higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

REFRIGERATION TRADE THEORY N2

(11041572)

11 August 2021 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 7 pages and 1 formula sheet.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
REFRIGERATION TRADE THEORY N2
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. Start each question on a new page.
5. Only use a black or blue pen.
6. Write neatly and legibly.

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QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 A cylinder head serves as a pressure plate to support and hold the valves and valve plate in position.

1.1.2 An oil pump is used mainly on big ammonia compressors running at low speeds and at low pressures.

1.1.3 A shaft seal in a refrigeration system is used as a leak proof container which houses the complete mechanism of a compressor.

1.1.4 A stationery bellows-type seal is mainly used in high speed compressors.

1.1.5 An oil sight glass is used to observe the condition of the refrigeration oil and oil level.

(5 × 1) (5)

1.2 State THREE advantages of a stationery bellows-type seal. (3)

1.3 Inefficient pumping of a compressor may be due to certain points of failure.

State FOUR causes that could result in an inefficient compressor. (4)

1.4 1.4.1 Describe the construction of an axial flow fan, indicate direction of the airflow and indicate two uses of these fans in refrigeration system. (4)

1.4.2 Name two advantages and two disadvantages of reciprocating compressors (4)

[20]

QUESTION 2

2.1 What is the purpose of a condenser? (2)

2.2 State SIX factors that should be considered when selecting an evaporator during the construction of a refrigeration plant. (6)

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2.3 Study the FIGURE of an evaporative condenser below and name the numbered components by writing only the correct answer next to the question number (2.3.1–2.3.6).

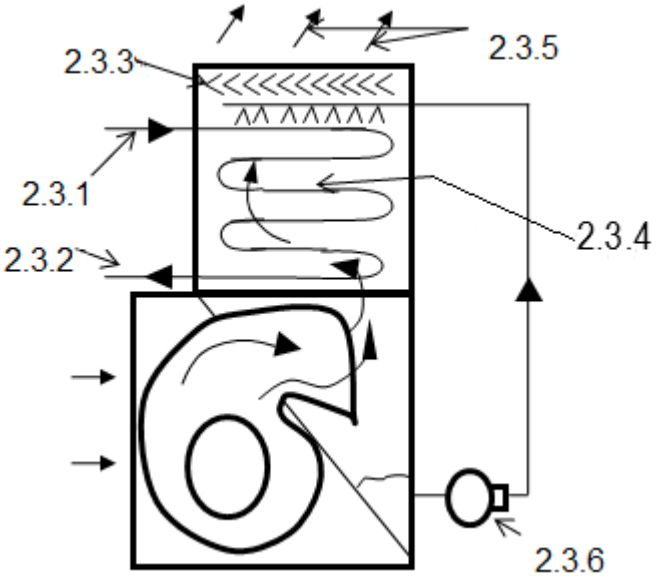


FIGURE (6)

2.4 Briefly describe the operating principle of an evaporative condenser as in QUESTION 2.3 above. (4)

2.5 What is the phase of the refrigerant at the inlet and outlet of the condenser? (2)

[20]

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QUESTION 3

3.1 What is the main function of the oil separator in a refrigeration system? (2)

3.2 Name the following tools and state the purpose of each as used in refrigeration systems.

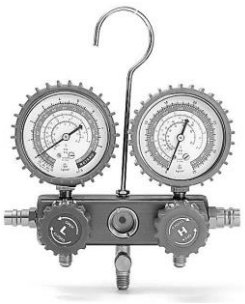
3.2.1



3.2.2



3.2.3



(3 × 2) (6)

3.3 Draw a neat, labelled sketch of a thermostatic pressure expansion valve. (8)

3.4 Explain the TWO main functions of an expansion valve. (4)

[20]

QUESTION 4

4.1 Types of refrigerants are indicated by the colour of the containers in which they are supplied.

Name the type of refrigerant based on the following colours of the containers and state the application of each:

4.1.1 Light green

4.1.2 Light blue

4.1.3 Orange

4.1.4 Light maroon

(4 × 2) (8)

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4.2 Define the following terms:

4.2.1 Super-heated vapour (3)

4.2.2 Saturated vapour (3)

4.3 Choose a description from COLUMN B that matches an item in COLUMN A. Write only the letter (A–F) next to the question number (4.3.1–4.3.6) in the ANSWER BOOK.

COLUMN A		COLUMN B	
4.3.1	Actuator	A	value at which the controlled variable is maintained and recorded by the control
4.3.2	Corrective action	B	difference between the highest and the lowest value of the controlled variables
4.3.3	Control point	C	device which receives a signal from the controller and changes it into corrective action
4.3.4	Lag	D	when its capacity exceeds the requirements at an instant in time
4.3.5	Cycle	E	delay in the response of a control system to change in the variable being controlled
4.3 6	Operating differential	F	action, initiated by a deviation, which brings about a change in the controlled variable

(6 × 1) (6)

[20]

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QUESTION 5

5.1 If a leak is found on a brazed joint, what corrective action should be followed? (4)

5.2 Briefly explain the cause of the following malfunctions in a refrigeration plant:

5.2.1 The compressor fails to start (no hum).

5.2.2 Entire plant fails to start.

(2 × 3) (6)

5.3 Draw a neat, labelled sketch of a halide torch leak detector. (6)

5.4 Name four ways in which moisture can affect the refrigeration system. (4)

[20]

TOTAL: 100

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REFRIGERATION THEORY N2

FORMULA SHEET

1. OHM'S LAW

$$I = \frac{V}{R}$$

$$V = R \times I$$

$$R_T = R_1 + R_2 + R_3$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

2. POWER

$$P = V \times I$$

$$P = I^2 R$$

$$P = \frac{V^2}{R}$$

3. HEAT

$$Q = m \times c \times \Delta t$$

$$Q_T = Q_1 + Q_2$$

$$℃ = (℉ - 32) \times \frac{5}{9}$$

$$K = 273 + ℃$$

4. AREAS AND VOLUMES

$$A = \frac{\pi}{4} D^2$$

$$V = A \times L$$

$$A = L \times B$$

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