Life Calculation of Aluminum e-cap

1.Basic formula of life calculation

$$Lx = L \times 2^{\frac{T_0 - Tx}{10}} \times A \quad \text{……(1)}$$

Lx : Estimated lifetime (h) under operating temperature.

L : Prescribed lifetime (h)

The lifetime contain guarantee lifetime and actual lifetime.

- Guarantee lifetime : Guarantee lifetime mentioned in Table-1.
- Actual lifetime : Lifetime which capacitor possesses in average. The value can not be guaranteed.

In case of using "guarantee lifetime",Lx is shorter. But safety margin is higher than the case using "actual life".

In case using "Actual lifetime",Lx is longer. But deigning risk is higher than the case using "guarantee lifetime".

It may, in this meaning, depends upon the circuitry to use guarantee lifetime or actual lifetime.

"L" value differs with series and ratings. (see Table-1)

To : Maximum rated temperature mentioned in the catalog (85℃ or 105℃)

Tx : Ambient temperature (℃) in the operating condition.

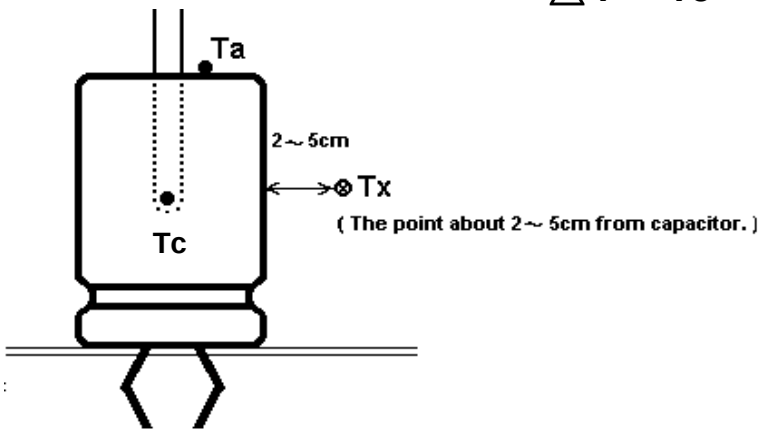
A : Life factor of ripple current.

2. Life factor of ripple current (A)

$$A = 2^{-\frac{\triangle T}{K}} \quad \text{……(2)}$$

△T : Temperature rise (℃) due to ripple current flow in the capacitor.
The difference of values between the internal temperature (Tc) and the ambient temperature (Tx)

$$\triangle T = Tc - Tx \quad \text{……(3)}$$



In case it is difficult to measure internal temperature (Tc), temperature rise (△T) is obtained by using surface temperature (Ta) based on following formula :

$$\triangle T = \triangle Ta / \alpha \quad \text{……(4)}$$

$$(\triangle Ta = Ta - Tx)$$

α is coefficient of temperature rise. The value changes with the case diameter of capacitor.
The value is show in the following table.

Case diameter § D (mm)	4	5	6.3	8	10	12.5	16	18
α	1.00	1.00	1.00	0.94	0.90	0.85	0.80	0.77

K : Life acceleration factor of temperature rise due to ripple current flow(seeTable-2)

Table-1 Guarantee Lifetime and Actual Lifetime

Series	CASE DIAMETER	Guarantee Lifetime	Actual Lifetime
		DC lifetime (ripple lifetime)	DC lifetime
VR	φ D=5,6.3	85℃ 2000h	85℃ 3500h
VX	φ D=8	85℃ 2000h	85℃ 4000h
	φ D≧10	85℃ 2000h	85℃ 5000h
VZ	φ D=5,6.3	105℃ 2000h	105℃ 3000h
VT	φ D=8	105℃ 2000h	105℃ 4000h
AQ	φ D≧10	105℃ 2000h	105℃ 5000h
PS	φ D=5,6.3,8,10	105℃ 2000h	105℃ 3500h
	φ D≧12.5	105℃ 3000h	105℃ 5000h
PW	φ D=4,5,6.3	105℃ 2000h(2000h)	105℃ 3500h
	φ D=8,10	105℃ 3000h(3000h)	105℃ 4000h
	φ D≧12.5	105℃ 5000h(5000h)	105℃ 5000h
PJ	φ D=5,6.3	105℃ 2000h(2000h)	105℃ 3500h
PF	φ D=8	105℃ 3000h(3000h)	105℃ 4000h
	φ D≧10	105℃ 5000h(5000h)	105℃ 5000h
HD	φ D=5,6.3	105℃ 2000h	105℃ 3500h
	φ D=8	105℃ 3000h	105℃ 4000h
	φ D=10	105℃ 4000h	105℃ 5000h
	φ D≧12.5	105℃ 5000h	105℃ 5000h

Table -2 K : Acceleration factor of temperature rise of ripple current

	Ambient temperature Tx				
	～45℃	55℃	65℃	75℃	85℃
△T＜5℃	10.0	10.0	10.0	7.5	7.5
5℃≦△T＜10℃	10.0	7.5	7.5	5.0	5.0
10℃＜△T	7.5	5.0	5.0	2.5	2.5