Cautions for Using Aluminum Electrolytic Capacitors

Please read product specifications before using ELNA products.

The following cautions should be observed when using our aluminum electrolytic capacitors to assure their maximum stability and performance. When your application design conditions or operating conditions exceed the limit of the product specification, please contact us. If used under conditions beyond the limit of our specifications, it may cause defects such as short circuit, open circuit, leakage, explosion or combustion.

Cautions for usage

1. DC electrolytic capacitors are polarized.
   If used with a wrong polarity, it creates an abnormal current resulting in a short circuit or damage to itself. Use DC bipolar electrolytic capacitors for use with uncertain or unknown polarity. DC capacitors cannot be used in AC circuits.

2. Use within the rated voltage.
   If a voltage exceeding the rated voltage is applied, it may cause characteristic deterioration or damage due to the increased leakage current. When ripple current is loaded, make sure that the peak value of the ripple voltage does not exceed the rated voltage.

3. Do not use in a circuit which requires rapid charging or discharging.
   If used in a circuit requiring rapid charging or discharging, it may cause characteristic deterioration or damage to itself due to the heat generated inside the capacitor. In such cases, contact us for our rapid charging/discharging capacitors.

4. Use within the rated ripple current.
   If applied ripple current exceeds rated ripple current, the life of the capacitor may be shortened, or in an extreme case it gets destroyed due to its internal heat. Use high-ripple type capacitors for such circuits.

5. Changes in characteristics due to operating temperature.
   The characteristics of an electrolytic capacitor will change with a change in the temperature. Such changes are temporary and the original characteristics will be restored at the original temperature (if the characteristics are not deteriorated by remaining at a high temperature for a long time). If used at a temperature exceeding the guaranteed temperature range, the capacitor may be damaged due to the increased leakage current. Pay attention to the capacitor temperature being affected by the ambient temperature of the unit, the temperature inside the appliance, the heat radiated by another hot component in the unit and the heat inside the capacitor itself due to the ripple current.
   • The electrostatic capacitance is normally shown as the value at 20°C-120Hz. It increases as the temperature raises and decreases as it lowers.
   • The tangent of loss angle (tanδ) is normally shown as the value at 20°C-120Hz. It decreases as the temperature lowers.

6. Changes in the characteristics due to frequency.
   The characteristics of an electrolytic capacitor will change according to the change in the operating frequency.
   • The electrostatic capacity is normally shown as the value at 20°C-120Hz. It decreases as the frequency increases.
   • The tangent of loss angle (tanδ) is normally shown as the value at 20°C-120Hz. It increases as the frequency gets high.
   • The impedance is normally shown as the value at 100kHz 20°C. It increases as the frequency lowers.

7. Aluminum electrolytic capacitor life.
   The life of an aluminum electrolytic capacitor terminates when it fails due to the deterioration in its electronic characteristics. Temperature and the ripple current since they especially affect the life. See chart on page.

   After storage for a long period, whether unused or mounted on the appliance, the leakage current of an aluminum electrolytic capacitor will increase. This tendency is more prominent when the ambient temperature is high. If a capacitor has been stored for more than 2 years under normal temperature (shorter if high temperature) and it shows increased leakage current, a treatment by voltage application is recommended. Addition of a protective circuit in the design of the appliance is also recommended, considering the effect of the initial increased current.

9. Insulation between the capacitor case and the cathode terminal.
   The capacitor case and the cathode terminal are connected through the electrolyte which has uncertain resistance. If a complete insulation of the case is necessary, add an insulator at assembly.

10. External sleeve.
    During a preheating or a hardening of mounting adhesive may cause a sleeve cracked. The capacitors are usually sleeved with poly vinyl-
chroaide or poly ethylene terephtharate for the indication purpose only. Please do not consider it as an insulation.

11. Fumigation Process
When exporting electronic equipment abroad, fumigation process may be performed on wooden packaging material with a halogen (compound) gas such as methyl bromide. Exercise care as this halogen gas may corrode capacitors. Also, use caution to epidemic preventive agent as corrosive component such as halogen may be contained.

12. Specific Operating Environments
Capacitors may corrode when stored or used in a place filled with acidic toxic gases (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, bromine, methyl bromide, etc.) If capacitors are used or stored in such environments, please let us know.

13. Use at a high altitude
The use of capacitors at high altitudes such as on an airplane causes a large difference between the internal pressure of the capacitors and the atmospheric pressure. However, there is no problem in use under atmospheric pressure up to about an altitude of 10,000 meters. Please check the operation of electronic equipment at the operating environmental temperature because the temperature lowers with increased altitude.

14. Hole pitch adjustment of the PCB to the capacitors.
Set the hole pitch of the PCB to the lead pitch (the “F” distance in the catalog) of the capacitor. Be careful since a short circuit, a cut or an increase in the leakage current etc. may be caused by the stress given to the lead wire terminals due to the difference between the hole pitch and the lead pitch.

15. Capacitors with pressure valves.
(1) A part of the capacitor case is made thin to have the function as the pressure valve in order to prevent explosion due to the rise of inside pressure when a reverse or excessive voltage is applied to the capacitor. Once it has worked as a valve, the whole capacitor needs to be replaced since the valve will not restore.
(2) When you use a capacitor with pressure valve, provide certain space above the pressure valve as below to prevent an interference when it works as a valve.

<table>
<thead>
<tr>
<th>Diameter of the capacitor (mm)</th>
<th>18 to less</th>
<th>20 to 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required space above the valve(mm)</td>
<td>2.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

16. Double-sided PCB’s
When you use electrolytic capacitors on a double-sided PCB, be careful not to have the circuit pattern run under where the capacitor is mounted. Otherwise it may cause a short circuit on the PCB depending on the condition of mounting.

17. Regarding Connection of capacitors.
• When connecting more than one capacitor in parallel, over-ripple current may develop in some capacitors with the current balance lost if resistance values of the wires to be connected to each capacitor are different because the resistive component of the capacitors is close to the circuit resistance value. Careful consideration shall therefore be given in designing the circuits to prevent over-ripple current from flowing.
• When two or more capacitors are arranged in series, the voltage given to each capacitors shall be kept below the rated voltage level, by also giving consideration to the balance of the voltage impressed on the capacitors. Further, partial pressure resistor which considers leakage current shall be provided parallel to each condenser not to have over-voltage impressed on. Balance resistance are explained on p.88 of our Catalog.

Cautions for Mounting
1. Cautions for mounting.
(1)Check the ratings (electrostatic capacitance and rated voltage) of the capacitor before mounting.
(2)Check the polarity of the capacitor to the chassis.
(3)Do not drop the capacitor to the floor. Do not use the dropped capacitor.
(4)Do not deform the capacitor for mounting.

2. Do not apply excessive pressure to the capacitor, its terminals or lead wires.
(1)Make sure that the contact path of the capacitor meets the hole pitch of the PCB before mounting.
(2)Transient recovery voltage may be generated in the capacitor due to dielectric absorption. If required, this voltage can be discharged with a resistor with a value of about 1 kΩ.
(3)A PCB self-standing (snap-in) type capacitor should be pushed to the end (till there is no space) to the PCB for mounting.
(4)Do not set the automatic insertion machine to clinch the capacitor lead wires too strong.
(5)Pay attention to the impact given by the component receptacles of the automatic insertion/mounting machines and the product checker, and from the centering operation.
(1) Do not dip the capacitor into melted solder.
(2) The soldering conditions
   Chip type: Please refer to 14 page.
   small and large type: 260°C, 10 s (max.)
   The preliminary heating and other conditions
   described in the catalog or product specifications.
(3) Do not flux other part than the terminals.
(4) If there is a direct contact between the sleeve of
   the capacitor and the printed circuit pattern or a
   metal part of another component such as a lead
   wire, it may cause shrinkage of crack.
(5) When you use the capacitor with its sleeve touch-
   ing directly to the PCB, excessive solder tempera-
   ture or excessive soldering time may cause the
   sleeve to shrink or crack during the heat.
(6) If the application is for extended use, understand
   and manage the soldering characteristics to avoid
   abnormal current caused by a contact failure
   between the capacitor and the PCB.

4. Handling after soldering.
(1) After soldering, do not tilt, push down or twist the
    capacitor.
(2) After soldering, do not hold the capacitor as a
    handle to carry the PCB.
(3) After soldering, do not hit the capacitor with any
    obstacle. If PCB’s are piled up for storage, the ca-
    pacitor should not touch another PCB or compo-
    nent.

5. Cleaning after soldering.
(1) Capacitors must not be clean with halogen based
    solvents. If cleaning is required, clean-insured
    capacitors should be used within the scope of the
    delivery specifications. Clean-insured capacitors
    are explained on p.6 of our Catalog.
(2) Recommended cleaning method
   Cleaning Solvent : Clean Through 710M, 750H
   and 750L;
   Pine Alpha ST-100S;
   Technocare FRW-14--17;
   Isopropyl alcohol
   Cleaning conditions: The cleaner temperature shall
   be 60°C or less with the cleaning periods within 5
   minutes. After cleaning, thoroughly rinse the capacitor
   with water and dry it together with the printed circuit board
   using hot air for more than 10
   minutes. The hot air shall not exceed the
   maximum operating tempera-
   ture. Insufficient drying can damage appearance such as second-
   ary contraction of sleeve and
   swelling of the base plastic
   holder.
(3) Other cleaning liquids:
   Cleaning Solvent : AK225AES
   Cleaning conditions: Any of immersion, ultrasonic
   immersion and steam within 5
   minutes, with the exception of
   the surface-mount chip ca-
   pacitors within 2 minutes.
   • CFC substitute (AK225AES) is use prohibition will
     be carried out in the future, please avoid use.
   • Please consult us regarding other cleaning agents
     or cleaning methods.

6. Fixing adhesives and coating materials.
(1) Do not use fixing adhesive or coating material
    containing halogen-based solvent.
(2) Before applying the fixing adhesive or the coating
    material, make sure that there is no remaining flux
    or stains between the PCB and the sealed part
    of the capacitor.
(3) Before applying the fixing adhesive or the coating
    material, make sure that the detergent etc. has
    dried up.
(4) Do not cover the whole surface of the sealed part
    (terminal side) of the capacitor with the fixing ad-
    hesive or the coating material.
(5) Observe the description in the catalog or the prod-
    uct specifications concerning the thermal stiffening
    conditions of the fixing adhesive or the coating
    material. (If there is no such description, contact
    us.) When both discrete and SMT components are
    on the same PCB, the fixing material for the SMT
    components may cause crack, tear or shrinkage on
    the external sleeve depending on the thermal
    stiffening condition.
(6) Recommended fixing adhesives and coating
    materials
   Fixing adhesives: Cemedine 210,501,540,545N,Diabond
   DN83K,DA3288,Bond G103
   Coating materials: Taffy TF1159,HumiSeal 1B66,1A27NS

■ Other Cautions
1. Do not touch capacitor terminals with bare hands.
   You may get electric shock or your hand may be
   burnt. Discharge it with a 1 KΩ resistance before use
   if necessary.

2. Do not short the capacitor terminals with a con-
   ductor.
   Do not spill conductive solution including acid or alka-
   line solution on the capacitor.

3. Periodical inspections should be established
   for the capacitors used in industrial appliances.
   The following items should be checked:
   (1) Appearance: Check if there is any open valve or
leakage.

(2) Electronic performance: Check the leakage current, the electrostatic capacitance, the tangent of loss angle and other items described in the catalog or the product specifications.

4. Take the following measures in case of emergency.
   (1) If you see gas coming out of the capacitor valve when the set is in operation, turn off the power switch of the unit or unplug the power cord from the outlet.
   (2) Keep your face away from the capacitor pressure valve, since the high temperature gas at over 100°C bursts out when the valve works. If the gas gets into your eyes or your mouth, wash your eyes or your mouth. Do not ingest the capacitor electrolyte. If the electrolyte gets on your skin, wash it out with soap.

5. Storing conditions.
   (1) Avoid high temperature or high humidity when storing capacitors. Keep the storing temperature at 5°C to 35°C and the relative humidity not more than 75%.
   (2) The leakage current of an aluminum electrolytic capacitor tends to increase when stored for a long time. This tendency becomes more prominent if the ambient temperature is high. The leakage current will be decreased by voltage application. If necessary, treatment by voltage application should be made on the capacitors which have been stored for a long period (more than 2 years after production).
   (3) Do not store capacitors at a place where there is a possibility that they may get water, salt or oil spill.
   (4) Do not store capacitors at a place where the air contains dense hazardous gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
   (5) Fumigation treatment with toxic gas covering the whole wooden container frames as moth proofing during shipment may leave residual toxic gas.
   (6) Do not store capacitors at a place where it gets ultraviolet or radioactive rays.

6. Disposing of capacitors.
   (1) Punch a hole or crush the capacitors (to prevent explosion) before incineration at approved facility.
   (2) If they are not to be incinerated, bring them to a professional industrial waste disposal company.

7. Other notes.
Please refer to the following literature for anything not described in the product specifications or the catalog.
(Technical report of Japan Electronics and Information Technology Industries Association, EIAJ RCR-2367B “Guideline of notabilia for fixed aluminum electrolytic capacitors for use in electronic equipment”)

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**Product Symbol System for Aluminum Electrolytic Capacitors**

<table>
<thead>
<tr>
<th>Series code</th>
<th>Rated voltage symbol</th>
<th>Rated capacitance symbol</th>
<th>Capacitance tolerance symbol</th>
<th>Additional symbol</th>
<th>Taping, Lead-forming symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Write down the rated voltage itself; however, write 6 for 6.3WV.

<table>
<thead>
<tr>
<th>Rated capacitance (µF)</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>R10</td>
</tr>
<tr>
<td>1</td>
<td>010</td>
</tr>
<tr>
<td>2.2</td>
<td>2R2</td>
</tr>
<tr>
<td>33</td>
<td>330</td>
</tr>
<tr>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td>2200</td>
<td>222</td>
</tr>
<tr>
<td>33000</td>
<td>333</td>
</tr>
<tr>
<td>470000</td>
<td>474</td>
</tr>
</tbody>
</table>

Write down one of the forming symbols given on page 16 through 18 for taping and lead-forming capacitors. When tapping or lead-forming is not necessary, leave the boxes blank.

Additional symbols for denoting the case symbols and others. Refer to the examples given on the page for each series.