



Which is better, Aluminum Electrolytic capacitor or Conductive Polymer Aluminum Solid Capacitor?

By: Willard Wu/ Technical Dept.
willard@meanwell.com

To better evaluate whether the lifecycle of power supply exceeding warranty or not mainly depends on the lifecycle of the output capacitors. There are two kinds of capacitors that are commonly used, Aluminum Electrolytic and Conductive Polymer Aluminum Solid Capacitors. Understanding the characteristic of both capacitors is essential before making a choice

Table 1. shows the comparison of Aluminum Electrolytic Capacitor and Conductive Polymer Aluminum Solid Capacitor. Aluminum Electrolytic Capacitor is widely used in the rectifier circuits due to the huge capacity and lower price. However, heating will accelerate the consumption of electrolyte, which can lead to electrolyte ebullition and even explosion. Meanwhile, the dry-up of electrolyte can lower current ripple sustainability, sharply shorten capacitor lifecycle, and increase leakage current as well as instant high temperature, etc. Apparently, operating temperature of capacitor shall not be neglected. As a result, keeping capacitors operating at a steady temperature, avoiding heat source and implementing external cooling when necessary shall be taken as precaution.

Conductive Polymer Aluminum Solid Capacitors which is one of the high-end capacitors besides tantalum electrolytic capacitor, consisting of high conductive polymer, electrolyte powders. Electrolyte powders possess the advantages of explosion-proof, high stability, high reliability, high-temperature resistance and long lifecycle. Conductive Polymer Aluminum Solid Capacitor plays a role in rectifying the peak and noise of current, enhancing the stability of power circuit. The so-call explosion of motherboard is actually caused by Aluminum Electrolytic Capacitor being heating over the boiling point. Thus, higher-end motherboards tend to apply Conductive Polymer Aluminum Solid Capacitors to avoid this situation.

	Aluminum Electrolytic Capacitor	Conductive Polymer Aluminum Solid Capacitors
Dielectric material	Electrolyte	PEDT
Appearance	Aluminum shell with plastic cover, and vent open, shown as fig.1.	Aluminum shell with Spec. marked on the top, without vent open, shown as figure 2.
Temp. Feature	Low Temp. : Frozen electrolyte	High stability
	High Temp. : Swelled or exploded	
Cost	Low	High
Size	Big	Small
Resistance	High	Low
Working Frequency	Low	High
Application	Consumer electronics, industrial application, IT & communication and automobile electronics..etc	Circuit Breaker Power Meter, MDL Power Logger, camera, LED signboard, PC, server, IPC, CPU motherboard and Graph card... etc.

Table 1.Comparison of Aluminum Electrolytic Capacitor and Conductive Polymer Aluminum Solid Capacitor



Fig.1 Aluminum Electrolytic Capacitor



Fig.2 Conductive Polymer Aluminum Solid Capacitors

Table 2 shows the difference in the life cycle between two kinds of capacitor. A 6000hr/105°C Electrolytic capacitor compares with 5000hr/105°C Polymer Aluminum Solid Capacitors. From the curve in figure 3, the life cycle of polymer Aluminum Solid Capacitors does not take any advantage of Electrolytic capacitor at temperature higher than 90°C, while Polymer Aluminum Solid Capacitors show superior life cycle performance at temperature lower than 90°C.

Aluminum Electrolytic Capacitor	Conductive Polymer Aluminum Solid Capacitors
Rough calculation: life cycle doubles when temperature drops every 10C	Rough calculation: life cycle 10 times more when temperature drops every 20C
Formula : $L = L_0 \times 2^{(T_{max}-T)/10}$ L0 : life time @ T_{max} T : Temperature measured during operation	Formula : $L = L_0 \times 10^{(T_{max}-T)/20}$ L0 : life time @ T_{max} T : Temperature measured during operation

Table 2. Life Cycle Comparison

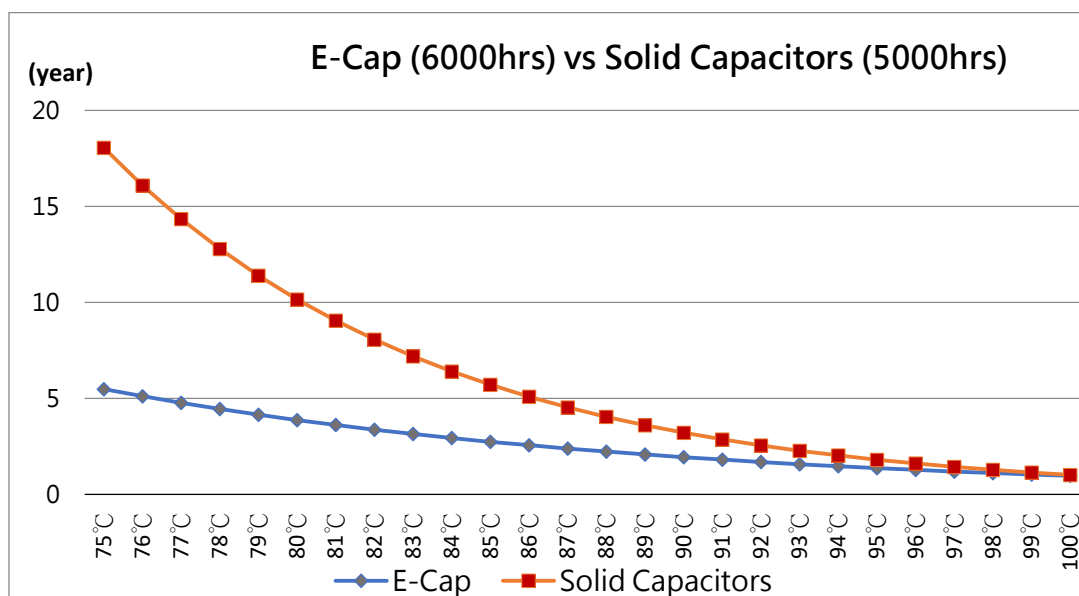


Fig 3. Life cycle curve comparison



Obviously, Aluminum Solid Capacitor has more advantages. However, taking cost and high voltage withstand ability into consideration; only part of the designer will implement Aluminum Solid Capacitor when there is a demand for compact size and long life cycle. Using Aluminum Solid Capacitor does not guarantee a long life cycle, but to choose properly according to customers' application and operating environment. For better evaluation of the life cycle calculation, you may refer to product test report.

Reference :

1 <https://kknews.cc/zh-tw/digital/2br25by.html>

2 https://www.flying1688.com/news_detail_36.htm