● CIRCUIT DESIGN

1. Ensure that operational and mounting conditions follow the specified conditions detailed in the catalog and specification sheets.
2. Category temperature must be within our specification. If category temperatures exceed the maximum guaranteed limit, rapid electrical parameter deterioration will occur, and irreversible damage will result.
3. Do not apply excessive current which exceeds the rated ripple current.
   3.1. The excessive ripple current will shorten the lifetime of capacitors and damage the capacitors by generating heat, venting, etc.
   3.2. The maximum rated ripple current has been specified at a certain ripple frequency.
4. Select the capacitors to meet the service life of a device.
5. Aluminum electrolytic capacitors are polarized. Do not apply reverse voltage or AC voltage.
   Note: Even bi-polarized capacitors can not be used for AC voltage application.
6. Do not use aluminum electrolytic capacitors in a circuit that requires rapid and very frequent charge / discharge. In this type of circuit, it is necessary to use a special design capacitor with extend life characteristics.
7. Do not apply an over-voltage exceeding the full rated voltage of the capacitor. When AC voltage is superimposed to DC voltage, the peak value of the DC voltage and peak AC voltage (ripple current) must not exceed the full rated voltage.
   A surge voltage value, which exceeds the full rated voltage, is prescribed in the catalogs, but it only applies to the limited conditions and for short periods of time.
8. Electrically isolate the following sections of a capacitor when designing the device circuits.
   8.1. The outer can case of a non-solid aluminum capacitor from the negative terminal, positive terminal and circuit traces.
   8.2. The dummy terminal of a non-solid aluminum capacitor, which may be especially designed for negative terminal and circuit traces.
9. The outer sleeve of a capacitor has not been assured as an insulation-functioning part. For a place that requires the outer sleeves functioning ad insulation, a special type of capacitors should be designed.
10. Ensure that operational and mounting conditions follow the specified conditions detailed in the catalog and specification sheets.
    10.1. Water, Salt water or oil spatters, or dewy places.
    10.2. Toxic gases (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium, etc.) fills into.
    10.3. Ozone, ultraviolet rays or radiation is applied to.
    10.4. Severe vibration or mechanical shock conditions that exceed the limits prescribed in the catalogs or product specification.
11. When designing a circuit board, please pay attention to following:
    11.1. Make the hole spacing on the P.C. board match the lead spaces of the capacitor.
    11.2. There should not be any circuit pattern or circuit wire above the capacitor safety vent.
    11.3. Unless other wise specified, following clearance should be made above the safety vent.

Case Diameter	Gap Required
φD8 ~φ16	2mm or more
φD18 ~ φ35	3mm or more
φD40 Up	5mm or more

    11.4. In case the vent side is placed toward P.O. board (such as end seal vented parts), make a corresponding hole on the P.C. board to release the gas when vent is operated.
    11.5. The main chemical solution of the electrolyte and the separator paper used in the capacitors are combustible. The electrolyte is conductive.
    11.6. 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 in result smoking or catching fire.
    Do not Locate and circuit pattern beneath the capacitor end seal.
    11.7. Do not design a circuit board so that generating components such as resistor and transistors are placed near an aluminum capacitor or reverse side of P.C. board (under the capacitor).
    11.8. When you are designing capacitors for use on double-sides P.C. boards, avoid circuit patterns or through holes (such to connect both sides), that are placed under the capacitor.
12. Please refer to the pad size layout recommendations in our catalog when designing in surface mount capacitors. (CE32).

● 回路设计

1. 请先确认使用环境及装设环境后，依目录或是规格表内规定的电容器规格性能范围内的状态下使用。
2. 请不要在高温(超过上限温度范围的温度)下使用。在超过上限温度范围下使用时，会让电容器的寿命明显减少，或是导致防爆炸装置启动。
3. 请勿施加过度电流(超过额定最高纹波电流容许值以上之纹波电流)。
   3.1. 施加过度纹波电流时，会造成电容器内部过热，寿命减短，或是导致防爆炸装置启动。
   3.2. 在使用规定以外的频率时，请依各系列所规定的频率补正系数上所示以下的数值。
4. 在设计回路时，请使用适合机器寿命的电容器。
5. 电容器有分正负极。请勿施加逆电流或交流电压。在极性会反转的回路上请使用两极性的电容器。但请注意就算是两极性的电容器也请勿使用在交流的回路上。
6. 请勿将电容器使用在急速充放电的回路上。需要能使用在需急速充放电的回路上之电容器时请另行洽询。
7. 请勿对电容器施加过电压(超过额定电压的电压)。请将直流电和重叠的纹波电压之峰值设计在定格电压以下。超过定格电压时虽有涌浪电压的规格值，但限定于一定的条件下，长时间使用时无法保证。
8. 在电路设计上，在下述部分请做回路上的完全隔离。
   8.1. 铝壳、正导针、负导针以及回路图之间。
   8.2. 自立型的非通电性辅助用端子和其它的正极、负极及电路板之间。
9. 电容器的表面套管并不能保证可绝缘。请勿使用在必需有绝缘功能的地方。
   需要套管有绝缘功能的时候请与敝司洽询。
10. 请先确认使用环境及装设环境后，依目录或是规格表内规定的电容器规格性能范围内的状态下使用。
    10.1. 直接和水、盐水、油接触，或是会结霜的环境。
    10.2. 充满有害气体(硫化氢、亚硫酸、亚硝酸、氯、尿酸)的环境。
    10.3. 照射于臭氧、紫外线及放射线的环境下。
    10.4. 在超过目录或是规格表中所标示可容许的振动或是冲击条件下的过激之环境。
11. 将电容器插件上 PC 板之前时，请先确认以下几点后再进行设计。
    11.1. 请配合电容器端子间距来设计 PC 配线板孔的间距。
    11.2. 在电容器的防爆瓣上方请勿设置配线或回路图等。
    11.3. 在电容器防爆瓣的上方，在规格表中没有特别注明的场合，请留下以下空间。

产品直径	间隔
φD8 ~ φ16	2mm 以上
φD18 ~ φ35	3mm 以上
φD40 以上	5mm 以上

    11.4. 如果配线板会和电容的防爆瓣连接在一起的话，请配合防爆瓣的位置在配线板上开孔，好让防爆瓣爆开时空气可从孔中流出。
    11.5. 在电容器的封口部下方请不要设置回路。
    11.6. 如果有电解液漏液的状况，恐怕会使得回路发生短路。
    11.7. 请勿在电容器周围及配线板背面(电容器的下面)配置会发热的部品。
    11.8. 欲将电容设置在双面的配线板时，设计上请勿在电容下方有多余的电路板孔以及连贯正反面的贯通孔.
12. 设计使用到 CHIP 型电容(CE-32)的 PC 配线板之焊接回路图时，请依目录或 SPEC 上规定做设计。

13. The electrical characteristics of capacitors vary with respect to temperature, frequency and service life.
Design the device circuits by taking these changes into account.

14. If using more than one capacitor to connect in parallel, design the circuits to that the currents can equally flow into the individual capacitors.

15. If using more than one capacitor to connect in series, connect resistors in parallel with the individual capacitors for balancing the voltage.

13. 电容器的电气特性会依温度及频率变动做变化。请确认变化范围后设计回路。

14. 要将 2 个以上的电容做并连时，在设计回路上请考虑到电流分配不平均的问题。

15. 要将 2 个比上的电容器做串连时，请考虑到电压分配不均的问题并插入分压抵抗器。

● MOUNTING

1. The used capacitors are not reusable, except the case that they are taken form a device for periodic inspection to measure their electrical characteristics and then returned to the device.

2. Capacitors may have been re-charged by a recovery voltage phenomenon. Although discharged at a final manufacturing process, the capacitors are somewhat re-charged spontaneously by a recovery voltage phenomenon, which is caused by a slowly polarizing dielectric, with time. If these capacitors bring an electric shock or damages any sensitive circuit at assembly processes, discharge the electricity of the capacitors through a resistor of approximately 1KΩ before use.

3. Leakage current of the capacitors, that have been stored for a long time, may increase. When leakage current ha increased, please perform a voltage treatment using 1KΩ resistor.

4. Make sure of the rated capacitances and voltages of the capacitors when installing.

5. Make sure of the polarity of the capacitors when installing.
 5.1. Negative polarity is indicated on the side of body by means of a stripe or an arrow.
 5.2. On radial leaded type capacitors, the shorter lead is the negative polarity.
 5.3. On snap-in and lug terminal type capacitors, the knurled rivet [ ] indicates the negative polarity.

6. Do not drop capacitors on the floor, nor use a capacitor that was dropped.

7. Do not deform the can cases of capacitors.

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

9. Snap-in type capacitor should be installed tightly to the P.C. board (allow no gap between the P.C. board an bottom of capacitor).

10. Do not apply any mechanical for more than the limits prescribed in the catalogs or product specifications to capacitors. Also, note the capacitors may be damaged by mechanical shocks caused by the vacuum / insertion head, component checker or centering operation of an automatic mounting or insertion machine.

11. Hand soldering:
 11.1. Kindly follow the soldering conditions (temperature and time) defined on your approval sheet, otherwise less 10 seconds at 260℃.
 11.2. If it is necessary that the leads must be formed due to a mismatch of the lead space to hole space on the board, bend the lead prior to soldering without applying too much stress to the capacitor.
 11.3. If you need to remove parts which were soldered, please melt the solder enough so that stress is not applied to lead.
 11.4. Please pay attention so that solder iron does not touch any portion of capacitor body.

12. Flow soldering:
 12.1. Aluminum capacitor body must be submerged into the solder bath. Aluminum capacitors must be mounted on the “top side” of the P.C. board and only allow the bottom side of the P.C. board to come in contact with the solder.
 12.2. Soldering condition must be confirmed to the within our specification.
 12.3. Please avoid having flux adhere to any portion except the terminal.
 12.4. Please avoid contact between other components and the aluminum capacitor.

13. Reflow soldering:
 13.1. Soldering condition must be confirmed to be within our specification.
 13.2. 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 of the capacitor body material of the sleeve and capacitor size.
 13.3. The number of reflow time for SMT aluminum electrolytic capacitors shall be one time. If this type of capacitor has to be inevitably subjected to the reflow twice, please contact our sales office.

● 电容器安装

1. 已装配上机板并通电后的电容器请勿再重复使用。除非是使用于定检确认电气特性的电容器以外均无法重复使用。

2. 容器有时会发生再起电压，此时请通过约 1kΩ 的电阻做放电。

3. 经过长期保管的电容有时漏电流会增高。此时请通过约 1kΩ 的电阻做电压处理。

4. 请先确认过电容器的规格(容量及电压)后再装配。

5. 请先确认过电容器的正负极后再装配。
 5.1. 电容本体侧面会以一条色带或箭头表示出负极。
 5.2. 导针在同一方向的 CE-04 品其导针较短一方为负极。
 5.3. 牛角形(CE-69)或接线端子形(CE-62)品其负极钉上压有［⊗］印的方向为负极。
 Chip 形(CE-32)品在印有［ ］形状的方向为负极。

6. 请不要让电容器掉落地上，掉落的电容器请不要使用.

7. 请物让电容器变型后使用。

8. 请先确认电容器的正负极间的距离和配线板的孔距后再进行装配。

9. 装配牛角形时请将电容器压到和机板密合(不要是浮起来的状态)。

10. 请不要对电容器施加超过 SPEC.所规定的机械强度。使用自动插件机进行吸附、装配、以及对准位置或是剪脚等会对电容器施压的场合，请注意其冲击力的大小.

11. 以烙铁焊接时的注意事项:
 11.1. 请确认焊接条件，否则，应在 260℃，10 秒钟内完成。
 11.2. 如果因为电容正负极的距离和配线板上的孔洞间距不同，需要将导针端子做加工时，请在焊接之前处理，并小心不要对电容器本体施加到压力。
 11.3. 人工重新焊接时如果需要将已经焊接上去的电容器拆下时，请小心不要压迫到电容器的端子，将焊锡完全融开后再拔起。
 11.4. 请勿将烙铁的尖端碰触到电容器本体。

12. 锡炉焊接时的注意事项:
 12.1. 请勿将电容器本体浸到锡炉内。请将 PC 配线板夹在中间，只要焊接没有电容器本体的那一面即可。
 12.2. 焊接条件(预备加热、焊接温度和时间) 请设定于目录或 SPEC.规定的范围内。
 12.3. 请勿让助焊剂沾到端子以外的部分。
 12.4. 在焊接时请勿让其它配件倒下碰触到电容器。

13. 回焊炉焊接时的注意事项:
 13.1. 焊接条件(预备加热、焊接温度和时间) 请设定于目录或 SPEC.规定的范围内。
 13.2. 使用远红外线加热时，请考虑到电容器的颜色、材质、大小不同，对远红外线的吸收度会不同，请小心加热的程度。
 13.3. 回焊电容器的次数请设定为一次。如果需要回焊两次的场合请务必洽询敝司。

14. Do not apply any mechanical stress to the capacitor after soldering to the P.C. board.
 14.1. Do not incline, twist or push the body of the capacitor down after soldering it to the P.C. board.
 14.2. Do not take the assembly board by the capacitor in lifting or carrying the assembly board.
 14.3. Do not bump or strike any object against the capacitor after soldering to the P.C. board.
 Also, if the assembly boards are piled up, they should be so placed that any of the boards and other components can not touch the capacitor.

15. Circuit Board cleaning:
 15.1. Do not clean capacitors with halogenated cleaning agent. However, if it is necessary to clean with halogenated cleaning agent, use cleaning proof capacitors but within the range specified in the specification.
 15.2. Recommended clearing method
 <cleaning agents>
 Pine Alpha ST-100S
 Clean Through-750H
 Iso-proryl Alcohol (IPA)
 <cleaning conditions>
 Total cleaning time shall be within 5 minutes (5mm and 7mm height: within 3 minutes) by immersion, ultrasonic or other method.(Temperature of the cleaning agent shall be 60 or lower.)
 After cleaning capacitors should be dried using hot air for minimum of 10 minutes along with the P.C. board.
 Hot air temperature should the below the maximum category temperature of the capacitor. Insufficient dry after water rinse may cause appearance problems. Sleeve shrink, bottom-plate bulge and such.

16. Fixing materials and coating materials:
 16.1. Do not use any ingredients which contain halogen.
 16.2. Please pay attention to remove flux and any contamination which remains in the gap between the end seal and P.C. board and dry that portion well before coating.
 16.3. Please do not apply any material all around the capacitor body but apply it partially.
 16.4. Please contact our sales office to make sure whether the curing condition of coating material would cause any problems.

14. 将电容器焊接上 PC 板后，请不要施加以下机械性压力。
 14.1. 请勿让电容器本体倾斜、推倒，或转动。
 14.2. 请勿把电容器当成把手，抓住电容器去移动 PC 板。
 14.3. 请勿让电容器撞到东西。如果要将 PC 板重叠起来时，请小心不要让电容器碰到 PC 板或其它配件。

15. 基板洗净
 15.1. 不可使用卤素系的清洁剂做洗净。
 15.2. 推荐的洗净方法
 <洗净剂>
 Pine Alpha ST-100S
 Clean Through-750H
 Iso-proryl Alcohol (IPA)
 <洗净条件>
 使用浸泡、超音波等方法的洗净时间请控制在合计五分钟以内(5mm、7mm 品则在三分钟以内)。
 洗净后请连同 PC 板一起使用热风吹干。热风的温度请勿超过电容器规定之上限。
 除此之外，如果脱水时未能做到充分的干燥，有时会发生套管的二次收缩、电容底板鼓起等外观上的不良，请注意。

16. 对电容有使用到固定胶、黏着剂在使用上，请确认以下内容。
 16.1. 请勿使用含有卤素的固定剂和黏着胶。
 16.2. 在使用固定剂、黏着胶之前，请先清除干净基板和电容封口处之间的助焊剂的残渣和污浊。
 16.3. 在使用固定剂、黏着胶之前，请先烘干洗净剂等。另外请注意不要完全堵住封口处。
 16.4. 固定剂、黏着胶的热度硬化条件请遵从 SPEC.的规定。

● IN THE EQUIPMENT

1. Do not directly touch terminal by hand.
2. Do not short between terminals 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 will be free from spilling water or oil, direct sunlight, ultraviolet rays, radiation, poisonous gases, vibration or mechanical shock.

● 机种的使用上

1. 请不要直接接触电容器的端子。
2. 请不要放置导电体在端子之间造成短路。并且也请不要使用酸性或碱性等导电体溶液在电容上。
3. 请确认电容器装配的机种设置环境。

● 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, Dissipation factor, Leakage current etc., which are specified in the drawing exchanged between GJT and our customers or the catalog.

● 安全检查

使用在产业用的机器上的电容请接受定期的检查。检查项目请依下述内容进行。

1. 外观:
 有无明显的外观异常，同防爆瓣开启、漏液等等。
2. 电气特性:

● 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 you face the safety vent since gas which in over 100 will be emitted when the safety vent operates.
3. If the gas has entered you eyes, please flush you eyes immediately in pure water. If you breathed the gas, immediately wash out your mouth and throat with water.

● 发生意外时

1. 如果在机种使用时发生电容器防爆瓣开启，或是气体外漏时，请将机种的主电源关掉，或是将电源插头拔离插座。
2. 当电容器的防爆瓣开启时，会喷射出超过 100 度的高温气体，请勿将头脸靠近。
3. 如果喷出的气体跑到眼睛内或误吸到气管内的话，请马上用清水清洗眼睛并漱口。

4. Do not ingest electrolyte. If your skin is exposed to electrolyte, please wash it away using soap and water.

4. 请不要舔食电解液。如果电解液沾到皮肤上，请用肥皂清洗。

● STORAGE

1. Do not keep capacitor in high temperature and high humidity.
   Storage ambient should be:
   Temperature: 5℃ ~ 35℃;
   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 poisonous gases such ad 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.

● 储存的条件

1. 请勿在高温潮湿的环境下保管电容器。
   请保管在室内温度在 5~35 度，相对湿度在 75%以下的环境里。
2. 请勿将电容器保管在不会直接接触到水、盐水、油等的环境下。
3. 请勿将电容器保管在充满对电容有害的气体(硫化氢、亚硫酸、亚硝酸、氯、尿酸)的环境下。
4. 请勿将电容器保管在照射于臭氧、紫外线及放射线的环境下。

● DESPOSAL

Please dispose capacitors in either of the following ways:

1. Incinerate capacitors (high temperature of more than 800℃) after making a hole on the capacitor body.
2. Bury capacitors in the ground.
   Please have a disposal specialist do it.

● 废弃处理

要将电容器废弃处理时，请依下述方法其一实行。

1. 将电容器开孔，或是压扁后做高温焚化处理(800)度以上。
2. 不使用焚化处理时，请交给专门的产业废弃处理业者做掩埋处理。

The above mentioned material is according to EIAJ, RCR 2367A (revised in march, 1999), titled “Guideline of notable for Fixed Aluminum Electrolytic Capacitors for use in Electrolytic Equipment”. Please refer to the book for details.

●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 gradual increase in tanδ and ESR. The following equation has been experimentally found to express the relationship between the temperature acceleration factor and the deterioration of the capacitor.

$Lx=L_0*K_{Temp}=L_0*B^{(T0-Tx)/10}$

$K_{Temp}=B^{(T0-Tx)/10}$

Where:
Lx= lifetime(hour) of capacitor to be estimated
L0=Base lifetime (time) of capacitor
T0=Maximum rated operating temperature (℃) of capacitor shown in catalog.
Tx=Actual ambient temperature (℃) of capacitor
B=Temperature acceleration factor (=2)

This equation is similar to Arrhenius’ equation that express a relationship between chemical reaction rates and temperature and called Arrhenius 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 mean 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 from the above formula by using the 40℃ as Tx.

寿命推定预见表 Expected Life Estimate Quick Reference Guide