Sunonwealth Electric Machine Industry Co., Ltd

Fan MTTF / L10 Test Procedure And Calculation Method
Definition

MTTF- Mean Time to Failure

MTBF- Mean Time between Failure

L10- Failed to 10% Times
Failure criteria

- Fan not function.
- Current over 15% of original.
- Speed under 15% of original.
- Noise over 3dB(A) of original.
MTTF Test Procedure and Calculation Method

1. Random sampling 50 units.
2. Perform function test in advance and set up temperature.
3. Function test once a week.
4. Test time for at least 3000 hrs.
5. Based on Total Test Hours( T ) and Failure Quantity ( r ) and refer Chi-Square table with Confidential Level (CL) to get MTTF.
MTTF Calculation Method

Formula: (Base on MIL-HDBK-781A)

$$MTTF = \frac{(2 \times T)}{(\chi^2, \alpha, 2\gamma + 2)}$$

- $T$: Total test time
- $\chi^2$: Chi-Square table
- $\alpha$: Producer’s risk; $\alpha = 10\%$ (CL: 90\%; CL = 1 - $\alpha$)
- $\gamma$: Failure Q’ty
- $\nu = 2\gamma + 2$; $\nu$: Degrees of freedom
Example:

Sample size : 50 units.
Test time : 3,000 hours.
Failure time : 2,400 hours * 1pc

2,736 hours * 1pc

Total test hours (T) = (2400 x 1) + (2736 x 1) + (3000 x 48)
= 149,136 hrs

Chi-Square table : 90% CL, 2 pcs failed, get a coefficient 10.6

MTTF = (2 x T) / 10.6 = (2 x 149,136) / 10.6 = 28,138 hrs.
1. Random sampling 50 units.
2. Perform function test in advance and temperature set up.
3. Function test once a week.
4. Continue test till 10% failure being found, then terminate.
5. Count total test hours (T) and failure quantity (r).
Weibull Distribution

Formula:

\[ L10 = \theta \times (0.10536)^{\beta} \]

\( \theta \): Characteristic Life
\( \beta \): Shape Parameter

\[ MTTF = \theta \times \Gamma(1 + \frac{1}{\beta}) \]

\( \Gamma \): Gamma Table
Example

Sampling 50 pcs/test for 27,384 hours.
1 Pc TTF at 9,912 hrs
1 Pc TTF at 15,624 hrs
1 Pc TTF at 20,160 hrs
1 Pc TTF at 23,856 hrs
1 Pc TTF at 27,384 hrs

Weibull distribution

\( \beta \): Shape parameter = 1.9202
\( \theta \): Characteristic Life = 91,650

\[
L_{10} = \theta \times (0.10536)^{\frac{1}{\beta}}
\]

\[
= 91,650 \times (0.10536)^{1/1.9202}
\]

= 28,390 hrs

Mean Life = \( \theta \times \Gamma \left( 1 + \frac{1}{\beta} \right) \)

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= 81,300 \text{ hrs}
\]

\( \beta = 2.2516, \eta = 4.5049 \times 10^4, p = 0.9971 \)
Thank You