

MANUAL No. PES-A68-006

S B F W - K

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1. **Scope**

2. This standard specifies "SBFW-K" for electrical equipments and circuits of automobiles (hereinafter referred to as "fuse-links"), which has a rated voltage of 32V.

3. **Identification**

4. The identification of the fuse-links shall be by color coding in accordance with current rating as shown in **Table 1**.

(Table 1)

Item	Specification									
▪ Rated current	Rated current(A)	K	K2	COLOR CODE						
	80	310200*0	3306-00*0	Red						
	100	311200*0	3316-00*0	Yellow						
	125	312200*0	3326-00*0	Green						
	150	313200*0	3336-00*0	Orange						
	175	314200*0	3346-00*0	White						
	200	315200*0	3356-00*0	Blue						
	225	316200*0	3366-00*0	Light brown						
	250	317200*0	3376-00*0	Pink						
	275	317400*0	-	Light blue						
	300	318200*0	3386-00*0	Gray						
	350	313400*0	3307-00*0	Dark green						
	400	314400*0	3317-00*0	Violet						
	450	315400*0	3327-00*0	Dark yellow						
	500	316400*0	3337-00*0	Brown						
▪ Shape	<p>&lt;Reference picture&gt; Drawing describes in detail</p> <table border="1"> <tr> <td></td> <td>K</td> <td>K2</td> </tr> <tr> <td>A</td> <td>8.5</td> <td>6.2</td> </tr> </table>					K	K2	A	8.5	6.2
	K	K2								
A	8.5	6.2								

**3. Performance requirements** The fuse-links shall meet the performance requirements specified in **Table 2** and **3** when tested in accordance with the test methods specified in clause **4**.

**3.1 General**

(Table 2)

Item	Performance requirements	Test method																																											
(1) Voltage drop	<table border="1"> <thead> <tr> <th>Rated current (A)</th> <th>Maximum voltage drop (mV)</th> </tr> </thead> <tbody> <tr> <td>80A~250A</td> <td>110</td> </tr> <tr> <td>275A~500A</td> <td>80</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>▪ The maximum voltage drop shall not exceed the values in the table.</li> </ul>	Rated current (A)	Maximum voltage drop (mV)	80A~250A	110	275A~500A	80	4. 2. 1																																					
Rated current (A)	Maximum voltage drop (mV)																																												
80A~250A	110																																												
275A~500A	80																																												
(2) Operating time rating	<table border="1"> <thead> <tr> <th rowspan="3">Test current A</th> <th colspan="4">Operating time</th> </tr> <tr> <th colspan="2">80A~250A</th> <th colspan="2">275A~500A</th> </tr> <tr> <th>Min</th> <th>Max</th> <th>Min</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>600% of rated current</td> <td>0. 1s</td> <td>1s</td> <td>0. 1s</td> <td>1s</td> </tr> <tr> <td>350% of rated current</td> <td>0. 3s</td> <td>5s</td> <td>0. 5s</td> <td>5s</td> </tr> <tr> <td>200% of rated current</td> <td>1s</td> <td>15s</td> <td>1s</td> <td>15s</td> </tr> <tr> <td>135% of rated current</td> <td>120s</td> <td>1800s</td> <td>—</td> <td>—</td> </tr> <tr> <td>100% of rated current</td> <td>14400s</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>75% of rated current</td> <td>—</td> <td>—</td> <td>14400s</td> <td>—</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>▪ Fuse-links shall operate with in above time. After the test, the current flow through the fuse-link shall not exceed 0.5mA at 32V d.c.</li> <li>▪ As for 350A and above 600% shall be not applicable.</li> </ul>	Test current A	Operating time				80A~250A		275A~500A		Min	Max	Min	Max	600% of rated current	0. 1s	1s	0. 1s	1s	350% of rated current	0. 3s	5s	0. 5s	5s	200% of rated current	1s	15s	1s	15s	135% of rated current	120s	1800s	—	—	100% of rated current	14400s	—	—	—	75% of rated current	—	—	14400s	—	4. 2. 2
Test current A	Operating time																																												
	80A~250A		275A~500A																																										
	Min	Max	Min	Max																																									
600% of rated current	0. 1s	1s	0. 1s	1s																																									
350% of rated current	0. 3s	5s	0. 5s	5s																																									
200% of rated current	1s	15s	1s	15s																																									
135% of rated current	120s	1800s	—	—																																									
100% of rated current	14400s	—	—	—																																									
75% of rated current	—	—	14400s	—																																									
(3)Breaking capacity	<p>After the test, the current flow through the fuse-link shall not exceed 0.5mA at 32V d.c. The following shall not occur:</p> <ul style="list-style-type: none"> <li>- permanent arcing;</li> <li>- Marking and color coding shall be visible;</li> </ul> <p>—After the test, the current flow through the fuse-link shall not exceed 0.5mA at 32V d.c</p>	4. 2. 3																																											
(4)Current steps	<ul style="list-style-type: none"> <li>▪ After the test, the current flow through the fuse-link shall not exceed 0.5mA at 32V d.c.</li> <li>▪ As for current steps, 275A and above shall be not applicable.</li> </ul>	4. 2. 4																																											
(5)Terminal strength	<ul style="list-style-type: none"> <li>▪ No deformation when fixed, and no deterioration on using.</li> </ul>	4. 2. 5																																											
(6)Appearance	<ul style="list-style-type: none"> <li>▪ No deterioration on using.</li> <li>▪ Fusing portion shall be visible from the outside.</li> </ul>	—																																											

**3.2 Durability**

(Table 3)

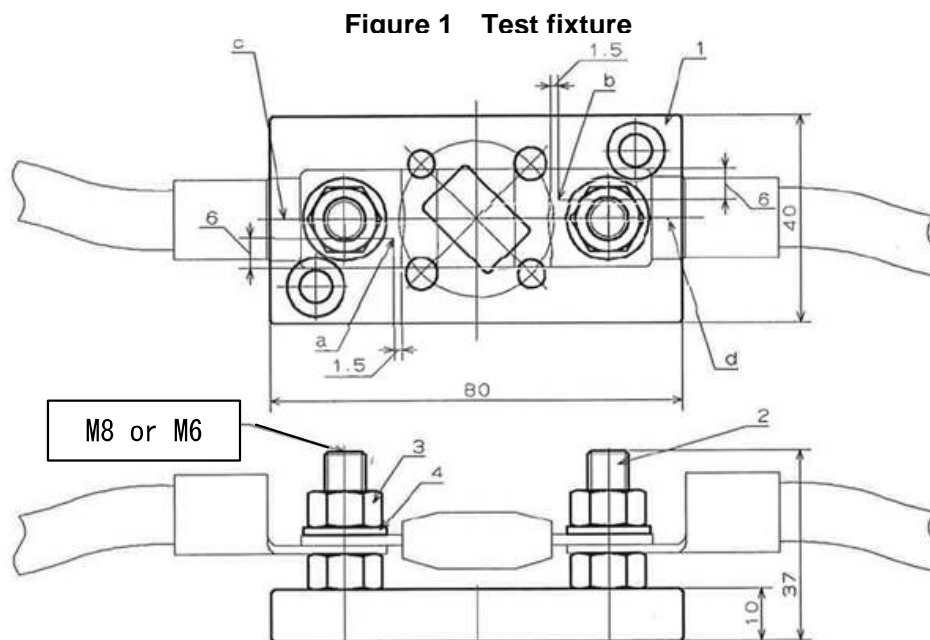
Item	Specification	Test method
(1) Transient current cycling	The fuse-links shall meet the requirements of <b>Table 2</b> after each test.  *As for transient current cycling, 275A and above shall be not applicable.	4.3.1
(2) Resistance to mechanical load		4.3.2
(3) Resistance to climatic load		4.3.3
(4) Resistance to chemical load		4.3.4

#### 4 Test procedure

##### 4.1 General

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

- (1) Carry out all electrical tests using the test fixture designed in accordance with **Figure 1** with direct current maintained within a tolerance of  $\pm 1\%$ , at an ambient temperature of  $(23 \pm 5)^\circ\text{C}$ , unless otherwise stated.
- (2) The connecting cables used in the electrical tests shall in accordance with JIS C 3406, JASO D 611 or ISO 6722.
- (3) Connections shall be made to the fuse-links using more than 600 mm in length specified in **Table 5**. When two or more fuse-links are tested in series, they shall be mounted more than 150 mm apart.
- (4) Carry out the Resistance to the mechanical load test and Climatic load test without current passing through the fuse-links.
- (5) Except as applicable to the Resistance to the mechanical load test, the fuse-links shall be mounted in the horizontal plane.
- (6) Test voltage shall not exceed the fuse's rated voltage.



※Points a and b are the measuring points for the voltage drop.

#### 4. 1. 1 Test sequence

The test sequence shall be in accordance with **Table 4**.

		Test sequence (Table 4)						
Test item	Test clause(s)/subclause	Test sample group						
		1	2	3	4	5	6	7
Terminal strength	4. 2. 5	X	X	X	X	X	X	X
Voltage drop	4. 2. 1	X	X	X				
Resistance to climatic load	4. 3. 3				X			
Resistance to chemical load	4. 3. 4					X		
Resistance to mechanical load	4. 3. 2						X	
Transient current cycling	4. 3. 1							X
Fuse-link voltage drop	4. 2. 1				X	X	X	X
Current step	4. 2. 4			X				
Breaking capacity	4. 2. 3	X						
Operating time rating	75%or 100%		X		X	X	X	X
	135%		2		2	2	2	2
	200%		2		2	2	2	2
	350%		2		2	2	2	2
	600%		2		2	2	2	2
Terminal strength <sup>2)</sup>	—	X	X	X	X	X	X	X
Appearance	—	X	X	X	X	X	X	X

[Note]

1) Test sample group of rated current 80A-250A shall contain 8 fuse-links, and rated current 275A-500A shall contain 6 fuse-links.

2)This terminal strength is just take the fuse away from the test fixture.

#### 4.1.2 Connecting wire

Connecting wire size shall be in accordance with Table 5.

(Table 5)

Rated current (A)	Cable size
80	10
100	15
125	
150	20
175	
200	30
225	
250	50
275	60
300	
350	
400	
450	
500	

#### 4.2 General

##### 4.2.1 Voltage drop

The voltage drop shall be measured at points shown in **Figure 1**, across the fuse-link terminals after 15 min of applied rated current. The rate to the rated current shall be 100% for 80A-250A, 75% for 275A-500A.

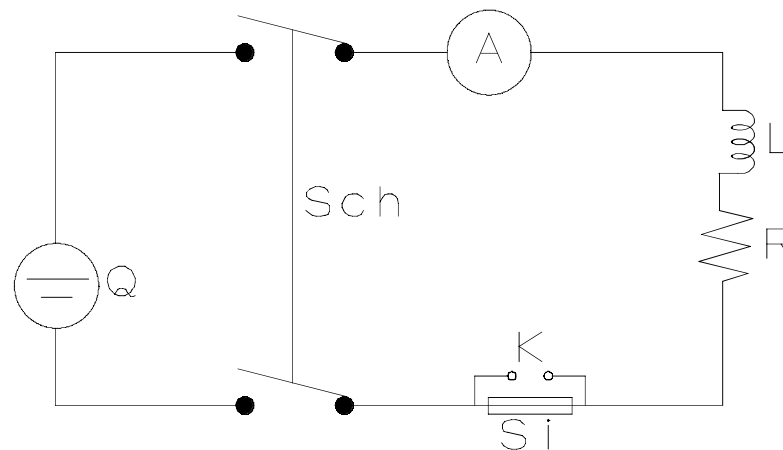
##### 4.2.2 Operating time rating

Stabilize the test fixture and fuse-link at room temperature of  $(23\pm 5)^{\circ}\text{C}$  prior to testing. Adjust the power supply to the test current specified in **Table 2**. Then apply this current to the fuse-link. Repeat this procedure for each sample. Allow sufficient cooling time, especially when testing a large number of fuse-links, to prevent excessive temperature build-up of the test fixture.

### 4.2.3 Breaking capacity

Apply a current of 2000(+100,-0) A at 32(+2,-0)V d.c. with a  $2.5 \pm 0.5$  ms time constant to the fuse-link until the fuse-element melts and the current is interrupted. The test circuit shall be in accordance with **Figure 7**. Connections shall be made to the fuse-link by  $500 \pm 50$  mm of cable. The cable sizes shall be in accordance with **Table 5**.

Figure2 Breaking capacity test circuit



**NOTE** The symbols in the figure refers to the following:

A	: Current meter	R	: Adjustable resistor
K	: Fuse-link dummy	Sch	: Switch
L	: Inductor, air core	Si	: Fuse-link mounted on the test fixture
Q	: Power supply		

### 4.2.4 Current steps

First apply a current equivalent in value to the rating of the fuse-link on test for 30 min. Sequentially increase the current in steps of 2.5% of the fuse-link current rating every 30 min until the fuse-element melts and the current is interrupted. After the test, the current flow through the fuse-link shall not exceed 0.5mA at 32V d.c.

### 4.2.5 Strength of terminal

A force of  $12 \pm 1$  Nm shall be applied to the tabs of the fuse-link in accordance with the **Figure 1**.

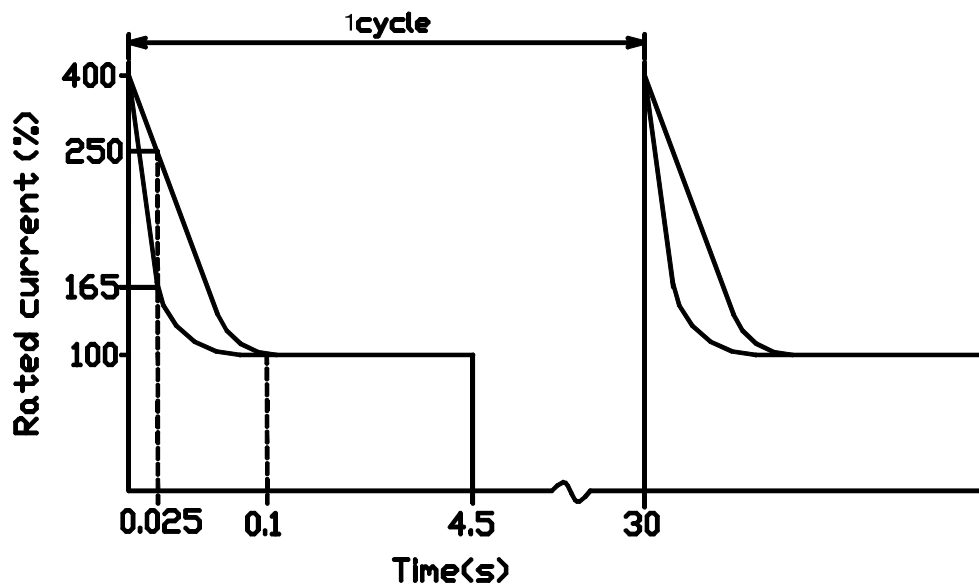
## 4.3 Durability

### 4.3.1 Transient current cycling

Apply a resistive load in order to adjust the initial peak transient current to the percentage of fuse-link rating and the initial steady-state current, as given in **Figure 3**. At an elapsed time of 0.025 s on-time, the current shall fall to a value between 165% and 250% of rated current. At no time shall the steady-state current fall below 90%. The transient current cycling, as shown in **Figure 4**, shall be applied a minimum of 50 000 times.



Figure 3 Transient current cycling



#### 4.3.2 Resistance to mechanical load

An appropriate test shall be chosen from ISO 16750-3 4.1.2.4.[ Test IV—Passenger car, sprung masses(vehicle body)] (or JASO D 014-3 4.1.3.1.5 [Test IV—sprung (vehicle body) Mounting device for passenger car ]), ISO 16750-3 4.1.2.7[Test VII—Commercial vehicle, sprung masses] ( or JASO D 014-3 4.1.3.2.3 [Test VII—sprung (vehicle body) Mounting device for commercial vehicle]) or alternative test which agreed between fuse-link manufacturer and vehicle manufacturer.

#### 4.3.3 Resistance to climatic load

##### 4.3.3.1 Accelerated ageing test

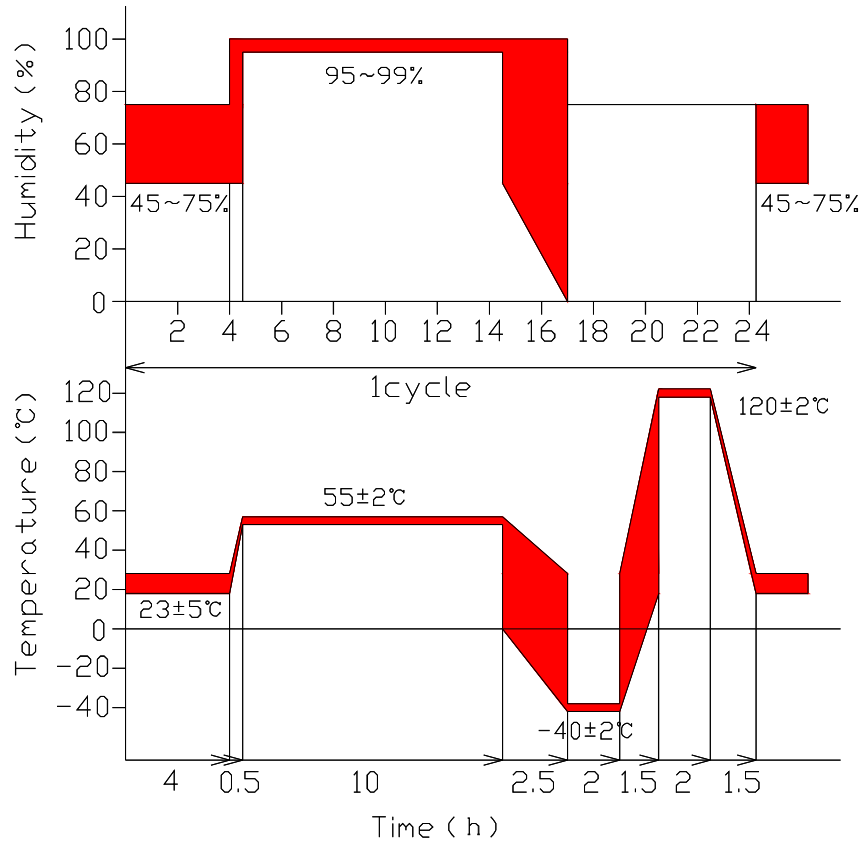
Subject the fuse-links to a temperature/humidity cycling test 10 times, as specified in **Figure 4**.

The test sequence shall be as follows.

- (1) Hold the samples at room temperature,  $(23 \pm 5)^\circ\text{C}$  for 4 h at 45% to 75% relative humidity (RH).
- (2) Raise to  $(55 \pm 2)^\circ\text{C}$  at 95% to 99% RH within 0.5 h.
- (3) Hold at  $(55 \pm 2)^\circ\text{C}$  at 95% to 99% RH for 10 h.
- (4) Lower to  $(-40 \pm 2)^\circ\text{C}$  within 2.5 h.
- (5) Hold at  $(-40 \pm 2)^\circ\text{C}$  for 2 h.
- (6) Raise to  $(120 \pm 2)^\circ\text{C}$  within 1.5 h from  $(-40 \pm 2)^\circ\text{C}$ .
- (7) Hold at  $(120 \pm 2)^\circ\text{C}$  for 2 h.
- (8) Allow a return to room temperature  $(23 \pm 5)^\circ\text{C}$  within 1.5 h.

**NOTE 1** One cycle consists of 24 h (complete hours).

**NOTE 2** For periods (4), (5), (6), (7) and (8), the humidity is uncontrolled.



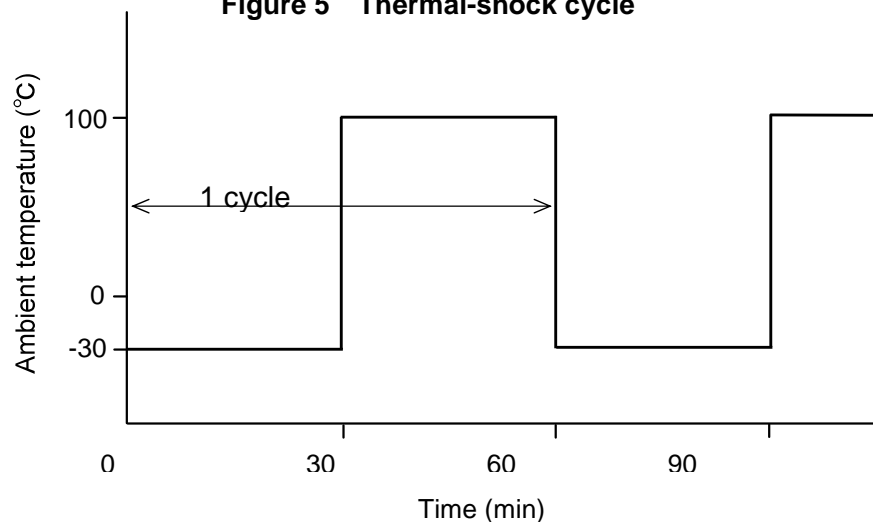
**Figure 4 Resistance to climatic load**

**4.3.3.2 Thermal-shock resistance test**

Testing of thermal-shock resistance is to be carried out by subjecting the test piece to 1,000 repetitions of the following thermal-shock cycle (see **Figure 5**).

- (1) Allow the fuse to stand for a period of 30 minutes in a room at  $-30 \pm 2^\circ\text{C}$ .
- (2) Relocate the fuse to another room at  $100 \pm 2^\circ\text{C}$  within 15 seconds, and allow it to stand for a period of 30 minutes.
- (3) Return the fuse to the room at  $-30 \pm 2^\circ\text{C}$  within 15 seconds. Note that 1 cycle is 60 minutes in length.

**Figure 5 Thermal-shock cycle**



#### 4. 3. 4 Resistance to chemical load

This test evaluates the resistance to diesel fuel, "blo" diesel fuel, unleaded petrol (gasoline), brake fluid (DOT4), engine coolant water-glycol mixture 1:1, engine oil ( multi grade) See ISO 16750-5 or JASO D 0145-5. Use a cotton cloth with a moistened area of each fluid type in succession. Wipe 5 times with a force of 5N over the external portions of the fuse-links(see also IEC 60068-2-70).