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Insulation resistance testers

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Electric Measuring Instruments Manufacturers' Association (JEMIMA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS C 1302:2014** is replaced with this Standard.

However, **JIS C 1302:2014** may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until February 19, 2019.

This **JIS** document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

Insulation resistance testers

Introduction

This Japanese Industrial Standard has been prepared based on **IEC 61557-1:2007**, Edition 2, and **IEC 61557-2:2007**, Edition 2, with some modifications of the technical contents.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standards. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies portable insulation resistance testers of built-in battery type, having a rated output voltage not exceeding 1 000 V, which are used for the measurements of the following a) to e).

- a) **Insulation measurement of low voltage distribution path** The insulation measurement of paths and devices which are powered off in a distribution system up to 1 000 V a.c. and 1 500 V d.c.
- b) **Insulation measurement of device, appliance, component, etc.**
NOTE : The photovoltaic array not in power generating state corresponds to an appliance or a component.
- c) **Insulation measurement of high-voltage equipment**
- d) **Insulation measurement of photovoltaic array in power generating state by short-circuiting P-N terminals**
- e) **Insulation measurement of photovoltaic array in power generating state without short-circuiting P-N terminals**

NOTE : The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

IEC 61557-1:2007 *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 1: General requirements*

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 (overall evaluation: MOD)*

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. For standards indicated below, only the editions of the indicated year shall be applied and any revisions (including amendments) made thereafter shall not be applied.

JIS C 0920:2003 *Degrees of protection provided by enclosures (IP Code)*

NOTE : Corresponding International Standard: IEC 60529:2001 *Degrees of protection provided by enclosures (IP Code)* (IDT)

JIS C 1010-1:2014 *Safety requirements for electrical equipment for measurement, control, and laboratory use—Part 1: General requirements*

NOTE : Corresponding International Standard: IEC 61010-1:2010 *Safety requirements for electrical equipment for measurement, control, and laboratory use—Part 1: General requirements* (MOD)

JIS C 1010-2-30:2014 *Safety requirements for electrical equipment for measurement, control, and laboratory use—Part 2-30: Particular requirements for testing and measuring circuits*

NOTE : Corresponding International Standard: IEC 61010-2-030:2010 *Safety requirements for electrical equipment for measurement, control, and laboratory use—Part 2-030: Particular requirements for testing and measuring circuits* (MOD)

JIS C 1102-1:2011 *Direct acting indicating analogue electrical measuring instruments and their accessories—Part 1: Definitions and general requirements common to all parts*

JIS C 60068-2-6:2010 *Environmental testing—Part 2-6: Tests—Test Fc: Vibration (sinusoidal)*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1 Items relating to performances

3.1.1 output voltage

voltage generated across the measuring terminals

3.1.2 rated output voltage

output voltage of ratings used as a supply, the value of which is marked on an insulation resistance tester

3.1.3 open-circuit voltage

output voltage when measuring terminals are open-circuited

3.1.4 rated current

current by which an insulation resistance tester can supply the rated output voltage

3.1.5 short-circuit current

current flowing across the short-circuited measuring terminals

3.1.6 first effective measuring range and second effective measuring range

of the range of insulation measurable by the insulation resistance tester, the range of insulation that is within the tolerance specified in this Standard, as guaranteed by the manufacturer

The first effective measuring range does not exceed the tolerance of $\pm 5\%$. The second effective measuring range does not exceed the tolerance of $\pm 10\%$.

3.1.7 effective maximum indicated value

maximum indicated value of an insulation resistance tester in the range securing the tolerance

3.1.8 effective medium value

indicated value of resistance designated by the manufacturer, which is near the centre of first effective measuring range (see Figure 1)

3.1.9 tolerance

permissible range of indicated values of an insulation resistance tester under the reference conditions

3.1.10 intrinsic uncertainty

uncertainty of the performance characteristics of an insulation resistance tester under the reference conditions

3.1.11 operating instrumental uncertainty

uncertainty of the performance characteristics of an insulation resistance tester, including the intrinsic uncertainty and the variation due to each influence quantity under the rated operating conditions

3.1.12 influence quantity

quantity of change in the rated operating conditions, by which the indicated value of an insulation resistance tester varies

3.1.13 variation due to an influence quantity

difference in indicated value when one of influence quantities is changed from the value of the reference conditions to that within the limit of the rated operating conditions

3.1.14 scale length

length of line (curved or straight) across the centres of shortest scale lines between scales on both ends

If an insulation resistance tester has more than one scale, the longest length. See 2.4.1 of JIS C 1102-1.

3.1.15 available effective battery voltage

voltage range of built-in batteries within which the performances of insulation resistance tester are satisfied

3.1.16 photovoltaic array

aggregate of photovoltaic modules or photovoltaic panels that are mechanically integrated and wire-connected, having a photovoltaic array mounting frame and/or foundation, and other structures

It is a part of the photovoltaic power generation system. See **JIS C 8960**.

3.2 Items relating to safety and structure

3.2.1 measurement category

classification of measuring circuits according to the types of main power supply circuit to which they are to be connected

See **3.5.101** of **JIS C 1010-2-30**.

3.2.2 double insulation

insulation comprising both the fundamental insulation and the supplementary insulation

See **3.6.3** of **JIS C 1010-1**.

3.2.3 reinforced insulation

insulation which provides a degree of protection against electric shock at least equivalent to double insulation

3.2.4 pollution degree

numerical value indicating the level of pollution that may be present in the environment

See **3.6.6** of **JIS C 1010-1**.

3.2.5 IP code

degree of protection provided by an enclosure, which is against the access to hazardous parts, ingress of solid foreign objects and ingress of water

See **3.4** of **JIS C 0920**.

4 Types of insulation resistance testers

4.1 Insulation resistance testers

Portable insulation resistance testers used for the measurements of **a)** to **e)** in Clause 1.

NOTE : The measurement on the photovoltaic array in power generating state sometimes fails unless P-N terminals are short-circuited.

4.2 PV insulation resistance testers

Insulation resistance testers used only for **e)** in Clause 1.

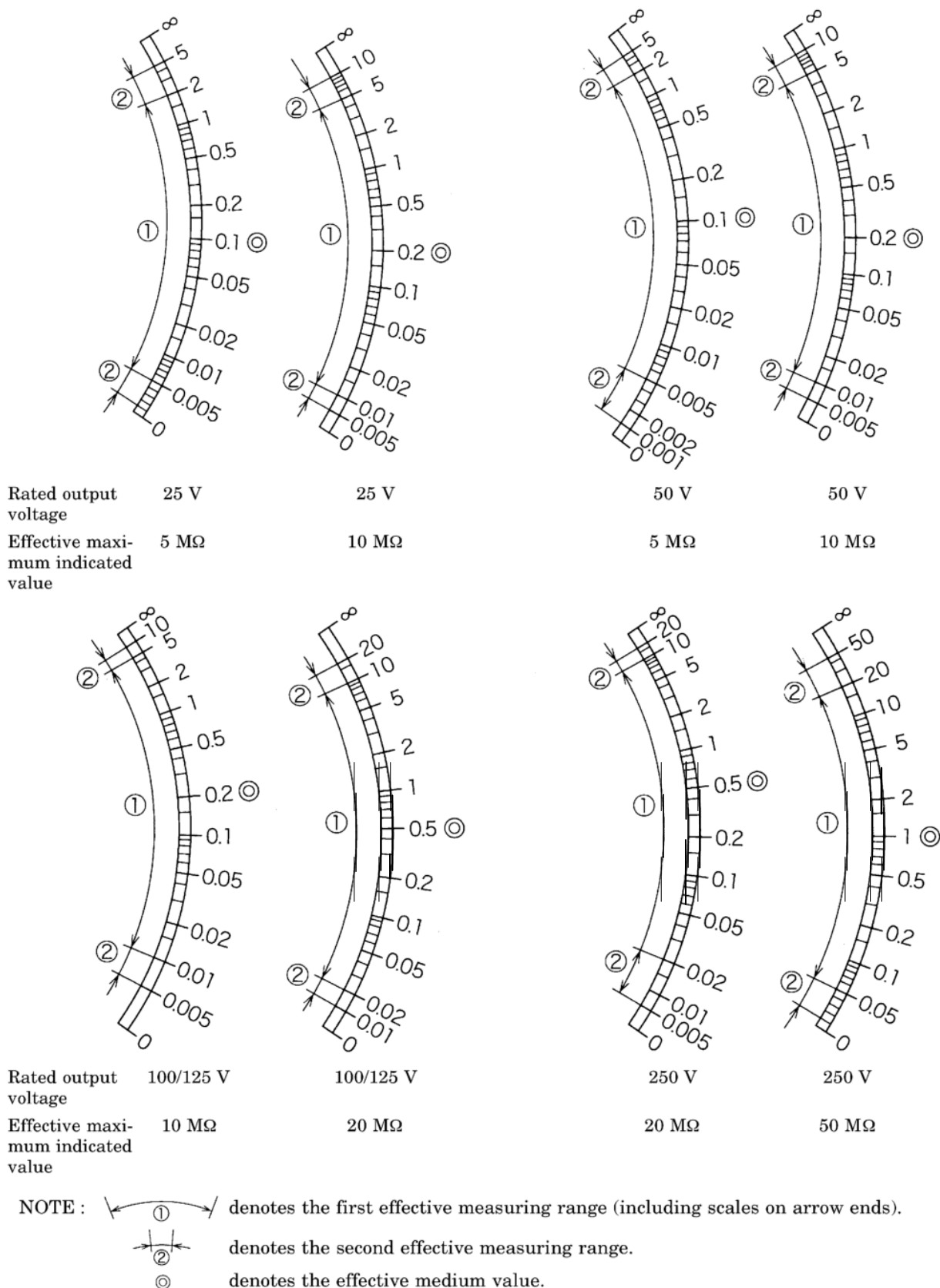
Items applicable to insulation resistance testers shall basically apply to PV insulation resistance testers.

5 Recommended values of rated output voltage and effective maximum indicated value

The rated output voltage shall be d.c. 25 V, 50 V, 100 V, 125 V, 250 V, 500 V or 1 000 V.

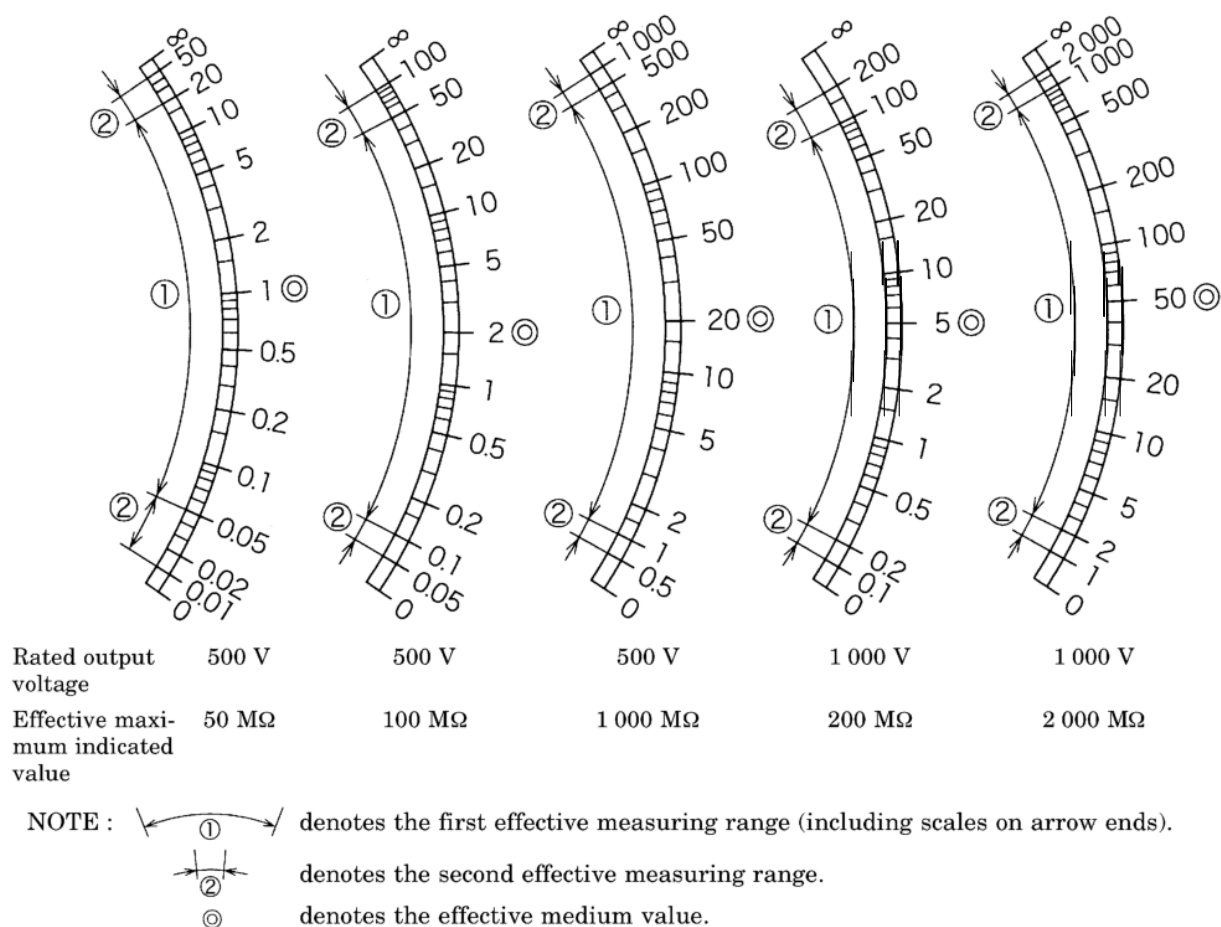
The effective maximum indicated value, 1 M Ω , 2 M Ω , 5 M Ω , 10 M Ω , 20 M Ω , 50 M Ω , 100 M Ω , 200 M Ω , 500 M Ω , 1 000 M Ω , 2 000 M Ω , 3 000 M Ω and 4 000 M Ω are recommended.

NOTE : In the pointer type testers, 1, 2, 5 or an integral power of 10 multiples thereof near 1/1 000 to 1/2 of the effective maximum indicated value in the scale range is the first effective measuring range. The scale ranges above it up to the effective maximum indicated value and below it down to the indicated value close to zero are the second effective measuring ranges. Refer to an example diagram of scale (see Figure 1).



The effective medium value is 1, 2, 5 or an integral power of 10 multiples thereof as the indicated value of resistance, which is located near the centre of first effective measuring range.

Figure 1 Example of rated output voltage and effective maximum indicated value



The effective medium value is 1, 2, 5 or an integral power of 10 multiples thereof as the indicated value of resistance, which is located near the centre of first effective measuring range.

Figure 1 (concluded)

6 Requirements

6.1 Rated operating condition

The rated operating conditions of insulation resistance testers shall include the following a) to c).

- Ambient temperature: 0 °C to 40 °C
- Position: reference position $\pm 90^\circ$

Level $\pm 30^\circ$, in the pointer type testers, when indicating the symbol D-2 "Instrument to be used with the dial horizontal" of JIS C 1102-1

- Battery voltage: available effective battery voltage

6.2 Permissible range of tolerance and deviation

6.2.1 Tolerance of first effective measuring range

When tested according to 8.2.1, the tolerance of the first effective measuring range shall not exceed $\pm 5\%$ of the indicated value.

6.2.2 Tolerance of second effective measuring range

When tested according to 8.2.2, the tolerance of the second effective measuring range shall not exceed $\pm 10 \%$ of the indicated value.

6.2.3 Permissible range of deviation

In the pointer type testers, when tested according to 8.2.3, the deviation from the infinity or zero indication shall not exceed 0.7% of the scale length.

In the digital type testers, when tested according to 8.2.3, the deviation from zero indication shall not exceed 6 digits.

6.3 Open-circuit voltage

The open-circuit voltage shall not exceed 1.25 times the rated output voltage when tested according to 8.3.

6.4 Rated current

The rated current shall be not less than 1 mA when tested according to 8.4.

In the case of PV insulation resistance testers, the rated current under 1 mA is permissible. The manufacturers shall designate the rated current of PV insulation resistance testers.

6.5 Short-circuit current

The short-circuit current shall not exceed 15 mA when tested according to 8.5.

The peak value of a.c. component shall not exceed 1.5 mA when tested according to 8.5.

6.6 Output voltage

The output voltage of insulation resistance testers shall be d.c. voltage. When tested according to 8.6, the change in indicated value shall not exceed $\pm 10 \%$ thereof.

6.7 Influence at d.c. voltage superimposing

In the case of PV insulation resistance testers to which d.c. voltage is superimposed, the change in indicated value shall not exceed $\pm 10 \%$ when tested according to 8.7.

6.8 Influence of environment

6.8.1 Operating instrumental uncertainty

Obtain the operating instrumental uncertainty of insulation resistance tester according to Formula (1), which shall not exceed $\pm 30 \%$.

Use the largest value for the intrinsic uncertainty and the variation due to each influence quantity, which are obtained from the test results in the first effective measuring range of 8.2.1 and 8.8.1 to 8.8.3.

$$B = \pm \left(|A| + 1.15 \sqrt{E_1^2 + E_2^2 + E_3^2} \right) \dots\dots\dots (1)$$

where, A : intrinsic uncertainty (%)

 B : operating instrumental uncertainty (%)