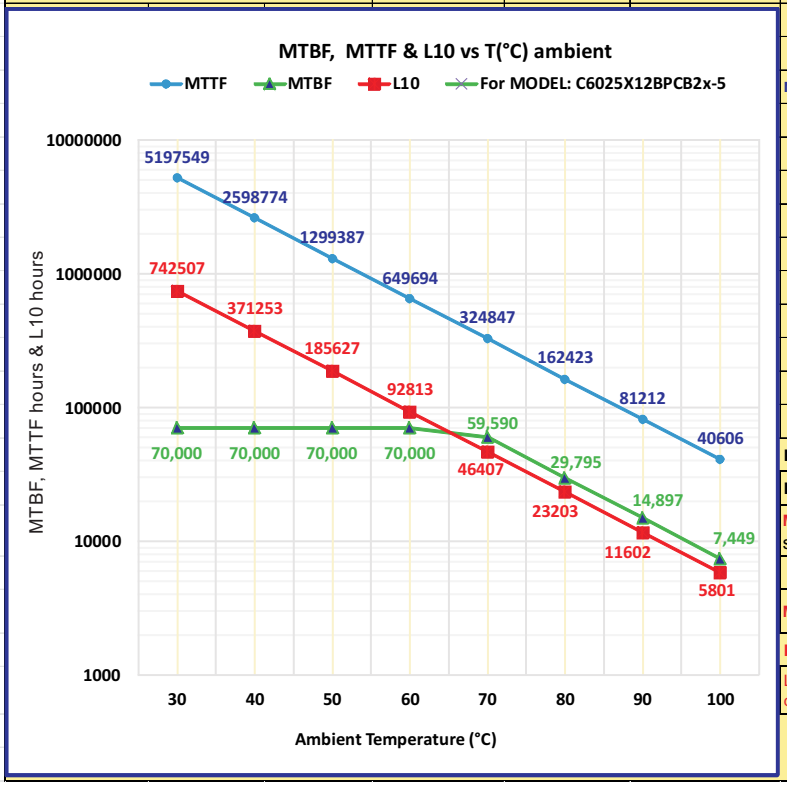
MTTF and L10 CALCULATION

The life expectantly of a fan motor is limited by the following:

1. The temperature of the motor (i.e. Ambient temperature plus Temp. Rise of the motor), (for every 10°C increase of Temp. its life is decrease by 50%).
2. The running speed of the motor (for every 19% increase of speed, its life is decreased by 25%).
3. Metal fatigue of the bearing system used (e. g. The maximum bearing life is 70000 hrs when the fan is running at 6000RPM as shown in the example below).
4. By the life of the electrolytic capacitor whose value is decreased by 50% with every 10°C of temperature increase.

Below is a sample of MTBF calculation of model C6025X12BPCB2x-5.
The calculation is based on tested sample C6025X12B-5, C6025Y12B-5, C6025X24B-5 (these models use the same size, use the same bearing system and are tested at the same 70℃ oven).

Elevated Test Temp. Ts (°C)	Typical Temp to run for L10 hrs: Tuse (°C)	Accelataion Factor Af	Units under test (N)	Poisson Distribution X², Factor Br;c	Actual, Non statistical oven 'no fail' data at 70 C	For MODEL:	C6025X12BPCB2x-5		70K @ 6000RPM @ 30C	RPM= 6000
70	40	8	32	2.303	30693	=test hrs	Max.Life of bearing due to metal fatigue:	830	@ RPM 6000 max life :	70000 hrs
Af=2^[(Ts-Tuse)/10] Arrhenius Acceleration factor					Speed Effect:	Speed Acceleration Factor=AS=1.25^((Smeas.-Sactual)/(Smeas.*0.19)) (i.e. for every 19% speed decrease, the life increases by 25%) = empirical long term test data				
MTTF=7*L10 as per Weibull Distribution					Tested: Model samples of same size, bearing type & normalized speed and at the same oven temperature					
Br;c=2.303 as per Poisson distribution factor					C6025X12B-5	C6025Y12B-5		C6025X24B-5		
MTTF=no fail test hrs*(Af/1.036)/[(Br;c)/N] ^ 0.91=				2598774	& L10 at 40 =	371253		USE Actual MTTF oven Data		Oven Data Date:
						(Actual MTTF data are zero failure or minimum MTBF Data)				1-Oct-17



MTTF & L10 (non-statictical, ACTUAL 30693 test hrs)				
MTTF	Ta °C	L10	Af	Bearing Limit
5197549	30	742507	16	70000
2598774	40	371253	8	70000
1299387	50	185627	4	70000
649694	60	92813	2	70000
324847	70	46407	1	59590
162423	80	23203	0.5	29795
81212	90	11602	0.25	14897
40606	100	5801	0.125	7449

NOTES:

DEFINITIONS

MTBF= (TTF1+TTF2+……+TTFN)/N- test stopped when all samples failed is the Mean Time Between Failures

MTTF:(TTF1+TTF2+….+TTFN)/N- test stoped at first failure (zero failure)

Mean Time To Failure Test without failures at 70 C= **30693 hours**

L10: time period, the fan shown above will survive and run with 90% confidence. MTTF = 7*L10