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 BFB 51x51x15 mm series as the right table	BFB0512HH	BFB0512H	BFB0512M	BFB0512L	
	BFB0524HH	BFB0524H	BFB0524M	BFB0524L	
Representative Test P/N : BFB0512HH					
Instruments used: 1.Oven: F00-5, E24-T057 2. DC Source: GW GPC-3060D				On/Off Cycles: Every 500 hours	

◎ **L_{10} Expectancy: 50,000 hours minimum @ fan rated voltage and the temperature of 40℃**

According to the equation for **Weibull distribution**, **MTTF ≒ 7×L10 = 350,000 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 (hours)	Verified L_{10} (hours)
80	40	16.00	20	2.303	3,170	13,014	1,436,881	205,269

Test Progress:

Date for Test Beginning	Date for Test Termination (at least)	Current Test Status			Current Total Test Time (hours)
1998/7/7 2:00 PM	1999/5/7 6:59 AM	☐ In process	☐ In process (exceed requested)	☑ Termination	13014.0

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.**)

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

Temperature for MTTF Estimation (℃)	Acceleration Factor A_F	Estimated MTTF (hours)	Estimated L_{10} (hours)
25	45.25	4,064,114	580,588
30	32.00	2,873,762	410,537
40	16.00	1,436,881	205,269
50	8.00	718,441	102,634
60	4.00	359,220	51,317
70	2.00	179,610	25,659
80	1.00	89,805	12,829

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
A108L	4119.00	2000/6/20 11:00 AM	Bonnie Chang	Robert Sun

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DC FAN FUNCTION TEST RECORD
FOR LIFE EXPERIMENT

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BFB0512HH	BFB0512H	BFB0512M	BFB0512L	
BFB0524HH	BFB0524H	BFB0524M	BFB0524L	

Required Test Time (hrs)	Date for Test Beginning	Date for Test Termination	Sample Size (pcs):	Failure (pcs):	Current Total Test Time (hrs)
3,170	1998/7/7 2:00 PM	1999/5/7 6:59 AM	20	0	**13014.0**

presentative Test P/N : BFB0512HH

Current Test Status ☐ In process ☐ In process (exceed requested) ☑ Termination

Instruments used: 1.Oven: F00-5, E24-T057 2. DC Source: GW GPC-3060D | On/Off Cycles: Every 500 hours

Test Data Between Initial Test and Final Test

ample P/N: BFB0512HH

Sample No.	Initial Test Current Spec. (A) **0.32 Max.**	Final Test Current Spec. (A) **0.32 Max.**	Deviation (%)	Initial Test Speed Spec. (RPM) **6500 Ref.**	Final Test Speed Spec. (RPM) **6500-15%**	Deviation (%)	Initial Test Noise Spec. (dB A) **48.0 Max.**	Final Test Noise Spec. (dB A) **51.0 Max.**	Deviation (%)
1	0.22	0.20	-9.1	6609	7596	14.9	43.7	50.1	14.6
2	0.22	0.21	-4.5	6592	7596	15.2	43.7	49.4	13.0
3	0.22	0.20	-9.1	6551	7500	14.5	43.7	49.1	12.4
4	0.23	0.21	-8.7	6312	7230	14.5	45.0	48.3	7.4
5	0.23	0.20	-13.0	6497	7692	18.4	44.1	49.7	12.6
6	0.23	0.20	-13.0	6435	7500	16.6	44.5	49.1	10.4
7	0.23	0.21	-8.7	6697	7596	13.4	44.4	49.4	11.2
8	0.23	0.21	-8.7	6548	7596	16.0	44.1	49.4	12.0
9	0.23	0.20	-13.0	6645	7692	15.8	43.7	49.7	13.6
10	0.23	0.20	-13.0	6503	7692	18.3	44.8	50.3	12.3
11	0.23	0.21	-8.7	6441	7500	16.4	44.8	49.1	9.6
12	0.23	0.21	-8.7	6659	7500	12.6	44.4	49.8	12.2
13	0.22	0.19	-13.6	6437	7500	16.5	44.5	49.4	11.0
14	0.23	0.20	-13.0	6510	7596	16.7	43.6	49.4	13.3
15	0.23	0.20	-13.0	6443	7500	16.4	43.5	49.1	12.9
16	0.22	0.21	-4.5	6527	7500	14.9	44.3	49.8	12.4
17	0.22	0.20	-9.1	6490	7794	20.1	44.3	49.9	12.7
18	0.22	0.19	-13.6	6559	7410	13.0	44.2	49.0	10.9
19	0.23	0.21	-8.7	6460	7500	16.1	43.3	49.1	13.4
20	0.22	0.20	-9.1	6604	7794	18.0	43.9	49.9	13.8
X-Bar	0.226	0.203	-	6526	7564	-	44.13	49.45	-
σ	0.005	0.007	-	92.909	131.412	-	0.476	0.463	-

QE File No.	Time-out for function test or others (hrs)	Issued Date	Reported By	Approved By
A108L	**4119.00**	**2000/6/20 11:00 AM**	Bonnie Cheng	Robert Sun