ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION SYSTEMS
UP TO 1 000 V a.c. AND 1 500 V d.c. –
EQUIPMENT FOR TESTING, MEASURING OR MONITORING
OF PROTECTIVE MEASURES –

Part 2: Insulation resistance
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Foreword

The Saudi Arabian Standards Organization (SASO) has adopted the International standard No. IEC 61557-2/2007 "ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION SYSTEMS UP TO 1 000 V a.c. AND 1 500 V d.c. – EQUIPMENT FOR TESTING, MEASURING OR MONITORING OF PROTECTIVE MEASURES – Part 2: Insulation resistance." The text of this international standard has been translated into Arabic so as to be approved as a Saudi standard without introducing any technical modification.
1 Scope

This part of IEC 61557 specifies the requirements applicable to equipment for measuring the insulation resistance of equipment and installations in the de-energized state.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61010-1:2001, Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

IEC 61557-1, Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 1: General requirements

3 Terms and definitions

For the purposes of this document, the definitions given in IEC 61557-1 and the following definitions apply.

3.1 rated output voltage

\( U_N \)

voltage output across the measuring equipment terminals when this equipment is loaded with the rated current

4 Requirements

The following requirements as well as those given in IEC 61557-1 shall apply.

4.1 The output voltage shall be a d.c. voltage; the indication at the rated output voltage across a resistor of a value of \( U_N \times (1 000 \, \Omega/V) \) shall not differ by more than 10 % relative to the indicated value, as a result of possibly present a.c. voltage components in the output voltage, when a capacitor of 2 \( \mu F \) is connected in parallel with the insulation resistance to be measured.

4.2 The open-circuit voltage shall not exceed 1,25 times the rated output voltage.
4.4 The measuring current shall not exceed 15 mA peak. Any a.c. component present shall not exceed 1.5 mA peak.

4.5 The maximum percentage operating uncertainty within the measurement range to be marked or stated shall not exceed ±30 % with the measured value as fiducial value, as determined in accordance with Table 1.

The operating uncertainty shall apply under the rated operating conditions in accordance with IEC 61557-1.

**Table 1 – Calculation of operating uncertainty**

<table>
<thead>
<tr>
<th>Intrinsic uncertainty or influence quantity</th>
<th>Reference conditions or specified operating range</th>
<th>Designation code</th>
<th>Requirements or tests in accordance with relevant parts of IEC 61557</th>
<th>Type of test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic uncertainty</td>
<td>Reference conditions</td>
<td>A</td>
<td>Part 2, subclause 6.1</td>
<td>R</td>
</tr>
<tr>
<td>Position</td>
<td>Reference position ± 90°</td>
<td>E₁</td>
<td>Part 1, subclause 4.2</td>
<td>R</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>At the limits stated by the manufacturer</td>
<td>E₂</td>
<td>Part 1, subclauses 4.2, 4.3</td>
<td>R</td>
</tr>
<tr>
<td>Temperature</td>
<td>0 °C and 35 °C</td>
<td>E₃</td>
<td>Part 1, subclause 4.2</td>
<td>T</td>
</tr>
<tr>
<td>Operating uncertainty</td>
<td>$B = \pm \left(</td>
<td>A</td>
<td>+ 1.15 \sqrt{E_{1}^2 + E_{2}^2 + E_{3}^2} \right)$</td>
<td>Part 2, subclause 4.5</td>
</tr>
</tbody>
</table>

$A = \text{intrinsic uncertainty}$  
$E_n = \text{variations}$  
$R = \text{routine test}$  
$T = \text{type test}$  

$B [\%] = \pm \frac{B}{\text{fiducial value}} \times 100 \%$

4.6 The user shall not be subjected to danger, when extraneous d.c. or a.c. voltages up to 120 % of the highest rated output voltage are accidentally applied for a duration of 10 s to the measurement terminals of the measuring equipment.

4.6.1 When the measuring equipment bears one of the following markings, the applied extraneous a.c. overvoltage can be reduced to a voltage of 1.1 times the phase to phase voltage:

a) **DO NOT USE IN DISTRIBUTION SYSTEMS WITH VOLTAGES HIGHER THAN ... V.**

The marking shall be written in the corresponding country language.

The value of the voltage shown on the marking shall be 1.1 times the maximum phase to phase voltage.

or
5 Marking and operating instructions

5.1 Marking

In addition to the marking in accordance with IEC 61557-1, the following information shall be provided on the measuring equipment.

5.1.1 Rated output voltage.

5.1.2 Rated current.

5.1.3 Measurement range in accordance with 4.5.

5.2 Operating instructions

The operating instructions shall state the following information in addition to the statements specified in IEC 61557-1.

5.2.1 A warning stating that measurements shall be carried out only on parts of an installation or equipment that are de-energized.

5.2.2 A statement on the correct operation when power is supplied by a hand-driven generator.

5.2.3 In accordance with 6.7, the possible number of measurements shall be stated for measuring equipment with power supplied by batteries/accumulators.

6 Tests

In addition to IEC 61557-1 the following tests shall be executed.

6.1 The operating uncertainty shall be determined in accordance with Table 1. In this process, the intrinsic uncertainties shall be determined under the following reference conditions:

ī nominal value of the supply voltage;

ī nominal r.p.m. when power is supplied by a hand-driven generator;
– reference temperature $23 \pm 2^\circ C$;

– reference position in accordance with the manufacturer’s statement.
6.2 The open-circuit voltage shall be checked for compliance with the specification in 4.2 (routine test).

6.3 The rated current shall be tested through a test resistor of a value of $U_N \times (1000 \Omega/V)$. Compliance with the requirements in 4.3 shall be checked (routine test).

6.4 The measuring current shall be tested and compliance with the requirements in 4.4 shall be checked (routine test).

NOTE When an a.c. voltage is superimposed on the d.c., then measuring equipment for measuring the peak value of the current must be used.

6.5 Tests shall establish that the indication is stable and does not change by more than 10% when a capacitor of $2 \ \mu F \pm 10\%$ is connected in parallel. In this condition, the measuring equipment is loaded by a resistor free from capacitance and inductance in such a manner that the rated output voltage and rated current will occur (type test).

6.6 Overload tests

6.6.1 Overload test with a.c. voltage

The permissible overload in accordance with 4.6 or 4.6.1 shall be tested. For this purpose an a.c. voltage according to 4.6 or 4.6.1 shall be applied for a duration of 10 s whilst the equipment is switched on and off.

The a.c. test source shall have the capability to activate protective devices and to indicate weak points of circuitry. If protective devices are activated or parts are damaged, the test shall be repeated with a test source having a capability according to 16.2 of IEC 61010-1:2001.

After test with a.c. overvoltage according to 4.6, defects, if any, shall be clearly indicated, indications and displayed values shall not lead to unsafe interpretations.

After tests with a.c. overvoltages according to 4.6.1, the equipment shall stay within the specification.

This includes reactivation of protective devices by the user without any repair.

NOTE The replacement of fuses accessible to the user should be considered as reactivation of a protective device.

6.6.2 Overload tests with d.c. voltage

In addition a d.c. voltage of 1.2 times the magnitude of the highest rated output voltage stored on a capacitor of $2 \ \mu F$ shall be applied in both polarities whilst the equipment is switched on and off. After this the measuring equipment shall stay within the specification, without activation of protective devices.

6.7 The number of measurements that it is possible to make, until the limit of the voltage range determined by the battery check facility is reached, shall be determined.
In this process, the measuring equipment shall be loaded with a test resistance of $U_N \times (1000 \Omega/V)$ alternating between 5 s loading and intervals of about 25 s prior to each new loading (type test).

6.8 Compliance with the tests in this clause shall be recorded.