承 認 書

SPECIFICATION FOR APPROVAL

客戶名稱：
CUSTOMERS:

品名規格：
SPECIFICATION: SK 47uF/160V 10*17mm 黑色白字 5000H

產品料號：
SUPPLIER P/N: WSK160M470G17S50

客戶料號：
CUSTOMER P/N:

承认日期：
APPROVAL date: 2026/09/20

BUYER`S STAMP	Approval by (Please return one copy after approved ; 承认后请寄回一份给我司)			

WHC STAMP	Submitted by			
	Approval	Check	Affirm	Design
湖南建顺电子有限公司 工程专用章	工程部 2026.09.20 张成伟	工程部 2026.09.20 熊仙平	工程部 2026.09.20 张 旗	工程部 2026.09.20 王代琴

World、High quality、Capacitor

electrolytic capacitors

Halogen Free RoHS COMPLIANT Environmental-Benefit Products

制造商：湖南建順電子有限公司

Manufacturer：Hunan JianShun Electronics Co.LTD

服务商：东莞市奥炳科技有限公司

Vendor ：Dongguan Aobing Technology Co., Ltd.

Explaination of parts numbers
for Aluminum Electrolytic Capacitors

W	SK	025	M	102	G	17	S	50

SERIES:

W:WHC
K:旧版

SERIES NAME:

See Catalongue Index Table

RATE VOLTAGE:

Rate Voltages is Shown:
In Volts
006=6.3V
010=10V
100=100V

CAPACITANCE TOLERANCE:

J=	±5%
K=	±10%
M=	±20%
A=	-0%~+20%
D=	-5%~+20%
V=	-10%~+20%
Q=	-10%~+30%
T=	-10%~+50%
E=	-15%~+20%
I=	-30%~+20%
B=	+10%~+30%
N=	+10%~+25%

RATE CAPACITANCE:

0R1=0.1uF
1R0=1uF
100=10uF
101=100uF
102=1000uF
103=10000uF
223=22000uF

LENGTH OF AL. CASE:

Two digits indicate integer, EX: 07=7mm

The following codes indicate containing decimal, EX:A6=7.7mm

A1	5.4	B1	10.2
A2	5.8	B2	10.4
A3	6.2	B3	10.5
A4	6.7	B4	12.2
A5	7.5	B5	12.5
A6	7.7	B6	13.5
A7		B7	16.5
A8		B8	21.5
A9		B9	

TYPE CODE DESCRIPTION:

RADIA	P	Taping(Ammo pack)
	R	Taping(Reel Pack)
	C	Lead Cut
	D	Lead Cut and Crimp
	F	Lead Forming Cut
	H	Lead Forming Cut and Crimp
	B	Forming Only
	S	Long Lead
	L	Bended lead of 90^0
Lug	G	LG Type Terminal
	Y	Snap in Terminal
	W	Screw Terminal

Diameter (Φ)	Code	Diameter (Φ)	Code
3	B	25	N
4	C	30	O
5	D	35	P
6.3	E	40	Q
8	F	51	R
10	G	64	S
12	H	76	T
12.5	X	90	U
13	I	100	V
16	J		
18	K		
20	L		
22	M		

LEAD SPACE

10:1.0mm
15:1.5mm
20:2.0mm
46:4.6mm
75:7.5mm

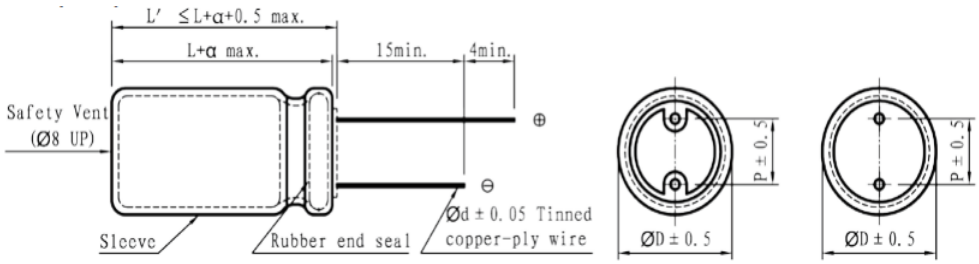
DIMENSIONS(mm)

Customer :	Electrolytic Capacitors SK Series

Electric Characteristics:

P/N	WHC P/N	Cap. 120Hz (uF)	Cap. Tol. (%)	Rate Volt. (V-DC)	Surge Volt. (V-DC)	Oper. Temp. (℃)	Nominal Case Size D*L(mm)	Leakage Current Max(uA)	D.F. Max ()	RC 120HZ (mArms)	ESR 100KHZ (Ω) at25℃	Normal service life (Hours)
	WSK160M470G17S50	47	±20	160	200	-40 ∽ +105	10*17	245	0.20	152	/	5000

以下空白



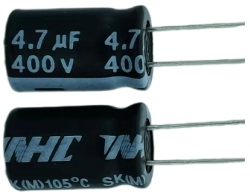
φD	5	6.3	8	10	13	16	18
P	2.0	2.5	3.5	5.0	5.0	7.5	7.5
φd	0.5	0.5	0.5	0.6	0.6	0.8	0.8

α	(L < 16) 1.5 (L ≧ 16) 2.0

Aluminum Electrolytic Capacitor

SK series

・105℃ 5000hours, long life product
. ・RoHS Compliance
・105℃ 5000H 长寿命产品



SPECIFICATIONS

Items 項 目	Characteristics 特 性											
Capacitance Tolerance 靜電容量誤差	± 20%(120Hz.20℃)											
Operating Temperature Range 適用溫度範圍	-40 ~ +105℃					-40 ~ +105℃				-25 ~ +105℃		
Rated Voltage Range 額定電壓範圍	6.3 ~ 100VDC					160 ~ 250VDC				350 ~ 500VDC		
Leakage Current 洩漏電流	I ≦ 0.01CV or 3 (µA) which is greater.(After 2 minutes application of DC rated voltage, at 20 ℃)					I ≦ 0.03CV +20 (µA) (After 3 minutes application of DC rated voltage, at 20 ℃)						
Dissipation Factor 散逸因素(tan δ)	Measurement Frequency: 120Hz. Temperature: 20℃											
	Rated Voltage(V)	6.3	10	16	25	35	50	63	80	100	160~250	350~500
	tan δ(Max)	0.24	0.20	0.16	0.15	0.12	0.10	0.09	0.08	0.08	0.20	0.25
	When nominal capacitance over 1000µF, tanδ shall be added 0.02 to the listed value with increase of every 1000µF .											
Low Temperature Stability 低温特性 Impedance Ratio(Max) 阻抗比率(最大值)	Measurement Frequency: 120Hz.											
	Rated Voltage(V)	6.3	10	16	25	35	50~100		160~250		350~400	450~500
	Z(-25℃)／Z(20℃)	5	4	3	2	2	2		3		6	15
	Z(-40℃)／Z(20℃)	10	8	6	4	3	3		4		-	-
Normal service life 使用壽命	5000hours,with application of rated voltage at 105℃											
	Capacitance Change	Within ± 20% of Initial Value										
	tan δ	200% or less of Initial Specified Value										
	Leakage Current	Initial Specified Value or less										
Shelf Life 放置壽命	The following specifications shall be satisfied when the capacitors are restored to 20℃ after exposing them for 1,000 hours 105℃ without voltage applied. Before the measurement, the capacitor shall be preconditioned by applying voltage according to them 4.1 of JIS C5101-4.											
	Capacitance Change	Within ± 20% of Initial Value										
	tan δ	200% or less of Initial Specified Value										
	Leakage Current	Initial Specified Value or less										
Standards 參照標準	JIS C 5101-4 (IEC 60384)											

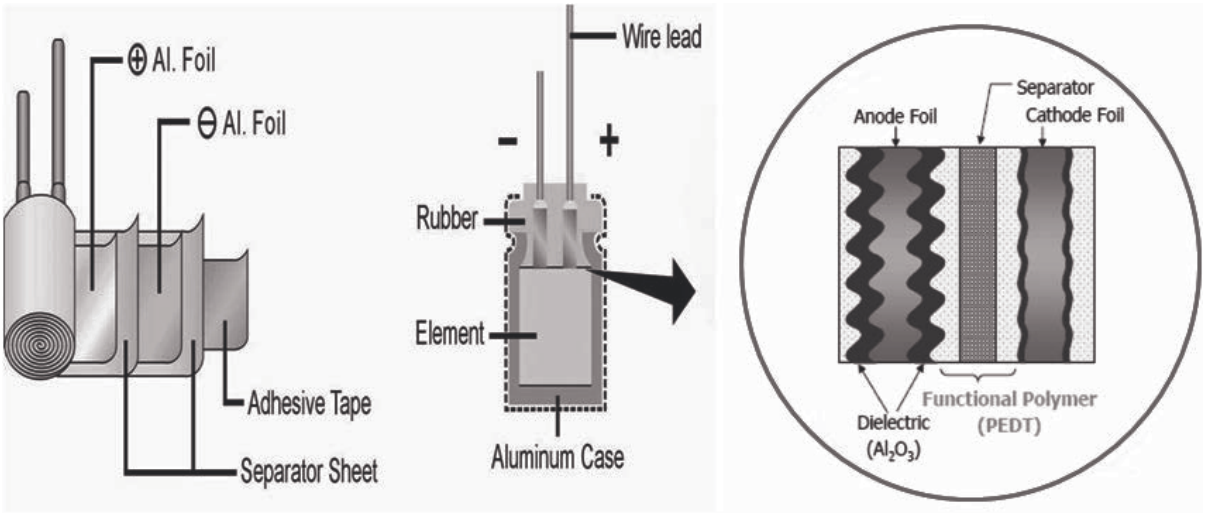
Frequency Coefficient of Permissible Ripple Current

Rated Voltage (V)	Capacitance (µF)	Frequency (Hz)			
		50	120	1K	≦20K
≦ 100	< 100	0.75	1.00	1.57	2.00
	100 ~ 470	0.80	1.00	1.34	1.50
	> 470	0.85	1.00	1.10	1.15
≧ 160	0.47 ~ 470	0.85	1.00	1.40	1.50

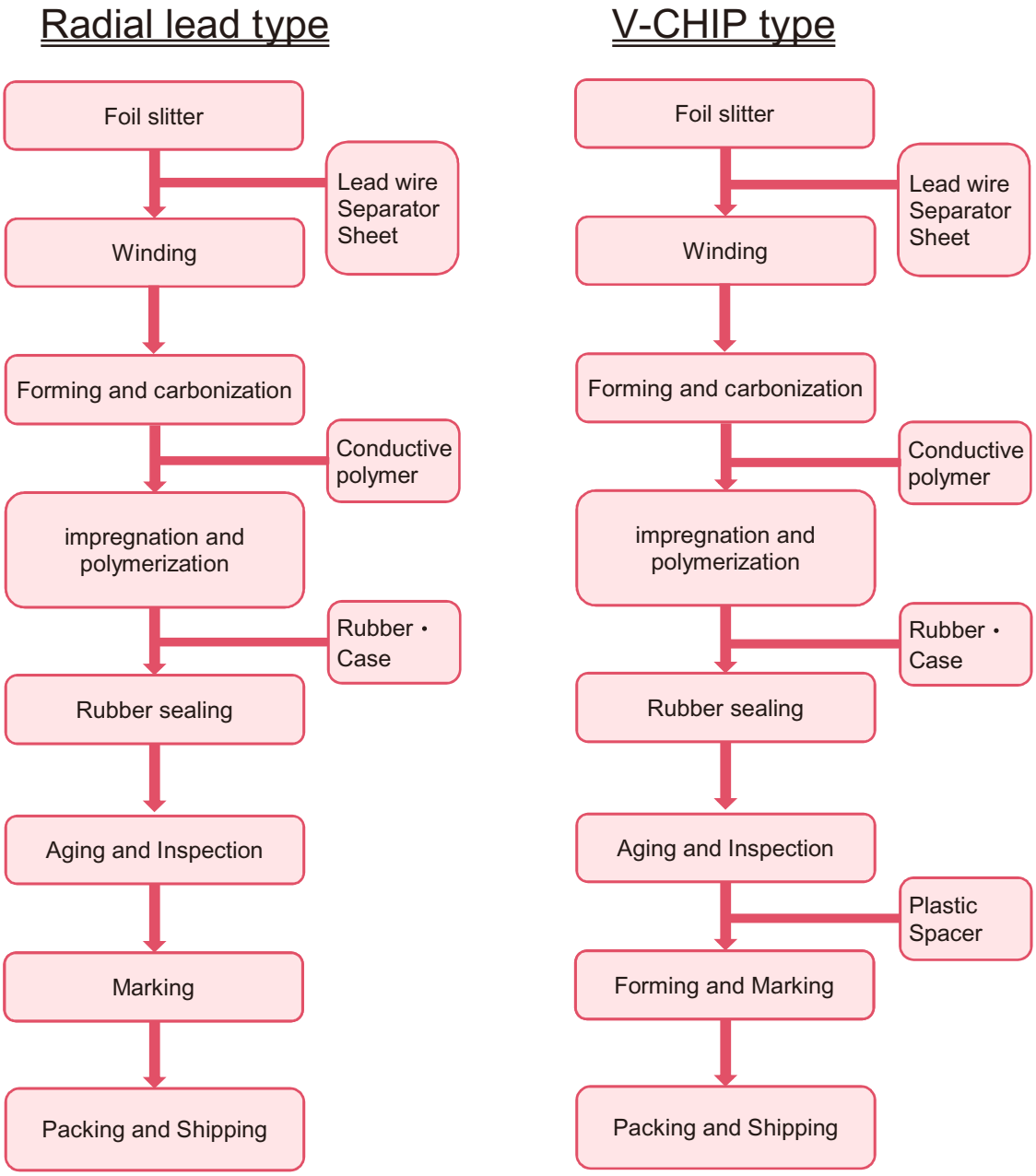
The endurance of capacitors is reduced with internal heating produced by ripple current at the rate of halving the lifetime with every 5℃ rise.
When long life performance is required in actual use , the rms ripple current has to be reduced.

Aluminum Electrolytic Capacitor

■Basic structure



■Manufacturing Method

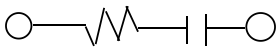
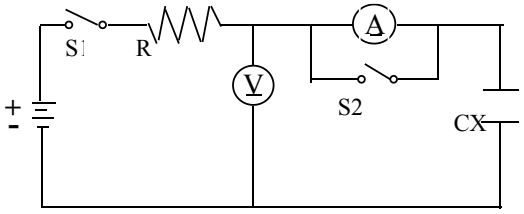


1. Scope 適用范圍 :

This specification applies to aluminium electrolytic capacitor , used in electronic equipment .

本說明對于用電子儀器設備進行檢測之鋁電解電容器 適用.

2. Electrical charateristics 電氣特性 :

NO.	ITEM 項目	TEST METHOD 測試方法	SPECIFICATION 規格
2.1	Rated voltage 額定電壓		Voltage range、capacitance range, see specification of this series. 電壓、容量范圍請看該系列之規格說明.
2.2	Capacitance 靜電容量	1. Measuring frequency : 120 ± 12Hz 測 定 頻 率 2. Measuring voltage : ≦0.5Vrms + 0.5 ~ 2.0VDC 測 定 電 壓 3. Measurement circuit : 〔  〕 測 定 電 路	
2.3	Dissipation factor 散逸因素 (損失角)		
2.4	Leakage current 泄 漏 電 流	DC leakage current shall be measured after 1~2 minutes application of the DC rated working voltage through the 1000 Ω resistor at 20℃. 在20 ℃通過1000Ω的電阻施加直流工作電壓1~2分鍾後測定直流泄漏電流.  R : 1000 ± 100Ω A : DC current meter 直流電流計 V : DC voltage meter 直流電壓計 S1 : Swich 開關 S2 : Swich for protect of current meter 直流電流計的保護開關 CX : Testing capacitor 測試電容	Dissipation factor、leakage current, see specification of this series. 損失角、泄漏電流請看該系列之規格說明.
2.5	Temperature characteristics 溫度特性	STEP 步驟 / TEMPERATURE 溫 度 / STORAGE TIME 放置時間 1 / 20 ± 2 ℃ / 30 minutes 2 / -40 ± 3 ℃ / 2 hours 3 / 20 ± 2 ℃ / 15 minutes 4 / 105 ± 2℃ / 2 hours Step 1. Measure the capacitance and impedance. 測定靜電容量及阻抗 (Z_{r0}) . (| Z | , 20℃ , 120Hz ± 10%) Step 2. Measure the impedance at thermal balance after 2 hours. 達到熱平衡2小時後測定阻抗 (Zr) . (| Z | , -40℃, 120Hz ± 10%) Step 4. Measure the capacitance and leakage current at thermal balance after 2 hours. 達到熱平衡2小時後測定靜電容量及漏電流 .	Step 2. Impedance ratio (Zr / Z_{r0}) less than specified value. 阻抗比 : 低于規定值 . Step 4 Capacitance change : within ± 20% of the initial measured value. 靜電容量變化 : 最初測定值的 ± 20%以內. Leakage current : Less than 10 times of initial specified value . 泄漏電漏:初期規格值的10倍以下.

NO.	ITEM 項目	TEST METHOD 測試方法	SPECIFICATION 規格
2.6	Surge test 突波試驗	Rated surge voltage shall be applied (swich on) for 30 ± 5 seconds and then shall be applied (swich off) with discharge for 5 ± 0.5 min at room temperature . This cycle shall be repeated for 1000 cycles . Duration of one cycle is 6 ± 0.5 minutes . 在常溫下施加 (合上開關) 額定涌浪電壓 30 ± 5 秒, 然後停止施加 (斷開開關) 涌浪電壓並且放電 5 ± 0.5 分鍾. 這個循環要重复 1000 次 . 以 6 ± 0.5 分鍾為一個循環周期 .	Capacitance change : within ± 20% of the initial specified value. 靜電容量變化 : 最初規定值的 ± 20%以內. Dissipation factor : lessthan 200% of the initial specified value. 損失角 : 低于最初規定值的 200%. Leakage current : within initial specified value. 泄漏電流:在最初規定值以內
2.7	APPLICABLE RIPPLE CURRENT 最大紋波電流測試	The maximum A.C.current having frequency of 100K Hz which can be applied to the capacitor at 105±2℃ continuously.Peak voltage not to exceed rated D.C.voltage. 在100K HZ頻率條件下施加最大的紋波電流,溫度105±2℃.施加的AC及DC偏壓不能超過DC電壓.	

3. Mechanical characteristics 機械特性 :

NO.	ITEM 項目	TEST METHOD 測試方法	SPECIFICATION 規格
3.1	Lead strength 端 子 強 度	(A) Tensile strength 拉伸強度 : wire lead terminal 導針型 : d (mm) ≦0.45 / 0.5 ~ 0.8 / 0.8＜d≦1.25 load (Kg) 0.51 / 1.0 / 2.0 snap-in terminal 尖腳型 : d (mm) snap-in terminal 尖腳端子 load (Kg) 2.0 The capacitor shall withstand the constant tensile force specified between the body and each lead for 10 seconds without damage either mechanical or electrical. 電容器各端子要承受規定的荷重 10 秒, 不能有電氣或機械特性上的損傷. (B) Bending strength 彎曲強度 : wire lead terminal 導針型 : d (mm) ≦0.45 / 0.5 ~ 0.8 / 0.8＜d≦1.25 load (Kg) 0.25 / 0.51 / 1.0 snap-in terminal 尖腳型 : cross section area of terminal 端 子 截 面 積 (mm²) / force 拉伸力 (Kg) 0.5＜S≦1 / 1.0 S＞1 / 2.5 With the capacitor in a vertical position appliy the load specified axially to each lead . The capacitor shall be rotated slowly from the vertical to the horizontal position , back to the vertical position . The 90° in the opposite direction and back the original position . Performance of capacitor shall not have changed and leads shall be undaaged . 給在豎直位置的電容器的每一端子以軸方向施加規定荷重 , 慢慢將電容器由豎直位置轉至水平位置. 然後向相反方向彎曲 90° , 再回到原來位置. 電容器性能不能有變化及端子不能有損傷.	When the capacitance is measured, there shall be no intermittent contacts, or open- or short- circuiting. 測定靜電容量時, 不能有接觸不良, 開路或短路. There shall be no such mechanical damage as terminal damage etc. 不能有如端子受損之類的機械特性上的損傷.

NO.	ITEM 項目	TEST METHOD 測試方法	SPECIFICATION 規格
3.2	Vibration resistance 耐振性	The frequancy of the vibration shall vary uniformly within the range 10 to 55 Hz with the amplitude of 1.5 mm , completing the cycle in the internal of one minute . The capacitor shall be securely mounted by its leads with hold the body of capacitor . The capacitor shall be vibrated in three mutually perpendicular directions for a period of 2 hours in each direction . 振動頻率要均勻 , 范圍為 10 Hz, 到 55 Hz , 振幅為 1.5 mm , 在 1 分鍾內完成該循環 . 電容器將由端子牢固地固定 . 電容器會被向三個互相垂直的方向每個方向振動 2 小時 .	Capacitance : no unsteady . 靜電容量 ： 穩定 . Appearance : no abnormal . 外 觀 : 無異常 . Capacitance change : within ± 5% of initial measured value . 容量變化 : 最初測得值的 ± 5% 之內 .
3.3	Solderability 焊錫性	The leads are dipped in the solder bath of Sn at 260 ± 5 ℃ for 2 ± 0.5 seconds . The dipping depth should be set at 1.5 ~ 2.0 mm . 端子浸沒在 260 ± 5 ℃ 的錫焊液中 2 ± 0.5 秒 . 浸沒深度設定為 1.5 ~ 2.0 mm .	The solder alloy shall cover the 95% or more of the dipped lead's area . 錫液要覆蓋導針浸入表面積的 95% 以上 .

4. Reliability 信賴度 .

NO.	ITEM 項目	TEST METHOD 測試方法	SPECIFICATION 規格
4.1	Soldering heat resistance 焊錫耐熱性	The leads immerse in the solder bath of Sn at 260 ± 5 ℃ for 10 ± 1 seconds until a distance of 1.5 ~ 2mm from the case . 導針在 260 ± 5 ℃ 的錫 焊液中浸沒至離本體 1.5 ~ 2 mm 的地方 10 ± 1 秒鍾 .	No damage or leakage of electrolyte . 無損傷或電解液漏出 . Capacitance change : within ± 10% of the initial measured value . 容量變化 : 最初測定值的 ± 10%以內 . Tan δ : less than specified value . 損失角 : 低于規定值 . Leakage current : less than specified value . 泄漏電流 : 低于規定值 .
4.2	Damp heat (steady state) 耐濕性 (穩定狀態)	Subject the capacitors to 40 ± 2 ℃ and 90% to 95% relative humidity for 240 ± 8 hours . 電容器在 40 ± 2 ℃ 及相對濕度 90% 到 95% 的條件下經歷 240 ± 8 小時 .	Capacitance change : within ± 10% of the initial measured value . 容量變化 : 最初測定值的 ± 10%以內 . Tan δ : less than specified value . 損失角 : 低于規定值 . Leakage current : less than specified value . 泄漏電流 : 低于規定值 .

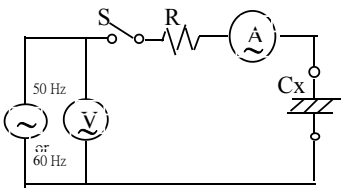
<table>
<tr><th>NO.</th><th>ITEM 項目</th><th>TEST METHOD 測試方法</th><th>SPECIFICATION 規格</th></tr>
<tr><td>4.3</td><td>Load life
高溫負荷</td><td>After X hours continuous application of DC rated working voltage at 105 ± 2 ℃ , the measurements shall meet the following limits .
Measurements shall be performed after 2 hours exposed at room temperature .
在105 ± 2 ℃ 環境當中連續施加直流定格電壓 X小時後 , 按以下條件測試 .

(X: see specification of this series. 見該系列規格說明 .)</td><td rowspan="2">Standard of judgement is according to requirement of this series .
判定標準依該系列要求 .</td></tr>
<tr><td>4.4</td><td>Shelf life
高溫無負荷</td><td>After storage for Y hours at 105 ± 2 ℃ without voltage application , the measurements shall meet the following limits .
Measurements shall be performed after exposed for 1 to 2 hrs at room temperature after application of DC rated voltage to the capacitor for Z minutes .
在 105 ± 2 ℃ 環境當中不施加直流定格電壓放置Y 小時 , 按以下條件測試 .
測試在室溫露置 1 到 2 小時 , 施加直流定格電壓 Z 分鍾後進行 .
(Y . Z : see specification of this series. 見該系列規格說明 .)</td></tr>
<tr><td>4.5</td><td>Storage at low temperature
低 溫 貯 存</td><td>The capacitor shall be stored at temperature of -40 ± 3 ℃ for 240 ± 8 hours , during which time no voltage shall be applied . And then the capacitor shall be subjected to standard atmospheric conditions for 16 hours or more , after which measurements shall be made .

電容器在 -40 ± 3 ℃ 環境當中貯存240 ± 8 小時 , 其間不施加電壓 .
之後 , 在標準大气壓中露置 16 小時以上 , 然後進行測試 .</td><td>Capacitance change :
within ± 10% of the initial value .
容量變化 : 最初值的 ± 10% 以內 .

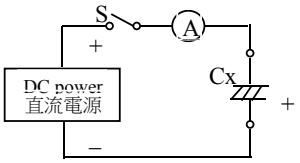
Tan δ :
less than specified value .
損失角 : 低于規定值 .

Leakage current :
less than specified value .
泄漏電流 : 低于規定值 .

Appearance : no abnormal .
外 觀 : 無異常 .</td></tr>
<tr><td>4.6</td><td>Pressure relief
防 爆 試 驗</td><td>AC test 交流試驗 :
Applied voltage : AC voltage not exceeding 0.7 times of the rated direct voltage or 250 V AC whichever is the lower .
施 加 電 壓 : 不超過定格電壓 0.7 倍的交流電壓或低于交流電壓 250 V 的任意電壓 .
Frequency 頻率 : 50 Hz or 60 Hz .
Series resitor : refer to the table below .
串 聯 阻 抗 : 參照下表 .
<table>
<tr><th>Capacitance (C)
容 量</th><th>Series resistor
串 聯 阻 抗</th></tr>
<tr><td>C ≦ 1 μF</td><td>1000 Ω</td></tr>
<tr><td>1 μF ＜ C ≦ 10 μF</td><td>100 Ω</td></tr>
<tr><td>10 μF ＜ C ≦ 100 μF</td><td>10 Ω</td></tr>
<tr><td>100 μF ＜ C ≦ 1000 μF</td><td>1 Ω</td></tr>
<tr><td>1000 μF ＜ C ≦ 10000 μF</td><td>0.1 Ω</td></tr>
<tr><td>10000 μF ＜ C</td><td>*</td></tr>
</table>
* Resistance is equivalent to a half impedance by test frequency .
相當于試驗頻率的一半阻抗值 .</td><td>AC test circuit 交流試驗回路
 

: AC power 交流電源
S : Swich 開關
V : AC voltage meter 交 流 電 壓 計
A : AC current meter 交 流 電 流 計
R : protection resistor 保護電阻

Cx : testing capacitor 供試電容器</td></tr>
</table>

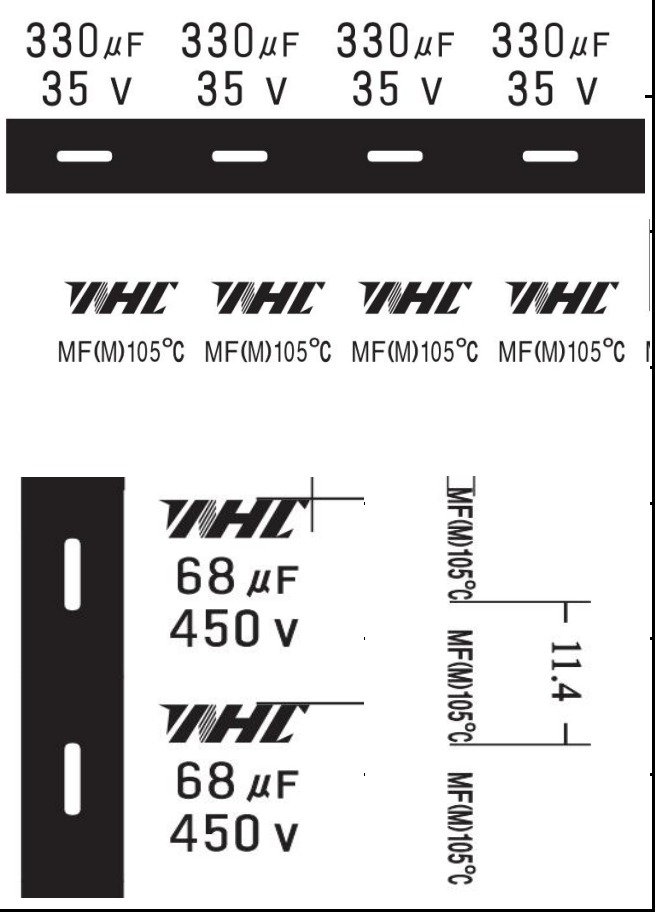
NO.	ITEM 項目	TEST METHOD 測試方法	SPECIFICATION 規格
4.6	Pressure relief 防 爆 試 驗	DC test 直流測試 : Send the following electricitios while applying the inverse voltage . 施加反向電壓時通入下記電流 . where case size 外殼尺寸 (D 直徑) : D ≦ 22.4 mm : 1 A d.c. max D ＞ 22.4 mm : 10 A d.c. max Note : 1. This requirement applies to capacitors with a diameter of 6 mm or more . the test may be ended . 注 : 1. 此要求對于直徑 6 mm 或以上之電容器適用 . 2. 試驗開始 , 經 30 分鍾後防爆裝置仍不動作 , 試驗終止 .	DC test circuit 直流試驗回路  S : Swich 開關 (A) : DC current meter 直 流 電 流 計 Cx : testing capacitor 供 試 電 容 器 of fire or explosion of capacitor elements (terminal and metal foil etc) or cover . 防爆裝置必須動作 , 以防止發生火災 、爆炸或金屬片飛濺 .

5 Marking 標識 :

Marking on capacitors include :

電容器上的標識包括

- trade-mark 商標 **WHC**
- Working voltage 工作電壓 例如 **35v**
- Norminal capacitance 標準靜電容量 例如 **330uF**
- Tolerance 靜電容量許容差 例如 **M**
- Polarity 負極线
- Operating temperature range 工作溫度范圍, 例如 **105℃**
- Product seriation 产品系列, 例如 **MF**



鋁電解電容器存放環境與控制
Storage Conditions and Control for Aluminum Electrolytic Capacitor

1. 環境溫度：5℃ ~ 35℃，環境相對濕度：75%以下 .

Store the capacitor at a temperature of 5℃ to 35℃ and at a relative humidity of less than 75% .

2. 存放環境不應有陽光直射，不宜高溫 .

Store the capacitor in low temperature places free from direct sun shine .

3. 存放環境不能有鹽分、油含量高的霧气 .

Store the capacitor in places free from oil vapor、salt water vapor.

4. 存放在遠離氯气、氨气、硫化氫、亞硫酸、硝酸等有害氣體含量高的地方 .

Store the capacitor in places far from toxic gases (chlorine、ammonium、 hydrogen sulfide、 sulphurous acid、nitric acid , etc)

5. 儲存環境不能有臭氧、紫外線或幅射.

Store the capacitor in place free from Ozone、ultraviolet ray or radiation .

使用清潔劑之注意事項 :
Detergent needing attention:

鋁質電解電容器會受含有碳化氫鹵素容劑之侵蝕 , 下列為各種安全與不安全之清潔劑 , 為避免不必要的損失 , 您所使用有關印刷基板之清潔劑名請事先告知本公司 .

Hydrogen carbide liquid and halogen liquid can cause Aluminium Electrolytic Capacitor to corrode. Some of Safe and Unsafe detergent are as follows;

Safe 安全	Unsafe 不安全
Dimethybenxene 二甲苯	**1.1.2- Trichloroethane** **1.1.2-** 三氯乙烷
Methanol 甲醇	**Tetrachloroethylene** 四氯化碳
Ethanol 乙醇	**Chloroform(colorless volatilizable liquid)** 哥羅仿(無色揮發性液體)
Propanol 丙醇	**Dichloromethane** 二氯甲烷
Butanol 丁醇	**Trichlorelethylene** 三氯甲烯
Detergent 去垢劑	

Application Guidelines For Aluminum Electroytic Capacitors

鋁電解電容器使用需知

一、電路設計的注意事項

1. 在確認使用環境及安裝環境的基礎上，在電容器的產品目錄及規格書上所規定的性能範圍內進行設計。

2. 在設計上，應該避免在下述情況下使用：

   (1) 不可超過電容器的最高使用溫度。

   (2) 不可有超過額定紋波電流的電流通過。

   (3) 不可有超過額定電壓的電壓通過電容器。

   a.要注意紋波電壓 (交流部分)重疊到直流電壓上時的峰值不可超過額定電壓。

   b.當兩個電容器串聯時，通過各個電容器的電壓不可超過額定電壓。此時，要在各個電容器上並聯用於防止漏損電流的分壓電阻器。

   (4) 電容器為極性電容器。要確認有無連接反向電壓或交流電壓。在極性反轉電路中請用雙極用性電容器，但是雙極性電容器也不可以用於交流電路。

3. 進行電路設計時，請選用與機器壽命相符的電容器。

4. 在需要重複進行急速充放電的電路中請選用與條件相符的電容器。

5. 電容器的外殼、輔助引出端子與正、負極以及電路板間必須完全隔離。

6. 當電容器套管的絕緣不能保證時，在有絕緣性能特定要求的地方請不要使用。需要外套具有絕緣功能時請諮詢我們。

7. 電容器如果在以下環境中使用，可能會發生故障。

   (1) 直接與水、油類、鹽水相接觸的環境或高溫高濕或結露的環境。

   (2) 充滿有毒氣體(硫化物、亞硫酸、亞硝酸、氯氣、氨水等)的環境。

   (3) 不能置於日照、O_3、紫外線及有放射性物質環境下使用。

   (4) 有酸性及鹼性溶劑濺落的環境。

一、Caution During Circuit Design

1. Please make sure the application and mounting conditions to which the capacitor will be exposed are within the conditions specified in the catalog or alternate product specification (Referred as to specification here after).

2. Design Aluminum Electrolytic Capacitors, please pay attention to the points listed below:

   (1) The capacitor shall not be used in an ambient temperature which exceeds the operating temperature specified in the specification.

   (2) Do not apply excessive current which exceeds the allowable ripple current.

   (3) Make sure that no excess voltage (that is higher than the rated voltage) is applied to the capacitor.

   a. Please pay attention that the peak voltage, which is DC voltage overlapped by ripple current, should not exceed the rated voltage.

   b. In the case where more than 2 aluminum electrolytic capacitors are used in series, please make sure that applied voltage will be lower than rated voltage and the voltage be will applied to each capacitor equally using a balancing resistor in parallel with the capacitors.

   (4) Aluminum electrolytic capacitors are polarized. Make sure that no reverse voltage or AC voltage is applied to the capacitors. Please apply bi-polarited capacitor to reverse polarity circuit but bi-polarited capacitors can not be applied to AC circuit.

3. Appropriate capacitors which comply with the life requirement of the products should be selected when designing the circuit.

4. For a circuit that repeats rapid charging/discharging of electricity, an appropriate capacitor that is capable of enduring such a condition must be used.

5. Aluminum case, cathode lead wire, anode lead wire and circuit pattern must be isolated .

6. The sleeve of capacitors is not recognized as an insulator, and therefore, the standard capacitor should not be used in a place where insulation function is needed. If you require a higher grade of insulating sleeve, please consult us.

7. Capacitors may fail if they are used under the following conditions:

   (1) Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.

   (2) In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.)

   (3) Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.

   (4) Being exposed to acidic or alkaline solutions.

Application Guidelines For Aluminum Electroytic Capacitors

鋁電解電容器使用需知

(5) 振動或衝擊條件超過交貨仕樣書規定範圍的惡劣環境。.

8. 在設計電容器的安裝時，必須確認下述內容：

(1) 線路板的孔距必須與電容器兩端子的間距相吻合。

(2) 在電容器防爆閥的上方盡量不要安裝配線及其它元件，應在防爆閥的上方保留一定的空間。

(3) 請勿在電容器的四周及電路板的背面 (電容器下面)配置發熱元件。

9. 電容器的電氣特性根據溫度及頻率的變動及變化，請在確認該變化量的基礎上進行電路設計。

10.在雙面印刷板上安裝電容器時，電容器的安裝位置避免多餘的基板孔和過孔。

11.並聯兩個以上的電容器時，要充分考慮電流平衡。

12.串聯兩個以上的電容器時，要充分考慮電壓平衡和插入並聯用分壓相抗。

二、安裝的注意事項

1. 除了定期點檢時為檢測電氣性能而拆卸的電容器外，對組裝到設備上已經通電的電容器，拆除後均不能再使用。

2. 當電容器產生再生電壓時，請通過約1KΩ的電阻器進行放電。

3. 長期保存的電容器，需通過約1KΩ的電阻加壓處理。

4. 請確認電容器的規格(靜電容量及額定電壓)及極性後，才可進行安裝。

5. 掉落在地上的電容器及本體已經變形的電容器，請勿再使用。

6. 安裝時請確認電路板的孔距是否與電容器兩端子的間距吻合。

7. 自動插入機扭結固定電容器引線的強度不可過大。

8. 焊接時請注意以下內容：

(1) 焊接條件(溫度、時間)不可超出承認書中所規定的範圍。

(2) 請勿讓烙鐵的烙鐵頭接觸到電容器的本體及不要將電容器本體浸入焊錫溶液中。

(5) Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.

8. In designing a circuit, the following matters should be ensured in advance to the capacitor assembly on the P.C. board.

(1) Design the appropriate hole spacing to match the lead pitch of capacitors.

(2) Do not locate any wiring and circuit patterns directly above the capacitor vent. Ensure enough free space above the capacitor vent.

(3) Do not design a circuit board so that heat generating components are placed near an aluminum electrolytic capacitor or reverse side of P.C. board (under the capacitor).

9. Electrical characteristics may vary depending on changes in temperature and frequency. Please consider this variation when you design circuits.

10.When you mount capacitors on the double-sided P.C. boards, avoid excess substrate holes and vias to capacitor location.

11.When you install more than 2 capacitors in parallel, consider the balance of current flowing through the capacitors.

12.If more than 2 aluminum electrolytic capacitors are used in series, make sure the applied voltage will be lower than the rated voltage and that voltage will be applied to each capacitor equally using a balancing resistor in parallel with each capacitor.

二、Caution For Assembling Capacitors

1. Once a capacitor has been assembled in the set and power applied, even if a capacitor is discharged, an electric potential (restricting voltage) may exist between the terminals.

2. Electric potential between positive and negative terminal may exist as a result of returned electromotive force, so please discharge the capacitor using a 1KΩ resistor.

3. Leakage current of aluminum electrolytic capacitors may be increased during long storage time. In this case, the capacitors should be subjected to voltage treatment a 1K Ω resistor before using.

4. Please confirm ratings (voltage and capacitance) and polarity before in stalling capacitors on the P.C. board.

5. Do not drop capacitors on the floors and damage, nor use a capacitors that was dropped.

6. Please confirm that lead spacing of the capacitor matches the hole spacing of the P.C. board prior to installation.

7. Please pay attention that the clinch force is not too strong when capacitors are placed and fixed by an automatic insertion machine.

8. Soldering

(1) Soldering condition (temperature and times) must be confirmed to be within Su'scon specification.

(2) Soldering iron should never touch the capacitors body and do not dip capacitors body into melted solder.

(3) 在進行焊接時，避免其它物件倒下碰到電容器。

(4) 在進行焊接時，除端子外電容器其它部位不可附著有焊劑。

9. 電容器焊接在電路板後，請注意以下內容：

(1) 不可將電容器本體傾斜、扭轉等。

(2) 不可讓其它物體碰到電容器。

10. 電解電容器不得以鹵化化學藥品類似溶劑，作為電容器洗滌用。

11. 在使用固定劑與塗層劑時，電路板與電容器的封口部之間須乾淨，不可留有焊劑殘渣及汙垢。

三、組裝使用注意事項

1. 不可直接觸摸電容器的端子，有導致觸電的危險。

2. 不可有導電體靠近電容器的兩端子，避免電容器端子之間短路。

3. 裝配了電容器的設備請不要在以下環境中使用：

(1) 直接與水、油類、鹽水相接觸的環境或高溫高濕或結露的環境。

(2) 充滿有毒氣體(硫化物、亞硫酸、亞硝酸、氯氣、氨水等)的環境。

(3) 不能置於日照、O_3、紫外線及有放射性物質環境下使用。

(4) 有酸性及鹼性溶劑濺落的環境。

(5) 振動或衝擊條件超過交貨仕樣書規定範圍的惡劣環境。

四、電容器的保養與檢修

電容器在工業機器中使用時要進行定期檢修，檢修時請注意電容器的外觀及電氣性能是否符合產品的標準。

五、安全注意事項

1. 在設備使用過程中，電容器的防爆閥開裂，並冒出氣體時，應切斷設備的主電源或從設備上拔下電線插頭。

2. 電容器的防爆閥開裂時，因為超過100℃高溫氣體噴出，臉不要接近。噴出的氣體進入眼睛時，立即用水清洗眼睛。如果噴出的電解液濺到皮膚上，請立即使用肥皂進行沖洗。

六、儲存條件

1. 電容器建議在環境溫度5~35 ℃、相對濕度低於75%的條件下存放。

(3) Please avoid contact between other components and the aluminum capacitor.

(4) Please avoid having flux adhere to any portion except the terminal.

9. After Soldering

(1) Do not bend or twist the capacitors body after soldering on P.C. board.

(2) Do not hit the capacitors and isolate capacitors from the P.C. board or other device when stacking P.C. boards in store.

10. Standard Aluminum Electrolytic Capacitors should be free from halogenated solvents during P.C. board cleaning after soldering.

11. Do not use halogenated adhesives and coating materials to fix aluminum electrolytic capacitors.

三、Caution For Assembling Capacitors

1. Do not directly touch terminal by hand.

2. Keep electric conductor off terminals to avoid short circuit.

3. Do not use following conditions for assembling capacitors.

(1) Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.

(2) In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.)

(3) Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.

(4) Being exposed to acidic or alkaline solutions.

(5) Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.

四、Maintenance Inspection

Please periodically inspect the capacitors that are installed in industrial equipment. Remarkable abnormality such as vent operating, leaking electrolyte, etc. Capacitance, dielectric loss tangent, leakage current, and items specified in the specification.

五、Safe Precautions

1. If you see smoke due to operation of safety vent, turn off the main switch or pull out the plug form the outlet.

2. Do not bring your face near the capacitor when the pressure relief vent operates, because the gases emitted from that are over 100℃. If the gas gets into your eyes, please flush your eyes immediately with pure water. If electrolyte exposed on your skin , please wash it with soap and water.

六、Storage

1. It is recommended to keep capacitors between the ambient temperatures of 5℃ to 35℃ and a relative humidity of 75% or below.

Application Guidelines For Aluminum Electroytic Capacitors

鋁電解電容器使用需知

2. 請勿儲存於下列所述的環境中。

(1) 直接與水、油類、鹽水相接觸的環境或高溫高濕或結露的環境。

(2) 充滿有毒氣體(硫化物、亞硫酸、亞硝酸、氯氣、氨水等)的環境。

(3) 不能置於日照、O_3、紫外線及有放射性物質環境下使用。

(4) 有酸性及鹼性溶劑濺落的環境。

(5) 振動或衝擊條件超過交貨仕樣書規定範圍的惡劣環境。

七、廢棄處理

1. 在電容器上開孔或壓碎後焚燒。

2. 電容器不焚燒時，請交給專業的工業廢棄物處理廠處理。

八、特別注意事項

在選用電容器時，如果在產品目錄及規格書中沒有找到符合要求的系列或規格時，請直接與我司的業務部或研發部聯繫，我司可根據客戶的要求開發特殊性能產品。上述鋁電解電容器的使用注意事項依據EIAJRCR-2367B 2002年3月發行的《電子機器用固定鋁電解電容器使用注意事項指南》製作而成，詳情請參照該指南。

2. Confirm that the environment does not have any of the following conditions:

(1) Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.

(2) In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.)

(3) Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.

(4) Being exposed to acidic or alkaline solutions.

(5) Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.

七、Disposal

1. Make a hole the in the capacitor body or crush capacitors and incinerate them.

2. If incineration is not applicable, hand them over to a waste disposal agent and have them buried in a landfill.

八、Special Notice

When choosing capacitors, if clients couldn't find the series or specification in catalogue and data sheet, please contact with our Sales or RD department, we are able to base on clients' needs to develop product with special functions. For further details, please refer to EAIJ RCR-2367B-Guideline of notabilia for fix for use in electronic equipment 〔Technical Standardization Committee on Passive Components (established in March 1995, revised in March 2002)〕

Environment Protection Policy

We are reducing environmentally harmful substances to do our capacitors in global environmental protection activities. Products compatible with Pb-free and products with non-PVC encasing and ROHS Compliance materials are available.

- ROHS Compliance

  Our capacitors do not use any of the materials specifically identified and restricted hazardous material under ROHS Prohibited

  Pb : Lead, Cr6+: Hexavalent chromium, Hg:Mercury, Cd:Cadmium, PBB:Polybrominated biphenyls, PBDE : Polybrominated diphenylethers, PVC:Polyvinyl chloride

- PVC free Capacitors

  We use PET (Polyethylene Terephthalate) sleeve to instead of PVC (Polyvinyl Chloride) sleeve since 2005 January. As there is a size limitation for this counter measure, Please consult our sales representative their availability in big size capacitors.

- Pb-Free Capacitors

  Our Capacitors lead wire and terminal doesn't contain lead.

  We follow up those conditions as rule and standards to use right materials to production capacitors for maintain earth environment everlasting for human.

Effects of ambient temperature to life (for reference)

Because an aluminum electrolytic capacitor is essentially an electrochemical component, increase temperatures accelerate the chemical reaction producing gas within the capacitor, diffuse the gas to outside through the end seal, and consequently accelerate a gradual decrease in capacitance and a guradual increase in tenδ and ESR, the following equation has been experimentally found to express the relationship between the temperature acceleration factor and the deterioration of the capacitor.

$$Lx = Lo.Ktemp = Lo.B^{(To-Tx)/10}$$

Where：

$$Ktemp = B(To-Tx)/10$$

Lx = Life time (hour) of capacitor to be estimated

Lo = Base life time (hour) of capacitor

To = Maximum rated operating temperature (℃) of capacitor shown in catalog

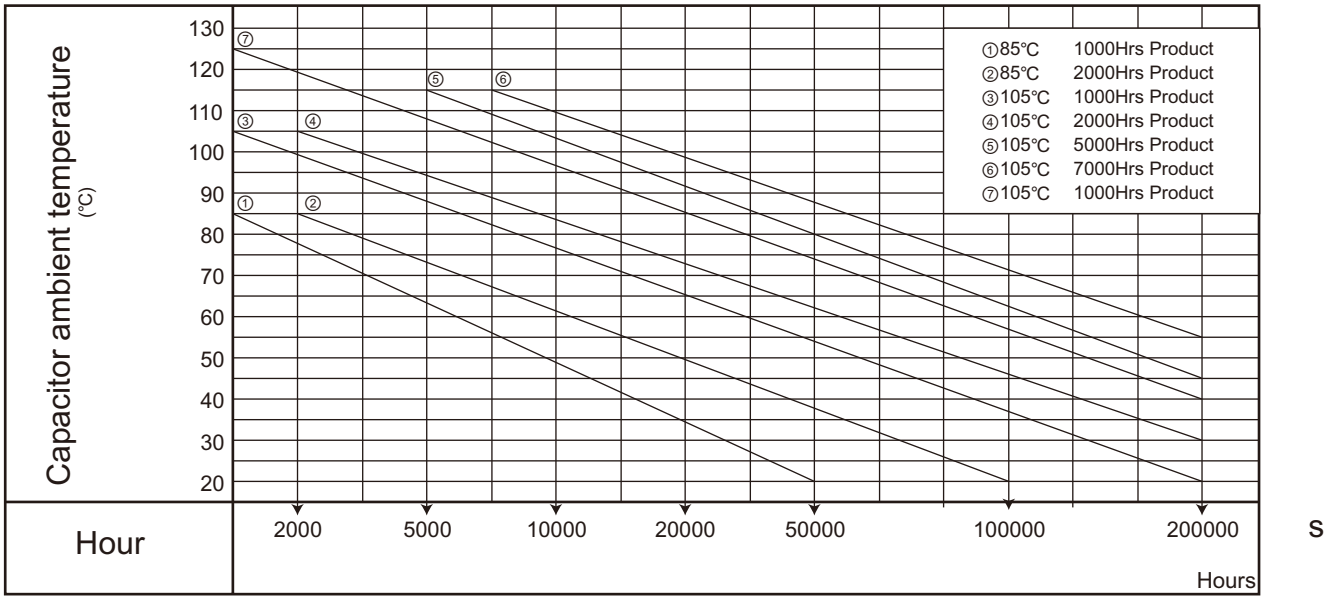
Tx = Actual ambient temperature (℃) of capacitor

B = Temperature acceleration factor (=2)

This equations is similar to Arrehenius equation that express a relationship between chemical reaction rates and temperature and called Arrehenius rule of aluminum electrolytic capacitors.

The temperature acceleration factor (B) is approximately 2 over an ambient temperature range (Tx) from 40 ℃ to the maximum rated operating temperature of the capacitor, and it means that the lifetime is approximately halved with every 10℃ rise in ambient temperature and can be extended by using the capacitors at low temperatures.

For an ambient temperature range (Tx) of 20℃ to 40℃, the factor B will be close to 2, and the lifetime will be actually extended. However, the environment where the devices are placed and their operating conditions influence ambient temperature, and in particular the ambient temperature in this range will be very inconstant. Therefore, a minimum lifetime should be estimated form the above formula by using the 40℃ as Tx.

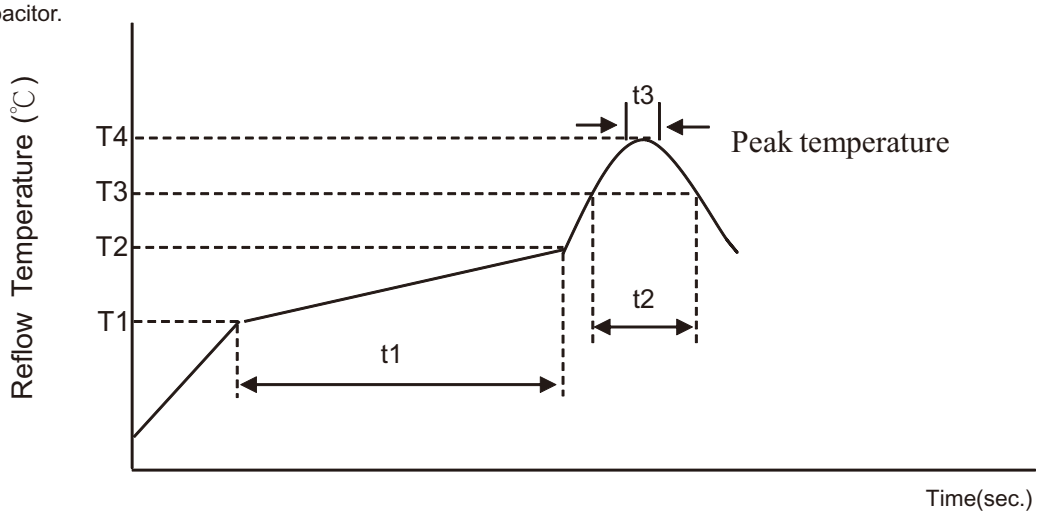


※ 1. A guide limit of the calculated like Aimo is 15 years max

2. Tx ≧40℃

RECOMMENDED PB-FREE REFLOW SOLDERING CONDITIONS

The following conditions are recommended for air or infrared reflow soldering of the surface mount capacitors onto a glass epoxy circuit board of 95 x 50 x 0.8mm (with resist) by cream solder (eutectic solder). The temperatures shown are the surface temperature values of the top of the capacitor.



TEMPERATURE PROFILE

Profile Feature	Pb Free Assembly	
	4~6.3Ø	8~10Ø
Average Ramp-up Rate	3℃/second max.	3℃/second max.
Preheat Temperature Min(T1 min) Temperature Max(T2 max) Time (t1 Max)	 150℃ 180℃ 120sec.	 150℃ 180℃ 120sec.
Ramp-up Rate (T2 ~T3)	3℃/second max.	3℃/second max.
Time maintained above Temperature(T3) Time(t2 Max)	 217℃ 90sec.	 217℃ 40sec.
Peak Temperature(T4)	260℃	245℃
Time(t3 Max)	5sec.	5sec.
Reflow cycles	1	2 or less

Application Guidelines For Aluminum Electroytic Capacitors

鋁電解電容器使用需知

PRECAUTIONS FOR USERS

Soldering method

The capacitors of Alchip-series have no capability to withstand such dip or wave soldering as totally immerses components into a solder bath.

Reflow soldering

Reflow the capacitors within recommended reflow soldering conditions. Verify no temperature stress to the capacitors because the following differences might degrade capacitors electrically and mechanically. Please consult us if other reflow conditions are employed

1. Location of components：Temperature increases at the edge of PC board more than the center.
2. Population of PC board：The less the component population is the more temperature rises.
3. Material of PC board：A ceramic made board needs more heat than a glass epoxy made board.The heat increase may cause damage of the capacitors.
4. Thickness of PC board：A thicker board needs more heat than a thinner board. The heat increase may damage the capacitors.
5. Size of PC board：A larger board needs more heat than a smaller board. The heat increase may damage the capacitors.
6. Location of infrared ray lamps：IR reflow as well as hot plate reflow applies heat only on the reverse side of the PC board to lessen heat stress to the capacitors.
7. Vapor heat transfer systems (VPS) are not recommended.

Rework of soldering

Avoid reflow soldering more than once. Use a soldering iron for rework. Do not exceed an iron tip temperature of 380 ± 10℃ and an exposure time of 3 ± 0.5 seconds.

Mechanical stress

Do not use the capacitors for lifting the PC board and give stress to the capacitor. Avoid bending the PC board. These may damage the capacitors.

Cleaning assembly board

Immediately after solvent cleaning, remove residual solvent for at least 10 minutes with an air knife. The solvent is so insufficiently dry for a long period of time that the capacitors may be cored.

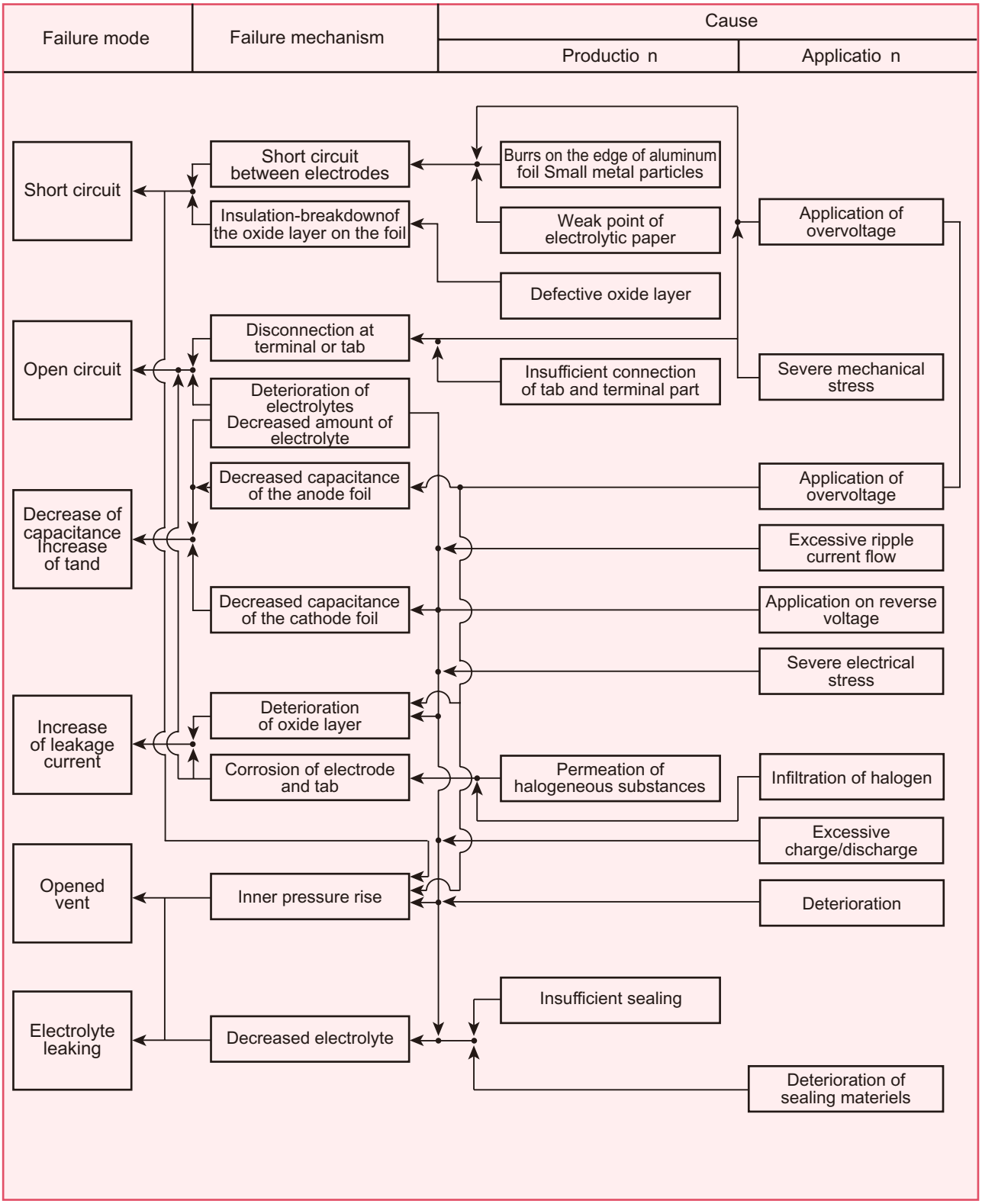
Coating on assembly board

1. Before curing coating material remove the cleaning solvents from the assembly board.
2. Before conformal coating, a chloride free pre-coat material is recommended to use for lessening stress to the capacitors.

Moldering with resin

Internal chemical reaction gradually produces gas in the capacitor; then, internal pressure is increasing. If the end seal of the capacitor is completely molded with a resin. The gas stays inside the capacitor. It will face dangerous situation. The chlorine contained resin will penetrate into the end seal, reach the inside element, and cause damage of the capacitor.

Others

Precautions and Guidelines for Aluminum Electrolytic Capacitors shell be referred.

Analysis of Failure Mode