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Miniature fuses—
Part 3 : Sub-miniature fuse-link

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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 in accordance with the Industrial Standardization Law.

Consequently **JIS C 6575-3** : 1999 is replaced with this Standard.

This revision has been made based on **IEC 60127-3** : 1988 *Miniature fuses—Part 3 : Sub-miniature fuse-link*, Amendment 1 (1991) and Amendment 2 (2002) 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 6575 consists of the following 4 parts under the general title “*Miniature fuses*”:

Part 1 : Definitions of miniature fuses and general requirements for miniature fuse-links

Part 2 : Cartridge fuse-links

Part 3 : Sub-miniature fuse-link

Part 4 : Universal Modular Fuse-links (UMF) and the other enclosed fuse-links except cartridge and sub-miniature fuse-links

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the original JIS is to be the final authority.

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Miniature fuses— Part 3 : Sub-miniature fuse-link

Introduction This Japanese Industrial Standard has been prepared based on the second edition of **IEC 60127-3** *Miniature fuses—Part 3 : Sub-miniature fuse-link* published in 1988, Amendment 1 (1991) and Amendment 2 (2002) with some modifications of the technical contents. The amendment has been edited and unified together.

Portions given sidelines or dotted underlines are the matters modified from the original International Standard. A list of modification with the explanations is given in annex (informative).

Section 1—Additional requirements and test equipment

1 Scope This part of **JIS C 6575** specifies special requirements applicable to sub-miniature fuse-links adapted to printed circuits and used for the protection of electric appliances, electronic equipment and component parts thereof, normally intended to be used indoors.

It does not apply to sub-miniature fuse-links for appliances intended to be used under special conditions, such as in a corrosive or explosive atmosphere.

NOTE : Electrical and electronic circuit designers and printed circuit board manufacturers are advised to allow a 10 mm cube space for all sub-miniature fuse-links.

This Standard applies in addition to the requirements of **JIS C 6575-1**.

NOTE : The International Standard corresponding to this part of **JIS C 6575** 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 60127-3 : 1988 *Miniature fuses—Part 3 : Sub-miniature fuse-link*, Amendment 1 (1991) and Amendment 2 (2002) (MOD)

1A 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 coming into effect is given to these referred standards, only the edition of indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year of publication apply only to the most recent editions (including amendments).

JIS C 6575-1 : 2005 *Miniature fuses—Part 1 : Definitions of miniature fuses and general requirements for miniature fuse-links*

NOTE : **IEC 60127-1** : 2003 *Miniature fuses—Part 1 : Definitions for miniature fuses and general requirements for miniature fuse-links* is equivalent to the said standard.

JIS C 60068-2-20 : 1996 *Basic environmental testing procedures Part 2 : Tests. Test T : Soldering*

NOTE : **IEC 60068-2-20** : 1979 *Environmental testing. Part 2 : Tests. Test T : Soldering*, Amendment 1 (1986) and Amendment 2 (1987) are identical with the said standard.

JIS C 60068-2-21 : 2002 *Environmental testing—Part 2-21 : Tests—Test U : Robustness of termination and integral mounting devices*

NOTE : **IEC 60068-2-21** : 1999 *Environmental testing—Part 2-21 : Tests—Test U : Robustness of terminations and integral mounting devices* is equivalent to the said standard.

IEC 60695 *Fire hazard testing*

2 Object The object of this Standard is: To define special and additional test methods for sub-miniature fuse-links applying in addition to the requirements of **JIS C 6575-1**.

3 Definitions As specified in **JIS C 6575-1**.

4 General requirements As specified in **JIS C 6575-1**.

5 Standard ratings As specified in **JIS C 6575-1**.

6 Marking Additionally to the requirements of clause 6 in **JIS C 6575-1**, the following criteria are to be observed:

6.1 The following requirements are added to **6.1 a)** of **JIS C 6575-1**.

- a) Addition to a): For the sub-miniature fuse-links specified in standard sheet J1 or J2, the rated current shall be marked together with its unit (mA or A). However the position of rated current marking is not necessarily placed just before the rated voltage marking.

Further if marking of the pre-arcing time/current class symbol is specified in the standard sheet in addition to the requirements of **6.1** in **JIS C 6575-1**, each sub-miniature fuse-link shall be marked with the following:

- f) Pre-arcing time/current class symbol. The symbols are as follows:

Class A: Ⓐ or A

Class B: Ⓑ or B

Special melting: J or standard sheet number (J1 or J2)

If A or B is marked as a pre-arcing time/current class symbol, it shall be marked immediately before the rated current.

6.3 In the case of sub-miniature fuse-links specified in standard sheet J1 or J2, the package container shall, in addition to the requirements in **6.3** of **JIS C 6575-1**, be marked with

- rated breaking capacity;
- minimum fusing current and pre-arcing time if the pre-arcing time/current class is special melting.

6.4 Sub-miniature fuse-links according to standard sheets 3 and 4 may be provided with markings for the rated current, the rated voltage and the time/current characteristics on the top so that they are visible when the fuse-link is mounted.

7 General notes on tests Additionally to the requirements of clause 7 in **JIS C 6575-1** the following criteria are to be observed:

7.2.1

A) Sub-miniature fuse-links specified in standard sheets 1 and 2 For testing individual fuse ratings according to standard sheets 1 and 2, the number of sub-miniature fuse-links required is 66, of which 12 are kept as spares. The testing schedule is shown in table 1.

For testing individual fuse ratings according to standard sheets 3 and 4, the number of fuse-links required is 51, of which 12 are kept as spares. The testing schedule is shown in table 2.

For the maximum ampere rating of a homogeneous series, the number of fuse-links required in the case of fuse-links in accordance with standard sheets 1 and 2 is 56, of which 22 are kept as spares. The testing schedule is shown in table 3. The number of fuse-links required in the case of fuse-links in accordance with standard sheets 3 and 4 is 51, of which 22 are kept as spares. The testing schedule is shown in table 4.

For the minimum ampere rating of a homogeneous series the number of fuse-links required is 38, of which 16 are kept as spares. The test schedule is shown in table 5.

B) Sub-miniature fuse-links specified in standard sheets J1 and J2 For testing individual fuse rating or the maximum ampere rating of a homogeneous series, the sub-miniature fuse-link shall be tested in accordance with the testing schedule shown in table J1. In this case, necessary numbers of sub-miniature fuse-links and spare sub-miniature fuse-link are as follows:

- Sub-miniature fuse-links of low-breaking capacity
The number of sub-miniature fuse-links required is 39, of which 18 are kept as spares.
- Sub-miniature fuse-links of intermediate-breaking capacity
 - when granular filler is used
The number of sub-miniature fuse-links is 45, of which 18 are kept as spares.
 - when granular filler is not used
The number of sub-miniature fuse-links is 39, of which 18 are kept as spares.

NOTE : For sub-miniature fuse-links of low-breaking capacity and sub-miniature fuse-links of intermediate-capacity without granular filler, the breaking test is carried out at the rated breaking capacity only, but not at $5 I_N$. Thereby, 6 sub-miniature fuse-links of numbers 28 to 33 become unnecessary (see table J1).

- When the test for minimum ampere rating is made, the sub-miniature fuse-links are subjected to the test in accordance with the test procedures shown in table J2. In this case the number of sub-miniature fuse-links required is 27, of which 6 are kept as spares.

Additionally to the test mentioned in 7.2.1 of JIS C 6575-1, sub-miniature fuse-links shall be taken and shall be tested or inspected in accordance with the following subclause:

- e) Sub-miniature fuse-link terminations (8.3)

7.3 Fuse-bases for testing For tests that require a printed wiring board for mounting and connection of the sub-miniature fuse-link, a standard test board as shown in figure 1 shall be used. This standard printed wiring board shall be mounted on the standard test base of figure 2. The base material for the board shall be phenolic cellulose paper, copperclad, laminated sheet. The nominal sheet thickness shall be 1.6 mm.

The nominal thickness of the copper layer shall be 0.035 mm, when the rated current is not exceeding 6.3 A; or 0.07 mm when the rated current exceeds 6.3 A.

Metal parts of the fuse-base shall be made of brass with copper content between 58 % and 70 %. Contact parts shall be silver-plated.

- A) **For sub-miniature fuse-links specified in standard sheets 1 to 4** When two or more sub-miniature fuse-links are tested in series, the fuse-bases shall be located so that there will be a spacing of not less than 50 mm between any two sub-miniature fuse-links under test. The conductor connecting the fuse-bases together and connecting the fuse-bases to the ammeter and the source of supply shall be insulated copper wire. The length of each conductor shall be 250 mm and the diameter of the wire shall be approximately 0.64 mm.

NOTE : Fuse-bases for testing having equivalent electrical and thermal properties and providing for quick insertion of sub-miniature fuse-links are under consideration.

- B) **For sub-miniature fuse-links specified in standard sheet J1 or J2** For testing of sub-miniature fuse-links with a rated current not exceeding 10 A, copper wires with a cross-sectional area of 2 mm² shall be used. For testing of sub-miniature fuse-links with a rated current exceeding 10 A, copper wires with a cross-sectional area of 8 mm² shall be used. The length of each terminal wire shall be approximately 1 m.

When two or more sub-miniature fuse-links are tested in series, the fuse-bases shall be located so that there will be a spacing of not less than 150 mm between any two sub-miniature fuse-links under test.

8 Dimensions and construction Additionally to the requirements of clause 8 in **JIS C 6575-1** the following criteria are to be observed:

8.2 Construction The sub-miniature fuse-link shall be resistant to heat according to **9.7** of **JIS C 6575-1** and to fire in accordance with **IEC 60695**.

Compliance is checked in accordance with **9.7** of this Standard.

This Standard is based on the assumption that the case of the sub-miniature fuse-link is made of glass, ceramic or similar non-combustible material. For other material, such as the optional insulating sleeve or epoxy coating or similar material shown on standard sheet 2, additional tests are under consideration.

8.3 Sub-miniature fuse-link terminations The sub-miniature fuse-link terminations shall be firmly attached so that it is not possible to remove them without damaging the sub-miniature fuse-link.

The samples are pre-conditioned by immersion in water for 24 h at a temperature between 15 °C and 35 °C.

Terminations shall withstand the mechanical forces likely to be encountered during normal use. With the sub-miniature fuse-link held in a fixed position, each terminal in turn is subjected at ambient temperature to the forces laid down in this Standard. These forces shall be exerted in the direction of the axis of the terminal and applied progressively without jerks. Test sample groups shall be equally divided among the specific termination tests stipulated in the relevant standard sheets.

Present test methods are to be performed in accordance with **JIS C 60068-2-21**.

- For the tensile test (U_{a1}), the force applied shall be 10 N.
- For the thrust test (U_{a2}), the force applied shall be 2 N.
- For the bending test (U_b), if applicable, the force applied shall be 5 N and the number of bends shall be one.

At the conclusion of testing, the sub-miniature fuse-link terminations shall remain firmly attached and the voltage drop shall not exceed the maximum allowed in the relevant standard sheet.

8.4 Termination configuration The sub-miniature fuse-link terminations shall be designed to permit easy installation on printed circuit wiring boards having a grid system of holes located on 2.54 mm centres, or into fuse-bases having a spacing between the terminations which is compatible with the 2.54 mm grid system.

NOTE : Electrical and electronic circuit designers are advised to note that grid systems for holes located on 2.54 mm centres may result in spacings between conductive tracks, in some applications, which do not provide sufficient creepage or clearance for open-circuit conditions. In such circumstances, it may be necessary to modify the land area around the mounting hole to ensure an acceptable minimum distance between conductive tracks or select a sub-miniature fuse-link with longer terminations which can be formed to fit into hole spacings offering the necessary degree of protection.

9 Electrical requirements Additionally to the requirements of clause **9** in **JIS C 6575-1** the following criteria are to be observed:

9.1 Voltage drop The use of a high impedance voltmeter is recommended for measuring the voltage drop. Voltage drop shall be measured at the points marked with U in figure 1.

9.3 Breaking capacity

9.3.1 Additionally to the requirements of **9.3.1** in **JIS C 6575-1** the following is to be observed:

A) For sub-miniature fuse-links specified in standard sheets 1 to 4 Typical test circuits for a.c. and d.c. are given in figure 3.

When alternating current is stipulated by the relevant standard sheets, the circuit power factor shall be larger than 0.95. To obtain this result, the circuit shall be adjusted by the use of resistors with negligible inductance.

B) For sub-miniature fuse-links specified in standard sheet J1 or J2 The breaking test shall be carried out by using the test circuit shown in figure J1, at the currents stated below, while the angle of making current is random.

- Sub-miniature fuse-links of low-breaking capacity
rated breaking capacity of 100 A
- Sub-miniature fuse-links of intermediate breaking capacity
 - when granular filler is not used
rated breaking capacity (300 A or 500 A)
 - when granular filler is used
rated breaking capacity (300 A or 500 A) and $5 I_N$

The power factor at the rated breaking capacity shall be between 0.7 and 0.8. For tests at a prospective current lower than the rated breaking capacity the inductance in the circuit shall remain constant and the current shall be adjusted by changing the resistance only.

9.3.2 In addition to the criteria of failure prescribed in **JIS C 6575-1**, in each of the tests, the sub-miniature fuse-link shall operate satisfactorily without any of the following phenomena:

- fusing together of the contacts or terminations;
- illegibility of marking after test;
- piercing of the external surfaces visible to the naked eye.

The following phenomena are neglected:

- black spots on the sub-miniature fuse-link terminations;
- small deformations of the sub-miniature fuse-link terminations;

— cracking of the sub-miniature fuse-link.

9.3.3 Insulation resistance For the sub-miniature fuse-links specified in standard sheet J1 or J2, the insulation resistance shall be measured after the breaking test and melting test (test for time/current characteristics of **9.2** in **JIS C 6575-1**). The insulation resistance shall be measured with a 500 V insulation resistance tester and shall show 0.2 MΩ or more.

9.4 Endurance tests

9.4.1 Endurance test at normal ambient temperature Compliance is checked by subjecting the sub-miniature fuse-links to test method A or B as required in the relevant standard sheets.

9.4.2 Test method A As specified in **JIS C 6575-1, 9.4 a) to d)**.

9.4.3 Test method B

- a) A direct current as specified in the relevant standard sheets is passed through the sub-miniature fuse-link for a period of 100 h. The current stability during the test shall be maintained within ± 1 % of the adjustable value.

A current of I_N (100 %) is then passed through the sub-miniature fuse-link for 1 h.

- b) Finally, the voltage drop across the sub-miniature fuse-link is measured again according to **9.1**.

The voltage drop across the sub-miniature fuse-link at the end of this test is measured and used for the calculation of the maximum sustained power dissipation.

- c) The voltage drop measured in item **b)** of **9.4.3** shall not have increased by more than 10 % of the value measured before the test. Also it shall not exceed the maximum allowable value specified in the relevant standard sheet.
- d) After the test, the marking shall still be legible and soldered joints on end caps, etc. shall not show any appreciable deterioration.

9.7 Temperature of sub-miniature fuse-link For the sub-miniature fuse-links specified in standard sheet J1 or J2, the test given below shall be carried out in the last 10 min of endurance test, instead of the test stated in **9.7** of **JIS C 6575-1**.

The temperature rise of sub-miniature fuse-links body shall be measured by thermocouple thermometer method.

The temperature rise shall not exceed 140 K. If the materials stated below are used for the fuse-link body, the temperature rise at the central part of the body shall not exceed the relevant value stated below.

Thermosetting resin

Phenolic resin: 120 K

Epoxy resin: 100 K

Thermoplastic resin

Polyamide: 60 K

Polycarbonate: 80 K

Polybutylene terephthalate: 90 K

9.8 Additional tests (under consideration) Additional tests under consideration including environmental, physical and electrical characteristics are as follows:

- a) Flammability
- b) Solderability (**JIS C 60068-2-20** : 1996)
- c) Resistance to soldering heat
- d) Resistance to solvents
- e) Dielectric withstand voltage
- f) Environmental test

Table 1 Testing schedule for individual ampere rating
(applicable for sub-miniature fuse-links specified in standard sheet 1 or 2)

Subclause	Description	Sub-miniature fuse-link number																											
		1	4	7	10	13	16	19	22	25	28	31	34	37	40	43	46	49	52	55	58	61	64						
9.7	Sub-miniature fuse-link temperature																												
9.4	Endurance tests	×	×																										
9.2.1	Time/current characteristics at normal ambient temperature									×																			
	10 I_N											×																	
	4.0 I_N																												
	2.75 I_N																			×									
	2.0 I_N																												×
9.3	1.0 I_N			×																									
	Breaking capacity: Rated breaking capacity					×																							
	Rated breaking capacity						×																						
	5 times the rated current							×																					
	5 times the rated current								×																				
	10 times the rated current												×																
	10 times the rated current													×															
	50 times the rated current														×														
	50 times the rated current															×													
	50 times the rated current																×												
9.3.3	250 times the rated current																	×											
	Insulation resistance																												
	Fuse-link terminations	×	×						×																				
	Soldered joints	×	×							×																			
6.2	Legibility and indelibility of marking																												