higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

MECHATRONIC SYSTEMS
NQF LEVEL 2

28 November 2023

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 1.1.1 Potential energy (1)

1.1.2 Kinetic energy (1)

1.1.3 He stops for a second before going down. (1)

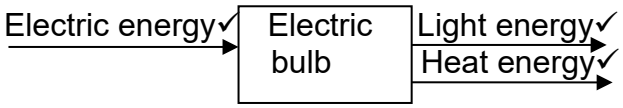
1.2 Ep = mgh
= 20 × 9,8 × 3,5✓
= 686 J✓
= 0,686 kJ✓ (3)

1.3 Nuclear fission is the splitting ✓ of an atom into two or more smaller atoms, ✓ while nuclear fusion is the fusing ✓of two or more smaller atoms into a larger atom. ✓
(2 + 2) (4)

1.4 Weight = mass × gravity
= 1 000 × 9,8✓
= 9 800 N✓

Work = force × distance
= 9 800 × 20✓
= 196 000 Nm✓ (4)

1.5



(3)

1.6
- Direct coupling
- Indirect coupling
- Electrotechnical coupling
- Electromechanical coupling
- Mechanical coupling (Any 3 × 1) (3)

[20]

QUESTION 2

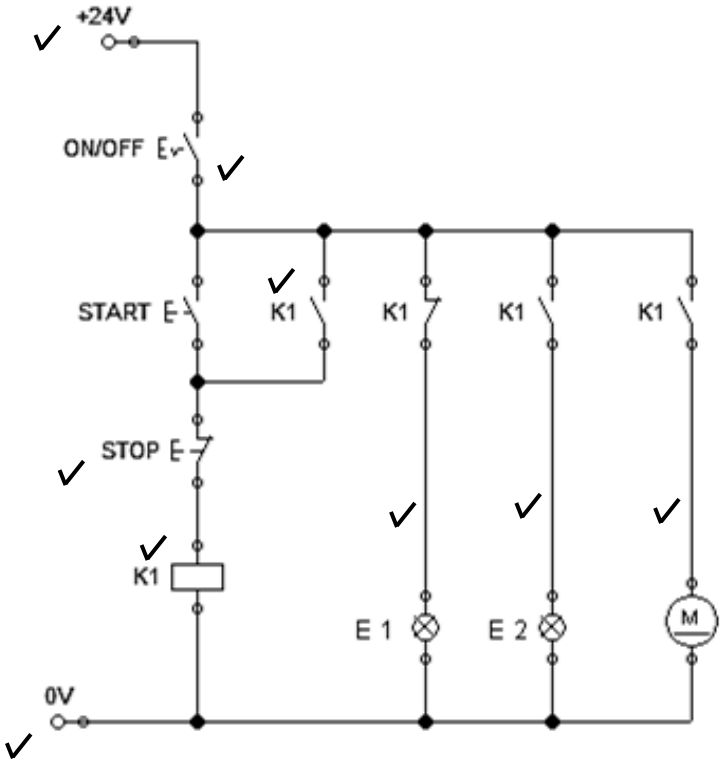
2.1 Proximity sensors are noncontact sensors ✓as they do not have any physical contact with the object or target that they are going to detect. ✓ (2)

2.2 2.2.1 A robot is a reprogrammable, multifunctional manipulator ✓designed to move materials, parts, tools or specialised devices ✓ through variable programmed motions for the performance of various useful tasks. (2)

2.2.2
- Arc welding
- Spot welding
- Material handling
- Machine tending
- Painting
- Picking, packing and palletising
- Assembling
- Mechanical cutting
- Grinding
- Deburring
- Polishing (Any 3 × 1) (3)

2.3 2.3.1 Arc welder
2.3.2 Spot welder
2.3.3 Suction gripper
(3 × 1) (3)

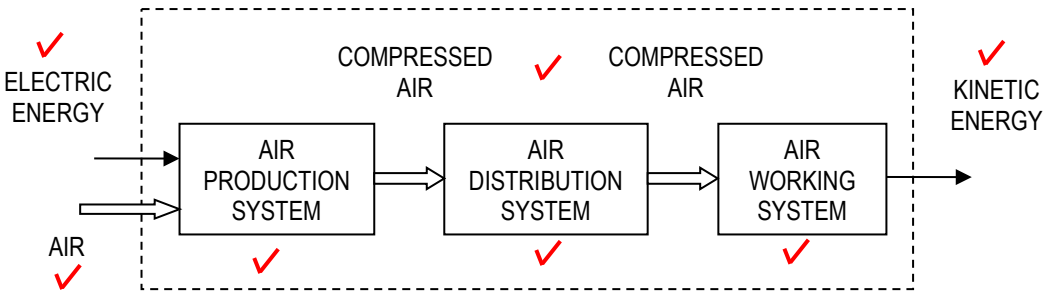
2.4



E1 is green and E2 is amber. (10)
[20]

QUESTION 3

3.1



(7)

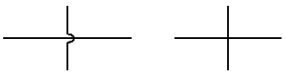
3.2 3.2.1



3.2.2



3.2.3



(3 × 1) (3)

3.3 A bidirectional valve is rated to function from inlet to outlet or vice versa ✓ and has the ability to control flows and pressures in both directions, ✓ whereas a unidirectional valve allows the air to flow in only one direction ✓ and prevents air flow in the opposite direction ✓. (2 + 2) (4)

3.4
- Compressed air requires good preparation as dirt and condensate should not be present.
- It is not always possible to achieve uniform and constant piston speeds with compressed air.
- Compressed air is only economical up to a certain force of 40 kN to 50 kN and 6 to 7 bar.
- Exhaust air is loud, which is a problem. It has been adequately reduced due to development of sound-absorption materials and silencers at an expense.
- A pneumatic device is sensitive to extreme changes in temperature as well as vibration.
- Compressed air is more expensive than electricity.
- It is essential to ensure that there are no leaks in a pneumatic system because compressed air escaping leads to energy loss.
- Pneumatic systems are known for making a loud noise. As a solution, a silencer can be installed in every dump line.
- Installation cost increases when the instrument requires speciality pipes.
- Pneumatic systems are not upgradable to become compatible with smart electronics.

(Any 4 × 1) (4)

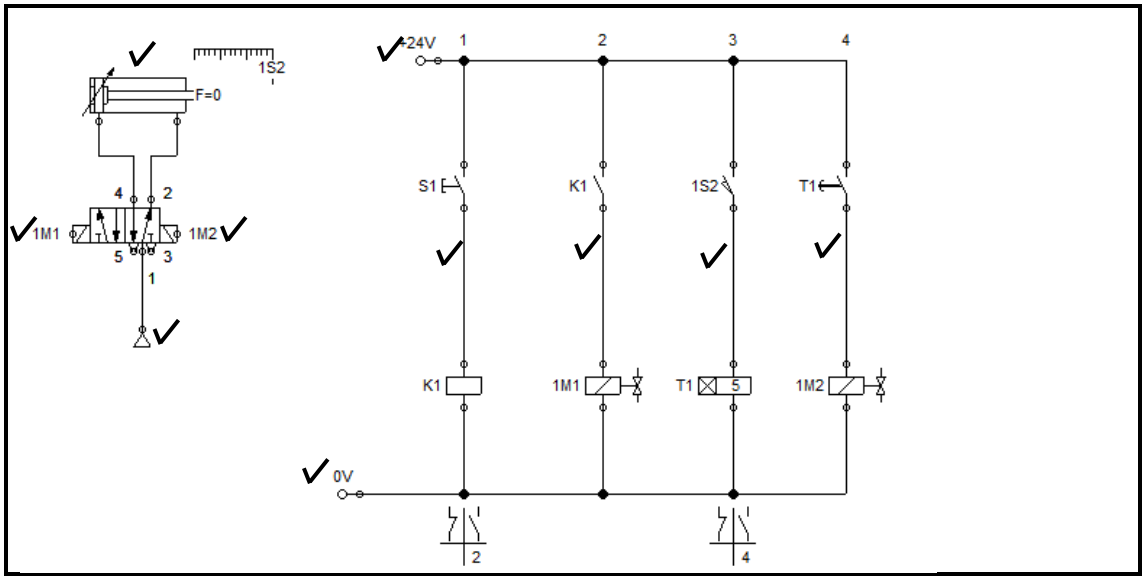
3.5 Reciprocating motion is repeating motion in a straight line, ✓ which includes up and down, side to side or in and out. ✓ (2)

[20]

QUESTION 4

4.1 Motion control is the process of moving machinery using rotary✓ and linear actuators✓ (2)

4.2



(10)

4.3
- Remote control is not possible.
- Latching is not possible.
- Design improvement is not flexible.
- Switching more than one valve at a time is not possible. (Any 3 × 1) (3)

4.4
- Electrocution
- Electric shock
- Burns
- Falls (4)

4.5 When the ON and OFF push-buttons are activated at the same time, the coil (K1) will energise.✓ When the OFF button is activated on its own, the relay coil will de-energise.✓ (2)

[21]

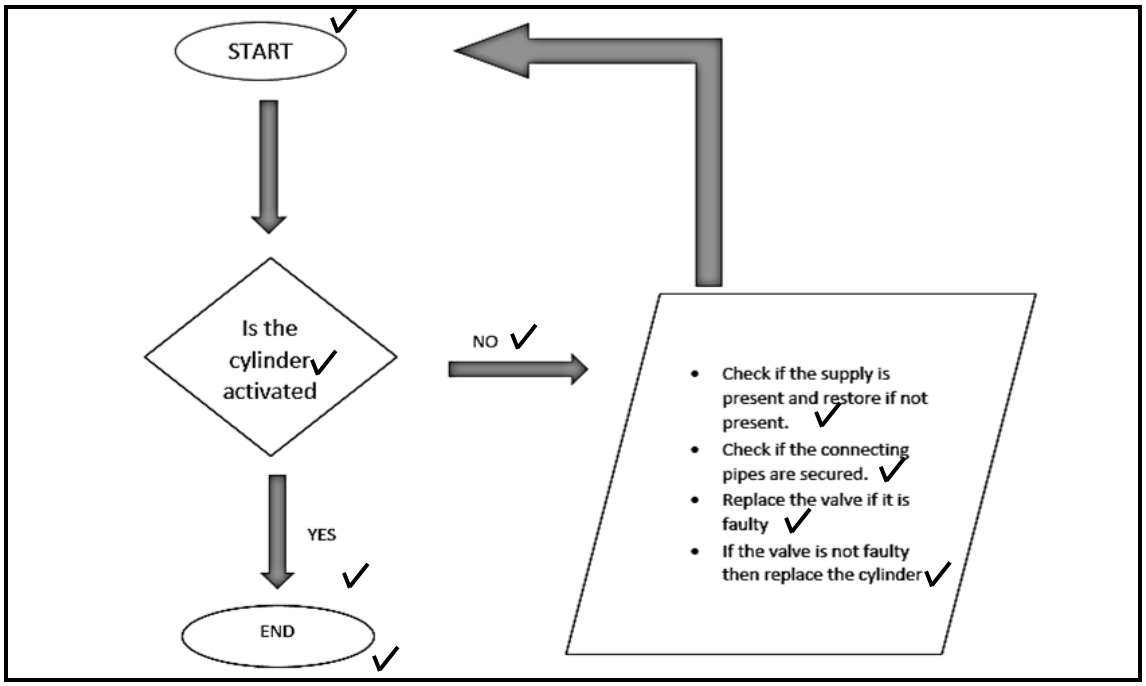
QUESTION 5

5.1
- Wrong switch positioning
- Mechanical fault with mechanical contact assembly
- Incorrect operating voltage over contacts
- Broken connecting wires
- Damaged insulation (Any 2 × 1) (2)

5.2
- Incorrect input and output circuitry
- Incorrect voltage type at the inputs
- Supply voltage incorrect or not present
- Interface cable faulty
- Damaged wiring between PLC and field devices
- Faulty insulation
- Terminations and connectors loose or defective
- Plug in modules not correctly fastened (Any 3 × 1) (3)

5.3
- Test at the middle point.
- Check the middle of the second half.
- If the fault is not evident
- Proceed backwards
- Repeat process until fault is found (5)

5.4



(9)
[19]

TOTAL: 100

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