

<b>Examination Procedure</b>  Rubrik / Title <b>Withstand voltage test</b>	Beteckning / Document <b>KBE EP-102</b>
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## 1 Scope

This Examination Procedure is applicable to all electrical equipment. Some sensors and low voltage components (rated voltage  $\leq 60$  V) may be excepted according to agreement between the Manufacturer and the Purchaser.

The examination procedure is performed as routine inspection to all equipment with electrical connections. For certain equipment withstand voltage test is prescribed in other product specific Examination Procedures.

As a minimum the test is to be carried out on all electrical circuits

- with rated voltage above 60 V
- for auxiliary power distribution (independent of the rated voltage)
- with galvanic separation from ground or from other circuits

## 2 Objective

To verify the insulation strength of the test item with attention to human and plant safety and resistance to overvoltage.

### Standardisation

Definitions in accordance with SS-IEC 60 and IEC 60664. If other requirements are specified in the relevant equipment standards (EN or IEC), they shall apply.

Test performed according to other generally accepted standard could replace this examination procedure after approval from the Purchaser.

### 3 Method

Withstand voltage testing is to be carried out on completed equipment. All electrical parts of the equipment must be connected for the test, except parts or items which, in accordance with currently valid specifications, are to be tested at lower test voltages. Such items are to be disconnected and tested separately. Current-consuming apparatuses (e.g. windings, instruments etc.) in which the test voltage would cause a current, may be disconnected from earth at their terminals. Cables and components necessary for power supply are to be included at test. The test voltage is to be applied between the electrical circuits and protective earth.

Interference suppression capacitors connected between live and exposed electrically conducting parts must not be disconnected, and must be able to withstand the test voltage.

When the test is carried out all switching devices shall be closed. If this is not possible, the test voltage shall be applied successively to all parts of circuit.

The test voltage is to be applied:

- a) Between connected terminals on the one side and the casing, mounting plate or other parts which, during normal operation, can be touched by hand or which are to be connected to earth, on the other side. If the casing is made of an insulating material, it shall be covered or fitted with a conductive layer on the outside during testing (e.g. aluminium foil).
- b) Between input and output terminals of isolation amplifiers and other high integrity components.

#### Electronic equipment

- Printed circuit boards may be removed during testing if they do not include any circuits for which testing is required.
- The circuits to be tested must be complete. Circuit boards including components, which are integral parts of an isolation circuit etc., must be included in the test or shortcircuited.
- When withstand voltage testing is specified for signal inputs and outputs, the signal common connection shall be connected to the protective earth.

#### Test Voltage

Table 1

Rated voltage (V)	Withstand voltage (50 Hz RMS)
< 60	500 V for electronic equipment
< 60	1 000 V for other equipment
60 – 250	1 500 V for control circuits
60 – 300	2 000 V for other equipment
300 – 660	2 500 V

### General procedure

Normally is the test voltage according to Table 1 instantly applied to the test item. However it is acceptable that the test voltage is increased during a few seconds to its final value. The test voltage is to be maintained during 60 s. AC power sources must be capable of maintaining the test voltage amplitude even though leakage currents may occur. The test duration may, if the product has been typetested with full test voltage for 60 s, be reduced to 5 s if the test voltage is increased to 110 %. On application, the test voltage may not exceed 50 % of the value shown in Table 1. The voltage is then to be increased to full value (as shown in Table 1) over a period of a few seconds and kept at this value for one minute. The test voltage waveform is to be sinusoidal and the frequency between 45 Hz and 65 Hz.

### Alternative procedure

A simplified method may be used for apparatus having few wire or cable connections:

- The test time may be reduced to 5 s, provided that the product has successfully undergone type testing in accordance with the general procedure as prescribed in this Examination Procedure.
- Full test voltage may be applied instantly

### Procedure for repeated test

At repeated test of the same item the test voltage must not exceed 80% of nominal test voltage.

## **4 Acceptance Criteria**

The item or equipment must not be damaged by the testing. This must be verified by visual inspection and operational tests. Insulation breakdown may not occur during test. When any uncertainty exist is the insulation resistance to be measured according to KBE EP-114 to verify that the insulation is intact.

If a discharge or other failure should occur, an inspection shall be made to establish whether the insulation or conductor spacing is sufficient. If it is not, the item or equipment must be redesigned. In other cases, the fault shall be corrected and the test voltage re-applied. All insulation failures detected must be recorded in the documentation.

## 5 Documentation

Inspection performed is to be documented in a inspection certificate, record or technical report as required in the Inspection Plan. Several examinations within one and the same Inspection Plan may be reported in the same document.

Examinations carried out as routine (100%) inspection are to be reported to the Purchaser as original documents.

The document must as a minimum include the following:

- Items examined

Product, designation, quantity, serial numbers and reference to the Purchasers or-der.

- Identity/Traceability

The identity of the objects under examination in comparison with type tested items and in comparison with relevant specifications must be specified, unless the identity is certified in a separate document (as per KBE EP-180).

- Examination procedure

It must be clearly stated if the inspection has been performed according to this Examination Procedure or to any other procedure agreed upon.

- Measurement equipment

Type of equipment, accuracy, identification, etc, and current calibration data for the equipment used where performance is significant to the results.

- Results

It must be evident that the items have fulfilled stated requirements and acceptance criteria. Measured and recorded values that are to be documented as per the procedure as well as any deviations from requirements in applicable specifications or test procedures must be reported.

- Approval

Date of inspection and name of responsible inspector are to be included. The document must be reviewed and approved in accordance with the Manufacturers or the laboratory's internal QA/QC routines.