higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

INSTRUMENTATION TECHNOLOGY
NQF LEVEL 3

04 November 2022

This marking guideline consists of 8 pages.

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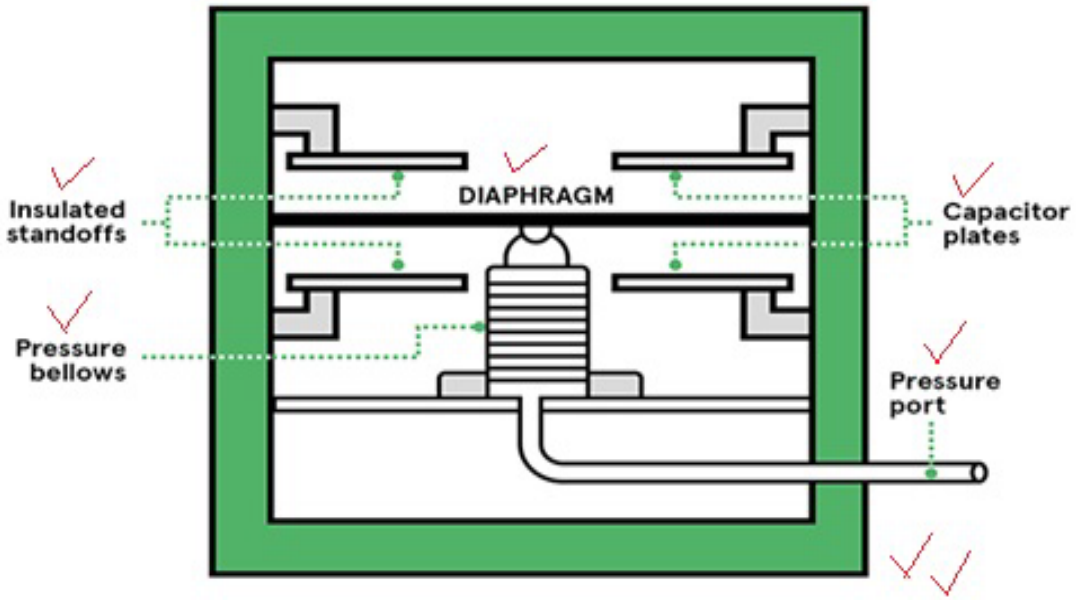
QUESTION 1

1.1
- High cost
- Slow reaction time
- Limited range of transmission
- Less reliability
- Less accuracy, especially in long signal lines
- A pneumatic signal line can be cumbersome to install (Any 5 × 1) (5)

1.2



ONE mark for labelling up to a maximum of THREE marks. √
TWO marks for drawing

- The transmitter is mounted onto the piping system with a process connection.
- The fluid pushes against the isolation diaphragm.
- The pressure that develops because of the fluid pushing on the isolating diaphragm increases the pressure inside the filling, fluid which then pushes against the sensor.
- The balancing line can be used to measure gauge pressure (open), absolute pressure or differential pressure.
- The bridge circuit measures the capacitance, amplifies the signal, and transfers it through the electronic socket. (10)

1.3
1.3.1 True
1.3.2 False
1.3.3 True
1.3.4 True
1.3.5 False

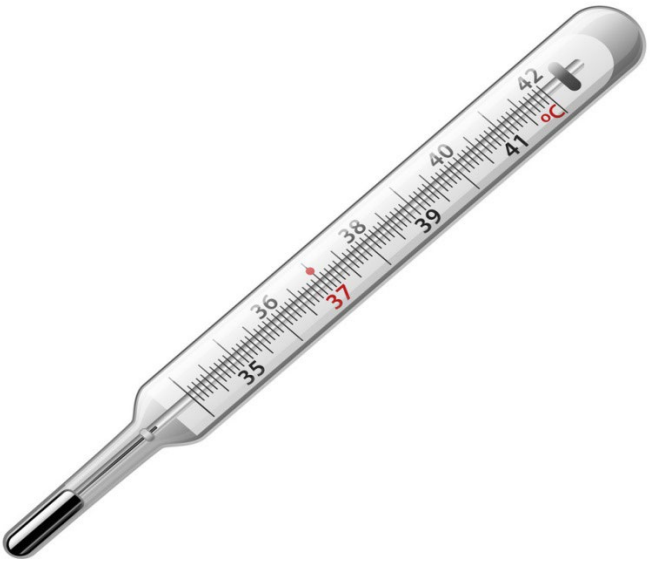
(5 × 1) (5)

1.4
- Steel diaphragm
- Silicone oil
- Silicon diaphragm
- Electrodes
- Pressure connections
- Circuit board
- Connector

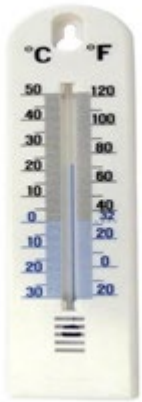
(Any 5 × 1) (5)
[25]

QUESTION 2

2.1 2.1.1



2.1.2



2.1.3

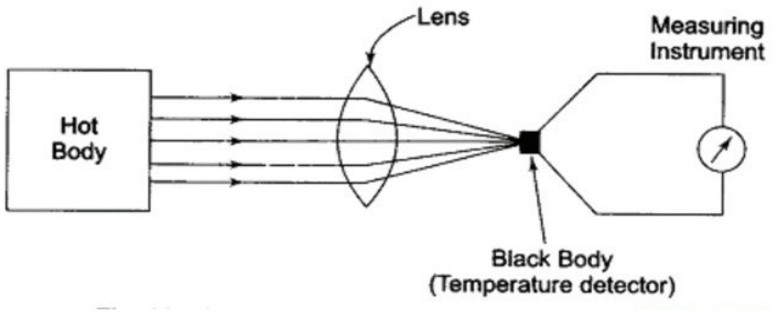


(3 × 3) (9)

2.2 Most of the liquid in a thermometer is in its bulb. As its temperature increases,✓ the liquid expands and pushes up into the narrow tube.✓ As the liquids expands, the meniscus of the liquid moves to a certain mark on the scale.✓ If the thermometer is calibrated correctly, the temperature can be read from where the meniscus is on the scale. (3)

2.3
- Mercury
- Alcohol (2)

2.4



FOUR marks for drawing
TWO marks for labelling (6)

2.5 Advantages
- A pyrometer is easy to operate.
- It can measure extreme temperatures from a safe distance.
- Pyrometers are available in mounted and handheld versions.
- The instrument cannot cause change in a process. (4)

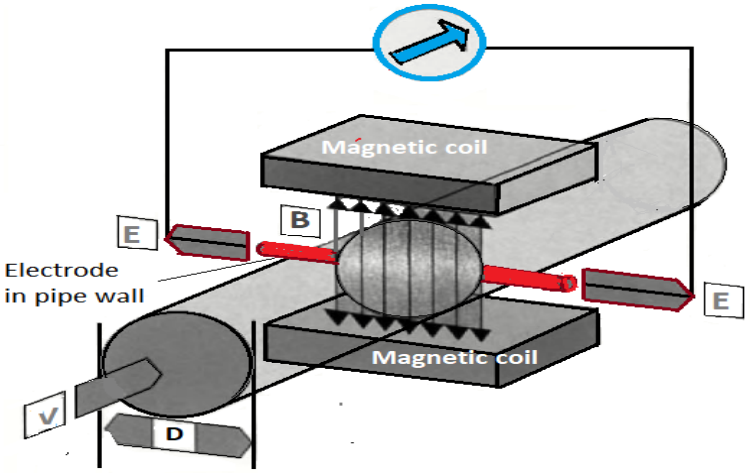
Disadvantages
- It's expensive.
- Temperature reading may be a little inaccurate.
- Specific pyrometers are needed for measuring different materials.
- Dust, smoke, fog, and steam affect readings.
- A dirty lens causes an inaccurate reading. (Any 4 × 1) (4)

2.6 2.6.1 F
2.6.2 D
2.6.3 B
2.6.4 C
2.6.5 A
(5 × 1) (5)

2.7 NTC✓ and PTC✓ (2)
[35]

QUESTION 3

3.1



SIX marks for the correct drawing
TWO marks for the output voltage
TWO marks for the direction of fluid flow (10)

3.2

ADVANTAGES	DISADVANTAGES
• Available in standard sizes	• Not suitable for large applications
• Provides high accuracy with uncertainty between only two and five percent	• Expensive to install

(2 × 2) (4)

3.3 The purpose of zero checking is to calibrate the lower-end values that the device will measure on the meter. During the check, the pipe section where the meter is situated should be full of liquid or gas✓ but standing still.✓ When the flow is still, an ammeter connected to the output of the flow meter should read the base current.✓ The base current is the amount of current the meter reads when the flow in the pipe is zero.✓ If the meter shows a reading above or below this current, the meter should be adjusted to give the base-current reading.✓ This calibrates the flow reading of the meter. (5)

3.4 3.4.1 They are used to monitor the flow rate of liquids through a surface open to the atmosphere.✓✓ This makes it possible to easily spot the flooding of rivers and malfunctioning of system.✓ (3)

3.4.2
- Measures flow from small applications such as gutters
- Measures flow from large applications such as rivers (2)

3.4.3 They have limited applications because they pose potential environmental or safety risks✓✓ since the liquid is exposed to the atmosphere. (2)

3.4.4
- Weirs
- Flumes
- Tracer method
- Velocity area method (4)

3.4.5
- Corrosion/erosion
- Dirt build-up (2)

3.4.6
- Inspect the weir pool floor and remove sediment and debris if necessary.
- Verify that the crest is horizontally and vertically level.
- Verify that the crest is at least 2 Hmax above the maximum downstream water level.
- Clean the crest of any debris, ragging, vegetative growth, etc.
- Inspect the weir crest for nicks, burrs, rust, ice, or any other condition that affects flow over it. (5)

3.5 3.5.1
- Transducer
- Transmitter
- LCD screen
- Keypad
- Preamplifier (5)

3.5.2 The amount of fluid that passes through the meter is weighed at two instances.✓ The amount of fluid that flows in and out of the container is weighed and compared to the reading that the meter displays.✓✓ (3)

[45]

QUESTION 4

4.1 4.1.1 Length = 2 × 39,3707
= **78.741 inches** (2)

4.1.2 Length = 12 × 30.48
= **366,96 cm** (2)

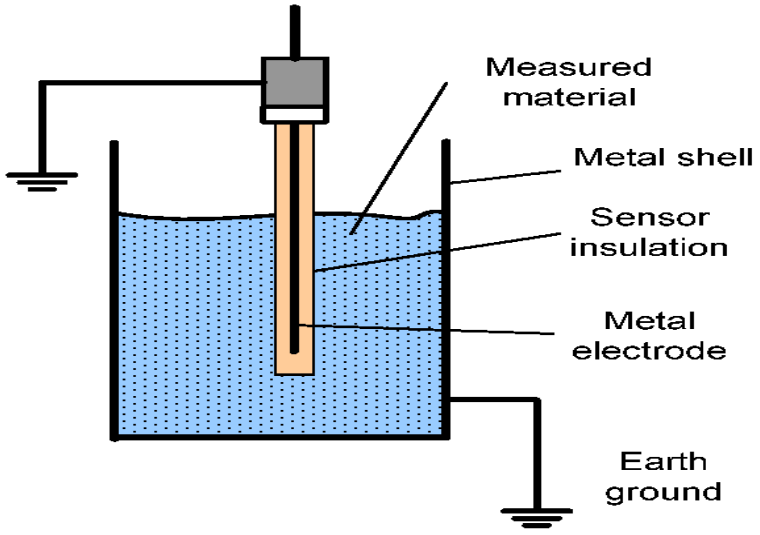
4.1.3 Percentage = $(l_t / L_{max}) \times 100$
= (2.6/4) × 100
= **65%** (4)

4.2
- Continuous level measurement is when a measurement can be taken at any time and when an exact value can be read.
- Discrete level measurements are an on/off type of measurement. This means that the measurement checks certain conditions such as a full or empty tank. (2 × 2) (4)

4.3
- Visual
- Bubbler pressure
- Float type
- Radar
- Ultrasonic
- Conductive
- Vibration
- Capacitive
- Hydrostatic pressure (Any 5 × 1) (5)

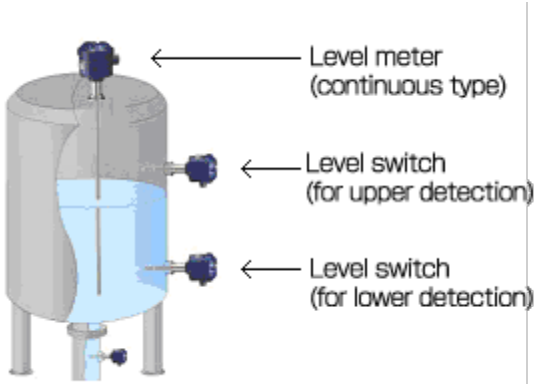
4.4
- Speedometer
- Dipstick
- Petrol gauge (3)

4.5



FIVE marks for drawing
ONE mark for each label (10)

4.6



SEVEN marks for correct drawing
ONE mark for each label. (10)

4.7
- The right displacer and spring for the job may not be installed.
- The displacer may be hanging at the wrong height.
- The spring might be damaged (overstretching).
- Whether the conditions such as the pressure and temperature inside the vessel, are the same as they were when the meter was ordered.
- Components might not be able to move freely. (5)

[45]

TOTAL: 150

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