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Miniature fuses—
Part 2 : Cartridge 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 in accordance with the Industrial Standardization Law.

Consequently **JIS C 6575-2 : 1999** is replaced with this Standard.

This revision has been made based on **IEC 60127-2 : 2003** *Miniature fuses—Part 2 : Cartridge fuse-links* and Amendment 1 (2003) 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 2 : Cartridge fuse-links

Introduction This Japanese Industrial Standard has been prepared based on the second edition of **IEC 60127-2** *Miniature fuses—Part 2 : Cartridge fuse-links* published in 2003 and Amendment 1 (2003) with some modifications of the technical contents. The amendment has been edited and unified together.

Portions underlined with dots are the matters modified from the original International Standard. A list of modification with the explanations is given in annex 1 (informative).

Section 1—Additional requirements and test equipment

1 Scope This part of **JIS C 6575** specifies special requirements applicable to cartridge fuse-links for miniature fuses with dimensions not exceeding $\phi 11 \text{ mm} \times 40 \text{ mm}$ for the protection of electric appliances, electronic equipment and component parts thereof, normally intended for use indoors.

NOTE : In the strict sense, cartridge fuse-links with a diameter exceeding 10 mm are out of category of miniature fuse-links, but this Standard applies to cartridge fuse-links with a diameter not exceeding 11 mm.

It does not apply to fuses for appliances intended to be used under special conditions, such as in corrosive or explosive atmospheres.

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

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

NOTES 1 The fuse-links specified in 1 to 6 of standard sheets and those fuse-links of special melting specified in standard sheet J1 are mainly those used by appliance manufacturers for building in their products.

2 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 60127-2 : 2003 *Miniature fuses—Part 2 : Cartridge fuse-links* and Amendment 1 (2003) (MOD)

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. Only the edition of indicated year of coming into effect or of publication constitutes the provision of this Standard but the revision and amendment made thereafter are not applied.

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*, together with 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 60249-2-5 : 1987 *Base materials for printed circuits—Part 2 : Specifications—Specification No. 5 : Epoxide woven glass fabric copper-clad laminated sheet of defined flammability (vertical burning test)*

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

3 Definitions The definitions contained in clause 3 of JIS C 6575-1 apply.

4 General requirements Clause 4 of JIS C 6575-1 applies.

5 Standard ratings As shown in section 2 standard sheets of relevant standard, in accordance with clause 5 of 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 shall be added to 6.1 a) in JIS C 6575-1.

- a) For the fuse-links specified in standard sheet J1, 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 symbol denoting rated breaking capacity or 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 fuse-link shall be marked with the following.

- e) Symbol denoting rated breaking capacity: This symbol shall be placed between the marking for the rated current and the marking for the rated voltage. These symbols are:

H: denoting high-breaking capacity

L : denoting low-breaking capacity

E : denoting enhanced-breaking capacity (rated breaking capacity 150 A)

Information : In the fuse-link of rated voltage 250 V specified in **IEC 60127-4**, there are three kinds of breaking capacity i.e. high-breaking capacity (1 500 A), intermediate-breaking capacity and low-breaking capacity (100 A). In intermediate-breaking capacity is left as it is and enhanced-breaking is used in this Standard because 150 A is not so large as compared with 100 A.

Example of marking:

T	3	1	5	L	2	5	0	V
---	---	---	---	---	---	---	---	---

		F	4	H	2	5	0	V
--	--	---	---	---	---	---	---	---

T	3	1	5	E	2	5	0	V
---	---	---	---	---	---	---	---	---

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

Class A: Ⓐ or A

Class B: Ⓑ or B

NOTE : Marking of pre-arcing time/current class symbol is not carried out on the one of special melting.

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

Examples of marking:

(Example of class A)

3	A	Ⓐ	1	2	5	V
---	---	---	---	---	---	---

(Example of class B)

2	5	0	V	B	5	A
---	---	---	---	---	---	---

(Example of special melting)

1	0	0	V	1	0	A
---	---	---	---	---	---	---

6.3 In the case of fuse-links specified in standard sheet J1 in section 2 standard sheets; 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 The values for “d” and “s” shall be 0.8 mm ± 0.2 mm.

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

7.2.1

A) **Fuse-links specified in 1 to 6 of standard sheets** For testing individual fuse ratings, the number of fuse-links required is 48, of which 12 are kept as spares. The testing schedule is shown in table 1.

For the maximum ampere rating of a homogeneous series, the number of fuse-links required is 48, of which 22 are kept as spares. The testing schedule is shown in table 2.

For the minimum ampere rating of a homogeneous series, the number of fuse-links required is 33, of which 16 are kept as spares. The testing schedule is shown in table 3.

B) **Fuse-links specified in standard sheet J1** For testing individual fuse ratings and maximum ampere rating of a homogeneous series, the fuse-link shall be tested in accordance with the test procedure shown in table J1. In this case necessary number of fuse-links and number of spare fuse-links shall be as follows:

— high-breaking capacity fuse-links

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

— low-breaking capacity fuse-links

The number of fuse-links required is 39, of which 18 are kept as spares.

— intermediate-breaking capacity fuse-links

• when granular filler is used

The number of fuse-links required is 45, of which 18 are kept as spares.

• when granular filler is not used

The number of fuse-links required is 39, of which 18 are kept as spares.

NOTE : For low-breaking capacity fuse-links and intermediate-breaking capacity fuse-links without granular filler, the breaking test is carried out at the rated breaking capacity only but not at 500 A and $5 I_N$. Therefore, 12 fuse-links of numbers 28 to 39 become unnecessary. For intermediate-breaking capacity fuse-links with granular filler the tests are carried out at the rated breaking capacity and at $5 I_N$, but not at 500 A, therefore 6 fuse-links of numbers 34 to 39 become unnecessary (see table J1).

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

7.3.1 Fuse-bases for tests

A) **Fuse-links specified in standard sheets 1 to 6** For tests that require a fuse-base for mounting the fuse-links, bases according to figures 1, 2 or 3, shall be used as appropriate.

The contact resistance between each contact and the gauge (a silvered brass piece having the same nominal dimensions and shape as the fuse-link to be tested) shall not exceed 3 m Ω and is measured under the following conditions:

- a) in order to prevent the breakdown of thin insulating layers on the contacts, the e.m.f. of the circuit shall not exceed 20 mV (d.c. or a.c. peak);
- b) in order to prevent undue heating of the contacts, the current flowing shall not exceed 1 A.

Metal parts of the fuse-base, except the spring and connections, shall be made of brass. Brass parts of the fuse-base and of the gauge for measuring contact resistance shall have a copper content of between 58 % and 70 %. Contacts shall be silver-plated.

For fuse-links with rated currents up to and including 6.3 A, a fuse-base according to figure 1 shall be used. The contact force shall be between 4 N and 6 N. The flexible lead and terminal wires shall be of copper and shall have a cross-sectional area of 1 mm²; the length of each of the terminal wires being approximately 500 mm.

For fuse-links with rated currents exceeding 6.3 A, a fuse-base according to figure 2 shall be used. The contact force shall be between 8 N and 12 N. The flexible lead and terminal wires shall be of copper and shall have a cross-sectional area of 6 mm²; the length of each of the terminal wires being approximately 500 mm.

For breaking capacity tests, a fuse-base according to figure 3, with the same contact force and conductor cross-sectional area as for the base in figure 2, shall be used.

B) Fuse-links specified in standard sheet J1 For tests that require a fuse-base for mounting the fuse-links, bases according to figures J1, J2 or J3 shall be used as appropriate. For tests of fuse-links with lead wires, the fuse-base shown in figure J2 shall be used. For fuse-links without lead wire, the fuse-base shown in figure J3 shall be used for the breaking test and the fuse-base shown in figure J1 shall be used for other tests.

Metal parts of the fuse-base except the springs shall be made of brass. Brass parts of the fuse-base shall have a copper content of between 58 % and 70 %, and the contacts shall be silver-plated.

The flexible lead wires shall be of copper and shall have a cross-sectional area of 8 mm². The terminal wire shall be of copper and shall have a cross-sectional area of 2 mm² for testing a fuse-link with a rated current not exceeding 10 A, or of 8 mm² for testing fuse-link with a rated current exceeding 10 A. The length of each of the terminal wires shall be approximately 1 m.

When two or more fuse-links are tested in series, the fuse-bases shall be so arranged that the spacing between adjacent fuse-links to be tested is 150 mm or more.

8 Dimensions and construction In addition to the requirements of clause 8 in JIS C 6575-1, the following criteria and tests shall be observed:

8.2 Construction Where a “non-transparent” fuse-link is specified, a transparent case (body) may be used provided that there is an opaque filler.

Compliance is checked by inspection.

This Standard is based on the assumption that the case (body) is made of glass, ceramic or similar non-combustible material.

For other materials, additional tests may be necessary.

8.3 Terminations Fuse-links shall have at each end a metallic cap of cylindrical form.

The outer ends of the cylindrical caps shall be substantially flat and at right angles to the axis.

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

Compliance is checked by inspection and by the following test:

The samples are immersed in water for 24 h at a temperature of between 15 °C and 35 °C. After removal from the water, and axial pull steadily increasing to 5 N is applied to each cap for 1 min.

The caps shall remain firmly attached.

A suitable test apparatus for this purpose is given in figure 7 and shall be used in cases of dispute. By using this apparatus, the test can be performed without distorting the end caps.

8.4 Alignment and configuration of terminations The end caps and the body of the fuse-link, except that having lead wires, shall be in reasonable alignment. Compliance is checked by means of the gauge shown in figure 4. The entire length of the fuse-link shall pass through the gauge by the fuse-link's own weight.

9 Electrical requirements In addition to the requirements of clause 9 in **JIS C 6575-1**, the following criteria and tests are to be observed:

9.3 Breaking capacity

9.3.1 In addition to the requirements of **9.3.1** in **JIS C 6575-1**, the following shall be observed:

AC shall be used for this test in the test circuit specified in the standard sheet.

A) Fuse-links specified in 1 to 6 of standard sheets A typical test circuit for the rated high-breaking capacity test is given in figure 5, and for the rated low-breaking capacity test, a typical test circuit is given in figure 6. A test base according to figure 3 shall be used.

The power factor of the test circuit at rated high-breaking capacity shall be between 0.7 and 0.8. For tests at lower prospective currents, the inductance in the circuit shall remain constant and the current shall be adjusted by changing only the resistance.

B) **Fuse-links specified in standard sheet J1** The breaking test shall be carried out by using the test circuit shown in figure J4, at the currents stated below, while the angle of making is random. For fuse-links without lead wires, the fuse-bases shown in figure J3 shall be used, and for those with lead wires, the fuse-bases shown in figure J2 shall be used.

- high-breaking capacity fuse-link
rated breaking capacity of 1 500 A, 500 A and $5 I_N$
- low-breaking capacity fuse-link
rated breaking capacity of 100 A
- intermediate-breaking capacity fuse-link
 - 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 Criteria In addition to the criteria of failure prescribed in **JIS C 6575-1**, in each of the tests the fuse-link shall operate satisfactorily without any of the following phenomena:

- fusing together of the contacts;
- illegibility of marking after test;
- piercing of the external surfaces of the end caps, visible to the naked eye.

The following phenomena are neglected:

- black spots on the end caps;
- small deformation of the end caps;
- cracking of the fuse-link.

9.3.3 Insulation resistance For the fuse-links specified in standard sheet J1, 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.

9.7 Temperature of fuse-link For the fuse-links with a rated current exceeding 10 A specified in standard sheet J1, 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 shall be measured by thermocouple thermometer method at the central part of cartridge and at the cap of the fuse-link.

The temperature rise so measured shall not exceed the relevant values given below.

central part of cartridge 140 K or less

cap 60 K or less

Table 1 Testing schedule for individual ampere rating

Subclause	Description	Fuse-link no.															
		1-6	7	8	12	16	19	22	23	28	31	34	35	40	43	46	
9.4 ^(a)	Endurance tests	×															
9.2.2 ^(a)	Test at elevated temperature ^(b)					×											
9.2.1 ^(a)	Time/current characteristics		×														
	10 I_N																
	4 I_N							×									
	2.75 I_N										×						
	2.0 I_N or 2.1 I_N														×		
9.3	Breaking capacity test: Rated breaking capacity				×												
	5 times the rated current							×									
	10 times the rated current																
	50 times the rated current									×							
	250 times the rated current													×			
8.3	Terminations (end cap test)		×												×		
8.5 ^(a)	Soldered joints	×	×			×						×			×		
6.2 ^(a)	Legibility and indelibility of marking		×									×			×		
Notes ^(a) These subclauses are to be found in JIS C 6575-1 .																	
^(b) Applicable only when specified on the standard sheet.																	

Table 2 Testing schedule for maximum ampere rating of a homogeneous series

Subclause	Description	Fuse-link numbers in decreasing value of voltage drop											
		1-6	7	10	13-17	18-27	28	31	34	37	40	43	46
9.4^(a)	Endurance tests	×											
9.2.2^(a)	Test at elevated temperature ^(b)						×						
9.2.1^(a)	Time/current characteristics		×										
	4 I_N							×					
	2.75 I_N								×				
	2.0 I_N or 2.1 I_N										×		
9.3	Rated breaking capacity				×								
8.3	Terminations (end cap test)		×						×		×		
8.5^(a)	Soldered joints	×	×				×		×		×		
6.2^(a)	Legibility and indelibility of marking		×						×		×		

Notes ^(a) These subclauses are to be found in **JIS C 6575-1**.

^(b) Applicable only when specified on the standard sheet.

Table 3 Testing schedule for minimum ampere rating of a homogeneous series

Subclause	Description	Fuse-link numbers in decreasing value of voltage drop						
		1-6	7	10	13-17	18-27	28	31
9.4 ^(a)	Endurance tests	×						
9.2.1 ^(a)	Time/current characteristics		×					
	$10 I_N$ $2.0 I_N$ or $2.1 I_N$						×	
9.3	Rated breaking capacity				×			

Note ^(a) These subclauses are to be found in **JIS C 6575-1**.

Table J1 Testing schedule (applicable to fuse-links of standard sheet J1) [see 7.2.1 B)]

Subclause	Description		Fuse-link number											
			1 to 6	7 to 9	10 to 15	16 to 21	22 to 27	28 to 33	34 to 39	40 to 42	43 to 45	46 to 48	49 to 51	
9.7	Temperature rise test		×											
9.4	Endurance test		×											
9.2.1	Pre-arcing time/current characteristics	Class A	1.1 I_N		×									
		Class B	1.3 I_N											
		Special melting	I_N											
		Class A	1.35 I_N									×		
		Class B	1.6 I_N											
		Class A, class B	2 I_N							×				
		Special melting Minimum fusing current												
9.3	Breaking test	Rated breaking capacity				×								
		500 A ⁽¹⁾						×						
		5 I_N ⁽²⁾							×					
9.3.3	Insulation resistance			×		×		×	×	×		×		
8.3	Cap joint strength			×						×		×		
8.5	Solder joints		×	×						×		×		
6.2	Legibility and indelibility of marking		×	×		×		×	×	×		×		
Notes ⁽¹⁾ Breaking test at 500 A is carried out on high-breaking capacity fuse-links only, and retest is not allowed.														
⁽²⁾ Breaking test at 5 I_N is carried out on high-breaking capacity fuse-links and intermediate-breaking capacity fuse-links using granular filler only, and retest is not allowed.														

Table J2 Testing schedule for minimum ampere rating of homogeneous series (applicable to fuse-links of standard sheet J1)

Subclause	Description		Fuse-link number					
			1 to 6	7 to 9	10 to 18	19 to 21	22 to 24	25 to 27
9.4	Endurance test		×					
9.2.1	Pre-arcing time/current characteristics	Class A $1.1 I_N$		×				
		Class B $1.3 I_N$						
		Special melting I_N						
		Class A $1.35 I_N$					×	
		Class B $1.6 I_N$						
		Class A, class B $2 I_N$			×			
		Special melting Minimum fusing current						
8.3	Cap joint strength			×	×		×	
8.5	Soldered joints		×	×	×		×	
6.2	Legibility and indelibility of marking		×	×	×		×	