

Test Request By:	Bel Fuse Limited		
Tested Product Name:	0AKL Fuse	Date of Received:	2019/08/06
Type Designation:	0AKL 20A 0AKL 30A	Serial No:	Engineering Sample
Test Specification:	Qualification Test, refer to JSAE JASO D622		
Test Place:			
Test Result:	The tested sample mentioned above Pass the testing according to test specification		
Test By:		Review By:	
Date:	2019/08/06	Date:	2019/08/30
<p>Others:</p> <p>Qualification Test for 0AKL Series</p>			

TEST PLAN

No.	Group	Test item	Testing according to	Type name	Quantity	Test condition	Acceptable Value/Range
1	0	DCR	UL248-1	0AKL 20A 0AKL 30A	12pcs	Surrounding environment: 23+/-5°C, measuring current <=10% rated current, test point: fuse cap	Test data
2	A	Temperature rise	ISO8820-8 JASO D622	0AKL 20A 0AKL 30A	2pcs from Item 1	Surrounding environment: 23+/-5°C, measuring current 0.7In	<50K
3	B	Temperature /humidity cycling	JASO D622 6.3.4.1	0AKL 20A 0AKL 30A	2pcs from Item 1	10 temperature/humidity cycles per standard in a constant temperature and humidity chamber	No appearance damage, Rc < 10%
4	B	Hot / cold shock test	JASO D622 6.3.6	0AKL 20A 0AKL 30A	2pcs from Item 1	48 cycles, -30° C-100° C;	No appearance damage, Rc < 10%
5	B	High temperature storage	Bel Spec.	0AKL 20A 0AKL 30A	2pcs from Item 1	125°C for 100 hours	No appearance damage, Rc < 10%
6	B	Mechanical shock	JASO D622 6.3.3	0AKL 20A 0AKL 30A	2pcs from Item 1	Ambient temperature: 23+ - 5°C, fixed fuse in vibration tester, 10-55hz, sinusoidal, peak value 1.5mm; One way 2 hours, three ways	No appearance damage, Rc < 10%
7	B	Impulse current cycle test	Refer to JASO D622 6.3.2	0AKL 20A 0AKL 30A	2pcs from Item 1	Ambient temperature: 23+ - 5 °C , impulse current 2In/0.25s and 0.5In/ 15s for one cycle, total 50,000 cycles.	No appearance damage, Rc < 10%
8	B	Wipe with Gasoline oil	Refer to GB/T31465.1-5.4	0AKL 20A 0AKL 30A	All the above tested samples	Wipe the tubes with gasoline / lube for 30s each,	Marking will be indelible and easily legible
9	B	Terminal strength test	JASO D622 ISO8820-8	0AKL 20A 0AKL 30A	All the above tested samples	Disassemble the fuse with 4.5+/-1Nm (M5)	Terminal remains physically intact after three times disassemble

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1. Purpose

Verify the electrical and reliability of the product.

2. Test equipment

Equipment	Type	Manufacturer
Multimeter	34401A	Agilent
Programmable DC Power supply	PST-3201	GW
Programmable DC Power Supply	PSM-3004	GW
mOHM meter	1154D	DHK
Current Shunt	2M-05	T&M Research
Oscilloscope	TDS5104B	Tektronix
DC electronic Load	63209	Chroma
Electric vibration system	RT-S50ZY	SZZL
Power Supply	6V3000A	YST
Temperature Measurement	40032	TH
Temperature/Humidity Chamber	RHP-150CT	REALE
Thermal Shock Chamber	TSA-71H-W	REALE

3. Test equipment and scheme

The test was conducted according to the test scheme of OAKL_Test_Report_2019. Mark the sample number (sample number from 1-12) and use the same sample to test all items in the test plan.

4. Test result

4.1.1 Initial test result

4.1.2 DCR (No. 1)

Test result

pass

Table 1 OAKL 20A (No. 1)

Type:		Error! Reference source not found.		Type:		Error! Reference source not found.	
Start date:		2019/08/06		Finish date:		2019/08/06	
Room temperature:		24.7°C		Room humidity:		63%	
No.\ Item	DCR	Visual		No.\ Item	DCR	Visual	
Unit:		mΩ		Unit:		mΩ	
Maximum:				Maximum:			
Minimum:		No appearance damage		Minimum:		No appearance damage	
1	5.11	pass		7	5.13	pass	
2	5.16	pass		8	5.14	pass	
3	5.15	pass		9	5.12	pass	
4	5.21	pass		10	5.1	pass	
5	5.21	pass		11	5.2	pass	
6	5.11	pass		12	5.12	pass	

Table 2 OAKL 30A (No. 1)

Type:		Error! Reference source not found.		Type:		Error! Reference source not found.	
Start date:		2019/08/06		Finish date:		2019/08/06	
Room temperature:		24.7°C		Room humidity:		63%	
No.\ Item	DCR	Visual		No.\ Item	DCR	Visual	
Unit:		mΩ		Unit:		mΩ	

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Maximum:				Maximum:			
Minimum:		No appearance damage		Minimum:		No appearance damage	
1	3.113	pass		7	3.135	pass	
2	3.148	pass		8	3.137	pass	
3	3.163	pass		9	3.116	pass	
4	3.195	pass		10	3.109	pass	
5	3.204	pass		11	3.179	pass	
6	3.104	pass		12	3.152	pass	

4.2. Electrical test result group A

4.2.1 Temperature rise (No. 2)

Test result:

pass

Table 3 OAKL 20A (No. 2)

Type	OAKL 20A	Finish	
Start date:	2019/08/07	date:	2019/08/07
Room temperature	24.5°C	Room Humidity:	51%

No.\ Item	Temperature rise @0.7In	Visual					
Unit:	K						
Maximum:	50						
Minimum:		No appearance damage					
1	39.1	pass					
2	40.5	pass					

Table 4 OAKL 30A (No. 2)

Type	OAKL 30A	Finish	
Start date:	2019/08/07	date:	2019/08/07

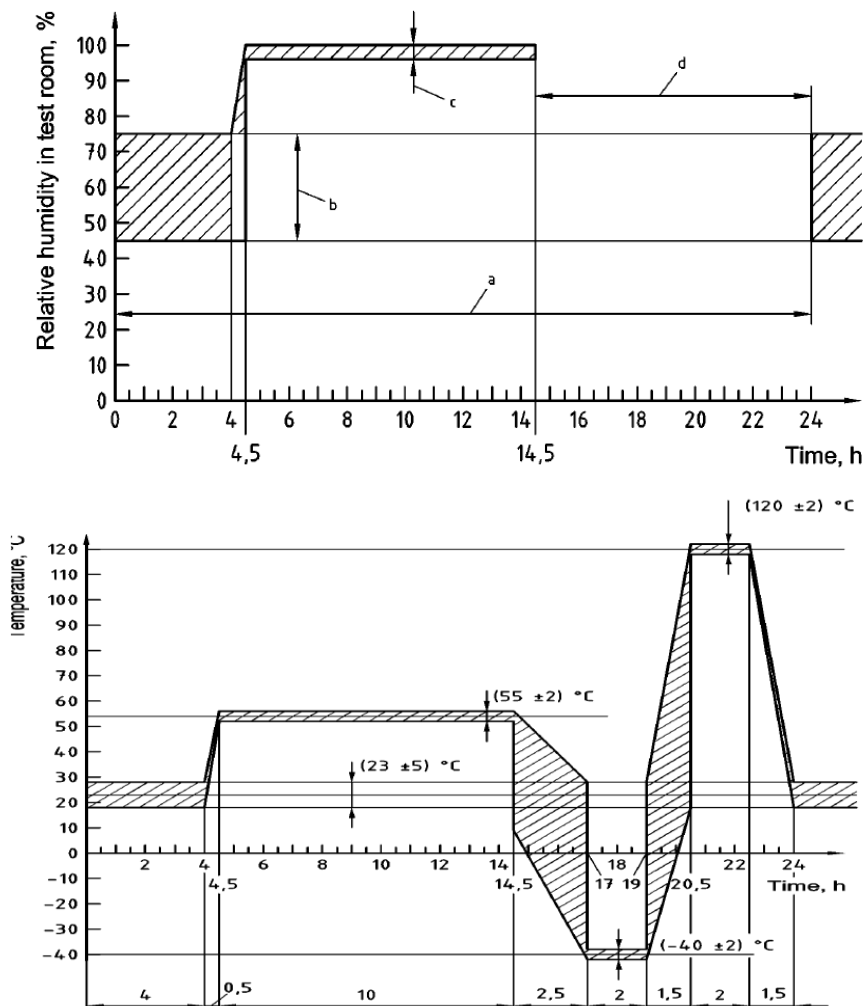
Room temperature 24.5°C Room Humidity. 51%

No.\ Item	Temperature rise @0.7In	Visual					
Unit:	K						
Maximum:	50						
Minimum:		No appearance damage					
1	42.3	pass					
2	43.6	pass					

4.3. Reliability test result group B

4.3.1 Temperature /humidity cycling test result(No. 3)

10 temperature-humidity cycles according the following setting and 24 hours per cycle



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Test result: **pass**

Table 5 Error! Reference source not found. (No. 3)

Type:		OAKL 20A						
Start date:		2019/08/06			Finish date:		2019/08/19	
Room temperature..:		24.8°C			Room Humidity.		58%	
No.\ Item	DCR	Visual						
Unit:	mΩ							
Maximum:								
Minimum:		No appearance damage						
3	5.18	pass						
4	5.25	pass						

Table 6 Error! Reference source not found. (No. 3)

Type:		OAKL 30A						
Start date:		2019/08/06			Finish date:		2019/08/19	
Room temperature..:		24.8°C			Room Humidity.		58%	
No.\ Item	DCR	Visual						
Unit:	mΩ							
Maximum:								
Minimum:		No appearance damage						
3	3.186	pass						
4	3.217	pass						

4.3.2 Hot / cold shock test result (No. 4))

48 cycles of hot / cold shock and the condition of single cycle as the following:

1. -30+/-2°C continued 30min;
2. Switching time 15s maximum;
3. 100+/-2°C continued 30min;
4. Switching time 15s maximum;

Test result: **pass**

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Table 7 Error! Reference source not found.(No. 4)

Type:		Error! Reference source not found.						
Start date:		2019/08/09			Finish date:		2019/08/14	
Room temperature:		25.1°C			Room humidity:		59%	
No.\ Item	DCR	Visual						
Unit:	mΩ							
Maximum:								
Minimum:		No appearance damage						
5	5.22	pass						
6	5.13	pass						

Table 8 Error! Reference source not found.(No. 4)

Type:		Error! Reference source not found.						
Start date:		2019/08/09			Finish date:		2019/08/14	
Room temperature:		25.1°C			Room humidity:		59%	
No.\ Item	DCR	Visual						
Unit:	mΩ							
Maximum:								
Minimum:		No appearance damage						
5	3.219	pass						
6	3.126	pass						

4.3.3 High temperature storage test result (No. 5)

Test result:

Pass

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Table 9 Error! Reference source not found. (No. 5)

Type:		OAKL 20A						
Start date:		2019/08/12			Finish date:		2019/08/19	
Room temperature.		24.6°C			Room humidity.		66%	
No.\ Item	DCR	Visual						
Unit:	mΩ							
Maximum:								
Minimum:		No appearance damage						
7	5.15	pass						
8	5.18	pass						

Table 10 Error! Reference source not found. (No. 5)

Type:		OAKL 30A						
Start date:		2019/08/12			Finish date:		2019/08/19	
Room temperature.		24.6°C			Room humidity.		66%	
No.\ Item	DCR	Visual						
Unit:	mΩ							
Maximum:								
Minimum:		No appearance damage						
7	3.167	pass						
8	3.181	pass						

4.3.4 Mechanical shock test result (No. 6)

Test result:

Pass

Table 11 Error! Reference source not found. (No. 6)

Type: **Error! Reference**

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source not found.

Start date:	2019/08/21	Finish date::	2019/08/26
Room temperature.	24.8°C	Room humidity.	57%

No.\ Item	DCR	visual					
Unit:	mΩ						
Maximum:							
Minimum:		No appearance damage					
9	5.14	pass					
10	5.14	pass					

Table 12 Error! Reference source not found. (No. 6)

Error! Reference source not found.

Type: _____

Start date:	2019/08/21	Finish date::	2019/08/26
Room temperature.	24.8°C	Room humidity.	57%

No.\ Item	DCR	visual					
Unit:	mΩ						
Maximum:							
Minimum:		No appearance damage					
9	3.144	pass					
10	3.139	pass					

4.3.5 Impulse current cycle test result(No. 7)

Test result: **Pass**

Table 13 Error! Reference source not found. (No. 7)

Error! Reference source not found.

Type: _____

Start date::	2019/08/10	Finish date:	2019/08/22
Room temperature.	25.3°C	Room humidity.	63%

No.\ Item	DCR	Visual					
Unit:	mΩ						
Maximum:							
Minimum:		No appearance damage					
11	5.23	pass					
12	5.15	pass					

Table 14 Error! Reference source not found. (No. 7)

Error! Reference source not found.							
Type:				Finish date:			
Start date::	2019/08/10			date:	2019/08/22		
Room temperature.	25.3°C			Room humidity.	63%		
No.\ Item	DCR	Visual					
Unit:	mΩ						
Maximum:							
Minimum:		No appearance damage					
11	3.221	pass					
12	3.176	pass					

4.3.6 Test result of wiping the tubes with gasoline / lube, (No. 8)

*Gasoline is GB #92, lubricating oil is synthetic oil.

Test result: **Pass**

Table 15 Error! Reference source not found. (No. 8)

Type:	OAKL 20A			Finish date:			
Start date::	2019/08/28			date:	2019/08/28		
Room temperature.	25.2°C			Room humidity.	62%		
No.\ Item	Marking can be recognized		No.\ Item	Marking can be recognized			
Unit:			Unit:				
Maximum:			Maximum: :				

Minimum::			Minimum::				
1	pass		7	pass			
2	pass		8	pass			
3	pass		9	pass			
4	pass		10	pass			
5	pass		11	pass			
6	pass		12	pass			

Table 16 Error! Reference source not found. (No. 8)

Type:	OAKL 30A	Finish date:	2019/08/28
Start date::	2019/08/28	Room temperature.	25.2°C
		Room humidity.	62%

No.\ Item	Marking can be recognized		No.\ Item	Marking can be recognized			
Unit:			Unit:				
Maximum:			Maximum: :				
Minimum::			Minimum::				
1	pass		7	pass			
2	pass		8	pass			
3	pass		9	pass			
4	pass		10	pass			
5	pass		11	pass			
6	pass		12	pass			

4.3.7 Terminal strength test, (No. 9)

*Gasoline is GB #92, lubricating oil is synthetic oil.

Test result: **Pass**

Table 1 Error! Reference source not found. (No. 9)

Type:	OAKL 20A	Finish date:	2019/08/26
Start date:	2019/08/09	Room temperature.	25.7°C
		Room humidity.	67%

No.\ Item	Times of disassembling	Visual	No.\ Item	Times of disassembling	Visual
Unit:			Unit:		
Maximum:			Maximum:		
Minimum:	3	No appearance damage	Minimum:	3	No appearance damage
1	>3	pass	7	>3	pass
2	>3	pass	8	>3	pass
3	>3	pass	9	>3	pass
4	>3	pass	10	>3	pass
5	>3	pass	11	>3	pass
6	>3	pass	12	>3	pass

Table 2 Error! Reference source not found. (No. 9)

Type: OAKL 30A

Start date: 2019/08/09

Finish

date: 2019/08/26

Room

temperature: 25.7°C

Room

humidity.

67%

No.\ Item	Times of disassembling	Visual	No.\ Item	Times of disassembling	Visual
Unit:			Unit:		
Maximum:			Maximum:		
Minimum:	3	No appearance damage	Minimum:	3	No appearance damage
1	>3	pass	7	>3	pass
2	>3	pass	8	>3	pass
3	>3	pass	9	>3	pass
4	>3	pass	10	>3	pass
5	>3	pass	11	>3	pass
6	>3	pass	12	>3	pass

5. Test image

Image 1, Mechanical shock curve

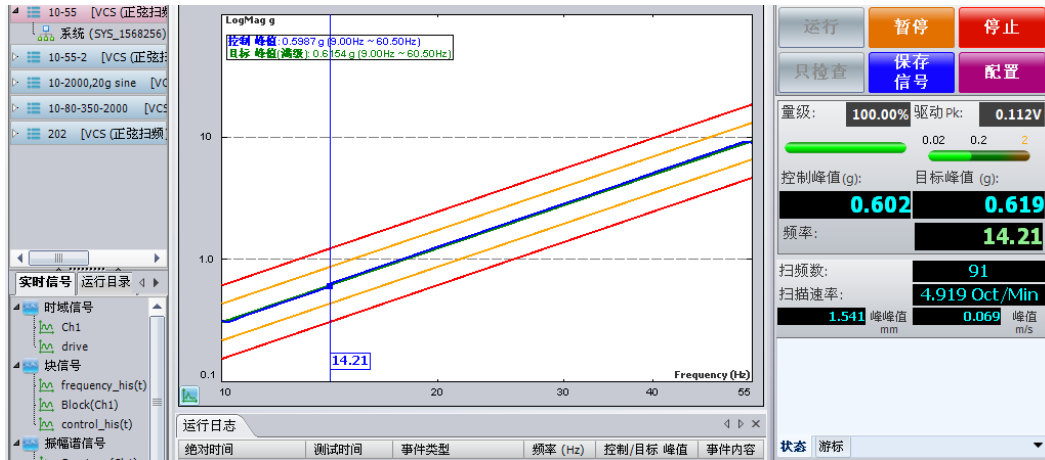


Image 2, Hot -cold shock curve

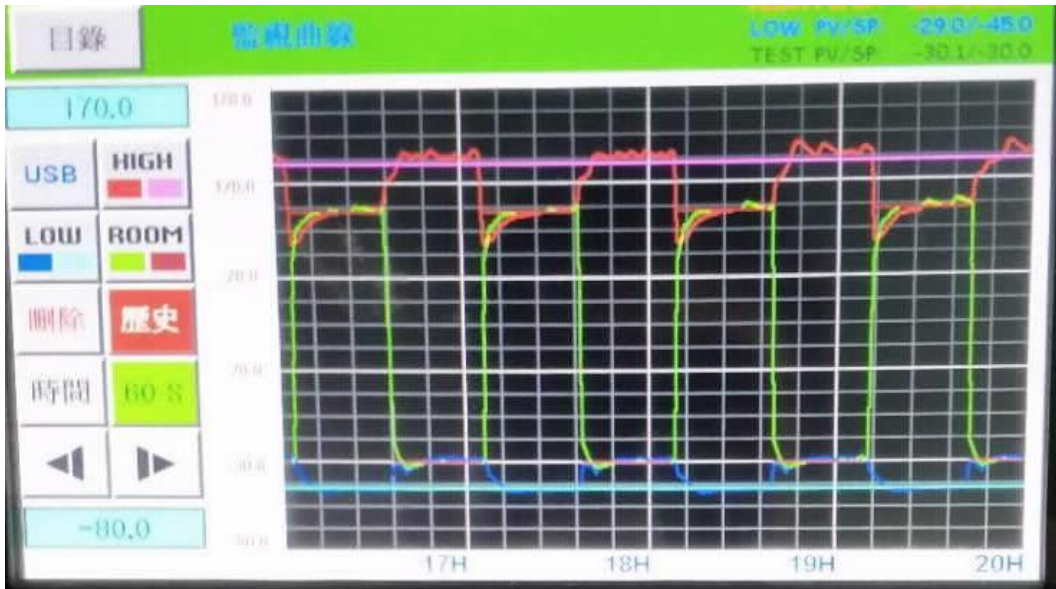
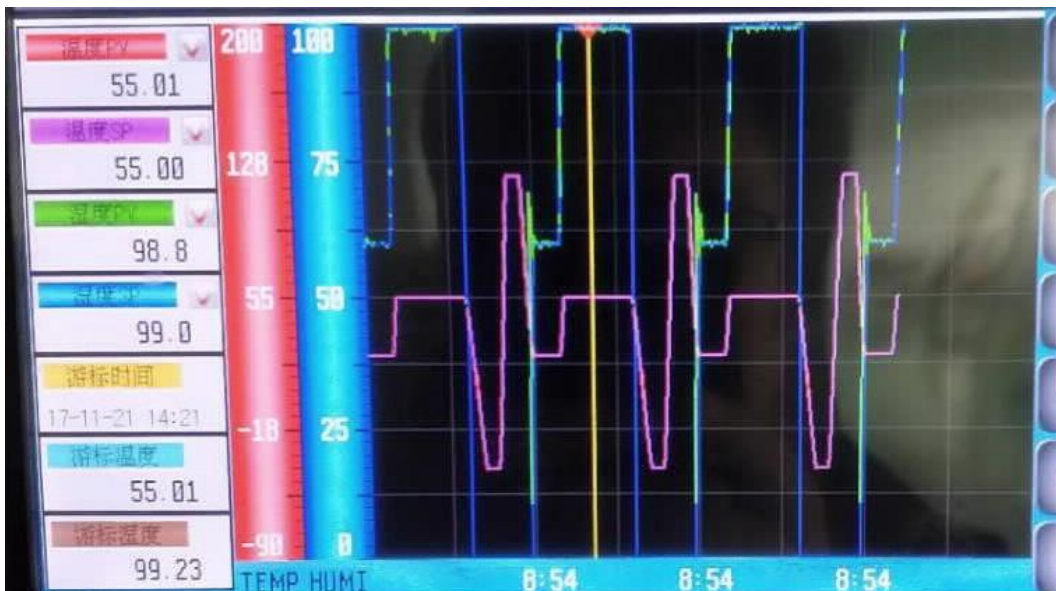


Image 3, Temperature-humidity cycling curve



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