)

2.4
2.4.1 Bursting disc.
2.4.2 Pressure relief valve.
2.4.3 Pressure-limiting device.
2.4.4 Package unit.
(4 × 1) (4)

2.5
- The oil must remain fluid at low temperature.
- It must be dry and as free from moisture as possible.
- It must not decompose into carbon under expected operating condition.
- It must not deposit wax when subjected to the low operating temperature that must be met.
- It must not remain stable at a high temperature.
- The oil must not react chemically with a refrigerant, a metal or a motor installation. (Any 3 × 1) (3)

[15]

QUESTION 3

3.1
- Metal corrosion.
- Scaling. (2)

3.2 Corrosion is the deterioration of a material, usually a metal, as it reacts to its environment. (2)

3.3
- Temperature
- Moisture
- Solutes
- Oxygen (Any 3 × 1) (3)

[7]

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QUESTION 4

4.1 4.1.1 Normally open contact.
4.1.2 Normally closed contact.
4.1.3 Load.
4.1.4 Changeover contact.
4.1.5 Relay coil.
(5 × 1) (5)

4.2
- Compressor
- Condenser
- Fan motor (3)

4.3 4.3.1 A – Freezer thermostat
B – Evaporator defrost heater
C – Door switch
D – Door frame heater
E – Cabinet ground
F – System ground
G – Bulb
H – Relay
I – Motor terminals
J – Overload protector (10)

4.3.2 The relay acts as a compressor switch. (2)

4.3.3 Resistive load. (1)

4.4 Low- and high-pressure safety switches monitor the pressure of refrigerant in a system.✓ When the pressure is lower than the set limits,✓ the compressor cuts off✓ and when the pressure is higher than the set limits, the compressor cuts off.✓ (4)
[25]

QUESTION 5

5.1 A thermostatic expansion valve regulates the flow rate of liquid refrigerant in proportion to the evaporation rate in the evaporator. (2)

5.2 A changeover device ensures a continuous gas supply to gas dosing systems✓ by timeously changing the gas supply over from an empty supply battery to a stand-by battery.✓ (2)

5.3
- Refrigerant leakages.
- Dirt in the system.
- Breakage of belts or compressor fans.
- Condenser air or water surface fouling.
- Incorrect setting of control instrument. (Any 3 × 1) (3)

5.4 Power wiring✓ – provides power to motors and energises them.✓
Control system✓ – operates contactors and solenoid.✓ (4)

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5.5 A Carefully clean the ends of the suction line, discharge line, and oil line.

B Carefully clean the suction line, discharge line and oil line connections on the motor compressor.

C Install the piercing valve, valve adaptor and the gauge manifold.

D Connect the lines.

E Cut the liquid line between the condenser and the refrigeration control.

F Put some vapour refrigerant into the system and check for leaks.

G Connect the vacuum pump to the system through the gauge manifold.

H Charge a small amount of R11 into the system and purge it.

I Charge the lines with a small amount of refrigerant used in the system.

J Charge the system with the correct amount of refrigerant.

K Reconnect the electrical circuit.

(11 × 1) (11)
[22]

QUESTION 6

6.1
- Reduction in heat transfer.
- Reduced water flow.
- Damage to equipment. (3)

6.2 Corrosion. (2)

6.3 Chilled water system or closed circuit. (1)
[6]

TOTAL: 100