TG 02-02

GUIDANCE ON THE CALIBRATION OF INSULATION TESTERS

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1. Background

Insulation testers are used to verify that electrical installations are safe to test windings on motors and insulation resistance on various appliances. It is essential that the tester provides the correct test voltage as the voltage may influence the measurement results.

Many accredited electrical laboratories have the technical ability to calibrate insulation testers provided they have calibrated resistors of sufficiently high nominal values at appropriate voltage. Specialised knowledge is however required in order to interpret accuracy specifications and to estimate uncertainties of measurement. This document recommends minimum requirements for the calibration of insulation testers.

2. Purpose and Scope

The purpose of this document is to specify guidelines for the calibration of portable insulation testers. This document applies to SANAS accredited calibration laboratories performing these calibrations.

The calibration requirements specified in this document apply to all portable insulation testers including analogue, digital and “crank handle” types. The document specifically excludes ‘loop testers’, ‘RCCB testers’ and ‘ELCB’ testers. In some instances these instruments are combined with an insulation tester in which case this document only has relevance on the insulation tester function.

3. References, Definitions and Abbreviations

3.1 References

[1] ISO 17025:2017 General requirements for the competence of testing and calibration laboratories.

3.2 Definitions

None

3.3 Abbreviations

ELCB - Earth Leakage Circuit Breaker
RCCB - Residual Current Circuit Breaker
rpm - Revolutions per Minute

4. General Requirements

4.1 Testers with a “crank handle” shall have the handle turned at a speed which causes the clutch to slip continuously, providing a constant rpm.

4.2 In order to safeguard calibrated resistors connected to the insulation tester, the maximum output current that can be used shall be determined.

5. Technical Requirements

5.1 Output Voltage Measurement

5.1.1 The output voltage is measured on each range to ensure that the tester delivers at least the minimum specified voltage. The voltage measurement is also used to determine the suitability of the resistors used for the calibration.

5.1.2 This measurement should be conducted at the load recommended by the manufacturer. The output voltage measured as well as the value of the load shall be stated on the calibration certificate.

5.2 Short Circuit Current Measurement

5.2.1 The short circuit current shall be measured by means of a milli-ammeter typically in the range of 1 to 2 mA.

5.3 Insulation Resistance Accuracy

5.3.1 A resistor of known value and voltage coefficient should be connected to the tester.

5.3.2 Calibrate the instrument on at least two points along the scale of each range.

5.3.3 It may be necessary to build up special purpose resistors, capable of withstanding the applied voltage.

5.3.4 Custom-built decade boxes may be used to calibrate exact resistance points. Care should be taken not to exceed the voltage and current limits marked on the decade boxes.

5.3.5 Instruments with analogue scales may prove difficult to calibrate using fixed value resistors. In these cases, scales should be interpolated and appropriate asymmetrical resolution uncertainty contributors taken into account.

5.4 Insulation Testers with a Continuity Function

5.4.1 Calibrate the low value ohms/continuity ranges by applying at least two low ohm resistance values.

5.4.2 Note that insulation testers are 2-terminal and are often calibrated with the leads supplied. This shall be reported on the calibration certificate.

5.5 Voltage Measurement Accuracy

5.5.1 Calibrate the voltage measuring ranges at a minimum of two points along the range using a suitable calibrator or known voltage source.

5.6 Confirming Functionality of the "Guard" Function

5.6.1 Where a guard terminal is incorporated on an insulation tester, the functionality of this terminal shall be verified. This can be done in the following way by connecting two suitable series resistors in parallel with the resistance being measured. (See figure 1 below)

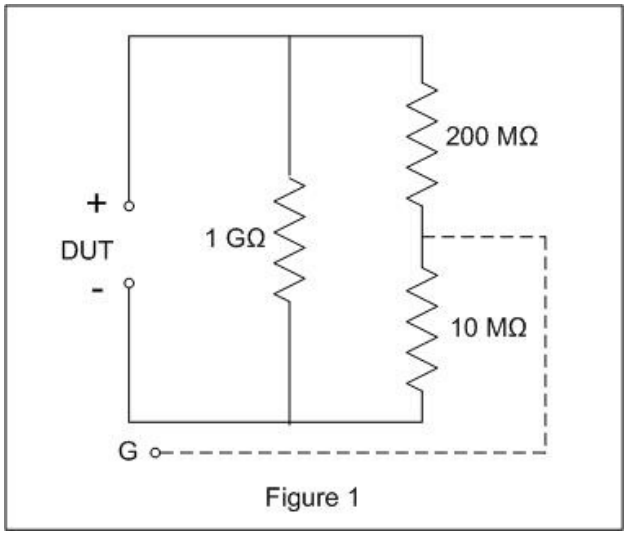

Figure 1

- Step 1 - Measure without the guard terminal connected (±173 MΩ expected)
- Step 2- Measure with the guard terminal connected (±1 GΩ expected)

  Note: these values are for guidance **only** and can be changed if **preferred.**

5.7 Interpretation of the Specifications

5.7.1 Many analogue insulation testers have an accuracy specification quoted as degrees of arc in order to approximate this on the instrument scale by means of a protractor generate a template as shown in figure 2. An approximation can then be made regarding the specified degrees of arc.

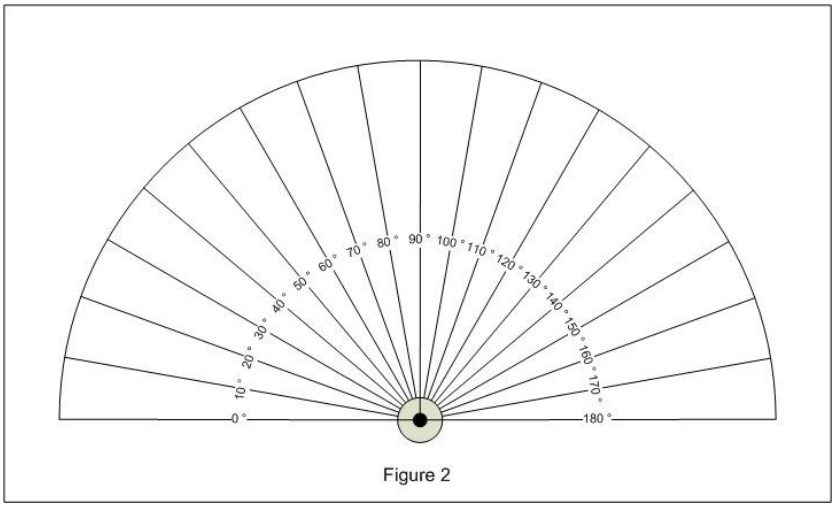

Figure 2

5.8 Expression of the Uncertainties

5.8.1 The scales of all analogue insulation testers are logarithmic.

5.8.2 The major source of uncertainty when calibrating analogue insulation testers is almost always the scale resolution.

5.8.3 The resolution on one side of the scale indication is not the same as on the other side. In these cases, it is necessary to quote an asymmetrical uncertainty figure.

ADDENDUM 1

AMENDMENT RECORD

Proposed by	Section	Change
AM Calibration	References	Updated reference to ISO/IEC 17025:2017