DELTA ELECTRONICS, INC.

DC FAN LIFE EXPERIMENT REPORT

Available for these models with lower speed and same physical structure. All model may be followed byRxx orFxx series suffixes. This test report applies to PFM 80x80x38.0**mm** series as the right table	PFM0812HE-01BCB				
	PFM0812HE-01BFY				

Representative Test P/N : PFM0812HE-01ADC

Equipment: 1.Oven: E24-T0161 | 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%).

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 40 ℃ (hours)	Verified L_{10} 40 ℃ (hours)
70	40	8.00	56	2.303	3,478	5,478.0	771,820	110,260

Test Progress:

Date for Test Beginning	Date for Test Termination (at least)	Current Test Status			Current Total Test Time (hours)
2015/8/11 5:10 PM	2016/6/21 3:46 PM	☐ In process	☑ In process (exceed requested)	☐ Termination	5478.0

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	22.63	2,183,036	311,862
30	16.00	1,543,639	220,520
40	8.00	771,820	110,260
50	4.00	385,910	55,130
60	2.00	192,955	27,565
70	1.00	96,477	13,782

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 Result	☑ Accept ☐ Reject

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG15FNL090	4080.83	2016/9/13	NaNa.Wang	Tim.Yi

BGN（dBA）: 16.2 Temp（℃）：25.0

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DC FAN FUNCTION TEST RECORD
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	PFM0812HE-01BFY				

Required Test Time (hrs)	Date for Test Beginning	Date for Test Termination	Sample Size (pcs):	Failure (pcs):	Current Total Test Time (hrs)
3,478	2015/8/11 5:10 PM	2016/6/21 3:46 PM	56	0	**5478.0**

Representative Test P/N : PFM0812HE-01ADC	Current Test Status	☐ In process	☑ In process (exceed requested)	☐ Termination
Equipment: 1.Oven: E24-T0161		On/Off Cycles: Every 500 hours		

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (A) **5.16 Max.**	Final Test Current Spec. (A) **5.16 Max.**	Deviation (%)	Initial Test Speed Spec. (RPM) **14670-17930**	Final Test Speed Spec. (RPM) **14670-17930**	Deviation (%)	Initial Test Noise Spec. (dB A) **81.0Max**	Final Test Noise Spec. (dB A) **81.0Max**	Deviation **3 dBMax.**
1	3.86	3.97	3.0	15092	16361	8.4	79.1	77.0	-2.1
2	4.23	3.94	-6.8	15740	16064	2.1	78.9	77.6	-1.3
3	4.24	3.95	-6.7	15694	16310	3.9	78.4	77.4	-1.0
4	4.12	3.95	-4.1	15591	16198	3.9	78.8	78.2	-0.6
5	3.80	4.05	6.7	14991	16230	8.3	79.2	77.4	-1.8
6	4.32	3.99	-7.7	15895	16275	2.4	79.5	77.5	-2.0
7	4.19	4.04	-3.6	15590	16238	4.2	78.4	76.7	-1.7
8	3.61	3.96	9.7	14892	16058	7.8	79.0	76.8	-2.2
9	3.95	3.96	0.1	15289	16270	6.4	78.6	77.2	-1.4
10	4.00	3.97	-0.9	15390	16044	4.2	78.8	77.3	-1.5
11	4.30	3.94	-8.3	15841	16166	2.1	79.3	77.3	-2.0
12	4.40	3.99	-9.4	16193	16243	0.3	79.5	77.1	-2.4
13	4.21	4.09	-3.0	14693	16161	10.0	78.4	77.0	-1.4
14	4.33	4.06	-6.2	15992	16091	0.6	78.6	77.4	-1.2
15	3.86	3.95	2.2	15091	16186	7.3	79.1	77.7	-1.4
16	4.00	3.97	-0.8	15441	16170	4.7	79.3	78.0	-1.3
17	3.98	4.10	3.2	15293	16189	5.9	78.8	78.0	-0.8
18	3.85	3.94	2.4	15040	16226	7.9	79.5	77.0	-2.5
19	4.35	4.01	-7.7	14791	16111	8.9	78.4	76.6	-1.8
20	3.85	3.96	2.9	15141	16220	7.1	78.6	77.8	-0.8
21	4.29	3.96	-7.6	15893	16214	2.0	79.1	77.5	-1.6
22	4.20	4.06	-3.3	14793	16169	9.3	79.3	77.4	-1.9
23	3.82	4.03	5.4	15140	16016	5.8	78.8	77.1	-1.7
24	3.73	3.89	4.3	14943	16246	8.7	79.5	77.2	-2.3
25	3.98	4.06	2.0	15441	16167	4.7	78.6	77.0	-1.6
26	4.28	4.02	-6.2	16095	16286	1.2	79.0	77.4	-1.6
27	4.28	4.07	-4.9	16195	16173	-0.1	79.2	76.6	-2.6
28	4.21	4.08	-3.1	14890	16185	8.7	78.9	77.7	-1.2
29	3.67	4.03	9.9	14843	16180	9.0	78.5	76.0	-2.5
30	3.91	3.92	0.3	15041	16260	8.1	78.7	78.0	-0.7
31	4.34	3.92	-9.8	16096	16190	0.6	79.0	77.0	-2.0
32	4.29	4.09	-4.7	14792	16240	9.8	79.3	77.0	-2.3

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG15FNL090	**4080.83**	**2016/9/13**	**NaNa.Wang**	**Tim.Yi**

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DC FAN FUNCTION TEST RECORD
FOR LIFE EXPERIMENT

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	PFM0812HE-01BFY				

Required Test Time (hrs)	Date for Test Beginning	Date for Test Termination	Sample Size (pcs):	Failure (pcs):	Current Total Test Time (hrs)
3,478	2015/8/11 5:10 PM	2016/6/21 3:46 PM	56	0	**5478.0**

Representative Test P/N : PFM0812HE-01ADC	Current Test Status	In process ☐	In process (exceed requested) ☑	Termination ☐
Equipment: 1.Oven: E24-T0161		On/Off Cycles: Every 500 hours		

Test Data Between Initial Test and Final Test

Sample No.	Initial Test Current Spec. (A) **5.16 Max.**	Final Test Current Spec. (A) **5.16 Max.**	Deviation (%)	Initial Test Speed Spec. (RPM) **14670-17930**	Final Test Speed Spec. (RPM) **14670-17930**	Deviation (%)	Initial Test Noise Spec. (dB A) **81.0Max**	Final Test Noise Spec. (dB A) **81.0Max**	Deviation **3 dBMax.**
33	4.30	3.96	-7.8	16137	16160	0.1	78.8	77.5	-1.3
34	4.02	3.92	-2.3	15042	16223	7.9	79.5	77.6	-1.9
35	4.21	4.08	-3.0	15593	16097	3.2	78.5	77.2	-1.3
36	4.28	4.10	-4.0	15591	16168	3.7	79.1	77.3	-1.8
37	4.03	3.93	-2.5	15490	16206	4.6	78.7	77.3	-1.4
38	3.68	4.03	9.8	14840	16044	8.1	79.2	76.8	-2.4
39	4.24	3.90	-8.0	15693	16262	3.6	79.4	76.7	-2.7
40	3.65	3.94	8.1	14744	16272	10.4	78.9	77.0	-1.9
41	4.26	4.01	-5.7	15642	16175	3.4	78.5	77.5	-1.0
42	4.09	3.87	-5.4	15541	16275	4.7	79.0	77.0	-2.0
43	4.11	4.07	-1.0	15340	16112	5.0	79.2	76.7	-2.5
44	4.02	4.07	1.2	15391	16074	4.4	78.7	77.6	-1.1
45	3.79	3.89	2.7	14840	16112	8.6	79.4	77.0	-2.4
46	4.07	3.90	-4.1	15441	16315	5.7	78.9	77.5	-1.4
47	4.09	4.07	-0.4	15242	16104	5.7	78.5	77.3	-1.2
48	3.81	4.10	7.7	14992	16201	8.1	79.0	77.2	-1.8
49	4.29	3.95	-8.0	14793	16178	9.4	79.2	76.7	-2.5
50	3.99	4.09	2.5	15390	16158	5.0	78.7	77.2	-1.5
51	4.26	3.93	-7.8	15342	16253	5.9	79.4	77.6	-1.8
52	4.25	3.94	-7.2	14740	16201	9.9	78.9	78.0	-0.9
53	4.03	4.09	1.3	15189	16128	6.2	78.7	76.8	-1.9
54	3.70	3.94	6.4	14693	16253	10.6	79.1	76.6	-2.5
55	4.02	4.08	1.3	15342	16114	5.0	79.3	77.6	-1.7
56	3.81	3.95	3.8	14841	16240	9.4	78.8	77.0	-1.8
X-Bar	4.06	3.99	-	15316.63	16186.82	-	78.95	77.24	-
σ	0.22	0.07	-	423.40	72.12	-	0.34	0.43	-

QE File No.	Time-out for function test or others (hrs)	Issued Date	Reported By	Approved By
DG15FNL090	**4080.83**	**2016/9/13**	**NaNa.Wang**	**Tim.Yi**