higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

MECHATRONIC SYSTEMS
NQF LEVEL 2

(6040102)

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

This question paper consists of 7 pages.

NCS

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. ALL drawings are to be neat and correctly labelled.
5. ALL symbols are to be of IEC standard.
6. ALL terminal numbers to be labelled.
7. Write neatly and legibly.

NCV

QUESTION 1

1.1 FIGURE 1, below indicates three mechatronic systems indicated as A, B and C.

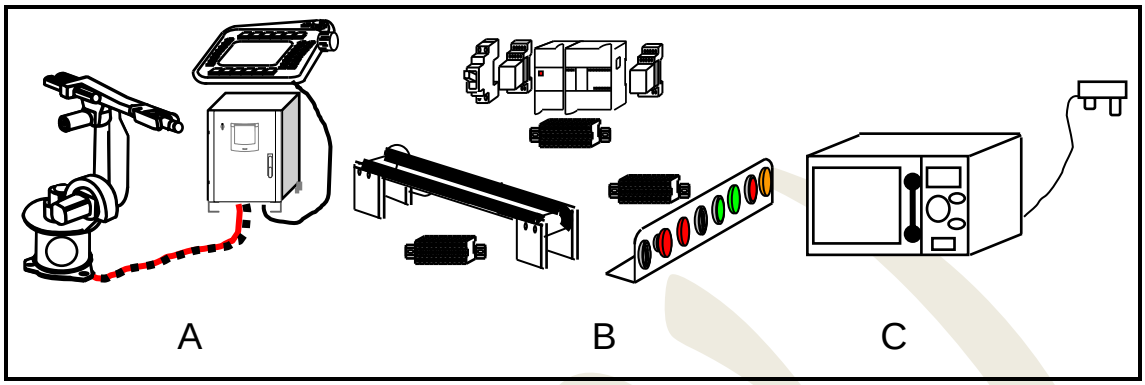


FIGURE 1

Answer the following questions:

1.1.1 Name the THREE mechatronic systems shown in FIGURE 1. (3 × 1) (3)

1.1.2 Name the controllers used to monitor and control the mechatronic systems in FIGURE 1. (3 × 1) (3)

1.1.3 Explain how the mechatronic controllers operate in each mechatronic system in FIGURE 1. (3 × 2) (6)

1.1.4 Which one of the mechatronic systems shown in FIGURE 1 would be considered to be a complex system? (1 × 1) (1)

1.2 Study FIGURE 2 of a pedestal drilling machine.

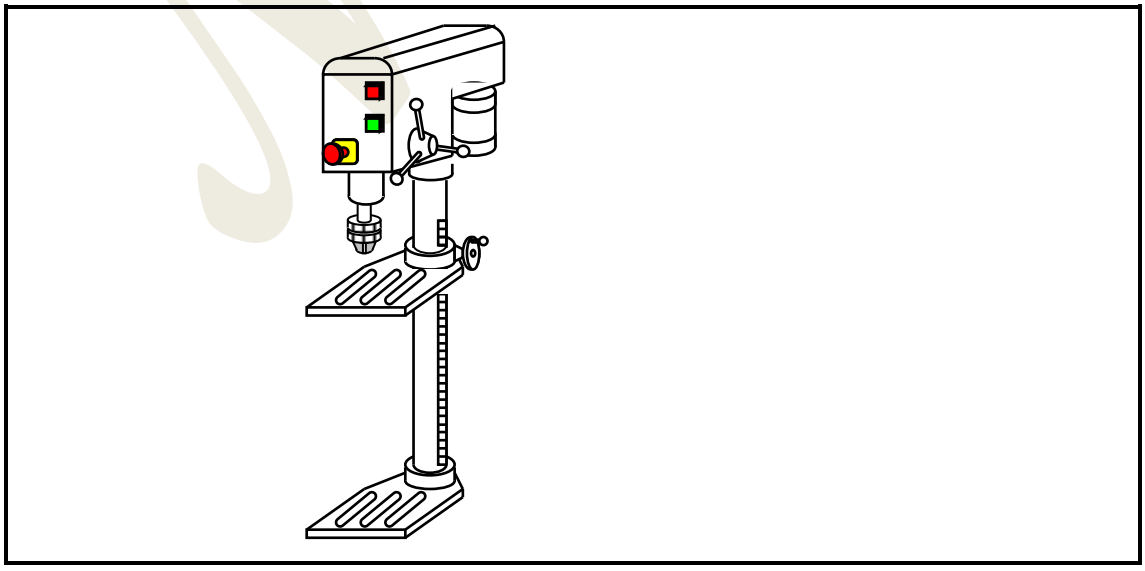


FIGURE 2

Answer the following questions:

1.2.1 Show by means of a technical system block diagram the energy conversion. (1 × 2) (2)

1.2.2 Draw a fully labeled systems diagram that represents the pedestal drilling machine. (5 × 1) (5)

[20]

QUESTION 2

A relay ladder logic (hard-wired) control application requires an operator panel made up of pilot devices.

2.1 Draw the fully labelled symbol of a 2P selector switch. Include the designation and terminal numbering. (3 × 1) (3)

2.2 Draw the fully labelled symbol of a normal open (NO) push button. Include the designation and terminal numbering. (3 × 1) (3)

2.3 Draw the relay ladder logic (RLL) hard-wired control circuit for the pedestal drill represented in FIGURE 2. (10 × 1) (10)

2.4 Is the pedestal drilling machine using a closed or open loop control circuit? (1 × 2) (2)

2.5 What type of gear system is used to move the spindle up or down? (1 × 2) (2)

[20]

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QUESTION 3

3.1 Complete the labelling on FIGURE 3. Write only the answer next to the question number (3.1.1–3.1.3) in the ANSWER BOOK.

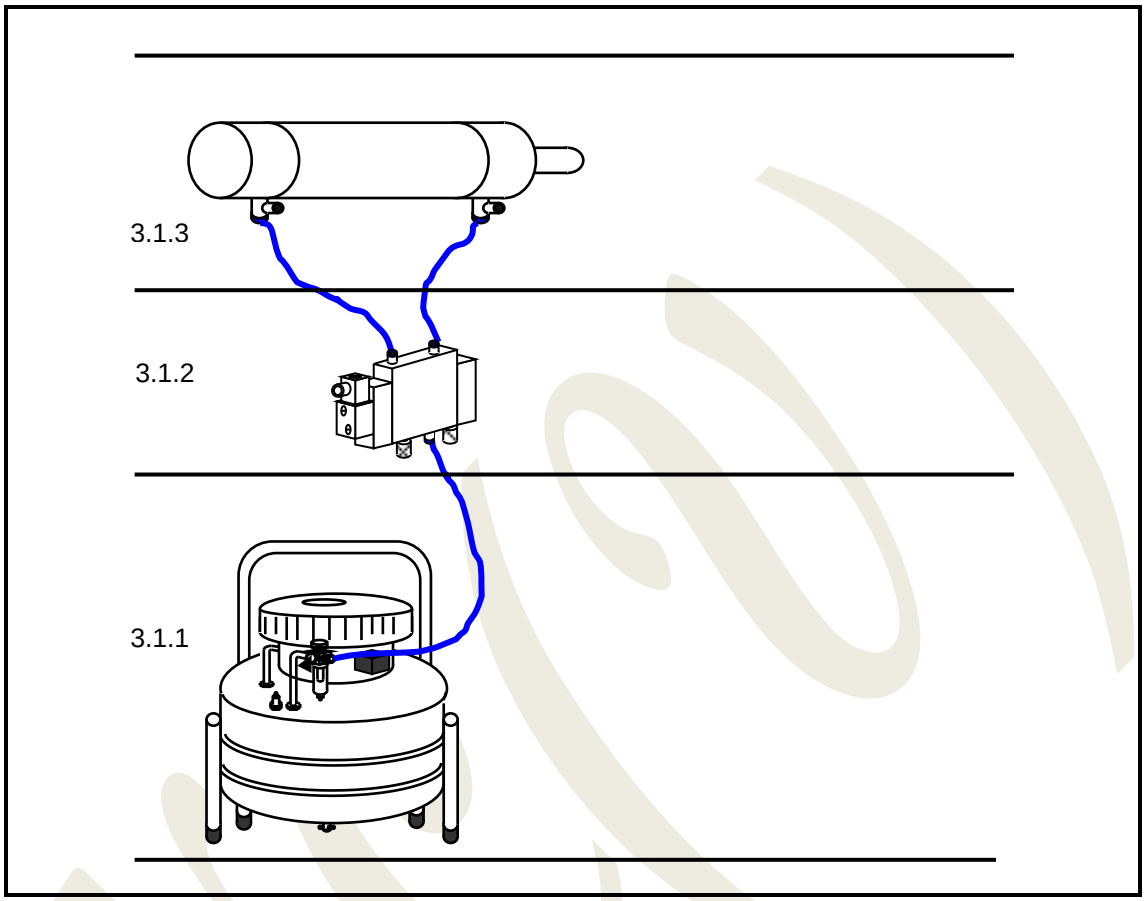


FIGURE 3

(3 × 1) (3)

3.2 Redraw the pneumatic circuit using IEC symbols of the pictorial drawing shown in FIGURE 4.

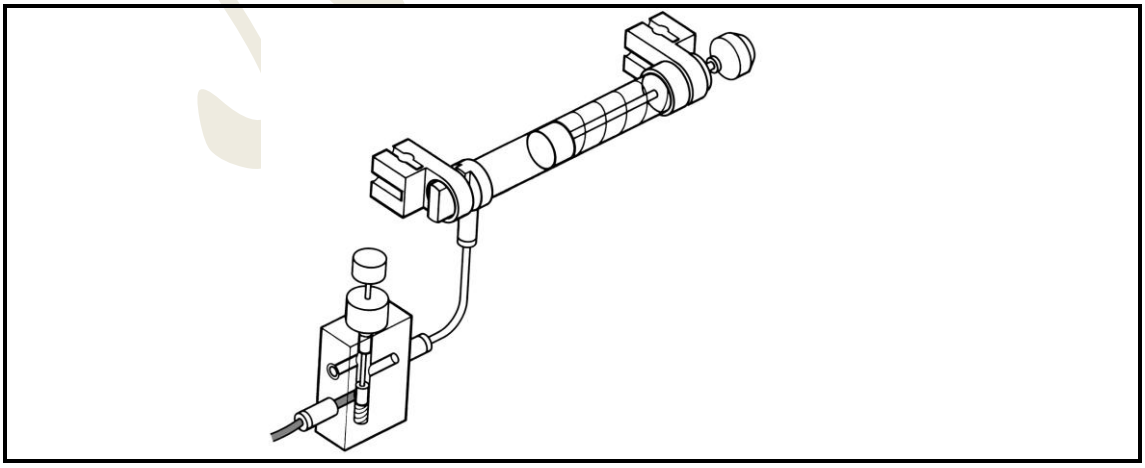


FIGURE 4

(3 × 1) (3)

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3.3 Redraw the pneumatic circuit using IEC symbols of the pictorial drawing shown in FIGURE 5.

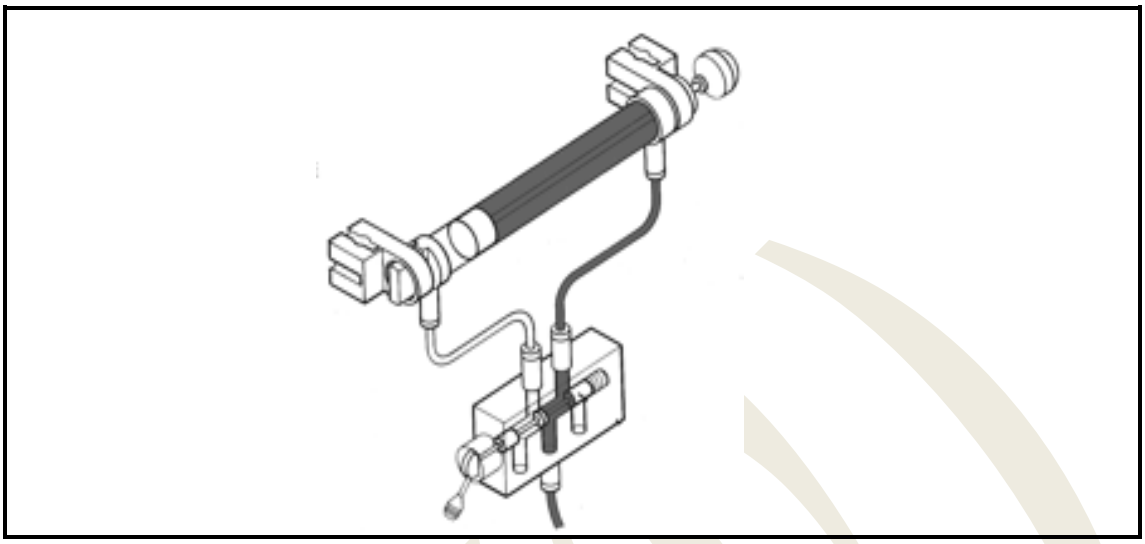


FIGURE 5

(3 × 1) (3)

3.4 Explain the function of a flow control valve in a pneumatic circuit. (1 × 2) (2)

3.5 Name THREE applications of pneumatics in industry. (3 × 1) (3)

3.6 List SIX basic design rules that need to be applied when working with pneumatic piping circuits. (6 × 1) (6)

[20]

QUESTION 4

4.1 Study the perception drawing shown in FIGURE 6 of a single acting solenoid valve.

Explain its operation using a solenoid circuit symbol.

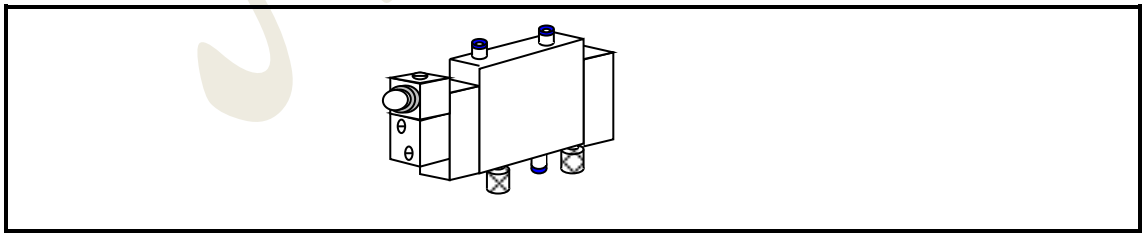


FIGURE 6

(4 × 1) (4)

4.2 List SIX safety rules that must adhered too when working with electro-pneumatic circuits. (6 × 1) (6)

4.3 Draw a sequence step diagram for the 'pick n place' device shown in FIGURE 7.

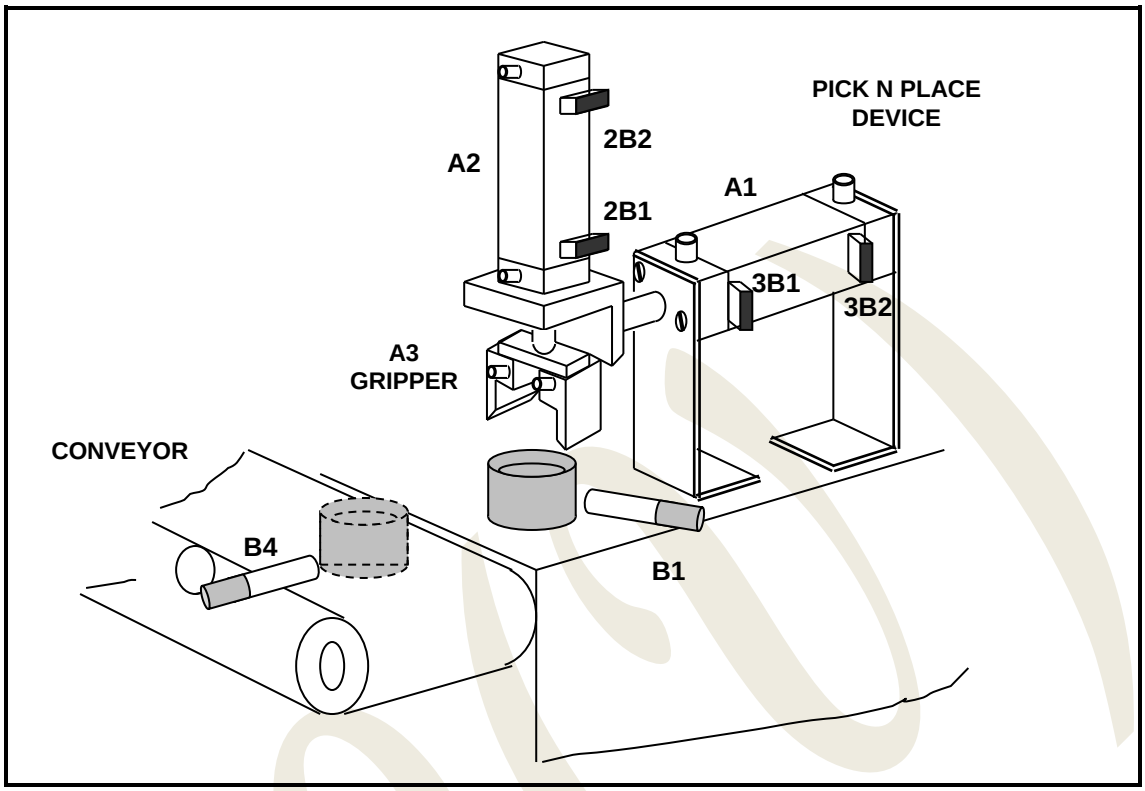


FIGURE 7

(10 × 1) (10)
[20]

QUESTION 5

5.1 Explain with the aid of a drawing how dead circuit continuity testing is carried out. (2 × 2) (4)

5.2 Explain with the aid of a drawing how live circuit continuity testing is carried out. (2 × 2) (4)

5.3 Explain with the aid of a drawing how the contacts of a relay can be tested. (2 × 2) (4)

5.4 List FOUR reasons why the quality of compressed air can be compromised. (4 × 1) (4)

5.5 Malfunctions can occur in the electrical sub-systems.

List FOUR possible malfunctions that can occur in *protective devices* (fuses and motor protection relays). (4 × 1) (4)
[20]

TOTAL: 100

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