DC FAN LIFE EXPERIMENT REPORT

DELTA ELECTRONICS, INC.

Available for these models with lower speed and same physical structure. All model may be followed byRxx orFxx series suffixes. This test report applies to FFB 40x40x28.0**mm** series as the right table					

Representative Test P/N : FFB0448EN-00EEY

Equipment: 1.Oven: E24-T0161	On/Off Cycles: Every 500 hours

◎ **L$_{10}$ Expectancy:**   **70,000**   hours minimum @ fan rated voltage and the temperature of 40℃

According to the equation for **Weibull distribution**,   **MTTF ≒ 7×L10 =**   **490,000** 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/Elevated Temperature 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)
80	40	16.00	56	2.303	1,739	360.0	101,444	14,492

Test Progress:

Date for Test Beginning	Date for Test Termination (at least)	Current Test Status			Current Total Test Time (hours)
2018/11/15 11:30 AM	2019/2/8 10:53 AM	☑ In process	☐ In process (exceed requested)	☐ Termination	360.0

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.

Temperature for MTTF Estimation (℃)	Acceleration Factor A$_F$	Estimated MTTF (hours)	Estimated L$_{10}$ (hours)
25	45.25	286,927	40,990
30	32.00	202,888	28,984
40	16.00	101,444	14,492
50	8.00	50,722	7,246
60	4.00	25,361	3,623
70	2.00	12,680	1,811
80	1.00	6,340	906

Fan permission criteria for the measurement after test :
1. Speed can not drop of ≧ 15% below the original measured rpm.
2. Current cannot increase > 15% of original measure current.
3. Noise cannot >3dB over the original measure noise.

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

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG18FNL107	300.50	2018/12/13	Loly.Wang	Tim.Yi

BGN（dBA）: 16.0   Temp（℃）: 20.2

DC FAN FUNCTION TEST RECORD
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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)
1,739	2018/11/15 11:30 AM	2019/2/8 10:53 AM	56	0	**360.0**

Representative Test P/N : FFB0448EN-00EEY		**Current Test Status**	☑ In process	☐ In process (exceed requested)	☐ Termination

Equipment: 1.Oven: E24-T0161   On/Off Cycles: Every 500 hours

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (A) 0.70 Max.	Final Test Current Spec. (A) 0.70 Max.	Deviation (%)	Initial Test Speed Spec. (RPM) 23850-29150	Final Test Speed Spec. (RPM) 23850-29150	Deviation (%)	Initial Test Noise Spec. (dB A) 70.5 Max	Final Test Noise Spec. (dB A) 70.5 Max	Deviation 3 dBMax.
1	0.43	0.46	5.3	26895	26665	-0.9	65.7	66.5	0.8
2	0.44	0.44	0.7	26849	26415	-1.6	66.2	66.8	0.6
3	0.42	0.44	6.0	26035	26597	2.2	66.5	67.3	0.8
4	0.41	0.43	5.9	26408	26312	-0.4	65.9	67.9	2.0
5	0.43	0.44	2.1	26548	26278	-1.0	66.1	67.0	0.9
6	0.41	0.45	10.3	26064	26661	2.3	66.0	67.4	1.4
7	0.43	0.45	4.2	26326	26351	0.1	64.9	66.8	1.9
8	0.39	0.44	12.6	25454	26517	4.2	66.1	66.5	0.4
9	0.44	0.40	-9.8	26076	25614	-1.8	65.4	66.2	0.8
10	0.41	0.42	2.2	26271	26053	-0.8	66.4	66.7	0.3
11	0.43	0.42	-2.1	26128	26133	0.0	66.3	66.0	-0.3
12	0.44	0.44	-0.7	26676	26559	-0.4	66.4	66.8	0.4
13	0.43	0.43	0.0	26319	26168	-0.6	66.1	66.9	0.8
14	0.41	0.42	3.9	26326	26226	-0.4	66.5	66.9	0.4
15	0.41	0.43	5.7	26066	26189	0.5	65.8	67.2	1.4
16	0.42	0.43	1.7	25402	26162	3.0	66.2	66.9	0.7
17	0.41	0.44	7.4	26255	26172	-0.3	66.6	66.8	0.2
18	0.45	0.42	-6.9	26846	26049	-3.0	66.0	66.5	0.5
19	0.42	0.44	4.0	25845	26539	2.7	66.2	66.9	0.7
20	0.43	0.43	-1.2	26120	26164	0.2	65.9	66.5	0.6
21	0.42	0.44	6.2	26173	26621	1.7	65.4	67.1	1.7
22	0.43	0.43	0.0	26495	26509	0.1	66.7	65.6	-1.1
23	0.38	0.40	4.2	25479	26674	4.7	67.0	66.8	-0.2
24	0.43	0.44	2.6	26286	26513	0.9	65.8	66.7	0.9
25	0.40	0.42	5.5	26053	26132	0.3	66.0	67.5	1.5
26	0.43	0.41	-3.3	26378	25992	-1.5	65.7	65.9	0.2
27	0.41	0.46	10.4	26128	26790	2.5	65.3	67.0	1.7
28	0.45	0.41	-10.8	26486	25900	-2.2	66.1	65.9	-0.2
29	0.42	0.43	1.2	26299	26238	-0.2	66.4	66.7	0.3
30	0.42	0.40	-3.4	25726	25572	-0.6	66.5	66.9	0.4
31	0.41	0.43	4.6	26113	26238	0.5	65.3	66.9	1.6
32	0.41	0.42	2.9	25950	26148	0.8	66.0	66.6	0.6

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG18FNL107	**300.50**	**2018/12/13**	**Loly.Wang**	**Tim.Yi**

DC FAN FUNCTION TEST RECORD
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1,739	2018/11/15 11:30 AM	2019/2/8 10:53 AM	56	0	**360.0**

Representative Test P/N : FFB0448EN-00EEY

Current Test Status

☑ In process ☐ In process (exceed requested) ☐ Termination

Equipment: 1.Oven: E24-T0161

On/Off Cycles: Every 500 hours

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Sample No.	Initial Test Current Spec. (A) 0.70 Max.	Final Test Current Spec. (A) 0.70 Max.	Deviation (%)	Initial Test Speed Spec. (RPM) 23850-29150	Final Test Speed Spec. (RPM) 23850-29150	Deviation (%)	Initial Test Noise Spec. (dB A) 70.5 Max	Final Test Noise Spec. (dB A) 70.5 Max	Deviation 3 dBMax.
33	0.44	0.40	-9.5	26840	25643	-4.5	65.8	66.2	0.4
34	0.44	0.40	-7.6	26048	25859	-0.7	65.0	66.2	1.2
35	0.43	0.43	0.5	26536	26077	-1.7	65.6	66.0	0.4
36	0.44	0.42	-3.4	25420	25969	2.2	66.3	65.8	-0.5
37	0.42	0.42	0.5	26268	26048	-0.8	66.2	67.2	1.0
38	0.43	0.41	-5.3	25949	25750	-0.8	65.9	66.6	0.7
39	0.43	0.44	0.9	26301	26505	0.8	66.0	66.8	0.8
40	0.44	0.41	-7.3	26541	25557	-3.7	66.5	66.9	0.4
41	0.43	0.44	1.4	26981	26131	-3.2	65.8	66.4	0.6
42	0.44	0.43	-3.6	26632	26332	-1.1	66.0	66.8	0.8
43	0.39	0.43	9.9	25589	26473	3.5	65.0	66.1	1.1
44	0.46	0.45	-1.8	26551	26620	0.3	65.0	66.4	1.4
45	0.42	0.43	3.3	26253	26301	0.2	66.1	66.3	0.2
46	0.44	0.44	-0.9	26657	26454	-0.8	66.2	66.5	0.3
47	0.41	0.42	2.7	26074	26281	0.8	66.1	66.5	0.4
48	0.45	0.44	-1.3	26651	26440	-0.8	66.8	66.9	0.1
49	0.40	0.41	3.3	25549	26083	2.1	66.0	66.7	0.7
50	0.43	0.44	3.1	26122	26308	0.7	65.9	67.2	1.3
51	0.43	0.45	5.4	26662	26809	0.6	66.5	66.7	0.2
52	0.44	0.44	-1.1	26509	26478	-0.1	66.4	66.8	0.4
53	0.43	0.42	-1.4	25435	25322	-0.4	66.9	66.6	-0.3
54	0.41	0.42	4.4	25532	26116	2.3	66.0	66.3	0.3
55	0.41	0.45	9.3	25977	26546	2.2	65.9	67.0	1.1
56	0.45	0.43	-3.6	26561	26296	-1.0	66.0	65.8	-0.2
X-Bar	0.42	0.43	-	26216.30	26241.95	-	66.02	66.66	-
σ	0.02	0.01	-	393.54	312.69	-	0.47	0.45	-

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DG18FNL107	**300.50**	**2018/12/13**	**Loly.Wang**	**Tim.Yi**