

MANUAL No. PES-A68-017

S B F W - L

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Approved by *muraoka*

Reviewed by *ml*

Issued by *T. Kobayashi*

1. Scope

2. This standard specifies "SBFW-L" for electrical equipments and circuits of automobiles (hereinafter referred to as "fuse-links"), which has a rated voltage of 58V.

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)	L-M5	L-M6	COLOR CODE												
	30	313900*0	333800*0	Orange												
	40	314900*0	334800*0	Green												
	50	315900*0	335800*0	Red												
	60	316900*0	336800*0	Yellow												
	70	317900*0	337800*0	Brown												
	80	318900*0	338800*0	White												
	100	310700*0	331900*0	Blue												
	125	311700*0	332900*0	Pink												
	150	-	310800*0	Gray												
	175	-	311800*0	Light Brown												
	200	-	312800*0	Violet												
	▪ Shape	<Reference picture> Drawing describes in detail														
<table border="1"> <thead> <tr> <th></th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>30A~80A</td> <td>8.0</td> <td>4.0</td> <td>0.4</td> </tr> <tr> <td>100~200A</td> <td>8.24</td> <td>4.24</td> <td>0.64</td> </tr> </tbody> </table>					A	B	C	30A~80A	8.0	4.0	0.4	100~200A	8.24	4.24	0.64	
		A	B	C												
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L-M5	5.4															
L-M6	6.2															

Item	Specification																				
<p>▪ Rated current</p>	Rated current(A)	L-1H-M5	L-1H-M6	COLOR CODE																	
	30	333100*0	323800*0	Orange																	
	40	334100*0	324800*0	Green																	
	50	335100*0	325800*0	Red																	
	60	336100*0	326800*0	Yellow																	
	70	337100*0	327800*0	Brown																	
	80	338100*0	328800*0	White																	
	100	339100*0	325700*0	Blue																	
	125	340100*0	326700*0	Pink																	
	150	-	327700*0	Gray																	
	175	-	328700*0	Light Brown																	
	200	-	329700*0	Violet																	
	<p>▪ Shape</p>	<p><Reference picture> Drawing describes in detail</p>																			
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<p>Bolt down fuse can be used for all test of this type fuse.</p>																					

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>30A</td> <td>105</td> </tr> <tr> <td>40A</td> <td>90</td> </tr> <tr> <td>50A~70A</td> <td>80</td> </tr> <tr> <td>80A~125A</td> <td>75</td> </tr> <tr> <td>150A~200A</td> <td>70</td> </tr> </tbody> </table> <p>▪ The maximum voltage drop shall not exceed the values in the table.</p>	Rated current(A)	Maximum voltage drop (mV)	30A	105	40A	90	50A~70A	80	80A~125A	75	150A~200A	70	4.2.1																																														
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(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">30A~125A</th> <th colspan="2">150A~200A</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>—</td> <td>—</td> <td>0.1s</td> <td>1s</td> </tr> <tr> <td>500% of rated current</td> <td>0.1s</td> <td>1s</td> <td>—</td> <td>—</td> </tr> <tr> <td>350% of rated current</td> <td>—</td> <td>—</td> <td>0.3s</td> <td>5s</td> </tr> <tr> <td>300% of rated current</td> <td>0.3s</td> <td>3s</td> <td>—</td> <td>—</td> </tr> <tr> <td>200% of rated current</td> <td>3s</td> <td>100s</td> <td>1s</td> <td>15s</td> </tr> <tr> <td>150% of rated current</td> <td>90s</td> <td>3600s</td> <td>—</td> <td>—</td> </tr> <tr> <td>110% of rated current</td> <td>4h</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>100% of rated current</td> <td>100h</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>75% of rated current</td> <td>—</td> <td>—</td> <td>100h</td> <td>—</td> </tr> </tbody> </table> <p>▪ Fuse-links shall operate with in above time. After the test, the current flow through the fuse-link shall not exceed 0.5mA at 58V d.c.</p>	Test current A	Operating time				30A~125A		150A~200A		Min	Max	Min	Max	600% of rated current	—	—	0.1s	1s	500% of rated current	0.1s	1s	—	—	350% of rated current	—	—	0.3s	5s	300% of rated current	0.3s	3s	—	—	200% of rated current	3s	100s	1s	15s	150% of rated current	90s	3600s	—	—	110% of rated current	4h	—	—	—	100% of rated current	100h	—	—	—	75% of rated current	—	—	100h	—	4.2.2
Test current A	Operating time																																																											
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(3)Breaking capacity	<p>After the test, the current flow through the fuse-link shall not exceed 0.5mA at 58V d.c. The following shall not occur:</p> <ul style="list-style-type: none"> - permanent arcing; - Marking and color coding shall be visible; <p>-After the test, the current flow through the fuse-link shall not exceed 0.5mA at 58V d.c</p>	4.2.3																																																										
(4)Current steps	<ul style="list-style-type: none"> ▪ After the test, the current flow through the fuse-link shall not exceed 0.5mA at 58V d.c. ▪ As for current steps, 150A and above shall be not applicable. 	4.2.4																																																										

(5) Terminal strength	<ul style="list-style-type: none"> No deformation when fixed, and no deterioration on using. 	4.2.5
(6) Appearance	<ul style="list-style-type: none"> No deterioration on using. Fusing portion shall be visible from the outside. 	—

3.2 Durability

(Table 3)

Item	Specification	Test method
(1) Transient current cycling	The fuse-links shall meet the requirements of Table 2 after each test. *As for transient current cycling, 150A 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

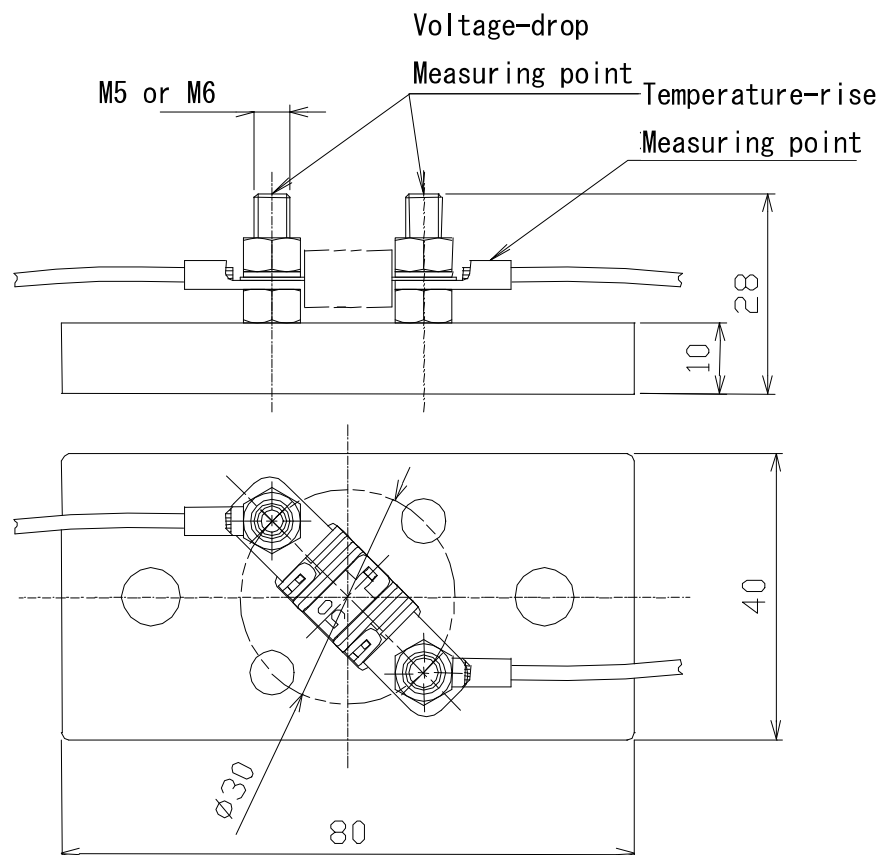
4 Test procedure

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.

Figure 1



4.1.1 Test sequence

The test sequence shall be in accordance with **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%	4.2.2		X		X	X	X	X
	110%			2(a)		2(a)	2(a)	2(a)	2(a)
	150%			2(a)		2(a)	2(a)	2(a)	2(a)
	200%			2(ab)		2(ab)	2(ab)	2(ab)	2(ab)
	300%			2(a)		2(a)	2(a)	2(a)	2(a)
	350%			2(b)		2(b)	2(b)	2(b)	2(b)
	500%			2(a)		2(a)	2(a)	2(a)	2(a)
	600%			2(b)		2(b)	2(b)	2(b)	2(b)
Terminal strength ²⁾		—	X	X	X	X	X	X	X
Appearance		—	X	X	X	X	X	X	X

[Note]

1) Test sample group of rated current (a)30A-125A shall contain 8 fuse-links, and rated current (b)150-200A 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
30	2.0
40	3
50	5
60	
70	10
80	
100	15
125	20
150	
175	30
200	

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 30A-125A, 75% for 150-200A.

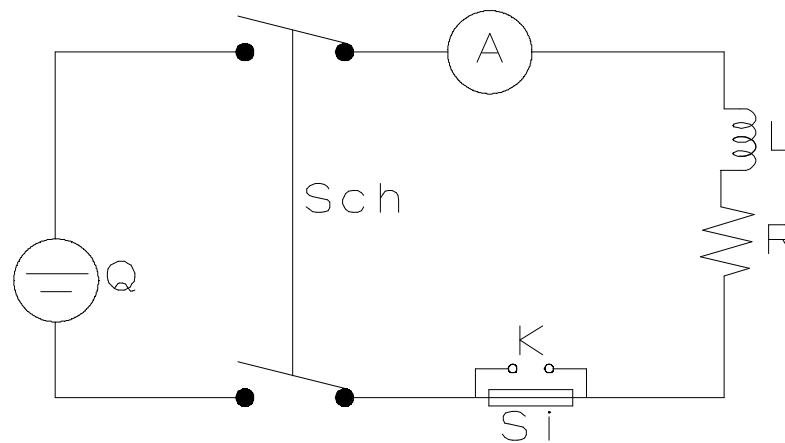
4.2.2 Operating time rating

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 $1000(+100,-0)$ A at $58(+2,-0)$ V d.c. with a 2.5 ± 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 ± 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 58V d.c.

4.2.5 Strength of terminal

A force shall be applied as stated in **Table 6** to the tabs of the fuse-link in accordance with the **Figure 1**.

(Table 6)

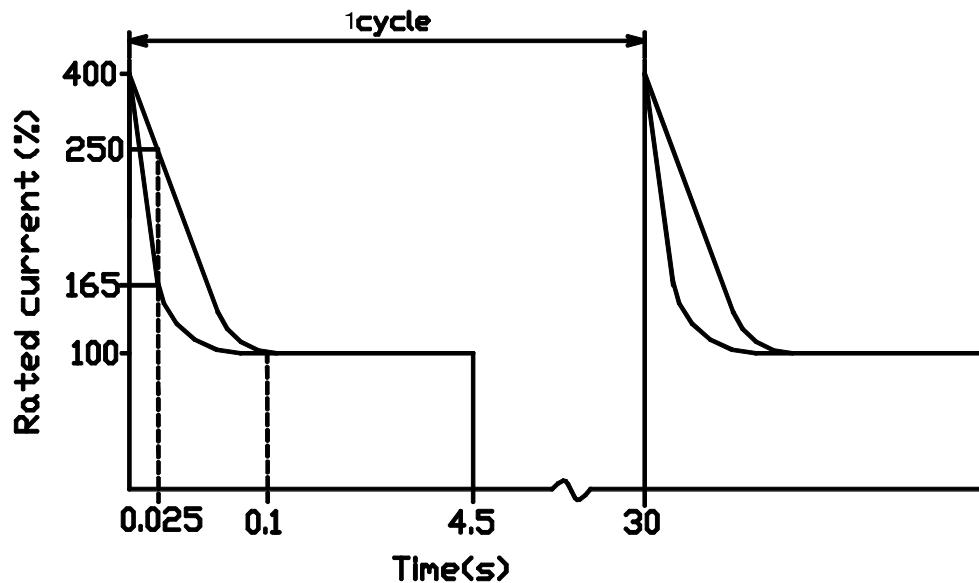
	Mounting Torque Nm
L-M5, L-1H-M5	4,5 ± 1
L-M6, L-1H-M6	6 ± 1

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 cycles.

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.

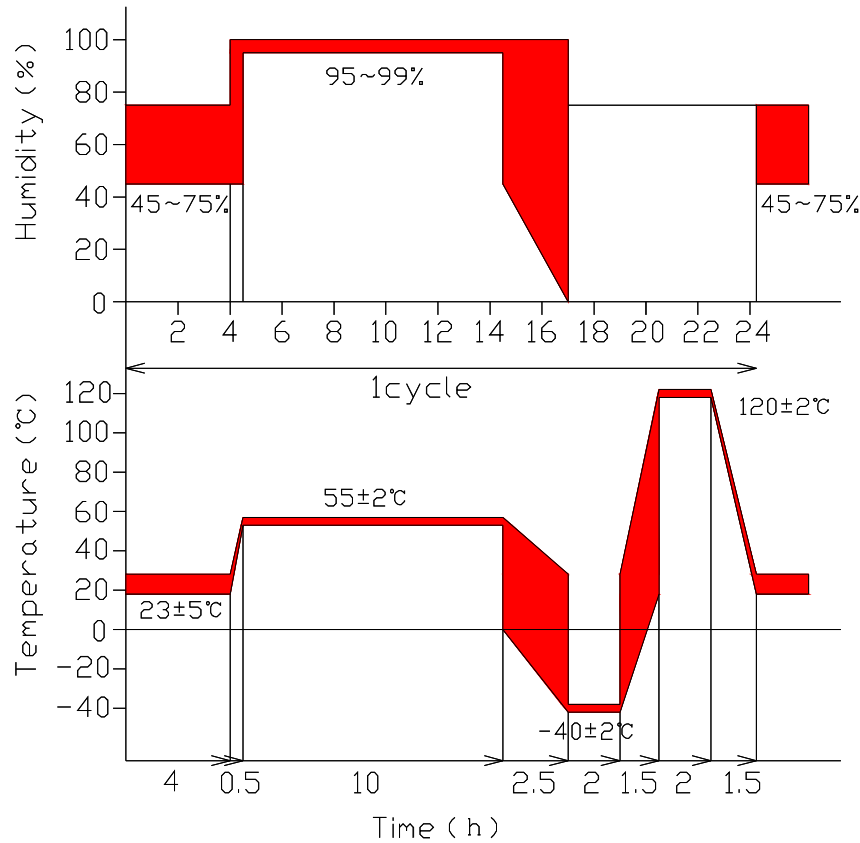


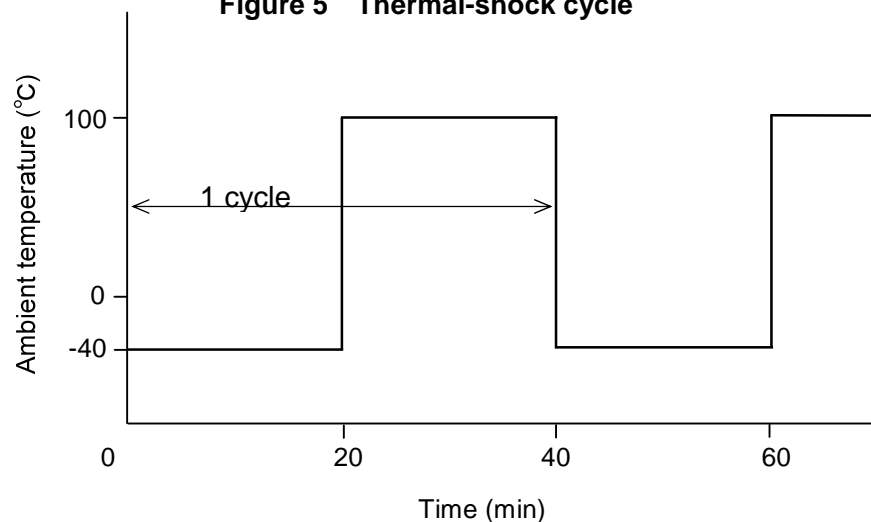
Figure 4 Resistance to climatic load

4.3.3.2 Thermal-shock resistance test

Testing of thermal-shock resistance is to be carried out by subjecting the test piece to 48 repetitions of the following thermal-shock cycle (see **Figure 5**).

- (1) Allow the fuse to stand for a period of 20 minutes in a room at -40 ± 2 degC.
- (2) Relocate the fuse to another room at 100 ± 2 degC within 15 seconds, and allow it to stand for a period of 20 minutes.
- (3) Return the fuse to the room at -40 ± 2 degC within 20 seconds. Note that 1 cycle is 40 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).