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 Rxx or Fxx series suffixes. This test report applies to **FFB127x127x38 mm** series as the right table	FFB1312EHE	FFB1312SHE	FFB1312VHE	FFB1312HHE	FFB1312HE
	FFB1312ME	FFB1312LE	FFB1324EHE	FFB1324SHE	FFB1324VHE
	FFB1324HHE	FFB1324HE	FFB1324ME	FFB1324LE	

Representative Test P/N : FFB1312EHE-F00	
Equipment: 1.Oven: E24-F0031	On/Off Cycles: Every 500 hours

◎ **L₁₀ 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 L₁₀ 40 ℃ (hours)
70	**40**	**8.00**	**56**	**2.303**	**3,478**	**3,478.0**	**490,031**	**70,004**

Test Progress:

Date for Test Beginning	Date for Test Termination (at least)	Current Test Status			Current Total Test Time (hours)
2004/1/13 10:30 AM	2004/8/24 8:46 PM	☐ In process	☐ In process (exceed requested)	☑ Termination	**3478.0**

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' L₁₀ 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.**)

Temperature for MTTF Estimation (℃)	Acceleration Factor A_F	Estimated MTTF (hours)	Estimated L₁₀ (hours)
25	22.63	1,386,017	198,002
30	16.00	980,062	140,009
40	8.00	490,031	70,004
50	4.00	245,015	35,002
60	2.00	122,508	17,501
70	**1.00**	**61,254**	**8,751**

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
DG04FNL002	1908.50	2004/8/24 9:00 PM	Huiling.Fu	Even.Liu

Note: The test sample equivalent to STD, Part number: FFB1312EHE-F00 .

DC FAN FUNCTION TEST RECORD

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	FFB1312ME	FFB1312LE	FFB1324EHE	FFB1324SHE	FFB1324VHE
	FFB1324HHE	FFB1324HE	FFB1324ME	FFB1324LE	

Required Test Time (hrs)	Date for Test Beginning	Date for Test Termination	Sample Size (pcs):	Failure (pcs):	Current Total Test Time (hrs)
3,478	2004/1/13 10:30 AM	2004/8/24 8:46 PM	56	0	3478.0

Representative Test P/N :FFB1312EHE-F00	Current Test Status	☐ In process	☐ In process (exceed requested)	☑ Termination

Equipment: 1.Oven: E24-F0031	On/Off Cycles: Every 500 hours

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (A) 4.11Max.	Final Test Current Spec. (A) 4.11Max.	Deviation (%)	Initial Test Speed Spec. (RPM) 3542-4158	Final Test Speed Spec. (RPM) 3542-4158	Deviation (%)	Initial Test Noise Spec. (dB A) 63.5Max.	Final Test Noise Spec. (dB A) 63.5Max.	Deviation (%)
1	2.22	2.24	0.9	3945	3990	1.1	60.6	60.3	-0.5
2	2.16	2.14	-0.9	3903	3969	1.7	59.8	59.5	-0.5
3	2.17	2.31	6.5	3960	3939	-0.5	60.6	60.1	-0.8
4	2.08	2.11	1.4	3863	3909	1.2	60.1	59.6	-0.8
5	2.14	2.19	2.3	3893	3939	1.2	60.3	60.0	-0.5
6	2.10	2.24	2.3	3874	3956	2.1	59.5	59.6	0.2
7	2.19	2.24	4.2	3974	3954	-0.5	59.9	59.8	-0.2
8	2.15	2.27	4.1	3896	3950	1.4	60.4	60.0	-0.7
9	2.18	2.18	0.9	3948	3944	-0.1	60.0	59.9	-0.2
10	2.16	2.17	-2.3	3863	3873	0.3	60.6	60.2	-0.7
11	2.22	2.19	3.3	3889	3941	1.3	60.0	59.7	-0.5
12	2.12	2.22	1.4	3840	3927	2.3	60.2	59.8	-0.7
13	2.19	2.19	0.5	3933	3943	0.3	60.5	60.1	-0.7
14	2.18	2.22	1.8	3924	3944	0.5	59.2	59.5	0.5
15	2.18	2.14	-1.4	3909	3990	2.1	60.2	60.0	-0.3
16	2.17	2.25	1.8	3862	3947	2.2	59.6	59.8	0.3
17	2.21	2.29	5.5	3960	3981	0.5	60.5	60.6	0.2
18	2.17	2.12	-0.9	3869	3966	2.5	60.3	60.5	0.3
19	2.14	2.22	2.8	3914	3910	-0.1	60.2	60.1	-0.2
20	2.16	2.28	6.5	3908	3962	1.4	59.6	59.8	0.3
21	2.14	2.19	2.3	3886	3972	2.2	60.5	60.1	-0.7
22	2.19	2.05	-6.4	3884	3982	2.5	60.1	60.0	-0.2
23	2.28	2.27	-0.4	3890	3922	0.8	59.2	59.6	0.7
24	2.14	2.23	4.2	3909	4005	2.5	60.0	59.5	-0.8
25	2.13	2.21	3.8	3906	3937	0.8	60.3	60.0	-0.5
26	2.17	2.20	1.4	3950	3927	-0.6	60.1	60.3	0.3
27	2.24	2.24	0.0	3886	3899	0.3	60.5	60.2	-0.5
28	2.11	2.19	3.8	3966	3897	-1.7	60.1	60.6	0.8
29	2.16	2.22	2.8	3897	3979	2.1	59.9	60.0	0.2
30	2.22	2.15	-3.2	3894	4032	3.5	60.5	59.9	-1.0
31	2.12	2.19	3.3	3921	3948	0.7	60.4	60.1	-0.5
32	2.13	2.20	3.3	3878	3928	1.3	60.2	60.2	0.0
33	2.10	2.15	2.4	3873	3911	1.0	59.4	60.0	1.0
34	2.13	2.18	2.3	3942	3896	-1.2	59.9	59.7	-0.3
35	2.19	2.15	-1.8	3899	3929	0.8	60.5	60.1	-0.7

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG04FNL002	1908.50	2004/8/24 9:00 PM	Huiling.Fu	Even.Liu

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		FFB1312ME	FFB1312LE	FFB1324EHE	FFB1324SHE	FFB1324VHE
		FFB1324HHE	FFB1324HE	FFB1324ME	FFB1324LE	

Required Test Time (hrs)	Date for Test Beginning	Date for Test Termination	Sample Size (pcs):	Failure (pcs):	Current Total Test Time (hrs)
3,478	2004/1/13 10:30 AM	2004/8/24 8:46 PM	56	0	3478.0

Representative Test P/N :FFB1312EHE-F00	Current Test Status	☐ In process	☐ In process (exceed requested)	☑ Termination

Equipment: 1.Oven: E24-F0031	On/Off Cycles: Every 500 hours

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (A) 4.11Max.	Final Test Current Spec. (A) 4.11Max.	Deviation (%)	Initial Test Speed Spec. (RPM) 3542-4158	Final Test Speed Spec. (RPM) 3542-4158	Deviation (%)	Initial Test Noise Spec. (dB A) 63.5Max	Final Test Noise Spec. (dB A) 63.5Max	Deviation (%)
36	2.15	2.18	1.4	3840	3857	0.4	59.7	59.5	-0.3
37	2.14	2.09	-2.3	3891	3907	0.4	60.0	59.8	-0.3
38	2.18	2.24	2.8	3943	3901	-1.1	60.5	60.2	-0.5
39	2.16	2.22	2.8	3904	3998	2.4	59.2	60.2	1.7
40	2.19	2.21	0.9	3921	3909	-0.3	60.8	60.3	-0.8
41	2.18	2.23	2.3	3863	3844	-0.5	60.0	60.2	0.3
42	2.17	2.13	-1.8	3843	3898	1.4	60.4	60.6	0.3
43	2.20	2.27	3.2	3922	3859	-1.6	60.6	60.5	-0.2
44	2.19	2.16	-1.4	3846	3916	1.8	60.7	60.4	-0.5
45	2.16	2.18	0.9	3886	3928	1.1	59.8	60.0	0.3
46	2.14	2.09	-2.3	3862	3932	1.8	59.8	59.7	-0.2
47	2.15	2.25	4.7	3856	3964	2.8	60.3	60.5	0.3
48	2.24	2.25	0.4	3918	4005	2.2	59.7	59.6	-0.2
49	2.22	2.32	4.5	3933	3907	-0.7	60.5	60.2	-0.5
50	2.25	2.25	0.0	3862	3960	2.5	60.8	60.5	-0.5
51	2.28	2.29	0.4	3936	3929	-0.2	60.5	60.2	-0.5
52	2.19	2.17	-0.9	3968	4004	0.9	60.7	60.3	-0.7
53	2.22	2.30	3.6	3909	3961	1.3	60.3	60.1	-0.3
54	2.24	2.25	0.4	3895	3902	0.2	59.2	59.8	1.0
55	2.24	2.29	2.2	3909	3878	-0.8	60.4	59.8	-1.0
56	2.30	2.31	0.4	3940	3924	-0.4	60.3	60.1	-0.3
X-Bar	2.177	2.209	-	3901.9	3937.3	-	60.14	60.03	-
	0.047	0.060	-	34.762	40.384	-	0.427	0.306	-

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