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**Miniature fuses—Part 4: Universal
modular fuse-links (UMF), and
non-UM through-hole and surface
mount fuse-links**

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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 based on the Industrial Standardization Law.

Consequently **JIS C 6575-4:2005** is replaced with this Standard.

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JIS C 6575 series 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 non-UM through-hole and surface mount fuse-links

Miniature fuses—Part 4: Universal modular fuse-links (UMF), and non-UM through-hole and surface mount fuse-links

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **IEC 60127-4** published in 2005 and Amendment 1 published in 2008 with some modifications of the technical contents to conform to the production status and usage situation of universal modular fuse-links (UMF) in Japan. This Standard shall be used together with **JIS C 6575-1**:2009. In addition, the Amendment has been compiled in this Standard.

The portions given sidelines or dotted underlines are the matters in which the contents of the original International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies the requirements on UM fuse-links, and non-UM through-hole type and surface mount type fuse-links used for printed circuits and other substrate systems, used for the protection of electric appliances, electronic equipment and component parts thereof, normally intended to be used indoors. This Standard also applies to enclosed fuse-links with a breaking capacity not exceeding 2 500 A and a principal dimension not exceeding 35 mm mainly used for alarming of communication equipment, although such fuse-links are strictly not in the category of miniature fuse-links.

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

These fuses are normally intended to be mounted or replaced only by appropriately skilled persons using specialized equipment. UM fuse-links for use in fuse-holders are under consideration.

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

The objectives of this Standard are as given in **JIS C 6575-1** with the additional requirement of a degree of non-interchangeability.

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

IEC 60127-4:2005 *Miniature fuses—Part 4: Universal modular fuse-links (UMF)—Through-hole and surface mount types* and Amendment 1 (2008) (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**.

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 0664:2003 *Insulation coordination for low-voltage equipment Part 1: Principles, requirements and tests*

NOTE: Corresponding International Standard: IEC 60664-1:1992 *Insulation coordination for equipment within low-voltage systems—Part 1: Principles, requirements and tests* and Amendment 1:2000 (MOD)

JIS C 6575-1:2009 *Miniature fuses—Part 1: Definitions of miniature fuses and general requirements for miniature fuse-links*

NOTE: Corresponding International Standard: IEC 60127-1:2006 *Miniature fuses—Part 1: Definitions for miniature fuses and general requirements for miniature fuse-links* (MOD)

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

NOTE: Corresponding International Standard: IEC 60068-2-20:1979 *Environmental testing. Part 2: Tests. Test T: Soldering*, Amendment 1 (1986) and Amendment 2 (1987) (IDT)

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

NOTE: Corresponding International Standard: IEC 60068-2-21:1999 *Environmental testing—Part 2-21: Tests—Test U: Robustness of terminations and integral mounting devices* (MOD)

JIS C 60068-2-58:2006 *Environmental testing—Part 2: Tests—Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*

NOTE: Corresponding International Standard: IEC 60068-2-58:2004 *Environmental testing—Part 2-58: Tests—Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)* (MOD)

ISO 3:1973 *Preferred numbers—Series of preferred numbers*

IEC 61249-2-7:2002 *Materials for printed boards and other interconnecting structures Part 2-7: Reinforced base materials clad and unclad—Epoxy woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

3 Terms and definitions

For the purposes of this Standard, the definitions given in clause 3 of JIS C 6575-1 and the following terms and definitions shall apply.

3.1 UM through-hole fuse-link

a UM fuse-link designed for soldering directly into a printed wiring board, with insertion of its terminals in suitably designed holes (fuse-link specified in standard sheet 1)

3.1A non-UM through-hole fuse-link

a fuse-link designed so that the terminals protrude from one surface of the fuse-link body and such terminals are inserted through the holes provided on a printed wiring board for soldering, or inserted into the holes of exclusive fuse-holder (fuse-link specified in standard sheet J1)

3.2 UM surface mount fuse-link

a UM fuse-link designed for direct conductive attachment by soldering or other means on to the surface of a printed wiring board without insertion of its terminals in suitably designed holes or sockets (fuse-link specified in standard sheet 2)

NOTE : Fuse-links specified in standard sheet 1 or 2 are called UM fuse-links.

3.2A non-UM surface mount type fuse-link

a fuse-link other than UM fuse-links designed so that it is directly mounted on a printed wiring board by means of soldering or other method without insertion of terminals through holes provided on a printed wiring board (fuse-link specified in standard sheet J2)

3.3 land

portion of a conductive pattern usually but not exclusively used for the connection and/or attachment of components (see **IEC 60194**)

NOTE : See **JIS C 5201-1** and **JIS C 5201-8** for further definitions which may be useful in the application of UM surface mount fuse-links.

4 General requirements

Clause 4 of **JIS C 6575-1** shall be observed.

5 Standard ratings

5.1 Rated voltage

See standard sheets.

5.2 Rated current

See table 1 for preferred ratings of fuse-links specified in standard sheet 1 or 2. For fuse-links specified in standard sheet J1 or J2, the preferred ratings are not specified; however, the maximum rated current is shown in the relevant standard sheet.

5.3 Rated breaking capacity

See standard sheets.

6 Marking

In addition to clause 6 of **JIS C 6575-1**, the following shall be observed; however, 6.4 is not specified.

6.1 In addition to 6.1 of **JIS C 6575-1**, the following shall be observed.

- a) For fuse-links specified in standard sheet J1 or J2, the rated current together with its unit (mA or A). However, the marking position of rated current is not necessarily placed immediately before the rated voltage marking.
- e) For fuse-links of rated voltage at 250 V specified in standard sheet 1 or 2, a symbol denoting the rated breaking capacity. This symbol shall be placed between the marking for rated current and the marking for rated voltage.

These symbols shall be as follows.

H : denoting high-breaking capacity

I : denoting intermediate-breaking capacity

L : denoting low-breaking capacity

- f) For fuse-links specified in standard sheet 1 or 2, the distinctive symbol shown in figure 1.
- g) The letters “a.c.”, “ac” or “AC”, before or after the voltage for fuse-links designed solely for alternating current application and specified in standard sheet 1 or 2.
- h) Pre-arcing time/current class symbol in place of **6.1 d)** of **JIS C 6575-1** for fuse-links specified in standard sheet J1 or J2. These symbols shall be as follows.

Class A : Ⓐ or A

Class B : Ⓑ or B

Special fusing: 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 addition to 6.3 of JIS C 6575-1, the following shall be observed.

In the case of fuse-links specified in standard sheet J1 or J2, the packaging container shall be marked with the following.

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

6.5

- a) **UM fuse-links specified in standard sheet 1 or 2** Where marking is impractical due to the space limitations, the relevant information shall be clearly marked on the smallest packaging container and in the manufacturer's technical literature.
- b) **Fuse-links specified in standard sheet J1 or J2** Where marking is impractical due to the space limitations, the rated current and the pre-arcing time/current class symbol shall be marked on the fuse-link, and other marking items may be marked on the packaging container.

7 General notes on tests

In addition to clause 7 of **JIS C 6575-1**, the following shall be observed; however, **7.3** shall be in accordance with this Standard.

7.2 Type test

In addition to 7.2 of JIS C 6575-1, the following shall be observed.

7.2.1

- a) **UM fuse-link specified in standard sheet 1 or 2** The testing of the fuse-link of individual rated current specified in standard sheet 1 or 2 shall be in accordance with table 2. For fuse-links designed and rated both for a.c. and d.c., the number of fuse-links required is 63. For fuse-links designed only for a.c., the number of fuse-links required is 48. There are nine spares.

The testing of the maximum rated current of fuse-links of a homogeneous series in standard sheet 1 or 2 shall be in accordance with table 3. For fuse-links designed and rated both for a.c. and d.c., the number of fuse-links required is 53. For fuse-links designed only for a.c., the number of fuse-links required is 48. There are 19 spares.

The testing of the minimum rated current of fuse-links of a homogeneous series in standard sheet 1 or 2 shall be in accordance with table 4. For fuse-links designed and rated both for a.c. and d.c., the number of fuse-links required is 38. For fuse-links designed only for a.c., the number of fuse-links required is 33. There are 16 spares.

- b) **Fuse-link specified in standard sheet J1 or J2** The testing of individual rated current or the maximum rated current of a homogeneous series, the test shall be performed in accordance with the testing schedule shown in table J1. In this case, the number of fuse-links required and the number of spare fuse-links shall be as follows.

— **High-breaking capacity fuse-links**

The number of fuse-links required is 63, of which 18 are spares.

— **Low-breaking capacity fuse-links**

The number of fuse-links required is 51, of which 18 are spares.

— **Intermediate-breaking capacity fuse-links**

- **When arc-extinguishing material is used**

The number of fuse-links required is 57, of which 18 are spares.

- **When arc-extinguishing material is not used**

The number of fuse-links required is 51, of which 18 are spares.

NOTE : For low-breaking capacity fuse-links and intermediate-breaking capacity fuse-links without arc-extinguishing material, the breaking test is performed at the rated breaking capacity only but not at 500 A and $5 I_N$. Therefore, 12 fuse-links of numbers of 40 to 51 become unnecessary.

For intermediate-breaking capacity fuse-links with arc-extinguishing material, the breaking test is performed at the rated breaking capacity and at $5 I_N$ but not at 500 A. Therefore, six fuse-links of numbers 40 to 45 become unnecessary (see table J1).

For testing the minimum rated current of a homogeneous series, the test shall be performed in accordance with the test schedule shown in table J2. In this case, the number of fuse-links required is 33 of which six are spares.

In 7.2.1 of JIS C 6575-1, the measurement of voltage drop of fuse-link is required; however, the voltage drop of fuse-links specified in standard sheet J1 or J2 is under consideration. Therefore, the measurement of voltage drop of such fuse-link is not necessary.

7.2.2 Fuse-links specified in standard sheet J1 or J2 may be numbered at random without necessity of numbering in the descending order of voltage drop.

7.3 Fuse-base for testing

7.3.1 General requirements

- a) **UM fuse-link specified in standard sheet 1 or 2** Fuse-links shall be mounted on the appropriate test board (see 7.3.2 or 7.3.3) by soldering.

This test board shall then be mounted on the fuse-base for testing (figure 4). The test board shall be made of epoxide woven glass fabric copper-clad laminated sheet specified in IEC 61249-2-7.

- The nominal thickness of test board shall be 1.6 mm.
- The nominal thickness of copper layer shall be 0.035 mm (0.070 mm when exceeding 5 A).

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

When two or more UM fuse-links are tested in series, the test fuse-bases shall be located so that there will be a spacing of 50 mm or over between any two fuse-links under test. The conductor connecting the test fuse-bases together and connecting the test fuse-bases to the ammeter and the power supply shall be insulated copper wire. The length of each conductor shall be 250 mm, and the cross-sectional area of the wire shall be approximately 1 mm².

- b) **Fuse-link specified in standard sheet J1 or J2** In the electrical test when it is necessary to attach the fuse-link on a printed wiring board, the test board according to figure 2 or figure 3 shall be used as appropriate. This test board shall be made of epoxide woven glass fabric copper-clad laminated sheet specified in IEC 61249-2-7.

- The nominal thickness of test board shall be 1.6 mm.
- The nominal thickness of copper layer shall be 0.035 mm when the rated current is 5 A or under, or 0.070 mm when the rated current exceeds 5 A.

For the fuse-link which uses the exclusive fuse-holder for the printed wiring board from among the fuse-links specified in standard sheet J1, the fuse-holder is soldered to the test board by modifying the holes and copper foil pattern applicable to the fuse-holder, and then the fuse-link may be attached to the fuse holder.

This test board shall be mounted on the fuse-base for testing shown in figure 4. For the fuse-link which uses the exclusive fuse-holder from among the fuse-links

specified in standard sheet J1, the electrical test may be performed without use of the test board in such a manner that the fuse-holder is fixed to an insulating board, the fuse-holder is directly connected to the test circuit and the fuse-link is attached to the fuse-holder.

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

In the test of the fuse-link with a rated current of 10 A or under, copper wires of 2 mm² in cross sectional area shall be used. In the test of the fuse-link with a rated current exceeding 10 A, copper wires of 8 mm² in cross-sectional area shall be used. The length of each copper wire shall be about 1 m.

When two or more fuse-links are tested in series, the fuse-bases shall be located so that there shall be a spacing of 150 mm or over between any two fuse-links under test.

7.3.2 UM through-hole fuse-link (standard sheet 1)

In the electrical test upon fuse-links specified in standard sheet 1, the fuse-link shall be mounted on the test board as shown in figure 2 in the pair of holes appropriate to the spacing of the terminals.

7.3.3 UM surface mount fuse-link (standard sheet 2) and non-UM surface mount type fuse-link (standard sheet J2)

In the electrical test upon fuse-links specified in standard sheet 2 or J2, the fuse-link shall be mounted on the test board as shown in figure 3. See Annex A.

8 Dimensions and construction

In addition to clause 8 of JIS C 6575-1, the following shall be observed, provided that 8.1, 8.2 and 8.4 shall be in accordance with this Standard.

8.1 Dimensions

The dimensions of the fuse-links shall comply with the relevant standard sheet.

Compliance is checked by the measurement of length, width and height.

For fuse-links specified in standard sheet 1, the spacing of terminals shall be checked. The terminal shall also pass through a hole of 1 mm in diameter. The length of terminal is not specified, as this is subject to the method of packaging.

8.2 Construction

The fuse element shall be completely enclosed excluding the fuse-link which uses the exclusive fuse-holder.

The fuse-link shall withstand the heat and chemical exposure of a printed wiring board or other substrate assembly operations with its performance unimpaired excluding the fuse-link which uses the exclusive fuse-holder.

Compliance is checked by the resistance to soldering heat test as specified in 8.7.

8.3 Terminals

In addition to 8.3 of JIS C 6575-1, the following shall be observed.

8.3.1 UM through-hole fuse-link

The terminals shall be firmly attached so that it is not possible to remove them without damaging the fuse-link.

Compliance is checked by performing the following test.

The sample shall be preconditioned by immersion in water for 24 h at a temperature between 15 °C and 35 °C.

The test shall be performed in accordance with **JIS C 60068-2-21**.

The following tests shall be performed.

- Tensile test U_{a1} : applied force of 10 N
- Thrust test U_{a2} : applied force of 2 N
- Bending test U_b : applied force of 5 N, number of bends shall be one

The number of samples shall be two for each test. After testing, the terminals shall remain firmly attached. The voltage drop measured in accordance with **9.1** shall not exceed the maximum allowance in table 1. Bending test U_b is omitted if the length of terminal is under 5 mm.

8.3.2 UM surface mount fuse-link

The fuse-links shall be mounted on the test board as shown in figure 3. The test board, with the fuse-link on the undersides shall be placed in the bending jig as shown in figure 5. The board shall then be bent by 1 mm at a rate of 1 mm/s. The test board shall be allowed to recover from the bent position, and then be removed from the test jig.

After the test, the terminals shall remain firmly attached, and the voltage drop shall be measured in accordance with **9.1**, and shall not exceed the maximum allowance in table 1.

8.3.3 Fuse-link specified in standard sheet J1

For the fuse-link which uses the exclusive fuse-holder, the fuse-link shall be attached to and then removed from the fuse-holder. This operation shall be repeated for 10 times and the terminals shall show no loosening nor damage.

For the fuse-link which does not use the exclusive fuse-holder, **8.3.1** shall apply.

8.3.4 Fuse-link specified in standard sheet J2

8.3.2 shall apply.

8.4 Alignment and configuration of terminals

The configuration and spacing of terminals shall be as specified in the relevant standard sheet.

NOTE 1 UM through-hole fuse-links

The dimensions shown in standard sheet 1 are such as to permit installation of the UM through-hole fuse-links on the printed wiring board having a grid system of holes located on centres of distance $e = 2.5$ mm. Attention is drawn to the fact that in some areas of the world, the board designed as $e = 2.54$ mm is still in use.

Electrical and electronic circuit designers should be advised to apply the requirements of **IEC 60326-3**.

NOTE 2 UM surface mount fuse-links

When installing the UM surface mount fuse-link (standard sheet 2), electrical and electronic circuit designers should be advised to design the land area to receive the UM fuse-link for achieving the maximum area of contact in the application by taking into account the tolerance on placing of the component, and the dimensions and tolerances on terminals shown in this Standard.

8.6 Solderability of terminals

In the tests specified in **8.6.1** and **8.6.2**, the lead-free solder specified in table 2 of **JIS C 60068-2-58** shall be used for the solder bath.

8.6.1 UM through-hole fuse-link

The fuse-links shall be subjected to Test Ta of **JIS C 60068-2-20** by method 1 with the following conditions.

Ageing:	None (as received)
Immersion conditions:	250 °C ± 3 °C, 3 s ± 0.3 s
Depth of immersion:	2.0 mm ± 0.5 mm (from seating plane)
Flux type:	Non-activated
Screen:	A screen shall be used.

After the test, the immersed surface shall be covered with a smooth and bright solder coating with no more than small amounts of scattered imperfections such as pin-holes or unwetted or de-wetted areas. These imperfections shall not be concentrated in one area. 10 × magnification shall be used.

8.6.2 UM surface mount fuse-link

The fuse-links shall be subjected to the test of **6.2** of **JIS C 60068-2-58** with the following conditions.

Preconditioning:	None (as received)
<u>For immersion time and temperature, one of the following conditions is specified by the manufacturer.</u>	
Immersion conditions:	<u>245 °C ± 3 °C, 3 s ± 0.3 s (intermediate-high temperature soldering)</u>
	250 °C ± 3 °C, 3 s ± 0.3 s (high temperature soldering)
Depth of immersion:	Entire metal surfaces are immersed in solder bath
Flux type:	Non-activated

After the test, the contact areas shall be covered with a smooth and bright solder coating, with no more than small amounts of scattered imperfections such as pin-holes or unwetted or de-wetted areas. These imperfections shall not be concentrated in one area. 10 × magnification shall be used.

8.6.3 Fuse-link specified in standard sheet J1

For the fuse-links which use the exclusive fuse-holder, requirements relating to solderability are not specified.

For the fuse-links which do not use the exclusive fuse-holder, **8.6.1** shall apply.

8.6.4 Fuse-link specified in standard sheet J2

8.6.2 shall apply.

8.7 Resistance to soldering heat

8.7.1 UM through-hole fuse-link

The fuse-links shall be subjected to Test Tb of **JIS C 60068-2-20** by method 1A under the following conditions.

Ageing:	None (as received)
Immersion conditions:	260 °C ± 5 °C, 10 s ± 1 s
Depth of immersion:	2.0 mm ± 0.5 mm (from seating plane)
Flux type:	Activated
Screen:	A screen shall be used.

After the test, the fuse-link shall not be cracked. Marking shall be legible, and colour coding (if used) shall not have changed colour.

The voltage drop measured in accordance with **9.1** shall not exceed the maximum allowance in table 1.

8.7.2 UM surface mount fuse-link

The fuse-links shall be subjected to the test in accordance with **6.2** of **JIS C 60068-2-58**.

Ageing:	None (as received)
Immersion conditions:	260 °C ± 5 °C, 10 s ± 1 s
Depth of immersion:	10 mm
Flux type:	Activated

After the test, the fuse-link shall not be cracked. Marking shall be legible, and colour coding (if used) shall not have change in colour.

The voltage drop measured in accordance with **9.1** shall not exceed the maximum allowance in table 1.

NOTE : For some designs, it may be necessary to use a less severe test. This should be in accordance with the manufacturer's recommendations, and should be recorded in the test report.

8.7.3 Fuse-link specified in standard sheet J1

For the fuse-links which use the exclusive fuse-holder, requirements relating to the resistance to soldering heat are not specified.

The fuse-links which do not use the exclusive fuse-holder shall be subjected to Test Tb of **JIS C 60068-2-20** by method 1A under the following conditions.

Ageing:	None (as received)
Immersion conditions:	260 °C ± 5 °C, 10 s ± 1 s
Depth of immersion:	2.0 mm ± 0.5 mm (from seating plane)
Flux type:	Activated
Screen:	A screen shall be used.

After the test, the fuse-link shall not be cracked. Marking shall be legible, and the fuse-link shall not show any broken wires.

8.7.4 Fuse-link specified in standard sheet J2

The fuse-links shall be subjected to the test in accordance with 6.2 of **JIS C 60068-2-58**.

Ageing:	None (as received)
Immersion conditions:	260 °C ± 5 °C, 10 s ± 1 s
Depth of immersion:	Whole specimen shall be immersed
Flux type:	Activated

After the test, the fuse-link shall not be cracked. Marking shall be legible, and the fuse-link shall not show any broken wire.

9 Electrical requirements

In addition to clause 9 of **JIS C 6575-1**, the following shall be observed; however, 9.6 is not specified and 9.7 shall be in accordance with this Standard.

9.1 Voltage drop

In addition to 9.1 of **JIS C 6575-1**, the following shall be observed.

For the measurement of voltage drop, see **JIS C 6575-1**. The voltage drop shall be measured at the points marked U in figure 2 for the UM through-hole fuse-link and in figure 3 for the UM surface mount fuse-link by using the fuse-base for testing shown in figure 4.

9.2 Time/current characteristics

In addition to 9.2 of **JIS C 6575-1**, the following shall be observed; however, 9.2.2 is not specified.

9.2.1 Time/current characteristics at normal ambient temperature

a) **Fuse-link specified in standard sheet 1 or 2** At 1.25 times the rated current, the pre-arcing time shall be 1 h or over (in the endurance test).

At 2 times the rated current, 2 min or under.

According to the pre-arcing time at 10 times the rated current, the following types shall be applied.