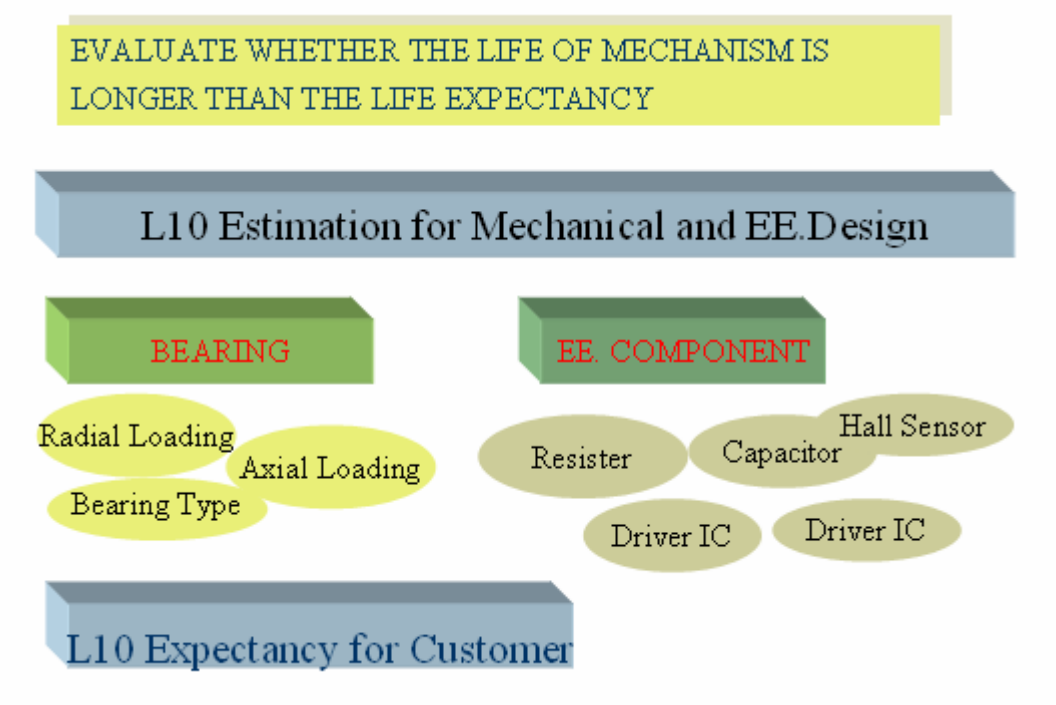
LIFE & RELIABILITY

The vast majority of fan and blower failures occur because either the motor insulation or the motor bearings fail, with bearing failures being more predominant. Crown fans and blowers use ball bearings exclusively, and the life of these bearings and lubricants are affected by temperature and speed. The typical dynamic load imposed by fans and blowers is such that bearing fatigue is not considered as contributing to the degradation of component life. Bearing failures occur more frequently than motor insulation breakdown failure.



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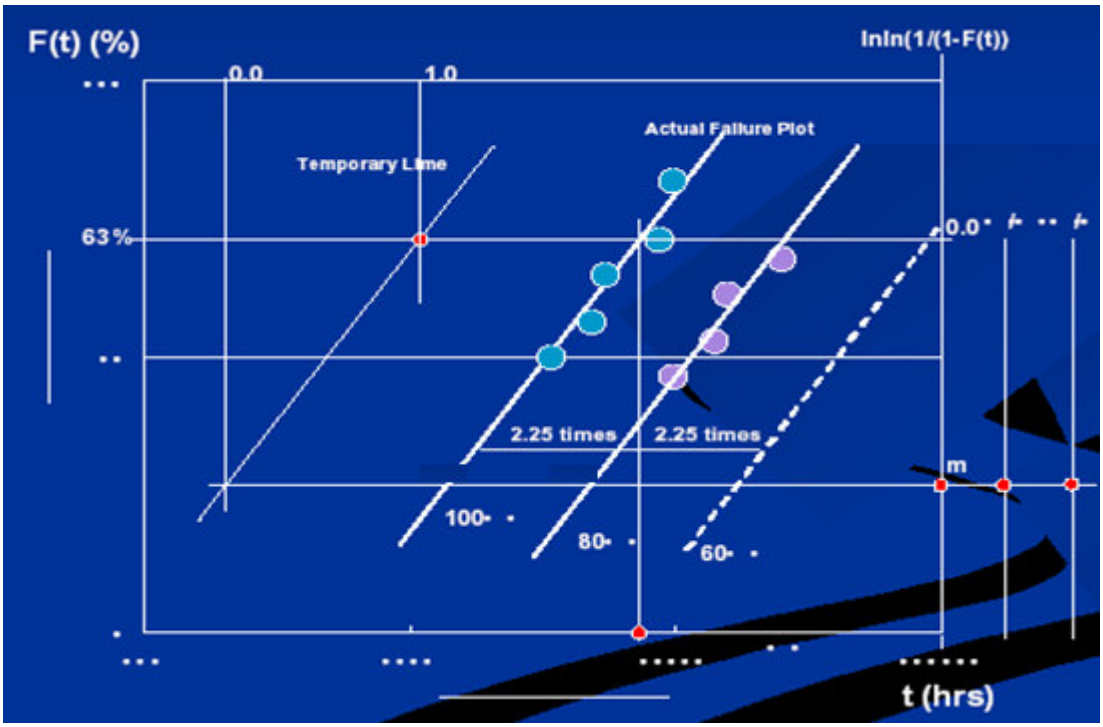
The principle degradation mechanism of the grease in ball bearings, oxidation and evaporation, are of a chemical nature so the Arrhenius relationship that life will be halved for each 20C increase in temperature is **approximately** valid. This slope of the live vs. Temperature curve varies considerably, however, for each grease in different temperature ranges. For instance, it has been found that the slope is constant temperature. The actual running life will be shorter if the unit is subjected to frequent start-stop cycles and/or temperature cycling.

Failure Rate

The failure rate is reciprocal of the MTBF, i.e. FR = 1 / MTBF



The following definitions relating to operating life are in common usage:

L10 of LIFE

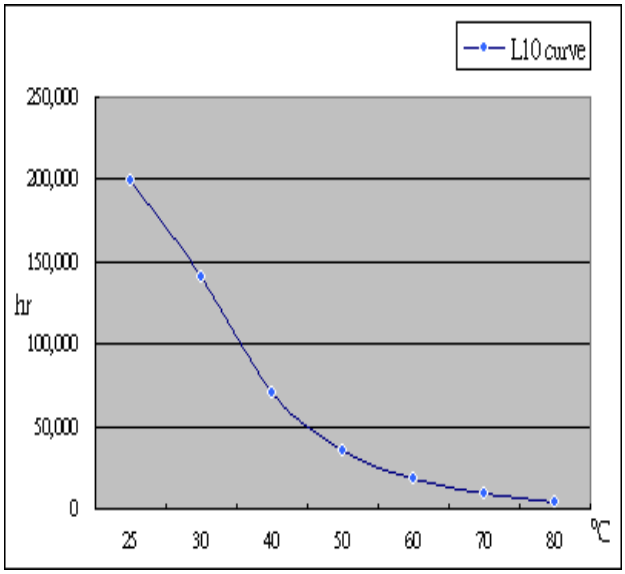
L10 of LIFE is that life in hours beyond which 90% of a given population of blowers can be expected to survive". This expression has been used for many years by the AFBMA (Anti-Friction Bearing Manufacturers' Association) to express the fatigue life of rolling contact bearings. It is an indication of the number of "infant mortality" failures which might be encountered from a given population of blowers produced with normal manufacturing techniques.

Mean Time Between Failures

MTBF, or mean life, is, for an exponential failure rate, the time where 63.2% of agiven population of a specific component has failed. Most electronic components exhibit a random failure pattern which is best characterized by this exponential distribution (i.e., constant) failure rate. Fractional horsepower motors of the type used in fans and blowers, however, exhibit a "wear-out" pattern of failure in which the failure rate is **not** constant but increases with age. This pattern is best described by the Weibull distribution. The MTBF can be approximated as that time when 50% of motors has failed.

Crown General Fan Life Capability

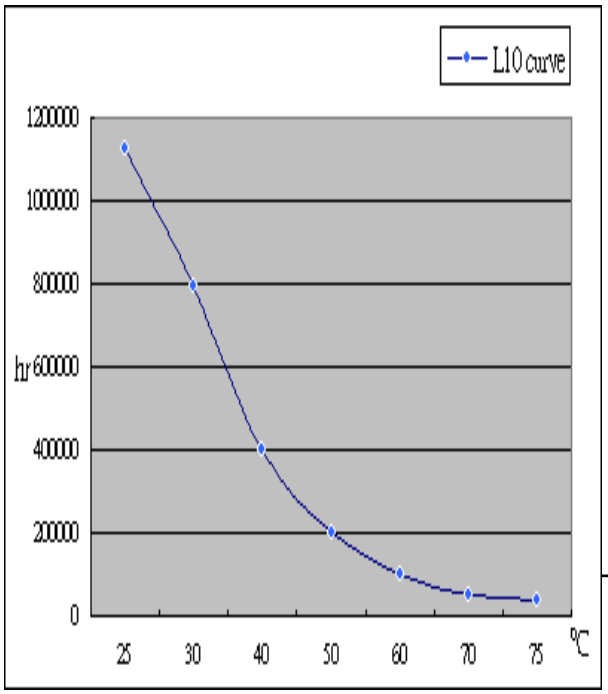
Life in different Temperature base on Fan L10 40c 70k hrs



Temperature for	Acceleration	Estimated MTTF	Estimated L_{10}
25	22.63	1,394,7	199,2
30	16.00	986,26	140,8
40	8.00	493,13	70,44
50	4.00	246,56	35,22
60	2.00	123,28	17,61
70	1.00	61,641	8,806
80	0.50	30,821	4,403

Crown Advanced Fan Life Capability

Life in different Temperature 40c 10 years



Temperature for MTTF	Acceleration	Estimated MTTF	Estimated L_{10}
25	**32.0**	**1,873,6**	**267,6**
30	**22.6**	**1,324,8**	**189,2**
40	**11.3**	**662,42**	**94,63**
50	**5.66**	**331,21**	**47,31**
60	**2.83**	**165,60**	**23,65**
70	**1.41**	**82,803**	**11,82**
75	**1.00**	**58,551**	**8,364**
80	**0.71**	**41,402**	**5,915**
90	**0.35**	**20,701**	**2,957**

Weibull distribution

$\lambda(t)$