

MANUAL No. PES-A68-007

Document name

S B F C - J T , L P J , L P J 2 , L P J 3

REVISION : G

ISSUE DATE : 18 JAN, 2013

FILE No. :

Approved by 

Reviewed by _____

Issued by J. Kobayashi

1. Scope

This standard specifies SBFC-JT and LPJ, LPJ2, LPJ3 (hereinafter referred to as “fuse links”) used for electrical equipments and circuits of automobiles with each rated voltage of 32VDC or less and 58VDC.

2. Classification

The fuse-links are classified as shown in **Table 1** by their respective rated currents and types.

Table 1 Classification

Rated current A	Part No.				Housing color
	JT	LPJ	LPJ	LPJ3	
20	3424-00*0	3422-00*0	3421-00*0	3322-00*0	Light Blue
25	3474-00*0	3472-00*0	3471-00*0	3372-00*0	White
30	3434-00*0	3432-00*0	3431-00*0	3332-00*0	Pink
40	3444-00*0	3442-00*0	3441-00*0	3342-00*0	Green
50	3454-00*0	3452-00*0	3451-00*0	3352-00*0	Red
60	3464-00*0	3462-00*0	3461-00*0	3362-00*0	Yellow

3. Material

The materials of the fuse-links shall be as shown in **Table 2**.

Table 2 Materials

Part name	Material
Housing	PA6T
Cover	Polyarylate
Element	Copper alloy

4. Structure

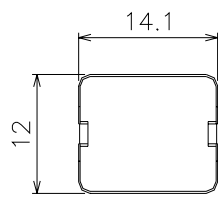
The structure of the fuse-links shall be as follows: a housing comprising an element that is integrated a fusing portion with female terminals for connection.

The fusing portion of the fuse-link shall be visible through the transparent top cover.

5. Dimensional requirements

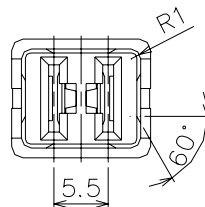
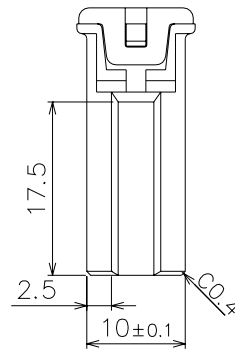
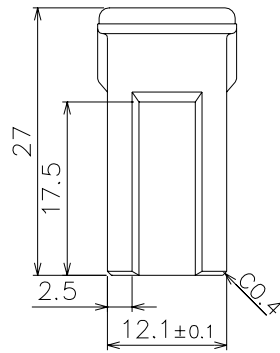
The dimensional requirements for the fuse-links shall be as shown in **Fig. 1**.

Fig.1 Dimensions

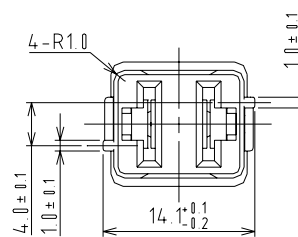
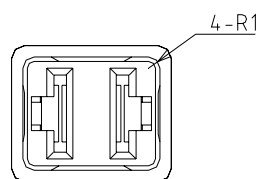
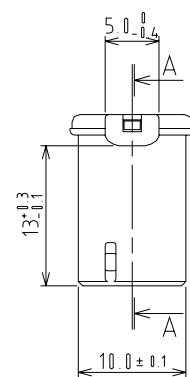
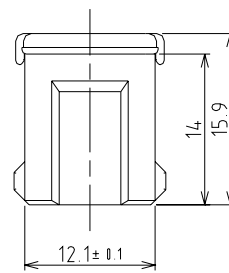
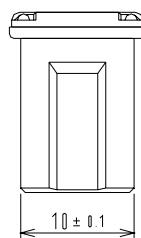
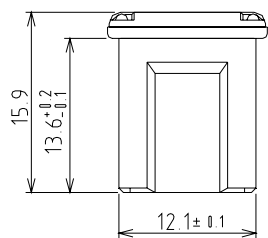
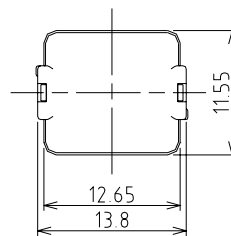
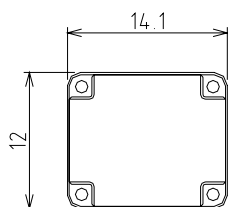


Unit: mm

Tolerance: ± 0.3 mm



JT



LPJ, LPJ3

LPJ2

6. Quality requirements

The quality requirements for the fuse-links shall be as shown in **Table 3**.

Table 3 Quality requirements

Item		Quality requirement	Measuring device	Measuring method
Appearance		The fuse-links shall be free from defects harmful to use such as flaws, cracks, burr and rust.	Visual inspection	Visual inspection/feeling under the illumination of 300Lx or more
Marking and Housing color		The rated current value the other markings, and the housing colors shall be clear in order not to misread.		Visual inspection from the top cover of the fuse links
Visibility of fusing portion		The fusing portion shall be visible clearly through cover.		
Inserting and drawing force of terminal		The force to insert a mating male tab into a female terminal for connection shall be 44.1N or less and the force to draw shall be from 9.8N to 24.5N.	Mechanical force gage	The fuse-links are inserted or drawn into the measuring device as the loads are applied perpendicularly to each terminal of the fuses. (at a constant speed of 50-150mm per min.)
Strength	Cover drawing strength	The drawing strength between the cover and the housing shall be 9.8N or more.		The housing is fixed and the tensile loads are applied to the cover. (at a constant speed of 50-150mm per min.)
	Lance breaking strength	The lance's breaking strength between the element and the housing shall exceed 60N.		The housing is fixed and the loads are applied perpendicularly to each terminal. (at a constant speed of 50-150mm per min.)
	Impact strength	The fuse-links shall be free from defects harmful to use such as terminal deformation, breaks and cracks.		The fuse-links are dropped from the height of 1m on a concrete floor.
	Breaking strength	The breaking strength of the fuse-links shall be 196N or more.		The compressive loads are applied to both the upper and lower ends of the fuse-links.
Heat resistance		The fuse-links shall be free from defects harmful to use such as corrosion, cracks and deformation.	Visual inspection	The fuse-links are left at 120°C for 100 hours.
Cold resistance				The fuse-links are left at -40°C for 24 hours.
Oil resistance				The fuse-links are left at 120°C for 24 hours after wiping engine oil of JIS K2215 and antifreeze of JIS K2234.

7. Performance requirements

The fuse-links, when tested in accordance with the test methods specified in Clause 8, shall meet the following performance requirements shown in Table 4.

Table 4 Performance requirements

No	Item	Performance requirements	Test Method
1	Maximum voltage drop	The maximum voltage drop of fuse-links shall be in accordance with Table 5.	8.2
2	Transient current Cycling	The fuse-links shall satisfy the values given in Table 6.	8.3
3	Vibration	The fuse-links shall satisfy the values given in Table 6.	8.4
4	Accelerated ageing	The fuse-links shall satisfy the values given in Table 6 and be free from defects harmful to use.	8.5.1
5	Resistance to dust		8.5.2
6	Operating time-rating	The fuse-links shall satisfy the values given in Table 6. After the test, the current flow through the fuse-link shall not exceed 0.5mA at the rated voltage.	8.6
7	Current steps	The current through the fuse-link shall not exceed 0.5mA at the rated voltage. The fuse-link shall be removable from the test fixture 2 min after returning to room temp.	8.7
8	Breaking capacity	The current through the fuse-link shall not exceed 0.5mA at the rated voltage and the fuse-link shall be removable from the test fixture. The following conditions shall not occur. - Permanent arcing, Piercing of the external surfaces visible to the naked eye, Welding together of the contacts or terminals	8.8
9	Temperature/vibration	The fuse-links shall satisfy the values given in Table 6 and be free from defects harmful to use.	8.9
10	Temperature rise	The temperature rise shall not exceed the values given in Table 7.	8.10
11	Resistance against temperature shock	The fuse-links shall satisfy the values given in Table 6 and be free from defects harmful to use.	8.11
12	Temperature coefficient of rated current	The temperature coefficient of the fuse-link's rated current shall not exceed 0.18% per 1°C.	8.12

Table 5 Maximum voltage drop

Current (% of rating) %	Maximum voltage drop mV
100	125

Table 6 Operation times

Test current A	Operating time	
	Minimum	Maximum
110% of rated current	100 h	—
135% of rated current	60 s	1800 s
200% of rated current	5 s	60 s
350% of rated current	0.2 s	7 s
600% of rated current	0.04 s	1 s

Table 7 Temperature rise

Current (% of rating) %	Temperature rise °C
50	40
70	60

Table 8 Connecting cable sizes

Rated current A	Cross-sectional area mm ²
20	1.25
25	2
30	2
40	3
50	5
60	

8. Test methods

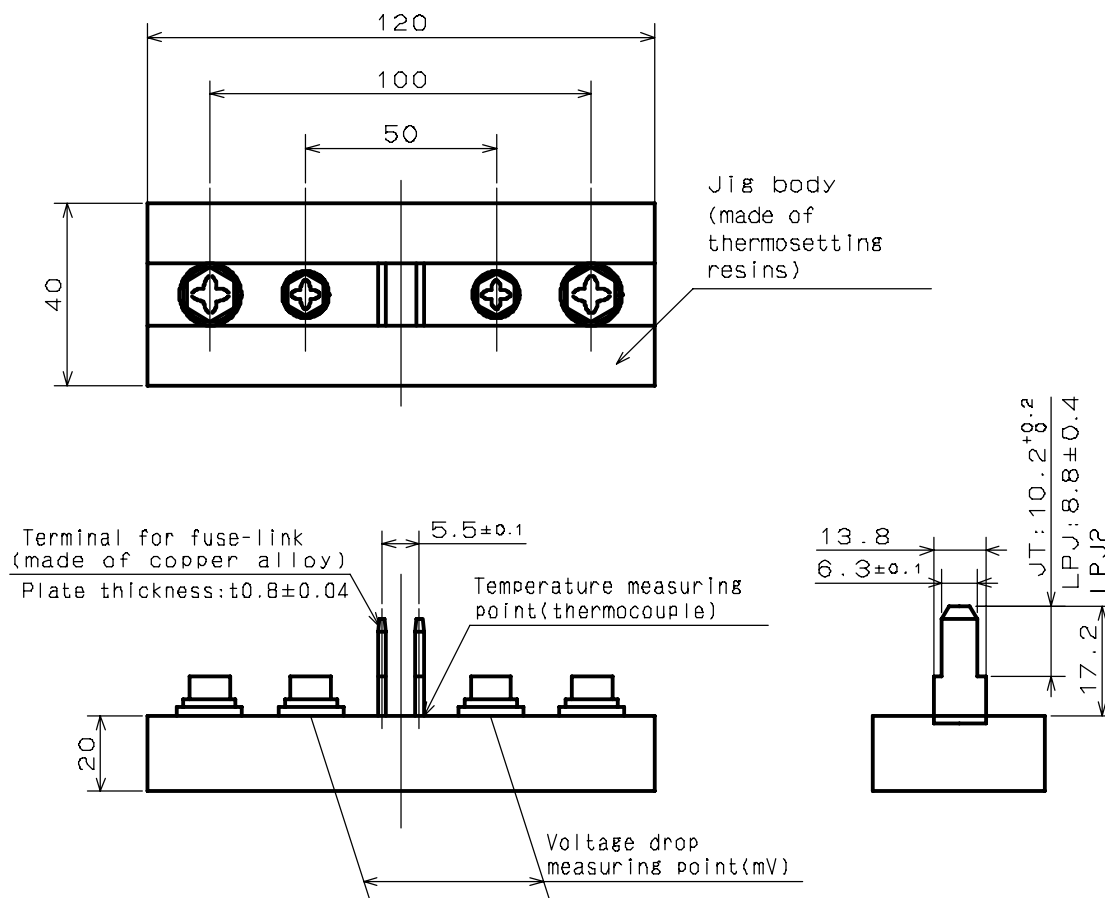
8.1 Test conditions

The tests of the fuse-links shall be conducted under the following conditions unless otherwise specified.

- (1) All the electrical tests shall be conducted with a direct current within $\pm 1\%$ deviation of the specified value supplied at a temperature of $(23 \pm 5)^\circ\text{C}$. The fuse-link shall be mounted on the standard test fixture as shown in **Fig. 2**.
- (2) The connecting cables used in the electrical test shall be in accordance with **JIS C 3406** and **JASO D 611**.
- (3) Connecting cables of 600 mm or longer as specified in **Table 8** shall be used for connecting to the fuse-link. When two or more fuse-links are tested in series, each fuse-link shall be mounted at intervals of 150 mm or longer.
- (4) The vibration test, thermal shock test, and environmental exposure test shall be conducted without supplying electric current to the fuse-link.
- (5) For those tests other than the vibration test, dust resistance test and combination accelerated aging test, the fuse-link shall be positioned vertically.

Fig.2 Standard test fixture

unit: mm



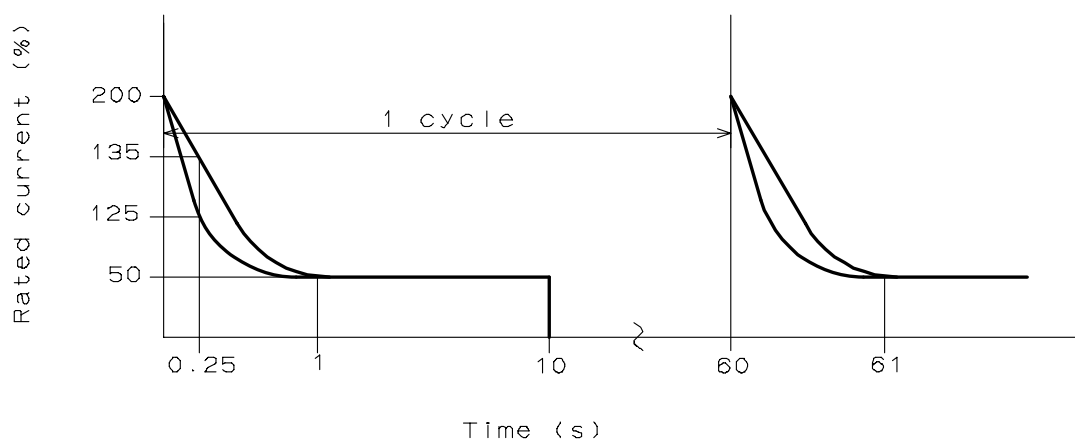
8.2 Voltage drop test

The measurement of the voltage drop (mV) shall be taken at the voltage drop measuring point between the fuse-link terminals as shown in Fig.2 after supplying a current corresponding to a 100% of the rated current for 15 min.

8.3 Transient current cycling test

After supplying the fuse-link with a transient current corresponding to values ranging from 50 to 200% of the rated current 50,000 times repeatedly in an intermittent pattern as shown in Fig.3, the operating time rating test shall be conducted according to Sub-clause 8.6. The supplied test voltage shall be (14 ± 0.2) VDC.

Fig.3 Transient current cycling



8.4 Vibration test

A simple harmonic motion with amplitude of 0.75 mm (1.5 mm from peak to peak) is applied to the fuse-link mounted on the standard test fixture shown in Fig.2. The applied vibration frequency shall be uniformly varied in a range from 10 to 55 Hz with a cycle procedure to increase from 10 up to 55 Hz, then to return to 10 Hz in about 1 min. The simple harmonic motion shall be applied in three directions cutting each other at right angles for two hours each. After that, the operating time rating test shall be conducted according to Sub-clause 8.6.

8.5 Environmental conditions

8.5.1 Accelerated ageing test

A temperature and humidity cycle specified below is applied 15 times repeatedly to the fuse-link, then the operating time rating test according to Sub-clause 8.6 shall be conducted.

- (1) A specimen is left for 4 hours in an ambience at the temperature of $(23\pm 5)^{\circ}\text{C}$ and Relative humidity (45~75)%.
- (2) The temperature and Relative humidity are raised within a half hour to $(55\pm 2)^{\circ}\text{C}$ and (95~99)%, respectively.
- (3) The specimen is left for 10 hours in an ambience at the temperature of $(55\pm 2)^{\circ}\text{C}$ and Relative humidity (95~99)%.
- (4) The temperature is lowered to $(-40\pm 2)^{\circ}\text{C}$ in 2 hours and a half.
- (5) The specimen is left in an ambience at the temperature of $(-40\pm 2)^{\circ}\text{C}$ for 2 hours.
- (6) The temperature is raised from (-40 ± 2) to $(120\pm 2)^{\circ}\text{C}$ in one and a half hour.
- (7) The specimen is left for 2 hours in an ambience at the temperature of $(120\pm 2)^{\circ}\text{C}$.
- (8) The temperature is returned to $(23\pm 5)^{\circ}\text{C}$ in one and a half hour.

The above-described cycle (1) through (8) shall complete at 24 hours.

Remark: In the above 24 hours, for the period from (4) to (8), no humidity control is made.

8.5.2 Test for resistance to dust <Reference test>

The dust resistance test shall be conducted in accordance with **JIS D 207-General Rules of Dust Test for Automobile Parts**, and then the operating time rating test according to Sub-clause 8.6 is conducted. The fuse-link shall be positioned horizontally.

8.6 Operating time rating test

Prior to the test, both the test fixture and fuse-link shall be stabilized at a temperature of $(23\pm 5)^{\circ}\text{C}$. After adjusting the power source to the test current specified in **Table 6**, the fuse-link is supplied with the current and the operating time to blow of the fuse-link is measured.

Especially when testing a number of fuse-links, a sufficient cooling time for the test fixture shall be taken into account to prevent its overheating. The test voltage to be applied shall be $(14\pm 0.2)\text{VDC}$.

8.7 Current steps

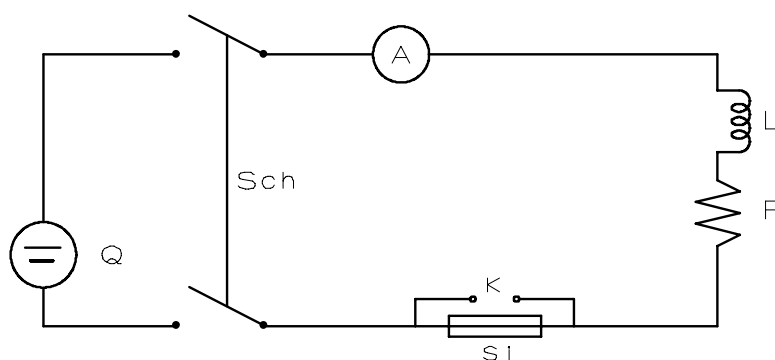
First apply a current equivalent in value to the rating of the fuse-link on test for duration of 5 min. Then sequentially increase the current value in steps of 2.5% of the fuse-link rating in 5 min intervals until the fuse-element melts and the current flow is interrupted.

8.8 Breaking capacity

If not otherwise specified the current of $(1000\pm 50)\text{A}$ shall be applied at each rated voltage of JT: $(32+2/-0)\text{VDC}$ and LPJ: $(58+2/-0)\text{VDC}$ with a $(2.0\pm 0.5)\text{ms}$ time constant to the fuse-link until the fuse-element melts and the current flow is interrupted. After interruption hold the rated voltage for 30s. The test circuit shall be in accordance with **Fig. 4**.

Connections shall be made to the fuse-link by not less than 600mm and the test cable sizes shall be as shown in **Table 8**.

Fig. 4 Breaking capacity test circuit



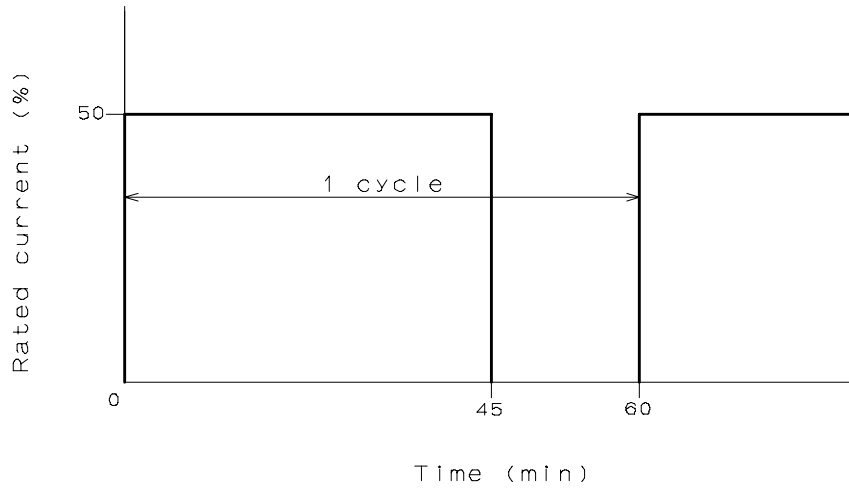
Key:

Q	Power supply	Sch	Switch
K	Fuse-link dummy	Si	Fuse
L	Inductor, air core	R	Adjustable resistor
A	Current meter		

8.9 Temperature/vibration test

While applying to the fuse-link at the temperature of $(80\pm 2)^{\circ}\text{C}$ a simple harmonic motion with a vibration acceleration of 44.1m/s^2 , a vibration frequency $20\sim 200\sim 20\text{Hz}$, and a sweep time of 3 min, in accordance with **JIS D 1601**, an electric current cycle as shown in **Fig. 5** is applied 300 times repeatedly, then the operating time rating test is conducted according to Sub-clause **8.6**. The test voltage shall be $(14\pm 0.2)\text{VDC}$.

Fig.5 Current cycling at temperature/vibration test



8.10 Temperature rise test

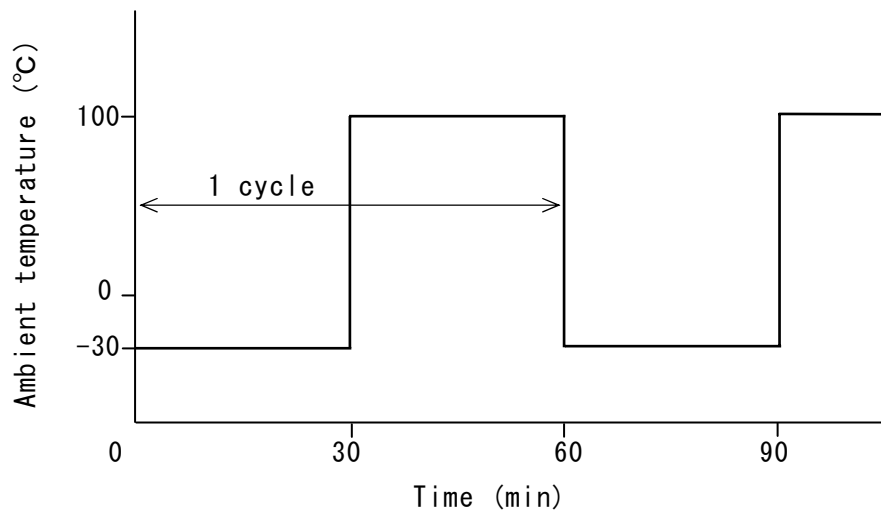
The temperature rise shall be measured at the temperature-rise measuring point at the terminal for fuse-link as shown in Fig.2 after supplying a current equal to a 50% and 70% of the rated current for 40 min.

8.11 Resistance against temperature shock test

A thermal shock cycle (as shown in Fig.6) shall be applied 48 times repeatedly to the fuse-link under the following conditions, then the operating time rating test shall be conducted according to Sub-clause 8.6.

- (1) A specimen is left in a room at the temperature of $(-30 \pm 2)^{\circ}\text{C}$ for 30 min.
 - (2) After that, the specimen is moved within 15 sec. into a room at the temperature of $(100 \pm 2)^{\circ}\text{C}$, where it is left for 30 min.
 - (3) Then, it is brought back within 15 sec. to the room at the temperature of $(-30 \pm 2)^{\circ}\text{C}$.
- The above-described cycle (1) through (3) shall complete at 60 min.

Fig.6 Resistance against temperature shock



8.12 Test for temperature coefficient of rated current <Reference test>

The operating time rating tests of the fuse-links are conducted in the ambience of -30 , 23 , and 70°C , respectively, then the coefficient is calculated by dividing the variation of the rated current by the temperature difference as follows.

$$\sigma = \frac{I_1 - I}{T - T_1} \times \frac{100}{I}$$

$$\sigma = \frac{I - I_2}{T_2 - T} \times \frac{100}{I}$$

Where σ : Temperature coefficient ($\%/^{\circ}\text{C}$)
 T : 23°C
 T_1 : -30°C
 T_2 : 70°C
 I : Rated current (at 23°C)
 I_1 : Varied rated current (at -30°C)
 I_2 : Varied rated current (at 70°C)

Remark: Through the operating time rating tests in the ambience of -30 and 70°C , find the respective current values, I_1 and I_2 , to cause the equivalent pre-arcing time-current characteristics to that obtained by I at 23°C .

9. Test sequence

The test sequence of the fuse-links shall be as shown in **Table 9**.

Table 9 Test sequence

No	Test item	Item no.	Test sample group									
			1	2	3	4	5	6	7	8	9	
1	Voltage drop	8.2	×	×	×							
2	Accelerated ageing	8.5.1				×						
3	Resistance to dust	8.5.2					×					
4	Vibration	8.4						×				
5	Transient current cycling	8.3							×			
6	Temperature/vibration	8.9								×		
7	Temperature rise	8.10										×
8	Resistance against temperature shock	8.11										×
9	Voltage drop	8.2				×	×	×	×	×	×	×
10	Current steps	8.7			×							
11	Breaking capacity	8.8	×									
12	Operating time-rating	8.6		×		×	×	×	×	×	×	×
				2		2	2	2	2	2	2	2
				2		2	2	2	2	2	2	2
				2		2	2	2	2	2	2	2
				2		2	2	2	2	2	2	2

Remark: Each sample group shall contain eight fuse-links (total 72).

The colored part shows the measurement after durability test.

10. Marking

On the body of fuse-link, the rated current, manufacturer's name or his trade name, and maximum operating voltage shall be permanently marked. The housings of the fuse-links shall be classified with colors according to the rated current as shown in **Table 1**.