higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS CONTROL
NQF LEVEL 3

24 November 2023

This marking guideline consists of 6 pages.

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SECTION A

QUESTION 1

1.1 False
1.2 False
1.3 True
1.4 True
1.5 True

(5 × 1) **[5]**

QUESTION 2

2.1 M
2.2 L
2.3 B
2.4 I
2.5 D
2.6 K
2.7 E
2.8 H
2.9 F
2.10 J

(10 × 1) **[10]**

QUESTION 3

3.1 Positive-displacement flowmeter
3.2 Thermocouple
3.3 Parallax error
3.4 Manual recording
3.5 Capsule

(5 × 1) **[5]**

TOTAL SECTION A: 20

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SECTION B

QUESTION 4

4.1
- Pressure
- Temperature
- Flow
- Level (4)

4.2
- International standards
- The primary (basic) standards
- Secondary standards (3)

4.3
- Lower control limit is the bottom limit in control for data points that fall below✓ the average line on a control chart.✓
- Upper control limit is the top limit in control for data points that fall above✓ the average line in a control chart.✓ (4)

4.4
- Systematic error
- Random error
- Parallax error
- Zero error
- Drift
- Hysteresis (Any 4 × 1) (4)

[15]

QUESTION 5

5.1
- Spring
- C-shape Bourdon tube
- Scale
- Sector gear
- Rack and pinion
- Link
- Pointer
- Pressure connection/socket (Any 5 × 1) (5)

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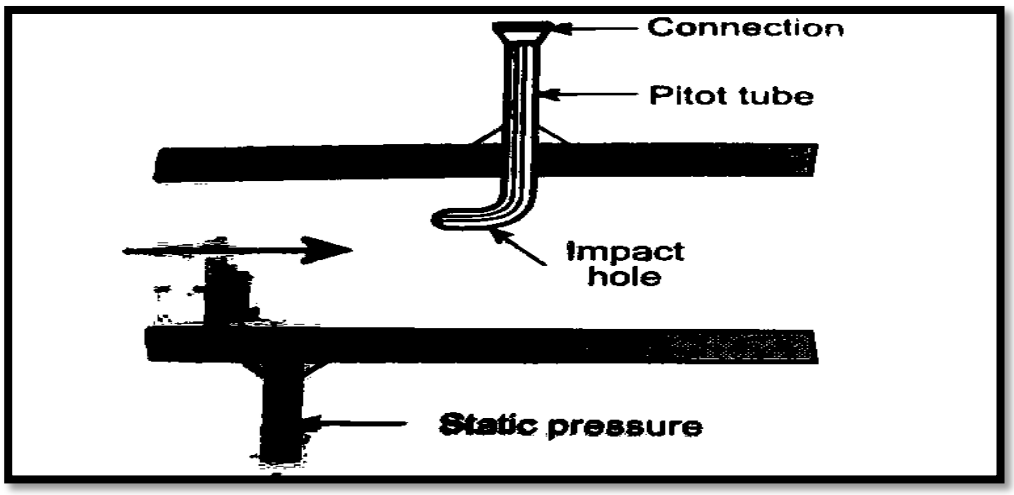
5.2

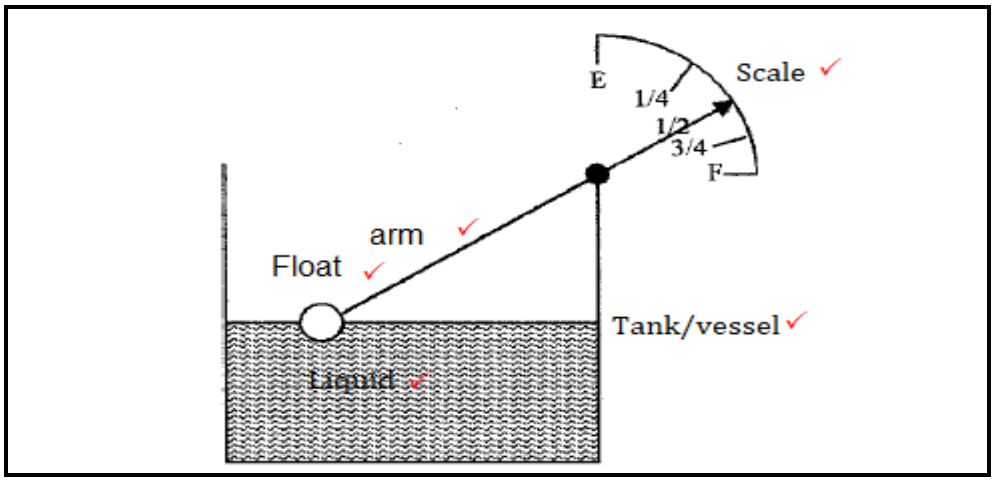


1 mark for correct diagram and 4 marks for correct labelling (5)

5.3
- They are cheap
- Interchangeable
- Have standard connection
- Can measure a wide range of temperature (4)

5.4 Rotating-paddle-type level switches detect the presence or absence of solids, as well as liquids. A small, low-power motor keeps the paddle in rotation✓ and when the material rises to the level of the paddle, its rotation is stopped.✓ The motor, prior to being stalled, applies its power to a micro-switch, which responds to the presence of the material.✓ (3)

5.5 5.5.1



(5)

5.5.2 As the liquid level rises, the float position follows it,✓ resulting in the arm pivoting.✓ And the pointer moving against the scale, thus indicating the level of the liquid.✓ (3)

[25]

QUESTION 6

6.1 Recorders:

- Chart recorder and strip chart
- Paper recording chart
- Data logger and recorder
- Digital video recorder
- Data acquisition systems and instrument
- Video monitors (Any 3 × 1)

Indicators:

- Sight flow indicator
- Grounding indicator
- Valve position indicator
- Pilot and indicator lights
- Temperature indicator
- Digital panel meter
- Analogue panel meter (Any 3 × 1)

(2 × 3) (6)

6.2 6.2.1 Controller examines the measurement✓ and determines what action should be taken.✓

OR

The element in a process control loop that evaluates any error of the measured variable✓ and initiates corrective action by changing the manipulated variable.✓

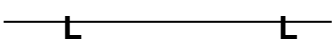
6.2.2 Actuator is a mechanical device used to move something✓ or to prevent motion, thereby controlling the system.✓

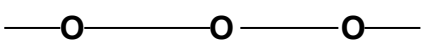
OR

A device that performs an action on one of the input variables of a process✓ according to a signal received from the controller.✓

6.2.3 Signal transfer elements is where measurements from a sensor is converted into a signal✓ and sent to a control device to be shown on a display.✓

(3 × 2) (6)

6.3 6.3.1 

6.3.2 

(2 × 2) (4)

6.4
- An open fail-safe system is a system that allows a circuit breaker or any other component to trip, thereby breaking a circuit connection by a switch.✓
- This configuration operates under an open condition, where the system shuts down completely,✓ or a relay is used to isolate the failed component, while the rest of the operations continues.✓
- This is more practical for troubleshooting purposes, instead of shutting down the whole system.✓

OR

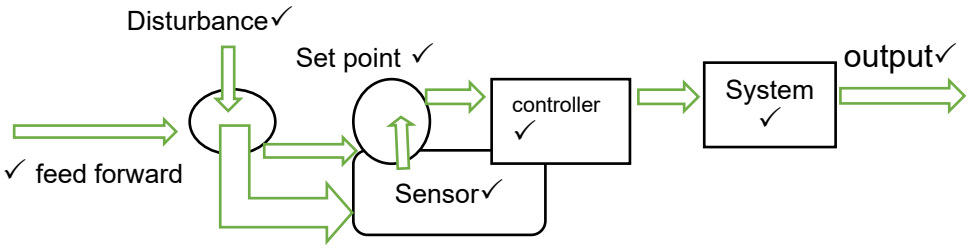
A fail-safe system is one ensuring that, in the event of an equipment failure✓ or any fault appearing,✓ the system will always go to a safe status,✓ normally affecting availability.✓ (4)

[20]

QUESTION 7

7.1
- Kettle boilers
- Thermosyphon boilers
- Fired boilers
- Forced circulation boilers
- Coal-fired boiler
- Oil-fired boiler
- Electric immersion boiler
- Fire-tube boilers
- Water-tube boiler (Any 4 × 1) (4)

7.2



(7)

7.3
7.3.1 Set point
7.3.2 Manipulated variable
7.3.2 Controller valve

(3 × 1) (3)

7.4
- Measurements
- Comparison
- Computation
- Correction (4)

7.5 A small-gauge pipe that is used to connect a point in a pipe to an instrument, in in order to measure the pressure. (2)

[20]

TOTAL SECTION B: 80
GRAND TOTAL: 100

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