

# ALUMINUM ELECTROLYTIC CAPACITORS

## Precautions in using Aluminum Electrolytic Capacitors

If the capacitors are used beyond the prescribed limits, short-circuiting, opening, solution leakage, explosion, ignition, or other fatal failure may occur. The precautions to be taken are detailed below.

Category		Precautions	Failure mode and corrective action								
Circuit Design	Operating temperature and ripple current	<ol style="list-style-type: none"> <li>1. Ensure that the operating temperature and ripple current are within the specified ranges.</li> <li>2. When connecting two or more capacitors in parallel, take the wiring resistance into account.</li> <li>3. The capacitors themselves also generate heat. Keep in mind that they will raise the equipment internal temperature.</li> </ol>	<ol style="list-style-type: none"> <li>1. If an excessive ripple is allowed to flow to the capacitors, shorting, ignition, or other fatal failure can result.</li> <li>2. Make wiring connections so that all capacitors are subjected to the same resistance.</li> <li>3. Operate the equipment under normal conditions to check the equipment internal temperature and capacitor temperature.</li> </ol>								
	Applied voltage	<ol style="list-style-type: none"> <li>1. The capacitors are polarized. Do not apply any reverse voltage or AC voltage to them.</li> <li>2. In circuits where polarity reversal occurs, bipolar capacitors must be used.</li> <li>3. When an AC component is superimposed over DC voltage, ensure that the peak value does not exceed the voltage rating.</li> <li>4. When connecting a number of capacitors in series, use capacitors having the same rating, and connect balancing resistors in parallel.</li> <li>5. Do not use the capacitors in circuits where sudden charging/discharging repeatedly occurs, as in strobe or welding equipment.</li> </ol>	<ol style="list-style-type: none"> <li>1. If a reverse voltage or AC voltage is applied to the capacitors, abnormal heat generation can take place, resulting in ignition or other failure.</li> <li>2. Note that even bipolar capacitors cannot be used in AC circuits.</li> <li>3. If a voltage higher than the rating is applied to the capacitors, abnormal heat generation can take place, resulting in shorting, ignition, or other fatal failure.</li> <li>4. When using two or more capacitors, take the above-mentioned wiring resistance into account. If not, the voltage applied to the capacitors may vary to incur capacitor deterioration.</li> <li>5. Use dedicated capacitors designed for use in such applications.</li> </ol>								
	Capacitor insulation	<ol style="list-style-type: none"> <li>1. Blank terminals (reinforcement terminals) of on-board self-supporting multi-terminal (4 terminal) capacitors must not be connected to any other circuit.</li> <li>2. Note that the external sleeves of on-board self-supporting capacitors are not insulated.</li> </ol>	<ol style="list-style-type: none"> <li>1. The blank terminals are not internally insulated. Take the precautions to avoid circuit shorting.</li> <li>2. If the sleeve has to have an insulation capability, consult your local Hitachi AIC agent.</li> </ol>								
	Operating conditions	<ol style="list-style-type: none"> <li>1. Capacitors must be free from moisture.</li> <li>2. Do not use the capacitors in an atmosphere of hydrogen sulfide, sulfurous acid, chlorine, or other harmful gas.</li> <li>3. Do not use the capacitors at a place where they may be exposed to ozone or ultraviolet or other radiations.</li> <li>4. Do not use the capacitors at a place where they may be subjected to vibration or undue shock.</li> </ol>	<ol style="list-style-type: none"> <li>1. If the capacitors get wet with water, saline water, or with condensed moisture, short-circuiting will occur. If oil is deposited on the capacitors, the sealing rubber can swell, thus impairing airtightness and shortening the useful life.</li> <li>2. A harmful gas will damage the sealing rubber, resulting in interior corrosion and wiring breakage.</li> <li>3. On-board self-supporting capacitors protected with epoxy resin are available. Contact your local Hitachi AIC agent.</li> <li>4. If the capacitors are subjected to excessive vibration or shock, consult your local Hitachi AIC agent.</li> </ol>								
Installation	Mounting precautions	<ol style="list-style-type: none"> <li>1. Ensure that screw terminal type safety vents do not face downward.</li> <li>2. Do not position any wiring or circuit conductor pattern near safety vents.</li> <li>3. Be sure that safety vent operations are not disturbed.</li> </ol>	<ol style="list-style-type: none"> <li>1. An electrolytic solution or compound may flow out of the safety vents.</li> <li>2. The electrolytic solution is conductive. Gushing out a combustible gas through the safety vent can cause ignition or other disasters.</li> <li>3. A screw terminal type safety vent is positioned toward the terminal side. In the case of an on-board self-supporting type, the case bottom swells to actuate the safety vent. Observe these clearances. <table border="1" data-bbox="1117 1843 1458 1948"> <thead> <tr> <th>Capacitor diameter</th> <th>Clearance</th> </tr> </thead> <tbody> <tr> <td>20~35mm dia or more</td> <td>3mm or more</td> </tr> <tr> <td>40mm dia or more</td> <td>5mm or more</td> </tr> <tr> <td>PS2, US2 series</td> <td>1mm or more</td> </tr> </tbody> </table> </li> </ol>	Capacitor diameter	Clearance	20~35mm dia or more	3mm or more	40mm dia or more	5mm or more	PS2, US2 series	1mm or more
Capacitor diameter	Clearance										
20~35mm dia or more	3mm or more										
40mm dia or more	5mm or more										
PS2, US2 series	1mm or more										

# ALUMINUM ELECTROLYTIC CAPACITORS

## Precautions in using Aluminum Electrolytic Capacitors

Category		Precautions	Failure mode and corrective action												
Installation	Prior knowledge of mounting	<ol style="list-style-type: none"> <li>1. Use care to avoid polarity reversal.</li> <li>2. Ensure that the curled section (sealed end of the case) is not stressed.</li> <li>3. Use extreme care in handling the capacitors.</li> <li>4. Never reuse a capacitor which has been installed and energized.</li> </ol>	<ol style="list-style-type: none"> <li>1. If a reverse voltage is applied to the capacitors, they must not be used any longer. Even if they have no apparent defects, they are seriously damaged.</li> <li>2. Do not tighten the curled section with a band or the like because solution leakage or sleeve cutting can result.</li> <li>3. If the capacitors fall on the floor or bump against any object, their external surfaces and internal structure can be rendered abnormal, resulting in electrical performance deterioration or destruction. Replace such capacitors.</li> <li>4. No capacitor can be reused except for those removed to measure their electric performance for a periodic checkup.</li> </ol>												
	Snap-in capacitors	<ol style="list-style-type: none"> <li>1. Properly insert the capacitors into the wiring board. The capacitor should be flush with the printed circuit board.</li> <li>2. Ensure that the flux is not applied to areas other than the terminals.</li> <li>3. Soldering must be conducted within 10 seconds at 260°C or within 3 seconds at 350°C.</li> <li>4. For washing off the flux, the use of water-soluble or high grade alcoholic cleaning agent or isopropyl alcohol is recommended. It is also recommended that the flux concentration be 2wt% relative to the cleaning agent.</li> <li>5. After the use of cleaning solution, it must be allowed to dry. Even when the flux is not to be removed, allow it to dry.</li> <li>6. When securing a capacitor to a circuit board with a coating or fixing material, be sure that the employed coating or fixing material does not contain halogen compounds. Before coating the capacitor, allow the flux or cleaning agent to dry completely.</li> <li>7. When securing a capacitor to a circuit board with a coating or fixing material, use care so that the sealed end of the capacitor is not entirely covered. Ensure, also that no coating or fixing material is applied to the safety vent section at the bottom of the capacitor. When conducting overall coating, consult your local Hitachi AIC agent.</li> </ol>	<ol style="list-style-type: none"> <li>1. If the capacitors are soldered while they are not flush with the wiring board, terminal breakage or conductive pattern separation can be caused by mechanical vibration or shock.</li> <li>2. If the flux comes into contact with the sealing rubber surface, corrosion can be caused by the halogen compound in the flux.</li> <li>3. If soldering is conducted without satisfying the prescribed conditions, the capacitors will be thermally stressed so that electrical characteristic deterioration or other problem can occur.</li> <li>4. If the flux concentration in the cleaning solution rises, the halogen concentration also increases. Therefore, corrosion can occur as indicated in paragraph 2 above.</li> <li>5. If any cleaning solution or flux remains between the circuit board and capacitor, the halogen compound can permeate into the sealing rubber, resulting in corrosion.</li> <li>6. If the employed coating or fixing material contains a halogen compound, corrosion can take place.</li> <li>7. If the overall coating method is employed, the flux or cleaning solution halogen compound residue is confined so that corrosion can occur. If a coating or a fixing material is applied to the safety vent section, the safety vent operations will be obstructed.</li> </ol>												
	Screw terminal capacitors	<ol style="list-style-type: none"> <li>1. Tighten terminal screws appropriately and maintain permissible terminal currents.</li> <li>2. Use appropriate terminal screws.</li> <li>3. Follow recommended bar hole diameter.</li> </ol>	<ol style="list-style-type: none"> <li>1. <table border="1"> <thead> <tr> <th>Terminal</th> <th>Recommended Torque (permissible level)</th> <th>Permissible Terminal Current</th> </tr> </thead> <tbody> <tr> <td>M5</td> <td>2.2 (1.5 ~ 3.0)</td> <td>60</td> </tr> <tr> <td>M6</td> <td>3.0 (3.0 ~ 3.5)</td> <td>100</td> </tr> <tr> <td>M8</td> <td>7.5 (7.0 ~ 8.0)</td> <td>120</td> </tr> </tbody> </table> </li> <li>2. Terminal screws furnished in a separate shipment are geared to wires no more than 2mm thick. For wires more than 2mm thick, ensure a screw length allowing for that thickness.</li> <li>3. Hitachi AIC recommends a bar hole diameter of 6mm for M5. An excessively large hole diameter may result in poor contact between the terminal surface and bar, causing a local heat-up and eventual breakdown.</li> </ol>	Terminal	Recommended Torque (permissible level)	Permissible Terminal Current	M5	2.2 (1.5 ~ 3.0)	60	M6	3.0 (3.0 ~ 3.5)	100	M8	7.5 (7.0 ~ 8.0)	120
Terminal	Recommended Torque (permissible level)	Permissible Terminal Current													
M5	2.2 (1.5 ~ 3.0)	60													
M6	3.0 (3.0 ~ 3.5)	100													
M8	7.5 (7.0 ~ 8.0)	120													

# ALUMINUM ELECTROLYTIC CAPACITORS

## Precautions in using Aluminum Electrolytic Capacitors

Category		Precautions	Failure mode and corrective action
During use	Test run	1. Before allowing the capacitors to conduct, mount them on a chassis.	1. If any abnormally high voltage is applied to the capacitors, they can explode.
Preventive maintenance		1. Capacitors used in industrial equipment must be inspected on a periodic basis. The inspection items are as follows: (1) Appearance (e.g., safety vent condition) (2) Electrical performance (e.g., capacitance, power loss, current leakage) 2. If the capacitors have reached the end of their life, they must be replaced.	1. Before performing periodic maintenance tasks, turn OFF the equipment and allow the capacitors to completely discharge.  2. If any capacitor in equipment needs to be replaced, replace all the capacitors used in the same equipment. If new and old ones are used together, an unbalanced ripple current or voltage sharing can result.
Notes on storing capacitors		1. The capacitors must be stored at 5 to 35°C, less than 75% R.H. and kept out of direct sunlight. The maximum storage period is three years. 2. There may be cases where an electric charge is generated due to transient phenomena. To avoid electrical shock hazard, do not touch the terminals with bare hands.	1. After the capacitors have been stored for a period of more than 3 years, reforming will be necessary.  2. Before touching the terminals, discharge them with a resistor (10 to 100Ω) or discharge plate.
Disposal		1. When disposing of the capacitors, punch holes or crush the case and then incinerate them.  2. When the capacitors are not to be incinerated, consult the EPA for the proper disposal of industrial waste.	1. If an attempt is made to incinerate the capacitors without punching holes or crushing their cases, they will explode, resulting in a safety hazard. Be sure that incineration is conducted at high temperature. If it is done at low temperature, chlorine or other poisonous gas may be generated from the external sleeves (made of polyvinyl chloride). 2. When the capacitors are disposed of by an industrial waste disposal agent, verify that they are properly buried. Ensure that no discarded capacitors will be put back on the market.
Other		1. For further details refer to EIAJ RCR-2367, Precautions and Guidelines for Using Electronic Device Fixed Aluminum Nonsolid Electrolytic Capacitors. 2. If you have any questions, feel free to contact your local Hitachi AIC agent.	

### IN AN EMERGENCY

1. If gas is detected when installed capacitors are used, turn off the main power to the installation or unplug the power cord from the wall outlet.
2. When the safety vent of a capacitor is activated, a hot gas exceeding 100°C will jet out. Do not get close to, or expose yourself to the gas. Otherwise severe injury may occur.
3. If a gas jet enters your eye, wash it immediately with clean water.
4. If electrolyte gets in contact with your skin, wash the area of you skin with soap and water. Never allow electrolyte to enter your mouth.