higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

REFRIGERATION AND AIR CONDITIONING PROCESS
NQF LEVEL 4

(6030054)

12 March 2018 (Y-Paper)
13:00 – 16:00

This question paper consists of 7 pages.

NCV

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.

NCV

QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1 1.1.1 Sub-cooling increase the refrigerating effect of a system.

1.1.2 Anemometer is an instrument to measure air pressure.

1.1.3 Evaporator defrosting reduces capacity of the system.

1.1.4 Resistive load is found in motor winding.

1.1.5 Power failure is an operational fault in a plant.

(5 × 1) (5)

1.2 Explain TWO effects of pipe pressure losses in a refrigeration system. (4)

1.3 Explain the difference between the basic and actual vapour compression refrigeration cycle with reference to sub-cooling. (4)

1.4 List ONE advantage of a Central plant or packaged unit air conditioning. (2)

1.5 Liquid line solenoid is a normally closed (NO) refrigerant control device used during refrigerant automatic pump down cycle.

Explain how this device operate when pump down of a plant is required. (5)
[20]

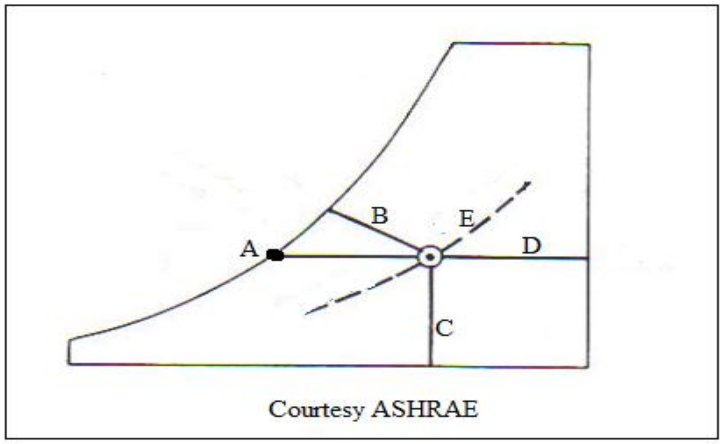
QUESTION 2

2.1 Humidity ratio is a property of air. What units is used to express it? (2)

2.2 Properties of air may be represented on a psychrometric chart by lines. The following figure indicate how to read some of the properties.

Give the properties of air as indicated by a point or a line on the chart by writing the letters (A–E) in your ANSWER BOOK and the correct answers: (5)

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(5)

Figure 1. Properties of Air

2.3 Air is heated from 15ºC dry bulb temperature to 30ºC dry bulb temperature. The air flow in a system is measured $3m^3/s$. The specific volume of the air is $0.812m^3/kg$. The specific heat capacity of air is 1.012kJ/kg K.

2.3.1 Give the formula of enthalpy in kW. (2)

2.3.2 Calculate the mass flow in kg/s. (3)

2.3.3 Calculate the sensible heat required to raise the temperature in kW. (4)

2.4 When air flows in the rectangular duct friction will take place. Explain the effects of this friction in the duct. (4)

[20]

QUESTION 3

3.1 An operating temperature parameter is comprised of the following:
-Sensor
-Monitor
-Set point
-Actuator

Explain how the circuit operate to control the temperature according to the set point. (5)

3.2 What is a Pressurestat? (2)

3.3 What will be a normal superheat measurement and the causes of a high superheat? (4)

3.4 What is the purpose of delaying the restarting of the evaporation fan and the compressor in a supplementary heat defrosts. (4)

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3.5 Defrost cycle may use automatic pump down control. Make a neat drawing of the automatic pump down control diagram indicating the following:

Thermostat (TS)
Liquid Line solenoid relay (LLS)
High pressure / Low pressure switches (HP/LP)
Overload protection switch (OL)
Crankcase heater element (CCH)

(1 × 5) (5)
[20]

QUESTION 4

4.1 Choose the correct answer and write only the letter (A–C) next to the numbers (4.1.1–-4.1.4) in your ANSWER BOOK.

4.1.1 A relay is used:

A When there is no voltage
B When there is a short circuit
C In a high resistance circuit
D As a low voltage switch

4.1.2 Star-Delta Starter:

A Draw less current during starting
B Can burn the motor during starting
C It is a single stage starter
D Is mainly used for low power motors

4.1.3 Direct on Line Starter (DOL) advantage:

A Expensive starter
B Starting current less than running current
C High starting torque
D Good for large motors with high kW rating

4.1.4 A Multimeter is used to measure:

A Air flow
B Water viscosity
C Electric current
D Electrical shock

(4 × 1) (4)

4.2 Connections in electrical wiring have three areas to be regularly checked during maintenance. Name the connections. (3)

4.3 FIGURE 2 below shows a control diagram of a Star-Delta-Starter.

Answer the following questions:

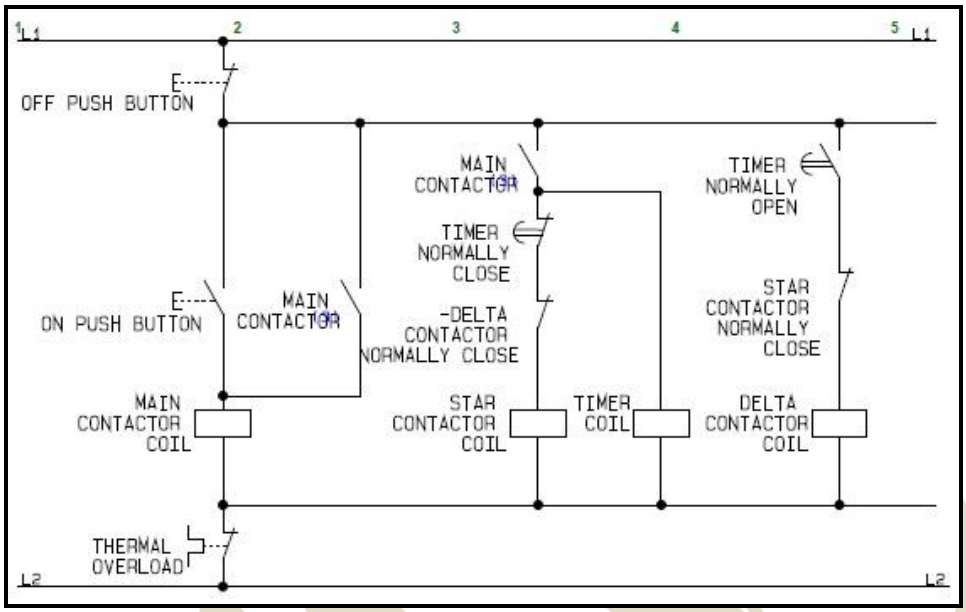


FIGURE 2

4.3.1 Which relay will be energised first with power supply on and 'on push button' on? (2)

4.3.2 Which TWO 'Normally Open' contacts will first make contact? (2)

4.3.3 What energise the 'Timer Coil' relay? (2)

4.3.4 Explain the operation of the 'Normally Closed' delay timer contact. (2)

4.3.5 When will the 'Delta Contactor Coil' be energised? (2)

4.4 Explain the meaning of a 95% refrigeration plant availability per month. (3)

[20]

QUESTION 5

5.1 Some of the faults may be observed during plant operations. You observed that an evaporator coil is frozen.

Discuss the effects of this in the plant operation in relation to system performance and compressor operation. (5)

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5.2 Choose a description from COLUMN B that matches an item in COLUMN A. Write only the letter (A–E) next to the question number (5.2.1–5.2.5) in the ANSWER BOOK.

COLUMN A		**COLUMN B**	
5.2.1	fault sensory skill odour	A	Costly
5.2.2	Fault sensory skill heat	B	Temperature
5.2.3	Fault sensory skill noise	C	overheating compressor
5.2.4	Temporary fixes	D	Burning oil
5.2.5	Operating parameter	E	Ceased bearing

(5)

5.3 Indicate whether the following statement is TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (5.3.1-5.3.2) in the ANSWER BOOK.

5.3.1 When doing corrections after diagnose, one must adhere to manufacture specification at all the times. (1)

5.3.2 Re-commissioning means comparing original parameters with measured parameters. (1)

5.4 List the first four steps of trouble shooting a refrigeration plant. (4)

5.5 Give FOUR causes of defective or burned relay. (4)

[20]

TOTAL: 100

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