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(JCMA)

**Rubber insulated cables—
Rated voltages up to and including
450/750 V—Part 2 : Test methods**

ICS 29.060.20

Reference number : JIS C 3663-2 : 2003 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard 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 The Japanese Electric Wire & Cable Maker's Association (JCMA) 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 3663-2** : 1998 is replaced with this Standard.

This revision has been made based on **IEC 60245-2** : 1994 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 2 : Test methods* for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS C 3663 consists of the following 8 parts under the general title *Rubber insulated cables—Rated voltages up to and including 450/750 V*.

Part 1 : General requirements

Part 2 : Test methods

Part 3 : Heat resistant silicone insulated cables

Part 4 : Cords and flexible cables

Part 5 : Lift cables

Part 6 : Arc welding electrode cables

Part 7 : Heat resistant ethylene-vinyl acetate rubber insulated cables

Part 8 : Cords for applications requiring high flexibility

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Rubber insulated cables—Rated voltages up to and including 450/750 V— Part 2 : Test methods

Introduction This Japanese Industrial Standard has been prepared based on the second edition of **IEC 60245-2** *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 2 : Test methods* published in 1994 together with Amendment 1 (1997) and Amendment 2 (1997) with some modifications of the technical contents.

Portions underlined with dots are the matters modified from the original International Standard. The list of modifications with the explanation is given in annex (informative).

1 General

1.1 Scope This part of **JIS C 3662** gives the test methods specified in all parts of **JIS C 3662** (rubber insulated cables of rated voltages up to and including 450/750 V) as far as not laid down in **JIS C 3660**.

NOTE : The International Standard corresponding to this Standard is as follows.

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.

IEC 60245-2 : 1994 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 2 : Test methods* together with amendment 1 (1997) and amendment 2 (1997) (MOD)

1.2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of publication is given to these referred standards, only the edition of the indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative reference without the indication of the year of coming into effect apply only to the most recent edition (including amendments).

JIS C 3660-1-1 *Common test methods for insulating and sheathing materials of electric and optical cables—Part 1-1 : Methods for general application—Measurement of thickness and overall dimensions—Tests for determining the mechanical properties*

NOTE : **IEC 60811-1-1 : 1993** *Common test methods for insulating and sheathing materials of electric and optical cables—Part 1-1 : Methods for general application—Measuring of thickness and overall dimensions—Tests for determining the mechanical properties* and Amendment 1 (2001) are identical with the said standard.

JIS C 3660-1-2 *Common test methods for insulating and sheathing materials of electric and optical cables—Part 1-2 : Methods for general application—Thermal ageing methods*

NOTE : **IEC 60811-1-2** : 1985 *Common test methods for insulating and sheathing materials of electric and optical cables—Part 1-2 : Methods for general application—Thermal ageing methods* together with Amendment 1 (1989) and Amendment 2 (2000) are identical with the said standard.

JIS C 3663-1 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 1 : General requirements*

NOTE : **IEC 60245-1** : 1994 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 1 : General requirements* together with Amendment 1 (1997) and Amendment 2 (1997) are equivalent to the said standard.

JIS C 3663-3 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 3 : Heat resistant silicone insulated cables*

NOTE : **IEC 60245-3** : 1994 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 3 : Heat resistant silicone insulated cables* and Amendment 1 (1997) are identical with the said standard.

JIS C 3663-4 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 4 : Cords and flexible cables*

NOTE : **IEC 60245-4** : 1994 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 4 : Cords and flexible cables* and Amendment 1 (1997) are equivalent to the said standard.

JIS C 3663-8 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 8 : Cords for applications requiring high flexibility*

NOTE : **IEC 60245-8** : 1998 *Rubber insulated cables—Rated voltages up to and including 450/750 V—Part 8 : Cords for applications requiring high flexibility* is equivalent to the said standard.

JIS C 3665-1 *Tests on electric cables under fire conditions—Part 1 : Test on a single vertical insulated wire or cable*

NOTE : **IEC 60332-1** : 1993 *Tests on electric cables under fire conditions—Part 1 : Test on a single vertical insulated wire or cable* is identical with the said standard.

ISO 1302 : 1992 *Technical drawings—Method of indicating surface texture*

1.3 Classification of tests The tests specified are type tests (symbol T) and/or sample tests (symbol S) as defined in 2.2 of **JIS C 3663-1**.

The symbols T and S are used in the relevant tables of the particular specifications (**JIS C 3663-3**, **JIS C 3663-4**, etc.).

1.4 Sampling If a marking is in relief in insulation or sheath the samples used for the tests shall be taken so as to include such marking.

For multicore cables, except for the test specified in 1.9, not more than three cores (of different colours, if applicable) shall be tested unless otherwise specified.

1.5 Pre-conditioning All the tests shall be carried out not less than 16 h after the vulcanization of the insulating or sheathing compounds.

1.6 Test temperature Unless otherwise specified, tests shall be made at ambient temperature.

1.7 Test voltage Unless otherwise specified, the test voltages shall be a.c. 49 Hz to 61 Hz of approximately sinewave form, the ratio peak value/r.m.s. value being equal $\sqrt{2}$ with a tolerance of $\pm 7\%$.

The values quoted and r.m.s. values.

1.8 Checking of the durability of colours and markings Compliance with this requirement shall be checked by trying to remove the marking of the manufacturer's name or trade mark and the colours of cores or numerals by rubbing lightly ten times with a piece of cotton wool or cloth soaked in water.

1.9 Measurement of thickness of insulation

1.9.1 Procedure The thickness of insulation shall be measured in accordance with 8.1 of JIS C 3660-1-1.

One sample of cable shall be taken from each of three places, separated by at least 1 m.

Compliance shall be checked on each core of cables having up to five cores, and on any five cores of cables with more than five cores.

If withdrawal of the conductor is difficult, it shall be stretched in tensile machine or the piece of core shall be immersed in mercury until the insulation becomes loose.

NOTE : In Japan, use of mercury is not recommended.

1.9.2 Evaluation of results The mean of the 18 values (expressed in millimetres) obtained from the three pieces of insulation from each core shall be calculated to two decimal places and rounded off as given below, and this shall be taken as the mean value of the thickness of insulation.

If in the calculation the second decimal figure is 5 or more, the first decimal figure shall be raised to the next number, thus, for example, 1.74 shall be rounded off to 1.7 and 1.75 to 1.8.

The lowest of all values obtained shall be taken as the minimum thickness of insulation at any place.

This test may be combined with any other measurements of thickness, for instance those of 5.2.3 of JIS C 3663-1.

1.10 Measurement of thickness of sheath

1.10.1 Procedure The thickness of sheath shall be measured in accordance with 8.2 of JIS C 3660-1-1. One sample of cable shall be taken from each of three places separated by at least 1 m.

1.10.2 Evaluation of results The mean of all the values (expressed in millimetres) obtained from the three pieces of sheath shall be calculated to two decimal places and rounded off as given below, and this shall be taken as the mean value of the thickness of sheath.

If in the calculation the second decimal figure is 5 or more, the first decimal figure shall be raised to the next number, thus, for example, 1.74 shall be rounded off to 1.7 and 1.75 to 1.8.

The lowest of all values obtained shall be taken as the minimum thickness of sheath at any place.

This test may be combined with any other measurements of thickness, for instance those of **5.5.3** of **JIS C 3663-1**.

1.11 Measurement of overall dimensions and ovality The three samples taken in accordance with **1.9** or **1.10** shall be used.

The measurement of the overall diameter of any circular cable and of the overall dimensions of flat cables with a major dimension not exceeding 15 mm shall be carried out in accordance with **8.3** of **JIS C 3660-1-1**.

For the measurement of flat cables with a dimension exceeding 15 mm, a micrometer, a profile projector or similar appliance shall be used.

The mean of the values obtained shall be taken as the mean overall dimension.

For checking the cable ovality of circular sheathed cables, two measurements shall be made at the same cross-section of the cable.

1.12 Solderability test for untinned conductors

1.12.1 Aim of the test The test is intended to verify the effectiveness of the separator between the non-tinned conductor and the insulation.

Compliance is checked by the solder bath method described below.

1.12.2 Selection of samples and preparation of test pieces One sample having a length suitable for the bending test defined below is taken at three points in the cable, and the cores in each sample are carefully separated from all other components.

Each sample of core thus obtained is wound, in three turns, on a mandrel, the diameter of which is three times that of the core.

The sample is then unwound and straightened out, whereupon it is wound again in such a way that the fibre which was compressed in the first case becomes the stretched fibre in the second.

This cycle of operations is repeated two more times, which represents three bending operations in one direction and three in the other.

From each sample of core which has been straightened out after the third cycle of bending operations, a test piece having a length of about 150 mm is taken from that part of the core which has actually been wound.

Each test piece is then subjected to accelerated ageing in a hot-air oven for 240 h at a temperature of $70\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$.

After this accelerated ageing, the test pieces are left at ambient temperature for at least 16 h.

Then each test piece is stripped at one end over a length of 60 mm and is subjected to the solderability test by the solder-bath method described below.

1.12.3 Description of the solder bath The solder bath shall have a volume sufficient to ensure that the temperature of the solder remains uniform at the moment when the conductor is introduced. It shall be provided with a device which maintains the temperature of the solder at $270\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$.

The height of the solder bath shall be at least 75 mm.

The visible surface area of the bath shall be reduced as far as possible, by using a perforated plate of heat resisting material in order to protect the core against direct radiation from the bath.

The composition of the solder shall be tin (between 59.5 % and 61.5 %) and lead.

Impurities (as a percentage of the total mass) shall not exceed:

Antimony	0.50	Zinc	0.005
Bismuth	0.25	Aluminium	0.005
Copper	0.08	Others	0.080
Iron	0.02		

1.12.4 Test procedure The surface of the solder bath shall be kept clean and shining.

After immersion for 10 s at ambient temperature in a pickling bath constituted by a solution of zinc chloride in water (ZnCl being 10 % of the total mass), the bared end of each test piece shall be immersed in the solder bath over a length of 50 mm in the direction of its longitudinal axis.

The speed of immersion is $25\text{ mm/s} \pm 5\text{ mm/s}$.

The duration of immersion is $5\text{ s} \pm 0.5\text{ s}$.

The speed of emergence is $25\text{ mm/s} \pm 5\text{ mm/s}$.

An interval lasting 10 s is observed from the start of one immersion to the start of a subsequent immersion. The number of immersions shall be 3.

1.12.5 Requirement The part of the conductor that has been immersed shall be adequately tinned.

2 Electrical tests

2.1 Electrical resistance of conductors In order to check the electrical resistance of conductors, the resistance of each conductor shall be measured on a sample of cable of at least 1 m in length, and the length of each sample shall be measured.

If necessary, a correction to $20\text{ }^{\circ}\text{C}$ and to a length of 1 km shall be obtained by the formula: