higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

REFRIGERATION AND AIR CONDITIONING PROCESSES

NQF LEVEL 4

(6030054)

22 November 2019 (X-Paper)
09:00–12:00

This question paper consists of 5 pages.

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TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Write neatly and legibly.

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QUESTION 1

1.1 Name TWO stages of refrigerant gas found in the basic vapour compression refrigerant cycle indicating the pressure levels. (2 × 2) (4)

1.2 Draw a flow diagram of the actual vapour compression refrigeration cycle with the following labels in the correct sequence.

1.2.1 Condenser, compressor, evaporator, expansion valve (4)

1.2.2
- Include the 8 phases of the refrigerant during the vapour compression cycle, numbering them from 1-8 in correct sequence on the flow diagram by using the words below:
- Liquid vapour mixture; de-superheating; saturated vapour; sub-cooled liquid; superheated low pressure vapour; saturated liquid; high pressure vapour; low pressure liquid (2 × 4) (8)

1.3 A cooling tower may be used in air conditioning system to reject heat.

Name TWO advantages of this type of system. (2)

1.4 Name TWO disadvantages of water-cooled towers. (2)

[20]

QUESTION 2

2.1 The sizes of a duct carrying conditioned air are 400 mm × 400 mm with a spigot of 250 mm diameter.

Calculate the following:

2.1.1 The area of the duct in square meters. (3)

2.1.2 The area of the round spigot in meters. (3)

2.1.3 If there is air velocity of 2,5 m/s in the spigot, calculate the volume flow in l/s. (4)

2.1.4 Calculate the air volume in l/s in the duct if the air velocity is 4 m/s. (4)

2.2 If the velocity pressure measured in a duct is 50 Pa at sea level, calculate the velocity of the air in m/s. (5)

2.3 Give the formula in words of how to calculate the total pressure in a duct. (1)

[20]

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QUESTION 3

3.1 When you check for a safe and effective operation of a system, which FOUR operating parameters are critical and what instruments will be used for the identified parameters? (4 × 2) (8)

3.2 Explain THREE reasons why a refrigeration plant may cut out on low pressure. (3)

3.3 Explain TWO possible causes of non-standard performance of a newly installed system. (4)

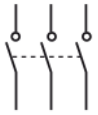
3.4 Explain the operation of an oil pressure switch in a refrigeration system. (5)

[20]

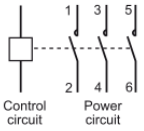
QUESTION 4

4.1 Name the following electrical symbols:

4.1.1 

4.1.2 

4.1.3 

4.1.4 

(2 × 4) (8)

4.2 Name TWO types of controls applied in refrigeration plants. (2)

4.3 Give FIVE factors used to select the size of a conductor used in electrical circuit, considering load and fault current requirements. (2 × 5) (10)

[20]

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QUESTION 5

5.1 An air conditioning plant is comprising of a compressor, condenser, evaporator and a thermostatic expansion valve. Various controls of the system are installed.

Answer the following questions based on an operational system:

5.1.1 If the condenser coil is blocked due to dirt.



Name TWO possible results. (4)

5.1.2 The condenser fan not starting.

Name TWO possible results. (4)

5.1.3 The compressor is on three phase power supply and one phase has failed.

Name THREE results on the compressor? (3)

5.1.4 The evaporator fan is not running. List THREE possible results. (3)

5.2 The air conditioning plant was running on cooling mode and changed to heating mode. The relays have the following delays on their contactors: The evaporator fan 5 seconds and the condenser 10 seconds when ON.



What will be the sequence of components starting when the system is switched ON and the temperature in the space is below set point? (3 × 2) (6)

[20]

TOTAL: 100

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