

**CAUTION FOR PROPER USE OF ALUMINUM ELECTROLYTIC CAPACITORS I**

Upon using Aluminum Electrolytic Capacitors, please pay attention to the points listed below.

When the following types of electrical loads indicated below are applied to Aluminum Electrolytic Capacitors, rapid deterioration of electrical property occurs :

- reverse voltage
- voltage exceeds rated working voltage
- rated ripple current is exceeded
- severe charging/discharging

At such times, severe heat is generated, gas is emitted, then electrolyte leaks from the sealing area, and pressure relief vent operates due to internal pressure.

On some condition, explosion or ignition may occur, and along with destruction of the capacitor combustibles may burst out.

**1.CAUTION DURING CIRCUIT DESIGN****1)OPERATIONAL ENVIRONMENT, MOUNTING ENVIRONMENT AND CONDITIONS.**

- Ensure that operational and mounting conditions follow the specified conditions detailed in the catalog and specification sheets.

**2)OPERATING TEMPERATURE, RIPPLE CURRENT AND LOAD LIFE**

- Operating temperature and applied ripple current should be within the specified value in the catalog or specification sheets.
  - ① Do not use Aluminum Electrolytic Capacitors at temperature which exceeds the specified category temperature range.
  - ② Do not apply excessive current to the capacitors, which exceeds the specified rated ripple current.
- Life time of capacitors can be calculated with "life estimation equation" base on acceleration test results of the capacitors. The life time calculated by the equation is not a guaranteed value as it contains errors and variations. It is recommended to select a capacitor with enough safety factor on the calculation results against expected life of the devices. Please refer to the article from our web-site or consult with us for information regarding "life estimation equation".

**3)APPLICATION**

- Aluminum Electrolytic Capacitors are normally polarized. Reverse voltage or AC voltage should not be applied. When polarity of applied voltage is uncertain or when the polarity may flip over, non-polar type capacitors should be used, but the non-polar type cannot be used for AC circuit.
- Standard Aluminum Electrolytic Capacitors are not suitable for rapid charge and discharge applications. Consult with Rubycon about specially designed capacitors for rapid charge and discharge.

**4)APPLIED VOLTAGE**

- Do not exceed the rated voltage of capacitors.

**5) INSULATION**

- Aluminum Electrolytic Capacitors should be electrically isolated from among the following points.
  - ① Aluminum case, cathode lead wire, anode lead wire and circuit pattern.
  - ② Auxiliary terminals of snap-in type, anode terminal, outward terminal and circuit pattern.
- The sleeve of Aluminum Electrolytic Capacitors is not recognized as an insulator, and therefore, the standard capacitor should not be used in a place where insulation function is needed. Please consult with Rubycon should you require a higher grade of insulating sleeve.

**6) CONDITIONS OF USE**

- The following environment should be avoided when using Aluminum Electrolytic Capacitors.
  - ① Damp conditions such as water, saltwater spray, or oil spray or fumes.  
High humidity or humidity condensation situations.
  - ② Hazardous gas/fumes such as hydrogen sulfide, sulfurous acid gas, nitrous acid, chlorine gas, ammonia or bromine gas.
  - ③ Exposure to ozone, ultraviolet rays or radiation.
  - ④ Severe vibration or shock which exceeds the condition specified in the catalog or specification sheets.

**7) CONSIDERATION TO ASSEMBLY CONDITION**

- In designing a circuit, the following matters should be ensured in advance to the capacitor's assembly on the printed wiring board (PW 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's vent.
  - ③ Ensure enough free space above the capacitor's vent.  
The recommended space is specified in the catalog or specification sheets.
  - ④ In case the capacitor's vent is facing the PW board, make a gas release hole on PW board.  
The sealing side of the screw terminal type should not face down in the application.
  - ⑤ When the capacitors are mounted horizontally, the anode screw terminals must be positioned at the upper side.

**8) CONSIDERATION TO CIRCUIT DESIGN**

- Any copper lines or circuit patterns should not be laid under the capacitor.
- Parts which radiate heat should not be placed close to or reverse side of the Aluminum Electrolytic Capacitors on the PW board.
- Land pattern of chip type capacitors should comply with the specification which is mentioned in the catalog or specification sheets.

**9) OTHERS**

- Performance of electrical characteristics of Aluminum Electrolytic Capacitors are affected by variation of operating temperature and frequency. Consider this variation when designing the circuit.
- Excessive holes and connection hole between both sides on the PW board should be avoided around or under the mounting area of the Aluminum Electrolytic Capacitors on double sided or multilayer PW board.
- Torque of tightening screw terminals should not exceed the specified maximum value which is described in the catalog or specification sheets.
- Consider current balance when 2 or more Aluminum Electrolytic Capacitors are connected in parallel.
- Use bleeder resistors when 2 or more Aluminum Electrolytic Capacitors are connected in series. In this case, the resistors should be connected parallel to the capacitors.

From the perspective of the importance of safety with electronic equipments and circuits, please observe safety measures in light of capacitor failure modes at the design stage.

- System to promote safety in circuit care and protective equipment.
- System to promote safety with redundant circuits, etc.

**2.CAUTION FOR ASSEMBLING CAPACITORS****1) CAUTION BEFORE ASSEMBLY**

- Aluminum Electrolytic Capacitors cannot be recycled after mounting and applying electricity in unit. The capacitors which are removed from PW board for the purpose of measuring electrical characteristics at the periodical inspection should only be recycled for the same position.
- Aluminum Electrolytic Capacitors may accumulate charge naturally during storage. In this case, discharge through a 1k $\Omega$  resistor before use.
- Leakage current of Aluminum Electrolytic Capacitors may be increased during long storage time. In this case, the capacitors should be subject to voltage treatment through a 1k $\Omega$  resistor before use.

**2) IN THE ASSEMBLY PROCESS - 1**

- Ensure rated voltage and capacitance of the capacitors before mounting.
- Ensure the capacitor's polarity before mounting.
- Do not use a capacitor which has been dropped onto a hard surface.
- Do not use capacitors with damaged or dented cases or seals.

### 3) IN THE ASSEMBLY PROCESS - 2

- Capacitors should be mounted after confirmation that hole spacing on PW board matches the lead pitch of the capacitors.
- The snap-in type of capacitors should be mounted firmly on the PW board without a gap between the capacitor body and the surface of PW board.
- Avoid excessive force when clinching lead wire during auto-insertion process.
- Avoid excessive shock to capacitors by automatic insertion machine, during mounting, parts inspection or centering operations.
- Please utilize supporting material such as strap or adhesive to mount capacitors to PC board when it is anticipated that vibration or shock is applied.

### 4) SOLDERING

- Soldering conditions (temperatures, times) should be within the specified conditions which are described in the catalog or specification sheets.
- In case lead wire reforming is needed due to inappropriate pitch between capacitor and holes on PW board, stress to the capacitor should be avoided.
- In case soldered capacitor has to be withdrawn from the PW board by soldering irons, the capacitor should be removed after solder has melted sufficiently in order to avoid stress to the capacitor or lead wires.
- Soldering iron should never touch the capacitor's body.

### 5) FLOW SOLDERING

- Do not dip capacitor's body into melted solder.
- Soldering condition (preheat, soldering temperature, dipping time) should be within the specified standard which is described in the catalog or specification sheets.
- Flux should not be adhered to capacitor's body but only to its terminals.
- Other devices which are mounted near capacitors should not touch the capacitors.

### 6) REFLOW SOLDERING

- Reflow soldering conditions (preheat, soldering temperature, reflow time, reflow cycle) should follow the specified standard which are described in the catalog or specification sheets. (\*) Consult with Rubycon when use beyond the specified standard are need.
- Heating standard should depend on surface of the capacitor color or materials when infrared rays is used because the capacitor's heat absorption depends on the surface color or materials. Check heat condition.

**7) HANDLING AFTER SOLDERING**

- Do not bend or twist the capacitor's body after soldering on PW board.
- Do not pick-up or move PW board by holding the soldered capacitors.
- Do not hit the capacitors and isolate capacitors from the PW board or other device when stacking PW boards in store.

**8) HANDLING AFTER SOLDERING**

- Standard Aluminum Electrolytic Capacitors should be free from halogenated solvents during PW board cleaning after soldering. Use solvent proof capacitors and follow the specified cleaning condition when halogenated solvents are used.
- Solvents should have well controlled conductivity, pH, specific gravity and water contents during the cleaning of solvent proof capacitors.
- Cleaned PW board with capacitors should not be kept in solvent environment or nonventilated places. Let PW board containing capacitors after cleaning dry with hot blast fully. The temperature of such breeze should be under the upper category temperature of capacitors.

**9) ADHESIVES AND COATING MATERIALS**

- Do not use halogenated adhesives and coating materials to fix Aluminum Electrolytic Capacitors.
- Flux between the surface of the PW board and sealing of capacitors should be cleaned before using adhesives or coating materials.
- Solvents should be dried up before using adhesives or coating materials.
- Do not cover up all the sealing area of capacitors with adhesives or coating materials, make coverage only partial.

**3. CAUTION DURING USE OF CAPACITORS IN SETS**

- Do not touch the terminals of capacitors.
- Do not connect electrical terminals of the capacitor. Keep the capacitors free from conductive solution, such as acid, alkali and so on.
- Ensure the operational environment of the equipment in which the capacitor has been built is within the specified condition mentioned in the catalog or specification sheets.

**4. MAINTENANCE**

- Periodical inspection should be carried out for the capacitors, which are used with industrial equipment. Check the following points at the inspection.
  - ① Visual inspection to check pressure relief open or leakage of electrolyte.
  - ② Electrical characteristics: leakage current, capacitance, dissipation factor and the other points which are mentioned in the catalog or specification sheets.

**5. EMERGENCY ACTION**

- When the pressure relief vent is open and some gas blows out from the capacitor, please turn the main switch of the equipment off or pull out the plug from the power outlet immediately.
- During pressure relief vent operation, extremely hot gas (over 100°C) may blow out from the capacitors. Do not stand close to the capacitors. In case of eye contact, flush the open eye(s) with large amount of clean water immediately. In case of ingestion, gargle with water immediately, do not swallow. Do not touch electrolyte but wash skin with soap and water in case of skin contact.

**6. STORAGE CONDITION**

- Aluminum Electrolytic Capacitors should not be stored in high temperatures or where there is a high level of humidity. The suitable storage condition is 5°C-35°C and less than 75% in relative humidity.
- Aluminum Electrolytic Capacitors should not be stored in damp conditions such as water, saltwater spray or oil spray.
- Do not store Aluminum Electrolytic Capacitors in an environment full of hazardous gas (hydrogen sulfide, sulfurous acid gas, nitrous acid, chlorine gas, ammonia or bromine gas).
- Aluminum Electrolytic Capacitors should not be stored under exposure to ozone, ultraviolet rays or radiation.

**7. DISPOSAL**

- Please take either of the following actions in case of disposal.
  - ① Incineration (high temperature of more than 800°C) after crushing the capacitor's body
  - ② Consignment to specialists of industrial waste.

**For further details**

Please refer to: JEITA RCR-2367C (Safety Application Guide for fixed aluminum electrolytic capacitors for use in electronic equipment).  
[Technical Report of Japan Electronics and Information Technology Industries Association (established in March 1995, Revised in March 2006)].

**CAUTION FOR PROPER USE OF ALUMINUM ELECTROLYTIC CAPACITORS II****1.Polarity Marking of Electrolytic Capacitors**

Please confirm the polarity to avoid applying any reverse voltage or AC voltage to the capacitors. Polarity is indicated as below:

- (1) Negative polarity is indicated on the side of body by means of a stripe or an arrow.
- (2) On radial leaded Aluminum Electrolytic Capacitors, the shorter lead is the negative terminal and a long lead version.
- (3) On Snap-In and Lug Terminal type capacitors, the knurled rivet [⊗] indicates the negative terminal.
- (4) Capacitors with markings on top of case, the mark [◀] indicates the direction of Negative Polarity.

**2.Mounting Capacitors with Pressure relief Vent**

Aluminum Electrolytic Capacitors are designed to open the pressure relief vent and release hot gas including electrolyte through it, in abnormal cases such as when reverse voltage or excess voltage was applied, or when ripple current exceeding the permissible value has flown into capacitors.

- Do not design to locate any wiring or circuit pattern around the capacitor's pressure relief vent.
- The pressure relief vent bulges right before the vent operation. Ensure enough free space directly above the capacitor's vent as shown in the below table so that bulged vent never touches to an object such as the case or cover of the set. The pressure relief vent will not open without the appropriate free space.

Body Dia.	φ 6.3~16mm	φ 18~35mm	φ 40mm~
Space	2mm MIN.	3mm MIN.	5mm MIN.

**3.Voltage Treatment**

The following voltage treatment should be done on the capacitors that have been stored for a long time.

- Voltage Treatment  
The capacitors shall be applied with a DC voltage which is equal to the Rated Voltage of the capacitor through a resistor of about 1kΩ in series for 1 hour, and then discharged through a resistor of about 1Ω /Volt.

**4.Ripple Current**

- (1) The combined value of D.C. voltage and the peak A.C. voltage shall not exceed the rated voltage and shall not be reverse voltage.
- (2) Use of aluminum electrolytic capacitor under ripple voltage with wide amplitude is equivalent to quick charge-discharge operation.  
If ripple voltage with the amplitude over 70Vp-p is expected, please contact us.

**5.PW BOARD CLEANING**

(1)PW board can be immersed or ultrasonically cleaned using suitable cleaning solvents for up to 5 minutes (5L and 7L is up to 3 minutes) and up to 60°C maximum temperatures about 100wv following.

The board should be thoroughly rinsed and dried. Recommended cleaning solvent include Pine Alpha ST-100S, Clean-thru 750H, IPA(isopropyl alcohol)

- The use of ozone depleting cleaning agents are not recommended in the interest of protecting the environment. Certain products may not be cleaned. Please refer to
- the Specification notes. Also, please consult us when using cleaning solvents other than those above listed.

Cleaning Solvents	Cleaning Condition
Pine alpha ST-100S Clean-thru 750H IPA (isopropyl alcohol)	Is less than 5 minutes by dipping, steam, ultrasonically cleaned and these combinations. (5L and 7L is less than 3 minutes)

(2) For solvent resistant capacitors, carefully follow the temperature and time requirements of the specification. Avoid using the following solvent groups.

- Halogenated cleaning solvents: except for solvent resistant capacitor types, halogenated solvents can permeate the seal and cause internal capacitor corrosion and failure. 1-1-1 trichloroethane should never be used on any aluminum electrolytic capacitor.Please consult us when using ASAHIKLIN AK-225AES solvent.
- Alkali solvents: could attack and dissolve the aluminum case.
- Petroleum based solvents: deterioration of the rubber seal could result.
- Xylene: deterioration of the rubber seal could result.
- Acetone: removal of the ink markings on the vinyl sleeve could result.

(3)A thorough drying after cleaning is required to remove residual cleaning solvents which may be trapped between the capacitor and the circuit board. Avoid drying temperatures which exceed the upper category temperature of the capacitor.

(4)Monitor the contamination levels of the cleaning solvents during use by electrical conductivity, pH, specific gravity, or water content. Chlorine levels can rise with contamination and adversely affect the performance of the capacitor.

**6.Photo Flash Aluminum Electrolytic Capacitors**

These Rubycon Photo Flash Capacitors are designed, manufactured and intended solely for use in photo flash and other photographic equipment. They are not intended for use in medical equipment. Rubycon Corporation, Rubycon America Inc., and Shin-Ei Capacitor Foil Company, Ltd. expressly disclaim any warranties or representations as to the suitability or fitness of these capacitors for use in medical equipment.



## ALUMINUM ELECTROLYTIC CAPACITORS

### 7. Electrolyte and Separator paper

Electrolyte and separator paper used in Aluminum Electrolytic Capacitors are flammable. Also, Electrolyte is electrically conductive. Therefore, in case Electrolyte gets contact with PC board, it may cause corrosion of circuit pattern, or tracking or short circuit between patterns, and may lead to smoke generation or ignition at the worst cases.

Please make considerations to the above risk in designing circuit patterns and determining the mounting method and mounting location of capacitors.

### 8. Fumigation, Disinfection and halogenated flame retardant

It may cause corrosion of internal electrodes, aluminum cases and terminal surface when the following conditions exist.

- (1) Fumigation of wooden pallets before shipment to disinfect vermin.
- (2) Existence of components or parts that contain halogenated flame retardant agent (bromine etc.) together with capacitors.
- (3) When halogenated detergents or antiseptics for preventing infection of epidemic diseases contact directly to capacitors.



## Proposal on Deletion of Old Series from Catalog

Production discontinuation of old series at Rubycon is implemented as planned.

Technical documents and samples are available upon the request to study alternative products.

Please consult us if continuous supply of products is necessary after the announced discontinuation date of the series.

It is greatly appreciated that you would understand and accept the proposal stated in above.

## LIST OF SUBSTITUTE FOR PREVIOUS SERIES

### ◆ MINIATURE ALUMINUM ELECTROLYTIC CAPACITORS

FEATURES	PREVIOUS SERIES	FINAL ACCEPTED ORDER DATE	SUBSTITUTE SERIES
SMD	REV	2007.09	SEV (62)
	RKV	2004.09	SKV (58)
	RGV	2007.09	SGV (54)
	RXV	2007.09	SXV (51)
	RZV	2007.09	SZV (48)
	RSV	2007.09	SEV (62)
	NEV	2007.09	NSEV (67)
	ZAV	2006.09	TZV (44)
LOW IMPEDANCE	JXA	2006.09	YXF (82)
	JXB	2004.09	YXG (85) ZL (77)
	ZA	2008.09	ZLH (74) ZLG (72)
FOR SWITCHING POWER SUPPLY	MXW (VSL)	2002.09	KXW (140)
	AXW	2010.09	
	VXW	2010.09	TXW (134)

### ◆ LARGE CAN TYPE ALUMINUM ELECTROLYTIC CAPACITORS

FEATURES	PREVIOUS SERIES	FINAL ACCEPTED ORDER DATE	SUBSTITUTE SERIES
85°C STANDARD	USP	1999.09	USC (178)
	USR	2007.09	USG (176)
105°C STANDARD	MXP	1998.09	MXC (153)
	MXR	2007.09	MXG (150)
20mm HEIGHT	MXF	2003.09	AXF (166) KXF (168)
105°C LONG LIFE	VXP	2008.09	VXG (161)

◆ **Typical failure modes and their factors**

