ALUMINUM ELECTROLYTIC CAPACITORS

TECHNICAL NOTE

$$V_1\ [\frac{1}{R_1}+\frac{1}{R_B}]=V_2\ [\frac{1}{R_2}+\frac{1}{R_B}] \quad (2)$$

3-2-2 Following formula can be established from preconditions.

$V_2 \leqslant V_0$ (3)
$V_1=V-V_2$ (4)
$=2aV_0-V_2$ (4')
3-2-3 Put formulas (1,), (3) and (4') in formula (2).

$$(2aV_0-V_2)\ [\frac{R_1+R_B}{R_1\cdot R_B}]=V_2\ [\frac{bR_1+R_B}{bR_1\cdot R_B}]$$

$2abV_0(R_1+R_B)=V2\ \{b\ (R_1+R_B)+bR_1+R_B\}$
$2ab(R_1+R_B)\leqslant 2b\ R_1+(1+b)\ R_B$
Accordingly, balance resistance Rs shall be the following formula.

$$R_B \leqslant 2b\ R_1\ \frac{(1-a)}{(2a-1)\cdot b-1}$$

3-3 Calculation Example
Calculation the value of the balance resistance in the case of connecting two 400V 470μF (LC standard value: 1.88mA) capacitors in series.

$$R_1=\frac{400(V)}{1.88(mA)}=2.13(K\Omega)$$

If a=0.8, 400(V) x2x0.8=640(V) as an impressed voltage.
If b=2, $R_2=b\ R_1=426(K\Omega)$, LC=0.94(mA).
Balance resistance R_B will be:

$$R_B \leqslant 2x2x213(K\Omega)\ \frac{1-0.8}{(2x0.8-1)x2-1}=852(K\Omega)$$

4 Regarding Recovery Voltage

After charging and then discharging the aluminum electrolytic capacitor, and further causing short-circuit to the terminals and leave them alone, the voltage between the two terminals will rise again after some interval. Voltage caused in such case is called recovery voltage. Following is the process that causes this phenomenon:
. When the voltage is impressed on a dielectric, electrical transformation will be caused inside the dielectric due to dielectric action, and electrification will occur in positive-negative opposite to the voltage impressed on the surface of the dielectric. This phenomenon is called polarization action.
. After the voltage is impressed with this polarization action, and if the terminals are discharged till the terminal voltage reaches 0 and are left open for a while, an electric potential will arise between the two terminals and thus causes recovery voltage.
. Recovery voltage comes to a peak around 10 to 20 days after the two terminals are left open, and then gradually declines. Recovery voltage has a tendency to become bigger as the component (stand-alone base type) becomes bigger.
. If the two terminals are short-circuit after the recovery voltage as generated, a spark may scare the workers working in the assembly line, and may put low-voltage driven components (CPU, memory, etc) in danger of being destroyed. Measures to prevent this is to discharge the accumulated electric charge with resistor of about 100 to 1KΩ before using,or ship out by making the terminals in short-circuit condition by covering them with an aluminum foil at the production stage. Please consult us for adequate procedures.

$$V_1\ [\frac{1}{R_1}+\frac{1}{R_B}]=V_2\ [\frac{1}{R_2}+\frac{1}{R_B}] \quad (2)$$

3-2-2 由已知条件可以推出下列公式：

$V_2 \leqslant V_0$ (3)
$V_1=V-V_2$ (4)
$=2aV_0-V_2$ (4')
3-2-3 将(1,), (3)以及(4')代入(2)，可得；

$$(2aV_0-V_2)\ [\frac{R_1+R_B}{R_1\cdot R_B}]=V_2\ [\frac{bR_1+R_B}{bR_1\cdot R_B}]$$

$2abV_0(R_1+R_B)=V_2\ \{b\ (R_1+R_B)+bR_1+R_B\}$
$2ab(R_1+R_B)\leqslant 2b\ R_1+(1+b)\ R_B$
因此，平衡电阻R_B可表示如下：

$$R_B \leqslant 2b\ R_1\ \frac{(1-a)}{(2a-1)\cdot b-1}$$

3-3 举例
两个400V 470μF 的电容器相串联的情况下的平衡电阻的推导：
（漏电流的标称值为1.88mA）

$$R_1=\frac{400(V)}{1.88(mA)}=2.13(K\Omega)$$

如果，a=0.8, 印加电压为400(V) x2x0.8=640(V)
若b=2, $R_2=b\ R_1=426(K\Omega)$, LC=0.94(mA).
均衡电阻R_B为：

$$R_B \leqslant 2x2x213(K\Omega)\ \frac{1-0.8}{(2x0.8-1)x2-1}=852(K\Omega)$$

4 冗余电压

铝电解电容器先充电，再放电，而后将两引线短接，再将其放置一段时间后，两端子间存在电压上升的现象；由这种现象所引起的电压称之为再生电压。下面介绍一下产生这种现象的过程。

当电压施加在介质之上时，在介质内部引起电子的转移，从而在介质内部产生感应电场，其方向与电压的方向相反，这种现象称之为极化反应。

在施加电压引起介质极化后，如果两端子进行放电一直到端子间的电压为零，尔后将其开路放置一段时间后，一种潜在的电势将出现在两端子上，这样就引起了再生电压。
再生电压在电容器开路放置10~20天时达到峰值，然后逐渐降低，再生电压有随元件变大而增大的趋势（基板自立形）

如果电容器在产生再生电压后，两端子短路，瞬间高电压放电可能引起组装线上的操作员工的恐惧感，并且，有可能导致一些低压驱动元件（如CPU，存储器等）被击穿的危险，预防出现这种情况的措施是在使用前加100Ω~1KΩ的电阻进行放电，或者在产品包装中用铝箔覆盖引起两端子间短路放电。如需更详细的解答，请与我们联系。