

STANDARD OF RK SERIES CAPACITORS**1. Applicable Standard**

Characteristic W of JIS C 5141

2. Environmental Protection Standard

Comply with the EU directive 2002/95/EC

3. Operating Temperature Range

-40°C ~ +105°C (6.3V ~ 100V)

-25°C ~ +105°C (160V ~ 450V)

4. DC Leakage Current

Applying the rated DC voltage to the capacitor. The leakage current is measured at 2 minutes after the DC voltage across the capacitor reached the rated voltage. The leakage current shall not exceed the value below (at 25°C).

$I = 0.01CV$ or $3\mu A$ whichever is greater (after 2 minutes)	$I = 0.02CV + 15\mu A$ (after 5 minutes)
$WV \leq 100$	$WV > 100$

Where, I: Leakage current (μA) C: Nominal capacitance (μF) V: Rated voltage (V)

5. Capacitance Tolerance

The capacitance shall be within the following tolerance to the nominal capacitance.

-20 ~ +20% (at 20°C, 120Hz)

6. Dissipation Factor Max.

(at 20°C, 120Hz)

When nominal capacitance is over 1000 μF , $\tan \delta$ shall be added 0.02 to the listed value with increase of every 1000 μF .

WV	6.3	10	16	25	35	50	63	100	160	200	250	350	400	450
$\tan \delta$	0.24	0.20	0.16	0.14	0.12	0.10	0.09	0.08	0.15	0.15	0.15	0.20	0.20	0.20

7. Temperature Characteristics

Impedance ratio of the -25°C or -40°C value to the 20°C value shall not exceed the value below (at 120Hz).

WV	6.3	10	16	25	35~100	160	200~350	400, 450
$Z (-25^\circ C) / Z (+20^\circ C)$	4	3	2	2	2	3	3	8
$Z (-40^\circ C) / Z (+20^\circ C)$	8	6	4	3	3	4	4	--

8. Load Life

The following specification shall be satisfied when the capacitors are restored to 20°C after the rated voltage is applied for 2000 hours at 105°C. (ϕ 5, 6.3 and 8 products are for 1000 hours)

Capacitance change	$\pm 20\%$ of initial measured value
$\tan \delta$	$\leq 200\%$ of initial specified value
Leakage current	\leq initial specified value

9. Shelf Life

(at 105°C)

After 1000 hours of no load test, leakage current, capacitance and $\tan \delta$ are same as load life value.

10. Solderability

The lead wires shall be dipped into Methanol (JIS K 1501) or Isopropyl Alcohol (JIS K 1522 or JIS K 1522 or JIS K 8839) solution of $10 \pm 20\%$ Rosin (JIS K 5902) for 2 ± 0.5 seconds. The depth of immersion shall be 2 to 2.5mm of the capacitor body. After immersion, the solder shall cover at least 3/4 of the lead wire surface immersed.

11. Lead Strength

Pull Strength

The lead wire shall not get loose or cut off, while a parallel force is gradually applied to the lead wire up to 5N retained for 10 seconds.

Bending strength

Apply the 0.22kg weight to the end of the lead wire, and lean the capacitors body 90° and return to the original position within approximately 5 seconds. Then repeat this cycle in the opposite direction at the same speed. After that, the lead wire shall not loose or cut off.

12. Vibration

The frequency shall be swept over the range of 10 to 55 Hz for 2 hours in each of 3 mutually perpendicular directions (a total of 6 hours). During the last 30 minutes of vibration in each direction. The capacitance shall be measured 3 to 5 times.

Amplitude (total excursion): 1.5 mm

Sweep rate: 10 to 55 to 10 Hz per minute

Capacitance	There shall be no intermittent contacts or open or short circuiting. Refer to the before test $\pm 5\%$.
Appearance	There shall be no such mechanical damage as terminal damage, etc, or leakage of electrolyte or swelling of the case. The marking shall be legible.
Inner construction	There shall be no damage of tab terminal or electrodes.

13. Damp Heat

The capacitors shall be stored at a temperature of $40 \pm 2^\circ\text{C}$ and relative humidity of 90% ~ 95% for 240 ± 8 hours. The capacitors shall then be subjected to standard atmospheric conditions for 1 ~ 2 hours before the measurement.

Capacitance	Less than values in the table
Leakage current	Referred to the value before test $\pm 10\%$
$\tan \delta$	Within the specified value

14. Surge Voltage

The surge voltage rating is the maximum DC over-voltage to which the capacitors may be subject of short periods not exceeding approximately 30 seconds at infrequent intervals of not less than 5 minutes. The rated surges of the electrolytic capacitors are as follows:

Rated voltage (V)	6.3	10	16	25	35	50	63	100	160	200	250	350	400	450
Surge voltage (V)	8	13	20	32	44	63	79	125	200	250	300	400	450	500

15. Ripple Current

Do not apply a ripple current exceeding the rated maximum ripple current. When an excessive ripple current passes, the capacitors may be damaged with the vent operating, etc. Use the electrolytic capacitors within the permissible ripple current range current at specified frequency and temperature.

16. Marking

The following items shall be marked on each capacitor.

(Note: White marking on the black sleeve)

Example:

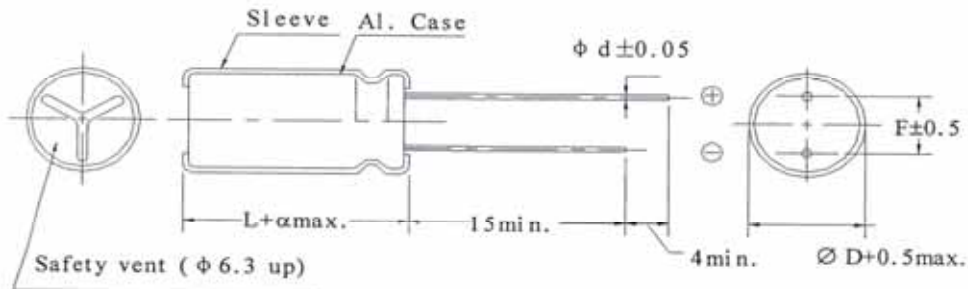


- ① Polarity
- ② Series number
- ③ Maximum operating temperature
- ④ Capacitance tolerance
- ⑤ Manufacturer's identification mark
- ⑥ Nominal capacitance and rated voltage

* Safety vent for product where diameter is more than 6.3 mm.

17. Insulating sleeve: PVC

18. Dimensions (Unit: mm)



19. Lead Spacing and Wire Diameter (Unit: mm)

∅D	5	6.3	8	10	13	16	18	22	25
F	2.0	2.5	3.5	5.0	5.0	7.5		12.5	
∅d	0.5		0.6	0.6	0.6	0.8		0.8	
α	1.0		1.5			2.0			

20. The raw materials of lead wire.

Name	Material	Percentage
TPCS	Fe	71.35%
	Cu	20%
	Sn	8.65%

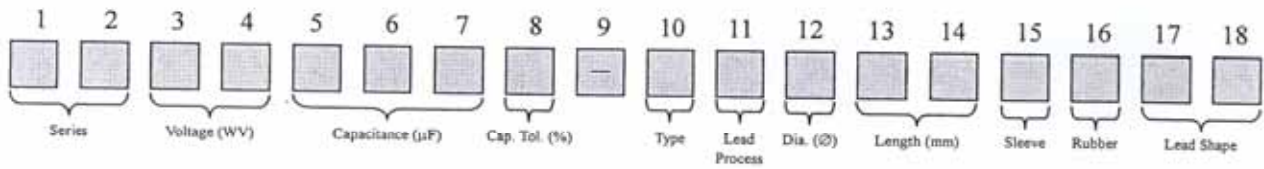
21. Dimensions & Maximum Permissible Ripple Current

Item	Fujicon P/N	Capacitance (μF)	Working Voltage (V)	Case Size ∅D×L (mm)	Ripple current (mA rms) at 105°C, 120Hz
1	RK2A010M-RBD11WP00	1	100	5x11	15
2	RK2A2R2M-RBD11WP00	2.2	100	5x11	23
3	RK1J3R3M-RBD11WP00	3.3	63	5x11	28
4	RK2A4R7M-RBD11WP00	4.7	100	5x11	37
5	RK1J100M-RBD11WP00	10	63	5x11	50
6	RK1J220M-RBE11WP00	22	63	6.3x11	82
7	RK1H330M-RBE11WP00	33	50	6.3x11	90
8	RK1H470M-RBE11WP00	47	50	6.3x11	125
9	RK1V101M-RBE11WP00	100	35	6.3x11	150
10	RK1H221M-RBG17WP00	220	50	10x17	345
11	RK1J471M-RBJ25WP00	470	63	13x25	700

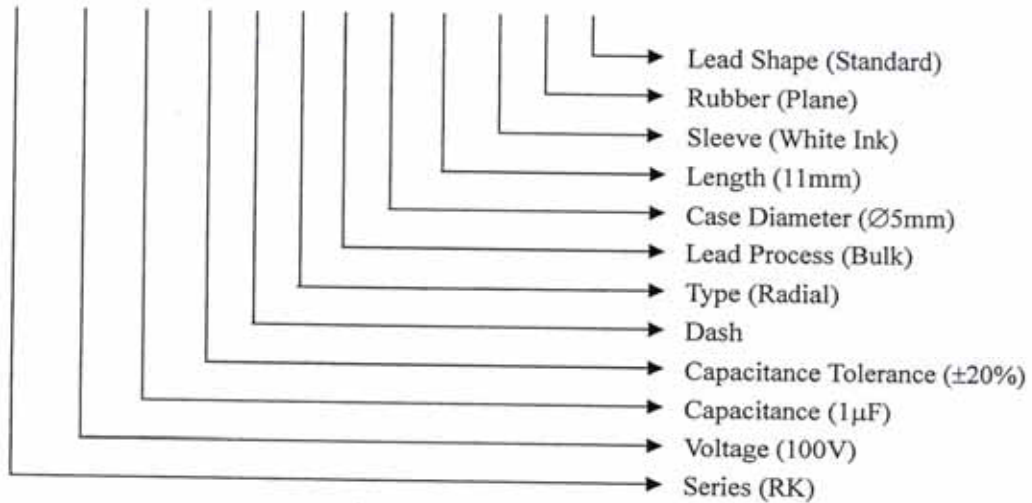
22. Frequency Coefficient of Allowable Ripple Current

μF	Frequency	50Hz	120Hz	300Hz	1kHz	10kHz
	0.47 ~ 47		0.75	1	1.35	1.55
68 ~ 680		0.80	1	1.25	1.34	1.5
1000 ~ 15000		0.85	1	1.10	1.13	1.15

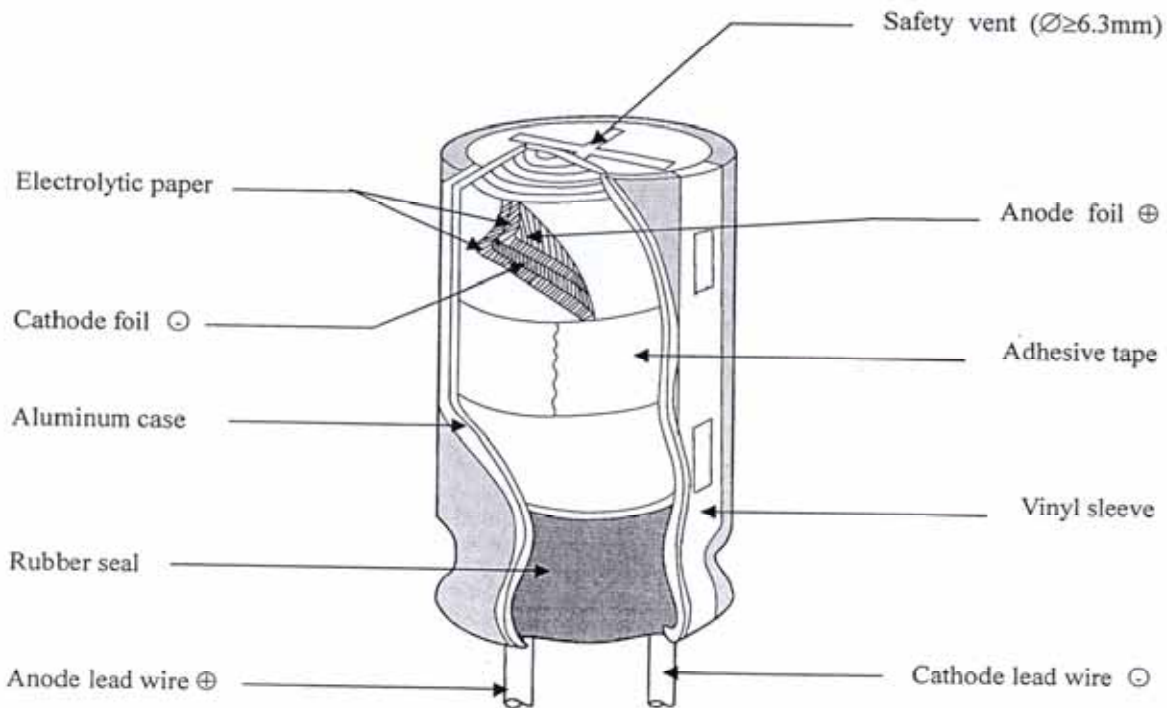
23. Explanation of Part Number



Example: **RK 2A 010 M - R B D 11 W P 00**



24. Construction

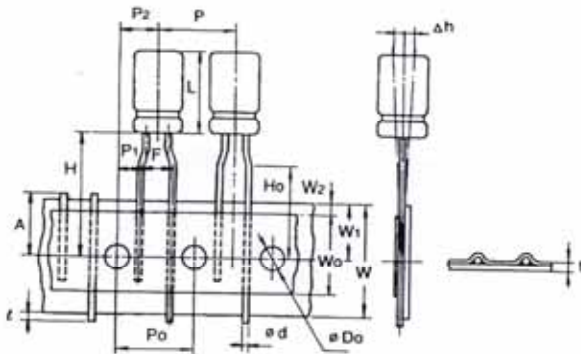


25. Taping Specifications

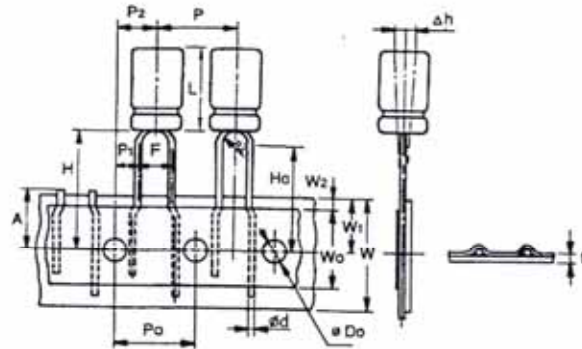
Lead Taping Capacitors for Automatic Insertion

■ Drawing (Unit: mm)

(Drawing A)



(Drawing B)



■ Dimensions (Unit: mm)

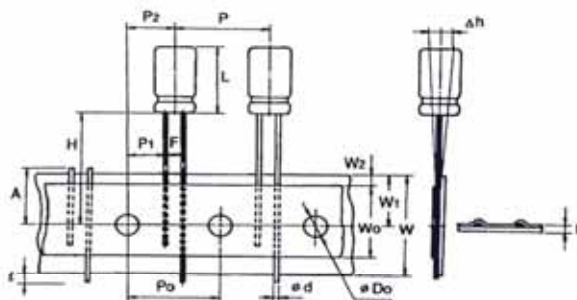
Application To Drawing			A (B)				C			A												
Description	Symbol	Tolerance	Ø4		Ø5		Ø6.3		Ø8		Ø4			Ø5			Ø6.3			Ø8		
Case Height	L	*Note	5, 7	5	7	5	7	5	5, 7	5	5, 7	5	7	11	5	7	11	5	7, 9	12, 14, 16		
Lead Diameter	d	±0.05	0.45	0.45	0.45 0.5	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.5	0.5	0.45	0.45	0.5	0.45	0.5	0.6		
Body Pitch	P	±1.0	12.7		12.7		12.7		12.7									12.7	12.7			
Feeding Hole Pitch	P ₀	±0.2	12.7		12.7		12.7		12.7									12.7	12.7			
Feeding Hole Alignment	P ₁	±0.7	5.1		5.1		5.1		3.85									3.85	3.85			
Feeding Hole Alignment	P ₂	±1.0	6.35		6.35		6.35		6.35									6.35	6.35			
Lead Center Spacing	F	+0.6 -0.2	2.5		2.5		3.5		5.0									5.0	5.0			
Body Inclination	Δh	±2.0	0		0		0		0									0	0			
Tape Width	W	±0.5	18.0		18.0		18.0		18.0									18.0	18.0			
Adhesive Tape Width	W ₀	Min	9.5		9.5		9.5		9.5									9.5	12.5			
Feeding Hole Alignment	W ₁	±0.5	9.0		9.0		9.0		9.0									9.0	9.0			
Adhesive Tape Margin	W ₂	Max.	2.0		2.0		2.0		2.0									2.0	2.0			
Length from Seating Plane	H	±0.5	17.5 (18.0)		17.5		18.5		18.5 (5.7L=17.5)									17.5	20.0			
Lead Clinch Height	H ₀	±0.5	16.0 (17.0)		--		--		16.0									16.0	16.0			
Lead Protrusion	ℓ	Max.	2.0		2.0		2.0		2.0									2.0	2.0			
Feeding Hole Diameter	ØD ₀	±0.2	4.0		4.0		4.0		4.0									4.0	4.0			
Total Tape Thickness	t	±0.2	0.7		0.7		0.7		0.7									0.7	0.7			
Cut Lead Height	A	Max.	11.0		11.0		11.0		11.0									11.0	11.0			
Taping Code	Ammo	⊕ leader	TA		TS		TS		TA									TA	TA			

*Note: Please refer to the drawing of each series for tolerance.

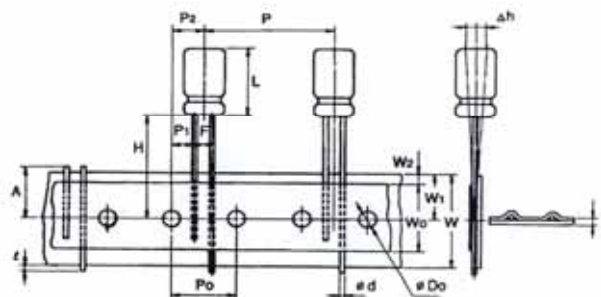
Lead Taping Capacitors for Automatic Insertion

■ Drawing (Unit: mm)

(Drawing C)



(Drawing D)

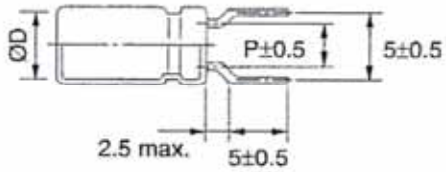
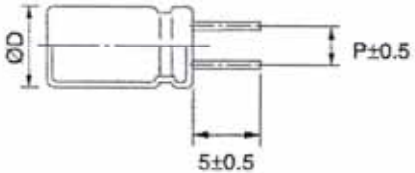
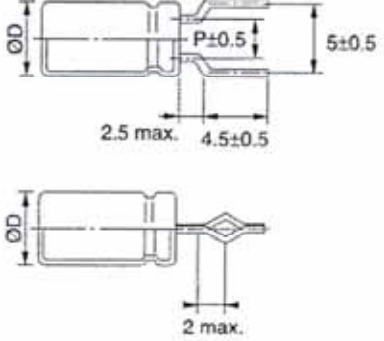
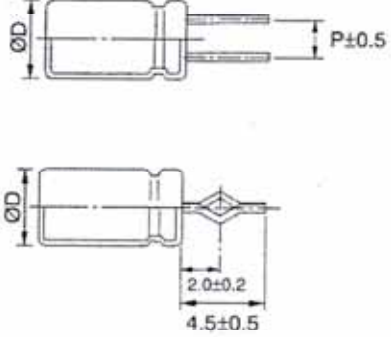


■ Dimensions (Unit: mm)

Application To Drawing			C	C	D	D
Description	Symbol	Tolerance	∅10	∅13	∅16	∅18
Case Height	L	Max.	25.0	25.0	35.0	40.0
Lead Diameter	d	±0.05	0.6	0.6	0.8	0.8
Body Pitch	P	±1.0	12.7	15.0	30.0	30.0
Feeding Hole Pitch	P ₀	±0.2	12.7	15.0	15.0	15.0
Feeding Hole Alignment	P ₁	±0.7	3.85	5.0	3.75	3.75
Feeding Hole Alignment	P ₂	±1.0	6.35	7.5	7.5	7.5
Lead Center Spacing	F	+0.6 -0.2	5.0	5.0	7.5	7.5
Body Inclination	Δh	±2.0	0	0	0	0
Tape Width	W	±0.5	18.0	18.0	18.0	18.0
Adhesive Tape Width	W ₀	Min	12.5	12.5	12.5	12.5
Feeding Hole Alignment	W ₁	±0.5	9.0	9.0	9.0	9.0
Adhesive Tape Margin	W ₂	Max.	2.0	2.0	2.0	2.0
Length from Seating Plane	H	±0.5	18.5	18.5	18.5	18.5
Lead Protrusion	ℓ	Max.	2.0	2.0	2.0	2.0
Feeding Hole Diameter	∅D ₀	±0.2	4.0	4.0	4.0	4.0
Total Tape Thickness	t	±0.2	0.7	0.7	0.7	0.7
Cut Lead Height	A	Max.	11.0	11.0	11.0	11.0
Taping Code	Ammo	⊕ leader	TS	TS	TS	TS

Note: All design and specifications are for reference only and is subject to change without prior notice. If any doubt about safety for your application, please contact us immediately for technical assistance before purchase.

26. Lead Forming & Cutting Specifications (Unit: mm)

Configurations	Code	Case diameter	Shape
F-Type	RF	$\varnothing D \leq 8$	
C-Type	RC	$\varnothing D \geq 4$	
K-Type	RK	$\varnothing D \leq 8$	
Y-Type	RY	$\varnothing D \geq 10$	

27. Packaging Specifications

1) Taping Type (Ammo)

Diameter (mm)	Ammo Box Size			Quantity (pcs)
	L (mm)	H (mm)	W (mm)	
∅5mm	342	235	50	2,000
∅6.3mm	348	305	56	2,000
∅8mm	342	235	50	1,000
∅10mm (12L)	342	235	50	500
∅10mm (16L)	342	235	50	500
∅10mm (20L)	342	235	50	500
∅13mm (25L)	340	320	65	500
∅16mm (25L)	340	320	65	300
∅18mm (25L)	340	320	65	250



2) Bulk Type

Case Size ∅D×L (mm)	Plastic Bag Quantity	Small Box Quantity		Carton Box Quantity		Small Box Size			Carton Box Size		
	pcs / per Bag	bag / per Small Box	pcs / per Small Box	Small Box/per Carton Box	pcs / per Carton Box	L (mm)	H (mm)	W (mm)	L (mm)	H (mm)	W (mm)
5×11	500	40	20,000	2	40,000	300	290	220	470	310	310
6.3×11, 12	500	30	15,000		30,000						
8×10~12	250	40	10,000		20,000						
8×13~20	250	30	7,500		15,000						
10×12~22	200	25	5,000		10,000						
10×25	100	25	2,500		5,000						
13×21~25	100	25	2,500		5,000						
13×30	100	20	2,000		4,000						
16×25~28	100	15	1,500		3,000						
16×31~37	100	10	1,000		2,000						
18×21	100	10	1,000		2,000						
18×35~40	100	7	700		1,400						
22×36, 40	50	10	500		1,000						
25X40,45	25	4	100		4						

The following items shall be marked on the box:

- 1) Customer part number (where customer designated)
- 2) P/O number (where customer designated)
- 3) Series description
- 4) Quantity
- 5) Code number

28. General Information for Application

The following precautions must be observed when using electrolytic capacitors.

A) 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.
- 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. Do not apply reserve voltage or AC voltage. Please use non-polarized capacitors for a circuit that can possibly see reserved polarity.
Note: Non-polarizes capacitors cannot be used for AC voltage application.
- 5) Do not use aluminum electrolytic capacitors in a circuit that requires rapid and very frequent charge or discharge. In this type of circuit, it is necessary to use special design capacitors with extended life characteristics.
- 6) Do not apply excess voltage.
 - ① Please 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.
- 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 must not be used under following conditions:
 - ① (a) Capacitors must not be exposed to water (including condensation), brine or oil.
 - (b) Ambient conditions that include toxic gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium, etc.
 - (c) Ambient conditions that expose the capacitor to ozone, ultraviolet ray and radiation.
 - 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: 1.5 (max. 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 Make the pad spacing on the PC board matching with the lead space of the capacitor.
 - ② There should not be any circuit pattern or circuit wire above the capacitor safety vent.
- 10) The main chemical solution of the electrolyte and the separator paper in the capacitor are combustible. The electrolyte is conductive. When it comes in contact with the PC board, there is a possibility of pattern

or short circuit between the circuit pattern, which could result in smoking or 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 PC board (under the capacitor).
- 12) Please refer to the pad size layout recommendations in our catalogue when designing 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 following in to the capacitor.

B) 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 1K Ω resistor.
- 3) Leakage current of the parts that have stored for long period may increase. When leakage current has increased, please perform a voltage treatment using a 1K Ω resistor.
- 4) Please confirm rating and polarity before installing capacitor on the PC board.
- 5) Be careful not to deform the capacitor during installation.
- 6) Please confirm that the lead spacing of the capacitor matches the pad spacing of the PC board prior to installation.
- 7) 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.
- 8) Do not tilt, lay down or twist the capacitor body after the capacitors are soldered to the PC board.
- 9) Do not carry the PC board by grasping the soldered capacitor.
- 10) Please do not allow anytime to touch the capacitor after soldering. If PC board are stored in stack, please make sure PC board or the other components do not touch the capacitor. The capacitor shall not be effected by any radiated heat from the soldered PC board or other components after soldering.

11) 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 : Pine Alpha ST-100S, cleaning through 750H/750L/710M, Sanelek B-12, Aqua Cleaner 210SEP, Techno Care FRW14~17, Isopropyl Alcohol.

Cleaning condition: Total cleaning time shall be within 5 minutes by immersion, ultrasonic or other method. Temperature of the cleaning agent shall be 60°C or lower. After cleaning, capacitors should be dried using hot air for minimum of 10 minutes along with the PC board. Hot air temperature should be below the maximum operating temperature of the capacitor. Insufficient dry after water rinse may cause appearance problems, sleeve shirk, bottom-plate bulge and such.

③ Avoid using ozone destructive substance for cleaning agents to concern about global environment. Please consult us regarding other cleaning agents or cleaning methods.

C) 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 will be free from spilling water or oil, direct sunlight, ultraviolet rays, radiation, poisonous gases, vibration or mechanical shock.

D) Maintenance and Inspection

Please periodically inspect the aluminum capacitors that are installed in industrial equipment. The following Items should be checked:

Appearance: Remarkable abnormality such as vent operation, leaking electrolyte etc.

Electrical characteristic: Capacitance, dielectric loss tangent, leakage current etc., which are specified in this catalogue.

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

F) 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.

G) Disposal

Please dispose capacitors in either of the following ways:

- 1) Incinerate capacitors after crushing parts or making a hole on the capacitor body.
- 2) Bury capacitors in the ground. Please have a disposal specialist do it.

29. Note

All design and specifications are for reference only and is subject to change without prior notice. If any doubt about safety for your application, please contact us immediately for technical assistance before purchase.