higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FAULT FINDING AND PROTECTIVE DEVICES N6

27 November 2023

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 Floating charge it is when a battery is continually connected to a load and is designed to maintain voltage constant throughout its load range.✓ The voltage to the battery should supply sufficient current to the battery to overcome internal losses and keep the battery fully charged,✓ so that the voltage from the battery remains at the correct value under all conditions.✓ (3)

1.2
- Do not smoke during maintenance.
- Acid will destroy an alkaline cell.
- Check the electrolyte level.
- Avoid spilling and keep the installation dry.
- If body is enclosed in steel, insulate them from each other
- Check the battery lugs for dry or poor connections.
- Do not treat battery terminals or interconnections with grease.
- Clean off deposits on the top surface of the cell.
- Investigate the cells for cracks.
- If the electrolyte is in excess of normal use, check the charging rate.
- Check the floating charge and test each cell's voltage.
- Take SG readings.
- A yearly boost charge is recommended.
- Never leave the boost charge on if unattended.
- Check whether voltage is retained after it is switched off for a period.
- Check the output voltage. (16)

[19]

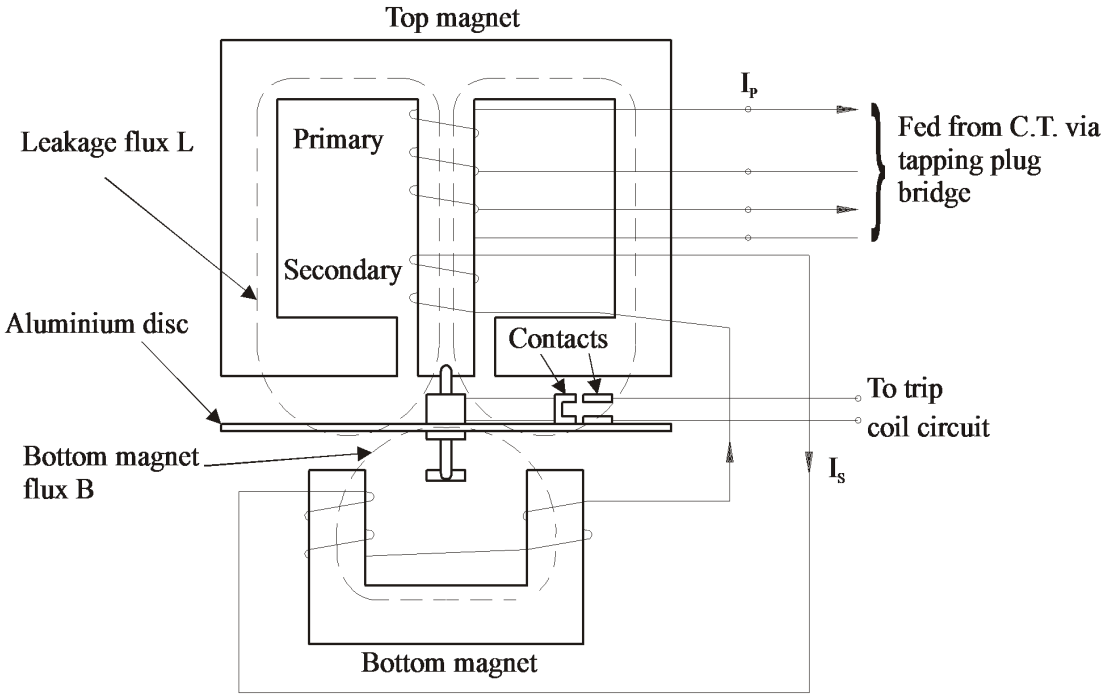
QUESTION 2

2.1
- It is only suitable for long lines. On a short line, the resistance of the arc at the fault may be comparable with the impedance of the line itself. The fault then seems to be further away from the relay than it actually is and faulty discrimination may result.
- Voltage transformers as well as current transformers are required.
- Greater time delays occur in clearing a fault at the far end of a section. For such a fault, the voltage at the voltage transformer will be higher than for a fault nearer the voltage transformer and the restraint will therefore be greater.
- Variations in the system affect operating times. (4)

2.2 A protection relay is a relay design to initiate disconnection of a part of an electrical installation or to operate a warning signal in the case of fault or other abnormal condition in the installation.✓✓ A protective relay may include more than one unit electrical relay and accessories.✓✓ (2 × 2) (4)

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2.3



(Any correct label 4 marks)
(Correct sketch 4 marks) (8)

2.4 100% current setting = 5 A in relay
∴ 5 A × 1,3 factor ✓ = 6,5 A in relay✓
= CT ratio × relay current✓
= 400/5 × 6,5✓
= 520 A✓ (5)
[21]

QUESTION 3

3.1
- Impulse voltage dry test
- Power frequency voltage dry test
- Temperature dry test
- Short circuit test
- Making and braking test
- Mechanical operation test
- Weatherproofing test (Any 6 × 1) (6)

3.2 The main purpose is to provide safety to operating✓ and maintenance staff✓ and also to prevent wrong sequencing of switching operators.✓ (3)

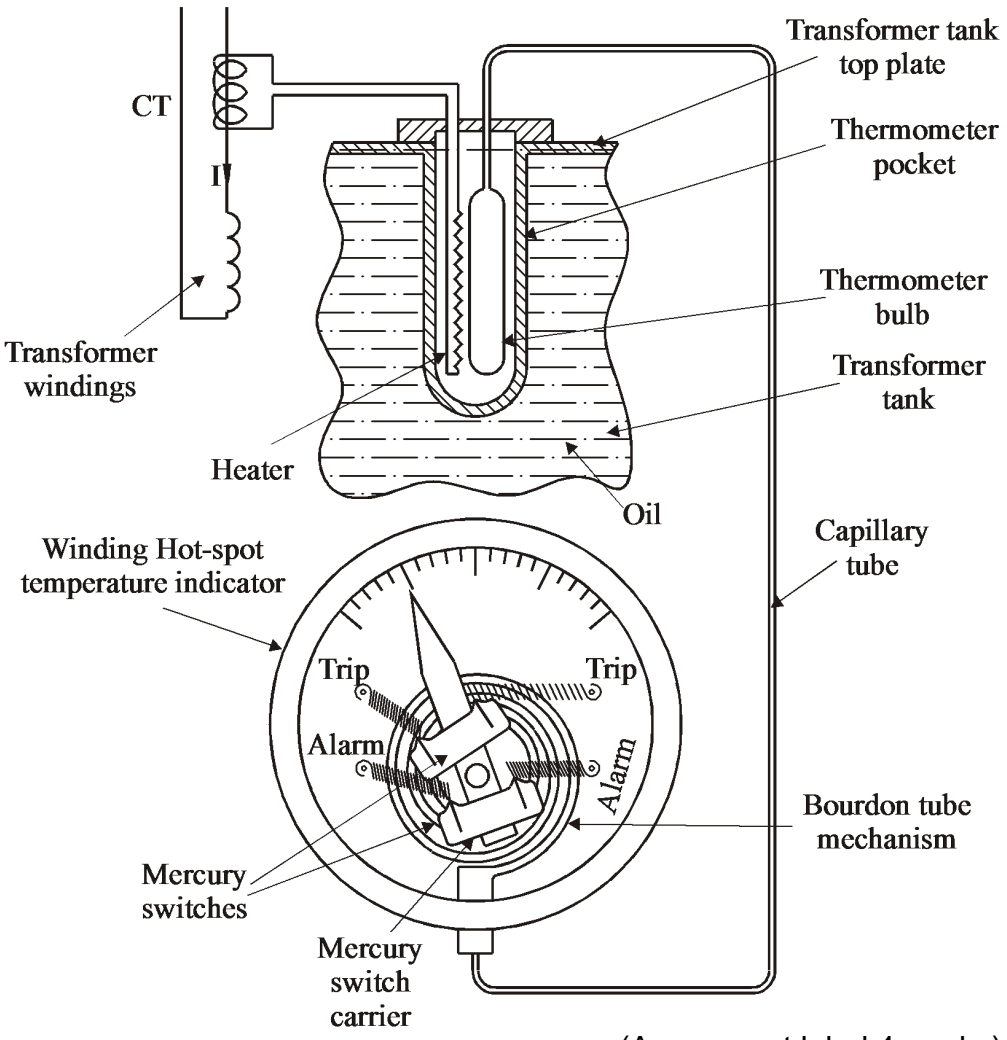
3.3 A circuit breaker is an automatically operated electrical switch✓ designed to protect an electrical circuit from damage✓ caused by overload or a short circuit.✓

Its purpose is to detect an abnormal fault condition✓ and interrupt current flow;✓ it can be reset either manually or automatically.✓ (2 × 3) (6)
[15]

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QUESTION 4

4.1



(Any correct label 4 marks)
(Correct sketch 3 marks) (7)

4.2
- Low oil level
- Slow gas leak
- Internal explosion (3)

4.3
- Alarm: 90 AC
- Trip: 100 AC (2)

4.4
- Spark overvoltage test
- Operating duty test
- Surface check for pollution
- Surface contamination test
- Test for unipolar oscillation switching impulse voltage
- Operating duty test for repeated spark-over (6)

[18]

QUESTION 5

5.1
- Earth fault
- Open circuit
- Short between conductors (3)

5.2 Before cutting the cable, it must be de-energised.✓ A good method to ensure de-energisation is through the spike method.✓ The spike method is a safety device for the electrician to prevent injury or loss of life.✓✓ (4)

5.5 $\therefore Velocity = \frac{2\ x\ total\ length}{total\ time}$ ✓

$= \frac{2 \times 2012}{40} = 100{,}6m/\mu s$ ✓

=NOW: $\frac{Velocity}{2} = \frac{100{,}6}{2} = 50{,}3m/\mu s$ ✓

∴ Distance of fault (lx)

$= \frac{Velocity}{2} \times time = 50{,}3 \times 20 = 1006m$ ✓

= 1 006 – 2 = 1 004 m✓✓ (6)

[13]

QUESTION 6

6.1
A − Reference voltage determines speed
B − Amplifier with two inputs from A and F amplifies signals
C − Converts amplifier voltage output into trigger pulses
D − Converts AC to DC
E − DC motor with shunt field for speed control drive
F − Gives DC output proportional to speed of motor
G − Reduces tacho-generator output to value acceptable to amplifier (7)

6.2
- Provide a gate pulse of the required size and shape.
- Provide control of timing of pulses.
- Ensure that there is no or little time delay between the change in the control signal and the change in the phase delay.
- Maintain the time between pulses to SCRs of different phases.
- Ensure a transfer function that is as near linear as possible. (5)

6.3 Erratic triggering is caused by insufficient gate current,✓ especially when the thyristor is cold.✓ (2)

[14]

TOTAL: 100

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