higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRICAL SYSTEMS AND CONSTRUCTION
NQF LEVEL 2

(12041032)

22 November 2018 (X-Paper)
09:00–12:00

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

1.1 What is the standard voltage and frequency used in single-phase domestic installations in South Africa? (2)

1.2 Table 1 indicates the conductor size and circuit-breaker rating for each circuit in a domestic installation.

Write only the missing value or answer next to the question number (1.2.1–1.2.5) in the ANSWER BOOK.

Circuit	Circuit-breaker rating (A)	Conductor size (mm²)
Main circuit breaker	60	16
Stove	**1.2.1**	6
Geyser	20	**1.2.2**
1.2.3	20	2,5
Light	**1.2.4**	1,5
Bell	1	**1.2.5**

TABLE 1 (5 × 1) (5)

1.3 You are required to install a single-phase stove circuit.

Draw a neat, fully labelled circuit diagram of the stove circuit. Your diagram should include a distribution board showing ALL its components. (9)

1.4 Complete the following sentences by choosing the applicable word(s) in the list below. Write only the word(s) next to the question number (1.4.1–1.4.5) in the ANSWER BOOK.

100 V; twice; certificate of compliance; 50 V; bell; phase; neutral; 1 MΩ; earth; 30 mA; ammeter; once; 1 000 Ω

1.4.1 Once an electrical installation has been inspected and tested, a … will be issued if the installation meets all provisions of the wiring code.

1.4.2 When doing an insulation resistance test, a voltage of at least ... the nominal voltage must be used.

1.4.3 If the reading obtained is more than ... when doing an elevated voltage-on-neutral test, you should disconnect the installation and inform the supplier.

1.4.4 A polarity test is done to ensure that the … conductor is connected to all circuit breakers and switches.

1.4.5 A reading of not less than … should be obtained when doing insulation resistance tests on an installation.

(5 × 1) (5)

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1.5 The supply voltage of an installation you are testing is 230 V. While conducting tests, the voltage of a socket outlet at the furthest point of consumption is found to be 207 V.

1.5.1 Is this reading acceptable according to SANS 10142? (1)

1.5.2 Give a reason for your answer to QUESTION 1.5.1. (3)

[25]

QUESTION 2

2.1 Explain how you would fit a plug top to a 3-core flexible cable. (5)

2.2 Name FOUR mechanical joints that are used to join electrical conductors. (4)

2.3 State the purpose of each of the following tools:

2.3.1 Crimping pliers

2.3.2 A hickey

2.3.3 A draw tape

(3 × 2) (6)

2.4 The table below shows the diameters of conduit, the cross-sectional area of conductors and the number of cables that can be drawn in the conduit.

Use the table to determine the maximum number of conductors that may be drawn into a 25 mm diameter conduit when wiring a stove circuit.

Cross-sectional area of conductors mm²	**Number of conductors**	
	Conduit diameter 20 mm	**Conduit diameter 25 mm**
1	11	16
1,5	9	13
2,5	6	9
4	5	7
6	4	6
10	3	4
16	-	3

TABLE 2 (2)

2.5 State THREE advantages of PVC conduit when compared to metal conduit. (3)

[20]

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QUESTION 3

3.1 Use the components in FIGURE 1 to design a wiring diagram for a capacitor-start induction-run motor. The diagram must include all labelling and supply inputs.

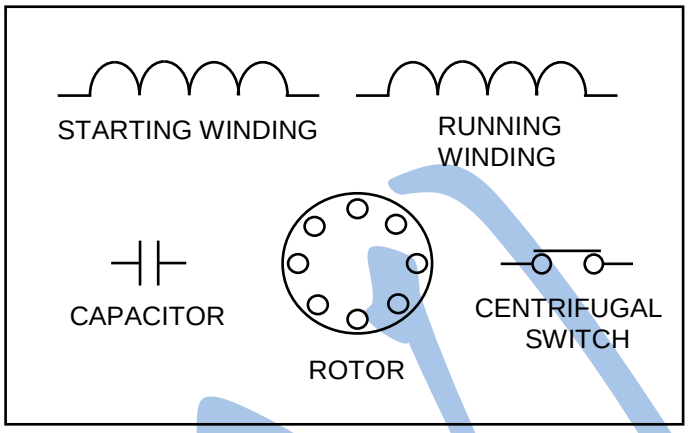


FIGURE 1

(6)

3.2 Motors have nameplates for identification and information purposes.

Match each item of a nameplate in COLUMN A to a description in COLUMN B. Write only the letter (A–H) next to the question number (3.2.1–3.2.6) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.2.1	Rated power	A	maximum voltage that can be applied to the motor
3.2.2	Frame size number	B	full-load kilowatt rating output of the motor
3.2.3	Frequency	C	ratio of the true power and the apparent power
3.2.4	Full-load current	D	length of time the motor can run at full load without overheating
3.2.5	Rated RPM	E	a code that indicates the dimensions of a motor
3.2.6	Rated voltage	F	number of cycles per second at which a motor operates
		G	the amperes that the motor draws at a given power and voltage
		H	number of rotations the motor completes at full-load operating conditions

(6 × 1) (6)

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3.3 When doing maintenance on an electric motor, you have to apply lockout and tag-out (LOTO) procedures.

Why is it necessary to apply LOTO procedures? (3)

[15]

QUESTION 4

4.1 One of the tests that should be performed on a miniature circuit breaker is a continuity test.

4.1.1 Briefly explain how a continuity test is performed on a miniature circuit breaker that is still connected to the distribution board.
(NOTE: Do not include specific readings in the explanation.) (5)

4.1.2 After completing the test in QUESTION 4.1.1, it was found that when the miniature circuit breaker was in the ON position an infinity reading was recorded.

Is this reading acceptable? Motivate your answer. (2)

4.2 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True or False' next to the question number (4.2.1 – 4.2.8) in the ANSWER BOOK.

4.2.1 A fuse is a protective device designed to trip when an overload occurs.

4.2.2 A sensitivity test on an earth-leakage unit is done by pushing the test button on the unit itself.

4.2.3 When doing an insulation resistance test on a transformer, a multimeter set on the highest ohm scale can be used.

4.2.4 The mechanical operation of a circuit breaker can be checked by turning it on and off several times.

4.2.5 A continuity test can be done on a thermostat to check whether it functions correctly.

4.2.6 For the bonding and continuity test on an installation, the resistance value should not be more than 0,2 Ω.

4.2.7 An overload tripping test is done on a fuse.

4.2.8 Aging could cause insulation deterioration on a cable.

(8 × 1) (8)

[15]

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QUESTION 5

5.1 Name TWO instrument transformers you are familiar with. (2)

5.2 Show, by means of a neat, labelled circuit diagram, how to connect a frequency meter in a single-phase circuit. (5)

5.3 You have finished installing a prepaid meter in a house.

State THREE tasks that need to be performed after you have completed the installation of the prepaid meter. (3)

5.4 Various engineering tools are used for marking-off dimensions when mounting/installing a metering unit.

5.4.1 Name TWO measuring tools that are used when marking off dimensions when installing a metering unit. (2)

5.4.2 Name THREE hand tools that are used when marking off dimensions when installing a metering unit. (3)

[15]

QUESTION 6

6.1 Study the diagram of a photovoltaic installation in FIGURE 2 and answer the questions:

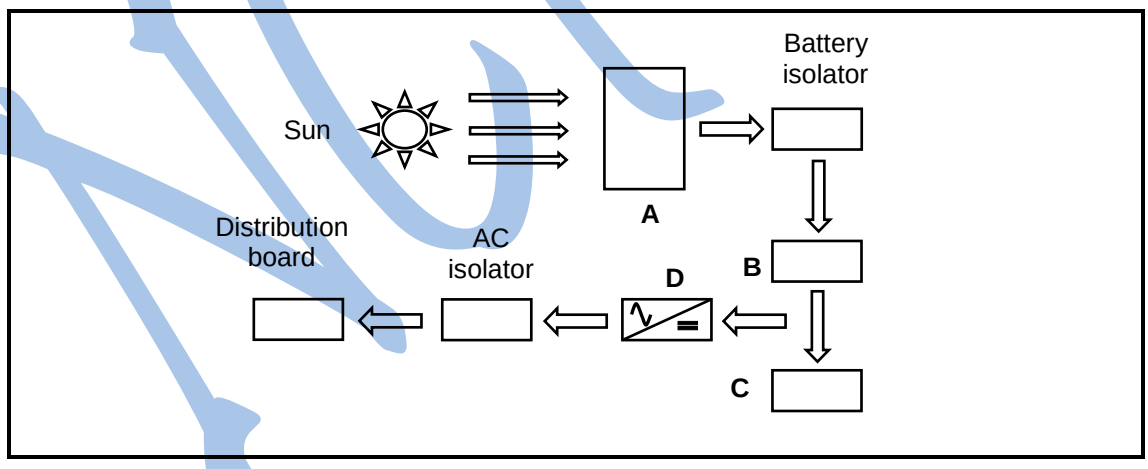


FIGURE 2

6.1.1 Identify the components labelled A to D. (4)

6.1.2 What is the function of component B? (2)

6.1.3 What is the function of component D? (2)

6.2 State TWO advantages of photovoltaic installations. (2)

[10]

TOTAL: 100

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