What Is Insulation Resistance?

Insulation resistance represents the state of insulation of electric equipment or circuits. It is one of the important measurement parameters in terms of safety and security. Methods of examining the state of insulation include using a clamp-on leakage tester for live circuits. Under normal circumstances, however, such electric equipment or circuits are shut down temporarily and their insulation is tested with an insulation tester.

Test Methods for Low-voltage Circuits

Insulation resistance between cables of a low-voltage circuit and between the circuit and ground is tested for each circuit that can be separated by a switch or overcurrent breaker installed as specified by the electrotechnical equipment standards.
The low-voltage circuit is shut down by opening the switch and insulation between cables of the circuit and between the circuit and ground is tested. If the measured value is below the rated resistance, all shunt switches of a trunk line are opened and insulation is tested separately for each shunt circuit.
The comparator function of the MY40 or 2426A series insulation tester allows for smooth judgment when checking the insulation of electric circuits.

Classification of Applications

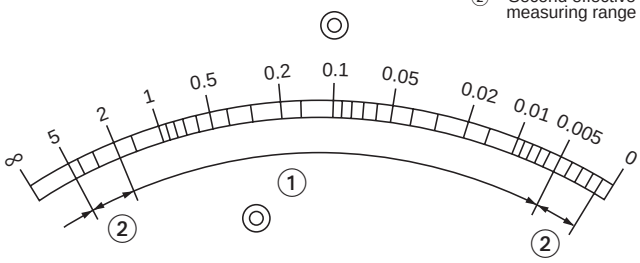
Applications are roughly classified into low-voltage, high-voltage and ultra-high-voltage circuits. The table below summarizes examples of using rated test voltages. A tester with the rated test voltage of 500 V or 100 V/250 V is used for low-voltage circuits.

Rated test voltage	General Electric Equipment	Electric Installations/Circuits
	Insulation testing at safe voltage levels	–
25V	For telephone network equipment	–
50	Insulation testing of control equipment	Insulation testing for maintaining low-voltage circuits or equipment handling 100 V or lower levels
100V	Insulation testing of control equipment	
125V 250V	Insulation testing of control equipment	Insulation testing for maintaining low-voltage circuiats or equipment handling 200 V or lower levels
500V	Insulation testing of circuits or equipment handling 300 V or lower levels (general equipment)	Insulation testing for maintaining low-voltage circuits or equipment handling 400 V or lower levels Insulation testing of 100 V, 200 V or 440 V circuits or equipment upon completion of installation
1000V	Insulation testing of circuits or equipment handling levels higher than 300 V (general equipment)	Insulation testing of circuits or equipment handling constantly high operating voltages (e.g., high-tension cables, high-voltage electric equipment, and communications equipment handling high voltages)

Methods of Scaling the 1st and 2nd Effective Measuring Ranges of Moving-pointer Insulation Testers

Rated test voltage: 25 V
Maximum effective reading: 5 MΩ

① = First effective measuring range
② = Second effective measuring range



Maximum effective reading:
The maximum reading that is indicated on the insulation tester and falls within the range with which the accuracy of the insulation tester is guaranteed.

Effective test range:
A test range or ranges, among those of the insulation tester, over which accuracy specified in the standards is guaranteed. In moving-pointer insulation testers, the range from a resistance value one-thousandth (1/1000) the maximum effective reading to the resistance value that is nearest to half (1/2) the maximum effective reading and equal to the maximum effective reading multiplied by 1, 2 or 5 or by any of these values multiplied by ten (10) raised to a whole-number power, shall be referred to as a first effective measuring range. In addition, the range from the upper limit of the first effective measuring range to the maximum effective reading and the range from the lower limit of the first effective measuring range to the zero (0) reading shall be referred to as second effective measuring ranges (see the figure above). In digital insulation testers, the first and second effective measuring ranges shall be those indicated on the insulation tester (Excerpt from JIS C1302-1994).

Points on How to Choose an Insulation Tester

1 Type

Two choices:
Choose an analog model if visual recognition is of utmost importance, or a digital model if precise numeric recognition is of utmost importance.

2 Ratings

A wide choice of voltage/resistance ratings, from 25 V/5 MΩ to 1000 V/2000 MΩ
Some models have two or three ranges; thus, you need not take more than one instrument to the site.

3 Functionality

Each series includes a model or models with a backlight for working in dark places. Multi-functional models capable of, for example, AC voltage measurement, are also available.

4 Accessories

Optional test probes and probe tips are available for a variety of test environments.

• General and Common Specifications

Effect of inclination (analog type): A change in the infinite scale value (∞) must be no more than 2% of the scale length when the tester is inclined 30° forward or backward and leftward or rightward from the horizontal position.
Effect of temperature (digital type): A change in the reading at an ambient temperature of 20°C must be no more than 2.5% at each of the maximum, minimum and central scale values of the first effective measuring range when the temperature is changed by ±20°C from 20°C.
Effect of temperature (analog type): A change in the reading at an ambient temperature of 20°C must be no more than 5% at the central scale value and no more than 0.7% of the scale length at either the infinite scale value or the zero scale value when the temperature is changed by ±20°C from 20°C.
Effect of humidity: A change in the reading must be within the specified tolerance range when the tester is left to stand for one hour under the relative humidity of 90%.
Effect of AC voltage component applied to test terminals: A change in the reading must be no more than 10% when a resistance corresponding to the central scale value is connected to the tester and then a capacitance of 5 μF ±10% is connected in parallel across the resistance.
Overrange input protection: No failure must be present when a 50 Hz or 60 Hz AC voltage with an amplitude 1.2 times the rated test range is applied for ten seconds across the test terminals.
Operating temperature/humidity range:-10°C to 50°C/90% RH maximum (no condensation)
Storage temperature/humidity range:-20°C to 60°C/70% RH maximum (no condensation—batteries should be removed)