DC FAN LIFE EXPERIMENT REPORT

DELTA ELECTRONICS, INC.

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 140x140x43.5 mm** series as the right table	PFM1412DE-DA2H				
	PFM1412DE-DF25 A				
	PFM1412DEB7V				

Representative Test P/N : PFM1412DE-BM3F

Equipment: 1.Oven: E24-T0161	On/Off Cycles: Every 500 hours

◎ L_{10} **Expectancy:**   **50,000**   hours minimum @ fan rated voltage and the temperature of 60℃

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%).

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 60 ℃ (hours)	Verified L_{10} 60 ℃ (hours)
60	60	1.00	56	2.303	19,873	11,360.0	200,070	28,581

Test Progress:

Date for Test Beginning	Date for Test Termination (at least)	Current Test Status			Current Total Test Time (hours)
2012/11/13 11:00 AM	2017/4/23 3:02 AM	☑ In process	☐ In process (exceed requested)	☐ Termination	11360.0

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.

Temperature for MTTF Estimation (℃)	Acceleration Factor A_F	Estimated MTTF (hours)	Estimated L_{10} (hours)
25	11.31	2,263,535	323,362
30	8.00	1,600,561	228,652
40	4.00	800,280	114,326
50	2.00	400,140	57,163
60	1.00	200,070	28,581

Test Result	☑ **Accept**
	☐ **Reject**

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG12FNL154	19047.00	2016/5/27	NaNa.Wang	Tim.Yi

BGN（dBA）: 16.4   Temp（℃）: 24.6

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PFM1412DE-DA2H	
PFM1412DE-DF25 A	
PFM1412DEB7V	

Required Test Time (hrs)	Date for Test Beginning	Date for Test Termination	Sample Size (pcs):	Failure (pcs):	Current Total Test Time (hrs)
19,873	2012/11/13 11:00 AM	2017/4/23 3:02 AM	56	0	**11360.0**

Representative Test P/N : PFM1412DE-BM3F	**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) 5.04 Max.	Final Test Current Spec. (A) 5.04 Max.	Deviation (%)	Initial Test Speed Spec. (RPM) 5850-7150	Final Test Speed Spec. (RPM) 5850-7150	Deviation (%)	Initial Test Noise Spec. (dB A) 74.0 Max	Final Test Noise Spec. (dB A) 74.0 Max	Deviation 3 dBMax.
1	3. 87	3. 99	3.2	6389	6101	-4.5	71.3	69.7	-1.6
2	4. 00	4. 07	1.8	6204	6148	-0.9	71.6	70.1	-1.5
3	3. 80	4. 17	9.8	6426	6097	-5.1	71.4	70.3	-1.1
4	3. 89	4. 21	8.3	6260	6150	-1.8	71.8	70.2	-1.6
5	3. 91	3. 99	2.0	6390	6322	-1.1	71.2	70.4	-0.8
6	3. 82	4. 08	6.8	6411	6191	-3.4	71.5	70.1	-1.4
7	3. 89	4. 21	8.1	6331	6122	-3.3	71.6	70.8	-0.8
8	3. 81	4. 10	7.8	6339	6162	-2.8	71.1	69.8	-1.3
9	4. 13	4. 20	1.7	6227	6126	-1.6	71.7	70.1	-1.6
10	3. 91	4. 11	5.1	6305	6176	-2.0	71.4	70.4	-1.0
11	3. 83	4. 03	5.1	6267	6130	-2.2	71.5	70.1	-1.4
12	3. 98	4. 18	4.9	6216	6091	-2.0	71.2	70.4	-0.8
13	3. 93	4. 08	3.8	6258	6164	-1.5	71.9	69.7	-2.2
14	3. 91	4. 07	4.1	6173	6091	-1.3	71.3	70.5	-0.8
15	3. 81	4. 12	8.3	6386	6153	-3.6	71.6	69.5	-2.1
16	4. 11	4. 14	0.8	6233	6122	-1.8	71.4	70.3	-1.1
17	3. 78	4. 16	10.0	6252	6040	-3.4	71.7	70.4	-1.3
18	3. 79	4. 04	6.8	6281	6126	-2.5	71.5	70.1	-1.4
19	3. 72	4. 07	9.3	6275	6083	-3.1	71.2	69.6	-1.6
20	4. 10	4. 07	-0.7	6127	6132	0.1	71.8	70.5	-1.3
21	3. 76	4. 11	9.4	6361	6189	-2.7	71.3	69.7	-1.6
22	3. 67	4. 00	8.9	6320	6130	-3.0	71.6	69.6	-2.0
23	4. 12	4. 07	-1.1	6078	6093	0.2	71.2	69.8	-1.4
24	3. 69	3. 90	5.7	6337	6238	-1.6	71.9	70.4	-1.5
25	3. 98	3. 92	-1.5	6136	6219	1.4	71.4	70.4	-1.0
26	3. 71	3. 88	4.6	6370	6277	-1.5	71.1	69.7	-1.4
27	3. 76	4. 00	6.5	6361	6165	-3.1	71.5	70.0	-1.5
28	3. 95	4. 18	6.0	6288	6089	-3.2	71.3	70.1	-1.2
29	3. 86	4. 06	5.1	6315	6158	-2.5	71.5	70.3	-1.2
30	3. 89	4. 06	4.2	6209	6105	-1.7	71.4	69.9	-1.5
31	4. 10	3. 94	-4.0	6109	6162	0.9	71.7	70.3	-1.4
32	3. 77	4. 15	9.9	6325	6117	-3.3	71.2	70.4	-0.8

QE File No.	Time-out for function test or others (hours)	Issued Date	Reported By	Approved By
DG12FNL154	**19047.00**	**2016/5/27**	**NaNa.Wang**	**Tim.Yi**

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PFM1412DEB7V	

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33	3. 96	4. 00	1.0	6186	6171	-0.2	71.3	70.2	-1.1
34	3. 84	4. 12	7.2	6405	6198	-3.2	71.6	70.3	-1.3
35	3. 79	3. 84	1.5	6254	6252	0.0	71.8	69.5	-2.3
36	3. 84	3. 88	1.3	6277	6279	0.0	71.4	69.6	-1.8
37	3. 72	4. 05	9.1	6321	6154	-2.6	71.9	69.7	-2.2
38	4. 08	4. 02	-1.4	6134	6185	0.8	71.5	70.1	-1.4
39	3. 92	3. 98	1.6	6149	6129	-0.3	71.6	69.8	-1.8
40	3. 84	4. 07	6.0	6265	6153	-1.8	71.1	70.3	-0.8
41	4. 09	4. 11	0.4	6219	6159	-1.0	71.4	70.6	-0.8
42	3. 80	3. 99	5.0	6274	6185	-1.4	71.3	69.8	-1.5
43	3. 83	3. 93	2.6	6342	6253	-1.4	71.7	70.6	-1.1
44	3. 93	4. 03	2.5	6285	6169	-1.8	71.2	70.0	-1.2
45	3. 78	4. 08	8.2	6441	6173	-4.2	71.8	70.1	-1.7
46	3. 79	4. 08	7.7	6293	6123	-2.7	71.5	70.0	-1.5
47	3. 85	4. 06	5.3	6241	6156	-1.4	71.4	70.2	-1.2
48	3. 75	4. 00	6.5	6328	6195	-2.1	71.1	70.7	-0.4
49	3. 95	3. 96	0.3	6287	6255	-0.5	71.7	70.5	-1.2
50	3. 75	3. 89	3.8	6341	6278	-1.0	71.8	70.2	-1.6
51	3. 79	3. 84	1.3	6284	6302	0.3	71.3	70.6	-0.7
52	3. 84	3. 94	2.7	6185	6138	-0.8	71.6	70.4	-1.2
53	3. 93	4. 14	5.4	6184	6065	-1.9	71.2	70.3	-0.9
54	4. 04	4. 16	3.0	6183	6082	-1.6	71.7	69.6	-2.1
55	3. 89	4. 06	4.5	6246	6139	-1.7	71.5	69.9	-1.6
56	3. 96	4. 10	3.7	6206	6142	-1.0	71.3	70.1	-1.2
X-Bar	3.88	4.0	-	6273.0	6160.8	-	71.47	70.1	-
σ	0.119	0.095	-	84.813	61.618	-	0.228	0.333	-

QE File No.	Time-out for function test or others (hrs)	Issued Date	Reported By	Approved By
DG12FNL154	**19047.00**	**2016/5/27**	**NaNa.Wang**	**Tim.Yi**