DC FAN LIFE EXPERIMENT REPORT

DELTA ELECTRONICS, INC.

Available for these models with lower speed and same physical structure. All model may be followed by ARxx or AFxx series suffixes. This test report applies to **BFB70x70x25.4 mm** series as the right table	BFB0712HH	BFB0712H	BFB0712M	BFB0712L	

Representative Test P/N :BFB0712HH-AF00

Equipment: 1.Oven: E24-F0030	On/Off Cycles: Every 500 hours

◎ **L_{10} Expectancy:**   **50,000**   hours minimum @ fan rated voltage and the temperature of 40℃

According to the equation for **Weibull distribution**,   MTTF ≒ 7×L10 =   **350,000** hours

And we rely on a zero failure Weibull test strategy and accelerated testing technique, to determine

the total test time **(t)** for verifying the above life estimation by the equations,

$$t = 1.036 \times MTTF \times [(B_{r;c}) \div n]^{0.91} \div A_F, \text{ and } A_F = 2^{(Ts-Tu)/10}$$

where, $(B_{r;c})$ is Poisson distribution factor with the failure number of r equal to 0 and

the decimal confidence level of c equal to 0.90(90%).

Stress/ElevatedTemperature Ts (℃) (Actual Test Temperature)	Unstress Temperature Tu (℃)	Acceleration Factor A_F	Quantity of Test Devices n (pcs)	Poisson Distribution Factor $B_{r;c}$	Required test time with zero failure t (hours)	Actual test time with zero failure t (hours)	Verified MTTF 40 ℃ (hours)	Verified L_{10} 40 ℃ (hours)
70	**40**	**8.00**	**56**	2.303	**2,484**	**2,484.0**	349,982	49,997

Test Progress:

Date for Test Beginning	Date for Test Termination (at least)	Current Test Status			Current Total Test Time (hours)
2006/1/26 2:00 PM	2006/7/15 2:07 PM	☐ In process	☐ In process (exceed requested)	☑ Termination	**2484.0**

Herewith , we could assume as right on the basis of above test result. Besides, if the actual test time exceed the required, it comes out that those fans' L_{10} expectancy and MTTF are greater than the warrant. (**MTTF :** means Mean Time To Failures, it should be used in a non-repairable system setting. Now we show the MTTF in our life report, that's because we will not repair the failed fans during life experiment. **MTBF**: means Mean Time Between failures, it should be used in a repairable system setting. **Basically , MTBF is equal to MTTF , they use same formula to work out a life data.**)

Fan permission criteria for the measurement after test :
1. For current, the limit is less than spec.(max.).
2. For speed, the allowable decrease is less than 15%.
3. For noise, the limit is less than spec.(max.). + 3 dB

Temperature for MTTF Estimation (℃)	Acceleration Factor A_F	Estimated MTTF (hours)	Estimated L_{10} (hours)
25	22.63	989,898	141,414
30	16.00	699,964	99,995
40	8.00	349,982	49,997
50	4.00	174,991	24,999
60	2.00	87,495	12,499
70	**1.00**	**43,748**	**6,250**

Test Result	☑ **Accept**
	☐ **Reject**

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG06FNL021	**1596.00**	**2006/7/15 2:00 PM**	**Nan.Yang**	**Gx.Xu**

DC FAN FUNCTION TEST RECORD FOR LIFE EXPERIMENT

DELTA ELECTRONICS, INC.

	BFB0712HH	BFB0712H	BFB0712M	BFB0712L	
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Required Test Time (hrs)	Date for Test Beginning	Date for Test Termination	Sample Size (pcs):	Failure (pcs):	Current Total Test Time (hrs)
2,484	2006/1/26 2:00 PM	2006/7/15 2:07 PM	56	0	2484.0

Representative Test P/N :BFB0712HH-AF00	Current Test Status	☐ In process	☐ In process (exceed requested)	☑ Termination

Equipment: 1.Oven: E24-F0030	On/Off Cycles: Every 500 hours

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (A) 0.42Max.	Final Test Current Spec. (A) 0.42Max.	Deviation (%)	Initial Test Speed Spec. (RPM) 3960-4840	Final Test Speed Spec. (RPM) 3960-4840	Deviation (%)	Initial Test Noise Spec. (dB A) 55.0Max	Final Test Noise Spec. (dB A) 55.0Max	Deviation (%)
1	0.33	0.38	13.9	4452	4514	1.4	51.8	51.5	-0.5
2	0.33	0.35	6.7	4370	4351	-0.4	50.9	52.0	2.2
3	0.35	0.37	6.3	4414	4529	2.6	51.1	51.3	0.4
4	0.35	0.37	4.9	4473	4499	0.6	51.8	51.7	-0.2
5	0.34	0.36	5.0	4369	4492	2.8	51.3	51.4	0.2
6	0.34	0.36	5.0	4365	4411	1.1	50.7	51.9	2.4
7	0.33	0.35	6.7	4492	4428	-1.4	51.5	51.5	0.0
8	0.34	0.36	5.0	4383	4417	0.8	51.1	51.5	0.8
9	0.33	0.34	4.2	4347	4422	1.7	51.6	52.1	1.0
10	0.30	0.35	16.0	4441	4442	0.0	51.3	51.3	0.0
11	0.33	0.35	5.2	4303	4411	2.5	51.7	51.8	0.2
12	0.32	0.35	9.1	4320	4500	4.2	51.3	51.4	0.2
13	0.31	0.34	8.1	4395	4464	1.6	50.6	51.6	2.0
14	0.35	0.36	2.6	4440	4498	1.3	51.5	51.3	-0.4
15	0.34	0.36	5.6	4375	4445	1.6	51.2	51.7	1.0
16	0.34	0.35	3.8	4357	4465	2.5	51.7	51.5	-0.4
17	0.34	0.33	-3.8	4322	4307	-0.3	50.9	51.9	2.0
18	0.32	0.36	12.2	4392	4594	4.6	51.5	50.9	-1.2
19	0.35	0.35	0.9	4372	4423	1.2	51.2	51.7	1.0
20	0.34	0.36	6.2	4411	4394	-0.4	51.2	51.3	0.2
21	0.34	0.36	6.2	4369	4478	2.5	51.6	51.6	0.0
22	0.37	0.38	2.4	4530	4511	-0.4	51.3	51.2	-0.2
23	0.34	0.35	4.1	4399	4491	2.1	51.7	51.7	0.0
24	0.34	0.38	10.6	4435	4477	0.9	50.7	51.4	1.4
25	0.33	0.34	3.3	4356	4387	0.7	52.0	51.6	-0.8
26	0.34	0.36	6.2	4409	4490	1.8	51.8	51.3	-1.0
27	0.34	0.35	1.8	4357	4423	1.5	51.3	51.6	0.6
28	0.33	0.36	7.9	4347	4425	1.8	51.7	51.2	-1.0
29	0.33	0.35	6.4	4345	4391	1.1	51.7	51.8	0.2
30	0.33	0.34	2.7	4299	4389	2.1	51.2	51.4	0.4
31	0.32	0.34	5.9	4318	4381	1.5	51.8	51.6	-0.4
32	0.36	0.37	3.1	4472	4527	1.2	51.4	52.0	1.2
33	0.32	0.34	5.6	4367	4423	1.3	50.9	51.8	1.8
34	0.35	0.36	2.6	4438	4493	1.2	51.8	51.4	-0.8
35	0.35	0.36	2.0	4397	4420	0.5	51.1	51.7	1.2

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG06FNL021	1596.00	2006/7/15 2:00 PM	Nan.Yang	Gx.Xu

DC FAN FUNCTION TEST RECORD
FOR LIFE EXPERIMENT

	BFB0712HH	BFB0712H	BFB0712M	BFB0712L	
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Representative Test P/N :BFB0712HH-AF00

Current Test Status: ☐ In process   ☐ In process (exceed requested)   ☑ Termination

Equipment: 1.Oven: E24-F0030

On/Off Cycles: Every 500 hours

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36	0.33	0.35	6.1	4345	4398	1.2	51.7	51.3	-0.8
37	0.34	0.35	2.6	4437	4422	-0.3	51.3	51.5	0.4
38	0.35	0.36	2.3	4381	4512	3.0	51.8	51.2	-1.2
39	0.33	0.34	2.7	4368	4436	1.6	51.2	51.6	0.8
40	0.35	0.36	2.9	4462	4463	0.0	52.0	51.4	-1.2
41	0.33	0.35	5.2	4372	4455	1.9	51.7	50.9	-1.5
42	0.33	0.34	4.2	4399	4367	-0.7	51.4	52.9	2.9
43	0.34	0.35	4.1	4397	4516	2.7	50.9	51.8	1.8
44	0.32	0.33	4.4	4355	4430	1.7	51.6	52.1	1.0
45	0.34	0.36	5.3	4378	4434	1.3	51.2	51.4	0.4
46	0.37	0.36	-2.7	4437	4492	1.2	51.5	51.7	0.4
47	0.33	0.35	6.1	4374	4369	-0.1	51.2	51.3	0.2
48	0.34	0.35	3.2	4395	4416	0.5	51.3	51.8	1.0
49	0.33	0.34	3.6	4381	4389	0.2	51.3	51.4	0.2
50	0.35	0.36	2.6	4414	4433	0.4	51.9	51.5	-0.8
51	0.35	0.36	2.9	4424	4488	1.4	51.4	51.2	-0.4
52	0.32	0.32	0.6	4316	4402	2.0	51.7	51.7	0.0
53	0.34	0.35	4.1	4397	4439	1.0	51.3	51.3	0.0
54	0.34	0.35	2.1	4387	4488	2.3	51.8	51.6	-0.4
55	0.35	0.36	2.3	4430	4452	0.5	51.4	51.4	0.0
56	0.34	0.36	6.8	4431	4438	0.2	51.2	51.9	1.4
X-Bar	0.337	0.353	-	4390.9	4445.6	-	51.40	51.56	-
σ	0.013	0.011	-	48.226	52.698	-	0.337	0.323	-

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DG06FNL021	1596.00	2006/7/15 2:00 PM	Nan.Yang	Gx.Xu