DELTA ELECTRONICS, INC.

DC FAN CUSTOMIZED
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 EFB40x40x20**mm** series as the right table	EFB0405VHD	EFB0405HHD	**EFB0405HD**	**EFB0405MD**	**EFB0405LD**
	EFB0412VHD	**EFB0412HHD**	**EFB0412HD**	**EFB0412MD**	**EFB0412LD**
	EFB0424VHD	**EFB0424HHD**	**EFB0424HD**	**EFB0424MD**	**EFB0424LD**
	EFB0412HD-8Y09	**EFB0424VHD-TZW2**			
Representative Test P/N : EFB0412VHD					
Equipment: 1.Oven: E24-F0108			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 ≒ 1.89×L10 = 132,300 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,

$$t = 1.119 \times MTTF \times [(B_{r;c}) \div n]^{0.33} \div A_F \text{ , and } A_F = 1.5^{(Ts-Tu)/10}$$

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 540℃ (hours)	Verified L_{10} 40 ℃ (hours)
80	**40**	**5.06**	**20**	**2.303**	**14,330**	**6,044.0**	**55,801**	**29,524**

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	2002/11/16 1:51 PM	☐ 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.)

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 Method according to IPC-9591.

Temperature for MTTF Estimation (℃)	Acceleration Factor A_F	Estimated MTTF (hours)	Estimated L_{10} (hours)
25	**9.30**	**102,513**	**54,240**
30	**7.59**	**83,702**	**44,287**
40	**5.06**	**55,801**	**29,524**
50	**3.38**	**37,201**	**19,683**
55	**2.76**	**30,374**	**16,071**
60	**2.25**	**24,800**	**13,122**
70	**1.50**	**16,534**	**8,748**
80	**1.00**	**11,022**	**5,832**
Test Result		☑ **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 CUSTOMIZED LIFE EXPERIMENT

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	EFB0405VHD	**EFB0405HHD**	EFB0405HD	EFB0405MD	EFB0405LD
	EFB0412VHD	**EFB0412HHD**	EFB0412HD	EFB0412MD	EFB0412LD
	EFB0424VHD	**EFB0424HHD**	EFB0424HD	EFB0424MD	EFB0424LD
	EFB0412HD-8Y09	**EFB0424VHD-TZW2**			

Required Test Time (hrs)	**Date for Test Beginning**	**Date for Test Termination**	**Sample Size (pcs):**	**Failure (pcs):**	**Current Total Test Time (hrs)**
14,330	1999/12/15 9:00 AM	2002/11/16 1:51 PM	20	0	**6044.0**

Representative Test P/N : EFB0412VHD	**Current Test Status**	☐ In process	☐ In process (exceed requested)	☑ Termination
Equipment: 1.Oven: E24-F0108		On/Off Cycles: Every 500 hours		

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (mA) **0.18Max.**	Final Test Current Spec. (mA) **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	9.21
2	0. 12	0. 11	-8.3	9466	9834	3.9	33.4	35.4	5.99
3	0. 11	0. 11	0.0	9237	9522	3.1	32.3	34.7	7.43
4	0. 12	0. 11	-8.3	9077	9522	4.9	32.6	34.7	6.44
5	0. 12	0. 11	-8.3	9071	9228	1.7	31.6	34.0	7.59
6	0. 12	0. 11	-8.3	9159	9678	5.7	32.5	35.1	8.00
7	0. 12	0. 11	-8.3	9119	9378	2.8	33.0	34.4	4.24
8	0. 12	0. 11	-8.3	9485	10002	5.5	34.8	36.8	5.75
9	0. 12	0. 11	-8.3	9297	9228	-0.7	34.7	36.2	4.32
10	0. 12	0. 11	0.0	9372	9678	3.3	33.2	35.1	5.72
11	0. 11	0. 11	-8.3	9301	9678	4.1	33.6	35.1	4.46
12	0. 12	0. 11	0.0	8915	9228	3.5	32.2	34.0	5.59
13	0. 11	0. 11	-8.3	9356	9678	3.4	32.9	35.1	6.69
14	0. 12	0. 11	-8.3	9136	9522	4.2	33.2	34.7	4.52
15	0. 12	0. 11	-8.3	9050	9378	3.6	32.3	34.4	6.50
16	0. 12	0. 11	-8.3	8845	9228	4.3	32.2	34.0	5.59
17	0. 12	0. 11	-8.3	9069	9678	6.7	33.3	35.1	5.41
18	0. 12	0. 11	-8.3	9312	9678	3.9	33.3	35.1	5.41
19	0. 12	0. 11	0.0	9244	9522	3.0	33.5	34.7	3.58
20	0. 11	0. 11	0.0	9212	9522	3.4	33.0	34.7	5.15
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**