# GENERAL INFORMATION FOR APPLICATION

**The following precautions must be observed when using electrolytic capacitors.**

## 1. Circuit Design

1) Please make sure that the environmental and mounting conditions to which the capacitor to be exposed are within the conditions specified in this catalogue.

2) Operating temperature and applied ripple must be within the specifications.
   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) Appropriate capacitors which comply with the life requirement of the products, should be selected when designing the circuit.

4) Aluminum electrolytic capacitors are polarized. Make sure that no reserve voltage or AC voltage is applied to the capacitors. Please use non-polarized capacitors for a circuit that can possibly see reserved polarity.
   Note: Even non-polarizes capacitors cannot be used for AC voltage application.

5) For a circuit that repeats rapid charging/discharging of electricity, an appropriate capacitor that is capable of enduring such a condition must be used. Welding machines and photo flash are a few examples of products that contain such a circuit. In addition, rapid charging/discharging may be repeated in control circuits for servomotors, in which the circuit voltage fluctuates substantially.
   For appropriate choice of capacitors for circuit that repeat rapid charging/discharging, please consult us. If excess a rush current due to drastic charge/dis-charge was applied to conductive polymer aluminum solid electrolytic capacitors, and conductive polymer hybrid aluminum electrolytic capacitors, it may cause a short circuit or an increase in leakage current. Therefore, please do not apply a rush current that is larger than 10A.

6) Make sure that no excess voltage (that is higher than the rated voltage) is applied to the capacitor.
   ① Pleased pay attention so that the peak voltage, which is DC voltage overlapped by ripple current, should not exceed the rated voltage.
   ② In the case where more than two aluminum electrolytic capacitors are used in series, please make sure that applied voltage should be lower than rated voltage should be applied to each capacitor equally using a balancing resistor in parallel with the capacitor.
   Please do not use conductive polymer aluminum solid electrolytic capacitors, and conductive polymer hybrid aluminum electrolytic capacitors for the application listed below, since the solid organic polymer aluminum electrolytic capacitors cannot reach it's maximum performance.
      a) Coupling circuits.
      b) R-C timing circuit.
      c) High impedance voltage retention circuit.
      d) Circuits, which extremely low voltage in compared to the rated voltage is only applied.
      e) Circuits, which are greatly affected by leakage currents for special use such as multiple parts used in a series, please contact us for recommendations.

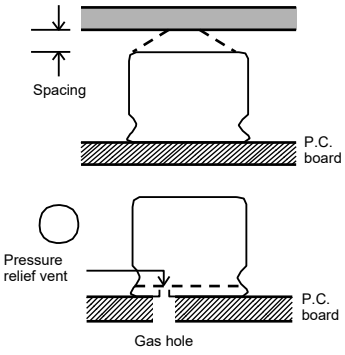
7) Outer sleeved of the capacitor is not guarantee as an electrical insulator. Do not use standard sleeve on a capacitor in applications that require electrical insulation. When the application requires special insulation, please contact our sales office for details.

8) Capacitors may fail if they are used under the following conditions:
   ① Environmental (climatic) conditions
      a) Being exposed to water, high temperature & high humidity atmosphere, or condensation of moisture.
      b) Being exposed to oil or an atmosphere that is filled with particles of oil.
      c) Being exposed to salty water or an atmosphere that is filled with particles of salt.
      d) In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, bromine, methyl bromide, ammonia, etc.).
      e) Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
      f) Being exposed to acidic or alkaline solutions.
   ② Severe vibration and physical shock conditions that exceed our specification.
   Vibration test condition:
      Vibration frequency range: 10~55~10Hz
      Sweet rate: 10~55~10Hz per minute
      Sweet method: logarithmic
      Amplitude or acceleration: 1.5mm (maximum acceleration is 10G)
      Direction of vibration: X, Y, Z direction
      Testing time: 2 hours per each direction
   Shock is not applicable normally.
   If a particular condition is required, please contact our sales office.

9) When designing a circuit board, please pay attention to the following:
   ① Have the hole spacing on the P.C. board match the lead spacing of the capacitor.
   ② There should not be any circuit pattern or circuit wire above the capacitor safety vent.
   ③ Unless otherwise specified, following clearance should be made above the pressure relief vent.

| Case Diameter (mm) | Clearance Required |
|---|---|
| ∅6.3 to 16 | 2mm or more |
| ∅18 to 35 | 3mm or more |
| ∅40 or more | 5mm or more |

   ④ In case the vent side is placed toward P.C. board (such as end seal vented parts), make a corresponding hole on the P.C. board to release the gas when vent is operated. The hole should be made to match the capacitor vent position.

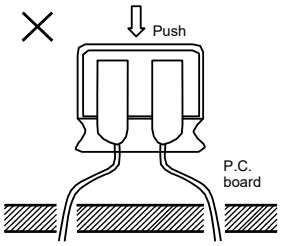



10) The main chemical solution of the electrolyte and the separator paper used in the capacitors are combustible. The electrolyte is conductive. When it comes in contact with the P.C. board, there is a possibility of pattern corrosion or short circuit between the circuit pattern which could result in smoking or catching fire. Do not locate any circuit pattern beneath the capacitor end seal.

11) Do not design a circuit board so that heat generating components are placed near an aluminum electrolytic capacitor or reserve side of P.C. board (under the capacitor).
12) Please refer to the recommended land size in this catalogue when you design in surface mount capacitors.
13) Electrical characteristics may vary depending on changes in temperature and frequency. Please consider the variation when you design circuits.
14) When you install more than 2 capacitors in parallel, consider the balance of current flowing through the capacitors. Especially, when a solid conductive polymer aluminum electrolytic capacitors, conductive polymer hybrid aluminum electrolytic capacitors and a standard aluminum electrolytic capacitors are connected in parallel, special consideration must be given.
15) While mounting capacitors on double side P.C. board, the capacitors should be away from those unnecessary base plate holes and connection holes.

## 2. Mounting

1) Once a capacitor has been assembled in the set and power applied, do not attempt to re-use the capacitor in other circuits or application.
2) Electric potential between positive and negative terminal may exist as a result of returned electromotive force, so please discharge the capacitor using 1KΩ resistor.
3) Leakage current of the parts that have stored for more than 2 years may increase. When leakage current has increased, please perform a voltage treatment using a 1KΩ resistor.
4) Please confirm rating and polarity before installing capacitor on the P.C. board.
5) Do not drop the capacitors on the floor, nor use a capacitor that was dropped.
6) Be careful not to deform the capacitor during installation.
7) Please confirm that the lead spacing of the capacitor matches the pad spacing of the P.C. board prior to installation.
8) Please pay attention that the clinch force is not too strong when capacitors are placed and fixed by an automatic insertion machine.
9) Please pay attention to the mechanical shock to the capacitor by suction nozzle of the automatic insertion machine or automatic mounted, or by product checker, or by centering mechanism.




10) Hand soldering (soldering iron):
① Soldering condition shall be confirmed to be within the specification.
② Please pay attention so that solder iron does not touch any portion of capacitor body.
③ If you need to remove parts which were soldered, please melt the solder enough so that stress is not applied to lead.
11) Flow soldering (wave solder):
① Soldering condition shall be confirmed to be within the specification.
② Capacitor body must not be submerged into the solder bath.
③ Capacitors are only to be mounted to the topside of the P.C. board.
④ Please avoid contact between other components and the capacitor.
12) Reflow soldering (SMD only):
① Soldering condition shall be confirmed to be within the specification.
② When an infrared heater is used, please pay attention to the extent of heating since the absorption rate of infrared, will vary due to difference in the color and size of the capacitor.
13) Do not tilt lay down or twist the capacitor body after the capacitor are soldered to the P.C. board.
14) Do not carry the P.C. board by grasping the soldered capacitor.
15) Please do not allow anytime to touch the capacitor after soldering. If P.C. board are stored in stack, please make sure P.C. board or the other components do not touch the capacitor. The capacitors shall not be effected by any radiated heat from the soldered P.C. board or other components after soldering.
16) Cleaning:
① Do not clean capacitors with halogenated cleaning agent. However, if it is necessary to clean with halogenated cleaning agent, please contact our sales office.
② Recommended cleaning method:
Applicable: Any type, any ratings.
Cleaning agents:
Based alcohol solvent cleaning agent: Isopropyl Alcohol
Based water solvent cleaning agent:
Premium alcohol solvent type: Pine Alpha ST-100S, Techno Care FRW14~17, Sanelek B-12
Surfactant type: cleaning through 750H/750L/710M
Alkaline saponification agent: Aqua Cleaner 210SEP
Cleaning conditions:
Total cleaning time shall be no greater than 5 minutes by immersion, ultrasonic or other method. (Temperature of the cleaning agent shall be 60°C maximum). For SMD and super miniature type, within 2 minutes total cleaning time (Temperature of agent: 40°C or below).
After the board cleaning has been completed, the capacitors should be dried using hot air for a minimum of 10 minutes.
If the cleaning solution is infiltrated between the case and the sleeve, the sleeve might soften and swell when hot air temperature is too high. Therefore, hot air temperature should not exceed softening temperature (80°C) of the sleeve.
Insufficient dries after water rinse may cause appearance problems, such as sleeve shrinking, bottom-plate bulging.
In addition, a monitoring of the contamination of cleaning agents (electric conductivity, pH, specific gravity, water content, etc.) must be implemented.
After the cleaning, do not keep the capacitors in an atmosphere containing the cleaning agent or in an air tight container.
In addition, regarding jet washing, please use caution since the sleeve may expand cause of the angle and/or the strength of the water jet. Depending on the cleaning method, the marking on a capacitor may be erased or blurred.
Consult us before using a cleaning method or a cleaning agent other than those recommended.
③ Avoid using ozone destructive substance for cleaning agents to concern about global environment.

17) Fixing Material and Coating Material:
① Do not use any affixing or coating materials, which contain halide substance.
② Remove flux and any contamination, which remains in the gap between the end seal and P.C. board.
③ Please dry the cleaning agent on the P.C. board before using affixing or coating materials.
④ Please do not apply any material all around the end seal when using affixing or coating materials.
There are variations of cleaning agents, fixing and coating materials, so please contact those manufacture or our sales office to make sure that the material would not cause any problems.

18) Other
Wooden package material may be subjected to fumigation by a halogen (e.g. methyl bromide) before they are exported in order to protect them against pests. If devices with aluminum electrolytic capacitors or capacitors themselves are directly fumigated or packed with the pallet that is fumigated, the capacitors may internally corrode due to the halogen contents of fumigation agents.

## 3. In The Equipment

1) Do not directly touch terminal by hand.
2) Do not short between terminal by conductor, nor spill conductible liquid such as alkaline or acidic solution on or near the capacitor.
3) Please make sure that the ambient conditions where the set is installed not have any of the following conditions:
① Where capacitors are exposed to water, high temperature & high humidity atmosphere, or condensation of moisture.
② Where capacitors are exposed to oil or an atmosphere that is filled with particles of oil.
③ Where capacitors are exposed to salty water, high temperature & high humidity atmosphere, or condensation of moisture.
④ The atmosphere is filled with toxic acid gasses (e.g. hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, bromine, methyl bromide, etc.).
⑤ The atmosphere is filled with toxic alkaline gasses (e.g. ammonia).
⑥ Where capacitors are exposed to acidic or alkaline solutions.
⑦ Since shrinkage, bulging and/or crack could be seen on outer sleeve of capacitor when capacitors are used in atmosphere where condensation of moisture occurs, please confirm their adaptation before the use. The condensation of moisture could occur when temperature cycling test/rapid change of temperature test is performed, in this case, aforementioned sleeve problem could be seen.

## 4. Maintenance and Inspection

Please periodically inspect the aluminum capacitors that are installed in industrial equipment. The following Items should be checked:
1) Appearance: Remarkable abnormality such as vent operation, leaking electrolyte etc.
2) Electrical characteristic: Capacitance, dielectric loss tangent, leakage current etc., which are specified in this catalogue.

## 5. In an Emergency

1) If you see smoke due to operation of safety vent, turn off the main switch or pull out the plug from the outlet.
2) Do not draw your face to the safety vent since gas over 100°C will be emitted when the safety vent operates. If the gas has entered your eyes, please flush your eyes immediately in pure water. If you breathed the gas immediately wash out your mouth and throat with water.
3) Do not ingest electrolyte. If your skin is exposed to electrolyte, please wash it away using soap and water.

## 6. Storage

1) Do not keep capacitor in high temperature and high humidity.
Storage conditions should be:
Temperature: +5°C ~ +35°C
Humidity: Lower than 75%
Place: Indoor
2) Avoid ambient conditions where capacitors can be covered with water, brine or oil.
3) Avoid ambient conditions where capacitors are exposed to poisonous gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium etc.
4) Do not keep capacitor in conditions that expose the capacitor to ozone, ultraviolet ray or radiation.
5) Store capacitors in a packed condition as much as possible.
6) In order to maintain a good solderability of the parts, shelf life of parts should not exceed 1 year (in unopened package).

## 7. Disposal

1) Please dispose capacitors in either of the following ways:
① Incinerate (at a temperature of 800°C or higher) capacitors after crushing parts or making a hole on the capacitor body.
② If incineration is not applicable, hand them over to a waste disposal agent and have them buried in a landfill.
2) When removing a capacitor from the circuit board or when disposing of capacitor please ensure that the capacitor is properly discharged.

## 8. AEC-Q200 Qualified

The Automotive Electronics Council (AEC) is an organization created by U.S. automakers and electronic component manufacturers for the standardization of reliability and certification criteria for automotive electronic components. AEC-Q200 is a certification reliability test standard for passive components widely adopted as the standard for electronic components for automotive use in Europe and the United States.
Fujicon provides products that conform to AEC-Q200 requirements. Please contact us for details.

*For further details, please refer to the following industrial standards:*

*IEC 60384-4 - Fixed capacitors for use in electronic equipment – Part 4: Sectional specification – Fixed aluminum electrolytic capacitors with solid ($MnO_2$) and non-solid electrolyte (Edition 5.0, 2016-08)*

*JEITA RCR-2367D - Safety application guide for fixed aluminum electrolytic capacitors for use in electronic equipment (Established in March 1995, Revised in October 2017)*