



L10

70x15 Model

Ball – Sleeve 7015-12HSB

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1.0 Overview

The bearing system incorporated in the JMC brushless DC axial fans is the determining factor in the life of the fan. JMC discloses L10 life based on the life of the mechanical structure of the fan. Electronic component failures in the circuitry of the fan are insignificant in comparison with the bearing system. In most cases the Life of the electronic components is an order of magnitude greater than the bearings.

The **70x15 (7015-12HSB)** JMC fan used in this report is a fixed speed 4000 rpm model with ball/sleeve combination bearing. The L10 Life is calculated to be 52523 hrs. The result was projected to be 70030 hrs. for the 3000 rpm fan model.

2.0 Test Method

A. Method:

The testing of the 70x15 ball sleeve fan started in September 1999 in accordance with JMC procedure WI-10-001 "Reliability Testing of JMC Fan". Below is a brief summary of the test:

- A sample of 30 fans (4000 rpm model) were selected for this test. A standard testing was applied to assure all fans were functioned as expected.
- All samples were placed into 70 ° C chamber running continuously at rated voltage in free air.

C. Record rpm, voltage, and current data during testing at 24h, 48h, 96h, 168h, 336h, then at 168-hour increments until testing is complete. Testing was complete when 2 samples record a primary fan failure for a 30 unit sampling size.

-Using the Weibull Distribution Curve presented in "The New Weibull Hand Book" Fourth Edition, by Dr. Robert B. Abernethy, plot the percent failures on the y-axis and the hours for failure on the x-axis using Weibull paper. Draw a straight line that best represents the actual slope of the data plotted.

- At the 10% location on the y-axis draw a horizontal line until intersecting the data line. At that intersection draw a vertical line perpendicular to the 10% horizontal line. At the

point where this vertical line intersects the x-axis, L10 Life data is projected for the fan samples at 70 ° C.

-Using the Temperature/Life factor, project the L10 fan life for 60 ° C, 50 ° C, 40 ° C, 30 ° C, and 25 ° C. An L10 at 25C is our standard L10 number.

-Project L10 for another similar fan model using relation ship between L10 Life and Speed variation.

B. Testing Criteria:

- Fan Failure: Point where fan speed (RPM) changes 15% from nominal start up fan speed (RPM)

- Temperature/Life Factor - Factor that is used to determine increased fan life for operation temperature drops. Temperature / Life factor data has been established based on 60 ° C, 50 ° C, and 40 ° C testing. Temperature/ Life factor: =1.5 /10 °C (1.5 per 10 ° C drop in operational temp).

3.0 L10 Calculation for 70x15 Fan

Table 1: Spreadsheet for Calculation

No. 1 = 7015-12HBS (Ball Sleeve)

L10 Life (In hours of service)

Temp.(C)	No. 1				
70	8300				
60	12450				
50	18675				
40	28012.5				
30	42018.75				
25	52523.44				

The L10 for 70C was projected from the Weibul graph-Attachment 1. The result for L10 (25C) was calculated, in Table 1 above, to be **52523 hrs.**

The project result for the 3000 rpm model is calculated as followed:

$$L10(3000) = L10(4000) \times ((\text{Speed } 4000) / (\text{Speed } 3000))$$

$$= 52523 \times (4000/3000)$$

$$\mathbf{L10(3000) = 70030 \text{ hrs}}$$

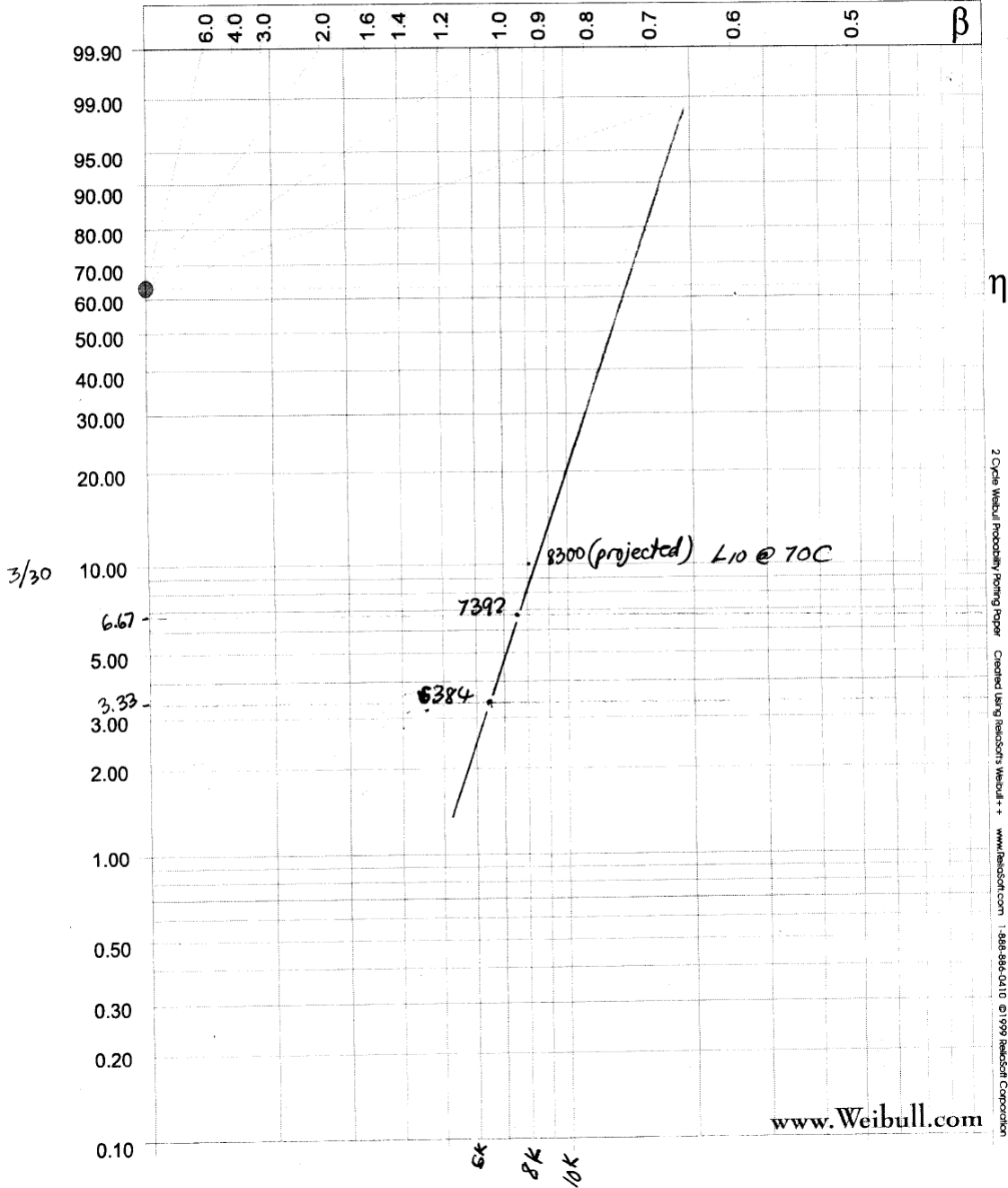
4.0 Attachment 1 - Weibull graph

L_{10} @ 25°C = 52 523 hrs.
for 4000 rpm



JMC Products

Model # 7015-12 HBS



2 Cycle Weibull Probability Plotting Paper Created Using ReliaSoft's Weibull++ www.reliasoft.com 1-888-896-0410 © 1999 ReliaSoft Corporation