## 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.

## 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 | Insulation testing of telephone line circuits |
| 25V<br>50V | Insulation testing of telephone network equipment and flame-proof equipment | |
| 100 V<br>125 V | Insulation testing of control equipment | Insulation testing for maintaining low-voltage circuits or equipment handling levels lower than 100 V |
| 250 V | Insulation testing of low-voltage circuits or equipment | Insulation testing for maintaining low-voltage circuits or equipment handling 200 V or lower levels lower than 100 V |
| 500 V | Insulation testing of newly installed circuits or of circuits or equipment handling levels lower than 600 V (general equipment) | Insulation testing for maintaining low-voltage circuits or equipment handling levels lower than 600 V; insulation testing of circuits or equipment handling 100 V, 200 V, or 400 V levels upon completion of installation |
| 1000 V | Insulation testing of circuits, equipment, or facilities handling levels higher than 600 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 and electric circuits handling high voltages) |

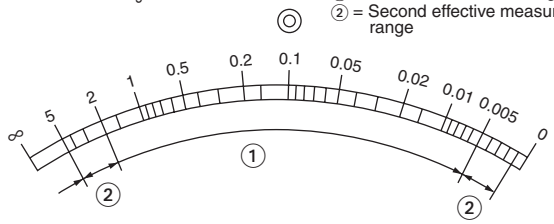
## Test Methods for Low-voltage Circuits

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 insulation tester allows for smooth judgment when checking the insulation of electric circuits.

## 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

◎ = Central scale value
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 C1302-2002).

Insulation Testers

# General Specifications

| | | | |
|---|---|---|---|
| **Display readings** | Digital | Analog | |
| **Applicable standard** | JIS C 1302 | | ——— |
| **Model** | MY40 | 3213A | MY10, 2406E |
| **Effect of AC components** | A change in the reading must not exceed ±10% when a resistance calculated from the rated measuring voltage and current is connected to the tester and a capacitance of 5 mF ±10% is connected in parallel across the resistance. | | Same as to the left, except that the connected resistance has the central scale value. |
| **Effect of temperature** | A change in the reading at an ambient temperature of 23°C must not exceed ±2% at each of the maximum, minimum, and central scale values of the first effective measuring range when the temperature is changed from 23°C to 0°C or to 40°C. | A change in the reading at an ambient temperature of 23°C must not exceed ±5% at the central scale value and be 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 from 23°C to 0°C or to 40°C. | A change in the reading must not exceed ±5% at the central scale value and be 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 from 20°C to 0°C or to 40°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 a relative humidity of 90%. | | |
| **Effect of external magnetic field** | A change in the reading must not exceed ±3% (analog) and be no more than ±1.2% (digital) at each of the maximum, minimum, and central scale values of the first effective measuring range when an external magnetic field of 400 A/m DC is applied to the direction where the effect thereof is the most significant. | | Same as to the left, except that a change at the central scale value must be read. |
| **Effect of inclination** | ——— | A change in the infinite scale value (∞) must not exceed ±2% of the scale length when the tester is inclined 90° forward or backward and leftward or rightward from the horizontal position. Also, a change in the reading must not exceed ±15% at each of the maximum, minimum, and central scale values of | A change in the infinite scale value (∞) must not exceed ±2% of the scale length when the tester is inclined 30° forward or backward and leftward or rightward from the horizontal position. |
| **Effect of external voltage application** | No damage should be present when a 50 Hz or 60 Hz AC voltage with an amplitude 1.2 times the rated test range is applied across the test terminals for 10 seconds each time the tester switch is turned ON and OFF. Nor should the user be subjected to any danger. | | Same as to the left, except that the voltage is applied for 10 seconds with the tester switch turned OFF. |
| **Effect of vibration** | No structural damage should be present and a change in the reading must be within the specified tolerance after applying a vibration frequency of 25 Hz and a displacement amplitude width of 1 mm for 20 minutes to each of three axis directions. | | No mechanical or electrical damage should be present and the rating within the specified tolerance must be satisfied after applying a vibration frequency of 16.7 Hz and a double amplitude of 4 mm for one hour to each of three axis directions. |
| **Effect of shock** | No structural damage should be present and a change in the reading must be within the specified tolerance after directly and reversely applying 1000 m/s$^2$, 6 ms half sine-wave shocks to the three axis directions three times each (i.e., 18 times in total). | | The rating within the specified tolerance must be satisfied after applying a shock of 1000 m/s$^2$ to each of three directions twice each. |
| **Operating temperature/ humidity range** | 0°C to 40°C/90% RH maximum (no condensation) | | |
| **Storag temperature/ humidity range** | -10°C to 60°C/70% RH maximum (no condensation – batteries should be removed) | | |