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 **EFB40x40x20mm** series as the right table	EFB0405VHD	EFB0405HHD	EFB0405HD	EFB0405MD	EFB0405LD
	EFB0412VHD	EFB0412HHD	EFB0412HD	EFB0412MD	EFB0412LD
	EFB0424VHD	EFB0424HHD	EFB0424HD	EFB0424MD	EFB0424LD

Representative Test P/N :EFB0412VHD

Equipment: 1.Oven: F00-5, E24-T057 | 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)
80	40	16.00	20	2.303	4,438	6,044.0	667,321	95,332

Test Progress:

Date for Test Beginning	Date for Test Termination (at least)	Current Test Status			Current Total Test Time (hours)
1999/12/15 9:00 AM	2000/6/17 6:59 AM	☐ In process	☐ In process (exceed requested)	☑ Termination	6044.0

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.**)

Temperature for MTTF Estimation (℃)	Acceleration Factor A_F	Estimated MTTF (hours)	Estimated L_{10} (hours)
25	45.25	1,887,468	269,638
30	32.00	1,334,641	190,663
40	16.00	667,321	95,332
50	8.00	333,660	47,666
60	4.00	166,830	23,833
70	2.00	83,415	11,916
80	1.00	41.708	5.958

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
A165L	11283.00	2001/12/6 8:00 AM	BONNIE.CHENG	Johnson Hsu

DELTA ELECTRONICS, INC.

DC FAN FUNCTION TEST RECORD
FOR LIFE EXPERIMENT

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 EFB40x40x20mm series as the right table	EFB0405VHD	EFB0405HHD	EFB0405HD	EFB0405MD	EFB0405LD
	EFB0412VHD	EFB0412HHD	EFB0412HD	EFB0412MD	EFB0412LD
	EFB0424VHD	EFB0424HHD	EFB0424HD	EFB0424MD	EFB0424LD

Required Test Time (hrs)	Date for Test Beginning	Date for Test Termination	Sample Size (pcs):	Failure (pcs):	Current Total Test Time (hrs)
4,438	1999/12/15 9:00 AM	2000/6/17 6:59 AM	20	0	**6044.0**

Representative Test P/N :EFB0412VHD	**Current Test Status**	☐ In process	☐ In process (exceed requested)	☑ Termination
Equipment: 1.Oven: F00-5, E24-T057		On/Off Cycles: Every 500 hours		

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (A) **0.18Max.**	Final Test Current Spec. (A) **0.18Max.**	Deviation (%)	Initial Test Speed Spec. (RPM) **9000 Ref**	Final Test Speed Spec. (RPM) **9000 Ref**	Deviation (%)	Initial Test Noise Spec. (dB A) **36.0Max**	Final Test Noise Check. (dB A) **36.0Max**	Deviation (%)
1	0.12	0.11	-8.3	8916	9378	5.2	31.5	34.4	9.2
2	0.12	0.11	-8.3	9466	9834	3.9	33.4	35.4	6.0
3	0.11	0.11	0.0	9237	9522	3.1	32.3	34.7	7.4
4	0.12	0.11	-8.3	9077	9522	4.9	32.6	34.7	6.4
5	0.12	0.11	-8.3	9071	9228	1.7	31.6	34.0	7.6
6	0.12	0.11	-8.3	9159	9678	5.7	32.5	35.1	8.0
7	0.12	0.11	-8.3	9119	9378	2.8	33.0	34.4	4.2
8	0.12	0.11	-8.3	9485	10002	5.5	34.8	36.8	5.7
9	0.12	0.11	-8.3	9297	9228	-0.7	34.7	36.2	4.3
10	0.12	0.11	0.0	9372	9678	3.3	33.2	35.1	5.7
11	0.11	0.11	-8.3	9301	9678	4.1	33.6	35.1	4.5
12	0.12	0.11	0.0	8915	9228	3.5	32.2	34.0	5.6
13	0.11	0.11	-8.3	9356	9678	3.4	32.9	35.1	6.7
14	0.12	0.11	-8.3	9136	9522	4.2	33.2	34.7	4.5
15	0.12	0.11	-8.3	9050	9378	3.6	32.3	34.4	6.5
16	0.12	0.11	-8.3	8845	9228	4.3	32.2	34.0	5.6
17	0.12	0.11	-8.3	9069	9678	6.7	33.3	35.1	5.4
18	0.12	0.11	-8.3	9312	9678	3.9	33.3	35.1	5.4
19	0.12	0.11	0.0	9244	9522	3.0	33.5	34.7	3.6
20	0.11	0.11	#REF!	9212	9522	3.4	33.0	34.7	5.2
X-bar	0.118	0.110	-	9182.000	9528.000	-	33.000	35.000	-
σ	0.004	0.000	-	178.689	215.332	-	0.859	0.695	-

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
A165L	**11283.00**	**2001/12/6 8:00 AM**	**BONNIE.CHENG**	**Johnson Hsu**