DELTA ELECTRONICS, INC.

DC FAN LIFE EXPERIMENT REPORT

Available for these models with lower speed and same physical structure. All model may be followed by Rxx or Fxx series suffixes. This test report applies to **FFC120x120x38 mm** series as the right table					
Representative Test P/N :FFC1212D-F00					
Equipment: 60℃ Burn-in Room			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%), and

Stress/Elevated Temperature Ts (℃)	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)
60	**40**	**4.00**	**56**	**2.303**	**6,956**	**6,956.0**	**490,031**	**70,004**

Test Progress:

Date for Test Beginning	Date for Test Termination (at least)	Current Test Status			Current Total Test Time (hours)
2004/11/18 4:30 PM	2006/8/8 2:03 PM	☐ In process	☐ In process (exceed requested)	☑ Termination	**6956.0**

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	**11.31**	**1,386,017**	**198,002**
30	**8.00**	**980,062**	**140,009**
40	**4.00**	**490,031**	**70,004**
50	**2.00**	**245,015**	**35,002**
60	**1.00**	**122,508**	**17,501**

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

Test Restult	☑ **Accept** ☐ **Reject**

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG04FNL327	**8114.00**	**2006/8/8 2:30 PM**	**Nan.Yang**	**Gx.Xu**

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DC FAN FUNCTION TEST RECORD
FOR LIFE EXPERIMENT

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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)
6,956	2004/11/18 4:30 PM	2006/8/8 2:03 PM	56	0	**6956.0**

Representative Test P/N :FFC1212D-F00	**Current Test Status**	☐ In process	☐ In process (exceed requested)	☑ Termination
Equipment: 60℃ Burn-in Room		On/Off Cycles: Every 500 hours		

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (A) **1.68Max.**	Final Test Current Spec. (A) **1.68Max.**	Deviation (%)	Initial Test Speed Spec. (RPM) **3680-4320**	Final Test Speed Spec. (RPM) **3680-4320**	Deviation (%)	Initial Test Noise Spec. (dB A) **60.4Max**	Final Test Noise Spec. (dB A) **60.4Max**	Deviation (%)
1	1.33	1.36	2.3	3996	4012	0.4	56.3	57.0	1.2
2	1.41	1.44	2.1	4016	3968	-1.2	56.4	57.2	1.4
3	1.40	1.45	3.6	3925	3958	0.8	56.5	57.3	1.4
4	1.42	1.46	2.8	4026	4012	-0.3	56.2	57.1	1.6
5	1.43	1.47	2.8	3978	3988	0.3	56.3	57.2	1.6
6	1.42	1.45	2.1	3976	4012	0.9	56.1	57.4	2.3
7	1.43	1.46	2.1	4021	4025	0.1	56.1	57.0	1.6
8	1.42	1.44	1.4	4023	4039	0.4	56.3	57.3	1.8
9	1.43	1.45	1.4	3997	4015	0.5	56.2	57.0	1.4
10	1.42	1.46	2.8	4012	4047	0.9	56.3	57.0	1.2
11	1.42	1.46	2.8	3942	4015	1.9	56.0	57.2	2.1
12	1.43	1.45	1.4	3978	4017	1.0	56.0	57.3	2.3
13	1.42	1.46	2.8	3976	3985	0.2	56.3	57.2	1.6
14	1.41	1.45	2.8	4015	3975	-1.0	56.2	57.0	1.4
15	1.42	1.46	2.8	4040	3974	-1.6	56.3	57.4	2.0
16	1.42	1.45	2.1	3975	3969	-0.2	56.4	57.3	1.6
17	1.42	1.44	1.4	3998	4011	0.3	56.6	57.0	0.7
18	1.43	1.42	-0.7	3998	4025	0.7	56.6	57.0	0.7
19	1.42	1.45	2.1	4021	4075	1.3	56.3	57.0	1.2
20	1.44	1.45	0.7	4013	3958	-1.4	56.2	57.3	2.0
21	1.42	1.43	0.7	3976	3978	0.1	56.0	57.3	2.3
22	1.42	1.45	2.1	4010	3995	-0.4	56.4	57.2	1.4
23	1.42	1.45	2.1	3958	4015	1.4	56.2	57.2	1.8
24	1.43	1.45	1.4	4001	4027	0.6	56.3	57.3	1.8
25	1.41	1.44	2.1	3968	4028	1.5	57.6	58.0	0.7
26	1.41	1.42	0.7	3976	4036	1.5	56.8	57.2	0.7
27	1.40	1.42	1.4	3985	4015	0.8	56.3	57.3	1.8
28	1.42	1.43	0.7	3992	3979	-0.3	59.2	58.9	-0.5
29	1.42	1.45	2.1	4025	4012	-0.3	58.0	58.2	0.3
30	1.40	1.42	1.4	4012	3975	-0.9	57.2	57.3	0.2
31	1.41	1.45	2.8	4001	3988	-0.3	57.6	57.7	0.2
32	1.42	1.45	2.1	4036	3997	-1.0	57.0	57.2	0.4
33	1.42	1.42	0.0	4074	4045	-0.7	57.3	57.0	-0.5
34	1.41	1.44	2.1	4056	3975	-2.0	56.8	57.3	0.9
35	1.42	1.45	2.1	4039	4012	-0.7	56.9	57.0	0.2

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG04FNL327	**8114.00**	**2006/8/8 2:30 PM**	**Nan.Yang**	**Gx.Xu**

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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)
6,956	2004/11/18 4:30 PM	2006/8/8 2:03 PM	56	0	**6956.0**

Representative Test P/N :FFC1212D-F00	**Current Test Status**	☐ In process	☐ In process (exceed requested)	☑ Termination
Equipment: 60℃ Burn-in Room		On/Off Cycles: Every 500 hours		

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (A) **1.68Max.**	Final Test Current Spec. (A) **1.68Max.**	Deviation (%)	Initial Test Speed Spec. (RPM) **3680-4320**	Final Test Speed Spec. (RPM) **3680-4320**	Deviation (%)	Initial Test Noise Spec. (dB A) **60.4Max**	Final Test Noise Spec. (dB A) **60.4+3Max**	Deviation (%)
36	1.41	1.42	0.7	4069	4041	-0.7	58.9	58.6	-0.5
37	1.42	1.44	1.1	4035	4025	-0.2	56.3	56.7	0.7
38	1.42	1.43	0.5	4025	3985	-1.0	56.4	57.3	1.6
39	1.42	1.44	1.4	4039	3975	-1.6	56.6	57.1	0.9
40	1.42	1.45	2.1	3989	3954	-0.9	56.7	57.2	0.9
41	1.40	1.42	1.4	3976	4015	1.0	56.8	57.0	0.4
42	1.41	1.42	0.7	3942	3959	0.4	56.3	57.2	1.6
43	1.42	1.43	0.7	4025	3995	-0.7	56.5	57.3	1.4
44	1.42	1.45	2.1	4036	4011	-0.6	56.6	57.2	1.1
45	1.45	1.44	-0.7	4034	4018	-0.4	58.4	58.9	0.9
46	1.45	1.42	-2.1	3956	4025	1.7	56.9	58.0	1.9
47	1.43	1.42	-0.7	3976	4000	0.6	56.7	57.3	1.1
48	1.46	1.42	-2.7	3976	3995	0.5	56.8	57.2	0.7
49	1.42	1.43	0.7	4011	3968	-1.1	58.4	58.9	0.9
50	1.42	1.42	0.0	3975	3957	-0.5	56.8	57.3	0.9
51	1.43	1.41	-1.4	3996	4012	0.4	56.3	57.2	1.6
52	1.42	1.40	-1.4	3986	4001	0.4	56.6	57.3	1.2
53	1.42	1.40	-1.4	3979	3957	-0.6	57.2	57.0	-0.3
54	1.42	1.40	-1.4	4010	3979	-0.8	56.8	57.2	0.7
55	1.43	1.41	-1.4	3956	3999	1.1	56.6	57.3	1.2
56	1.44	1.41	-2.1	3946	4018	1.8	56.9	57.2	0.5
X-Bar	1.420	1.435	-	3999.9	4000.2	-	56.73	57.35	-
σ	0.017	0.020	-	32.464	27.093	-	0.702	0.484	-

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