Specification
No. G210390A0002Z1 — 1 to 17

Electrolytic Capacitors
Specifications

Customer Part No. :

Customer Specification No. :

Nippon Chemi-Con Part No. : KXJ SERIES

Nippon Chemi-Con Corporation
Chemi-Con East Japan Corporation
Iwate Plant Design Group Manager

F. Endoh
Fusayoshi Endoh

Receipt Stamp

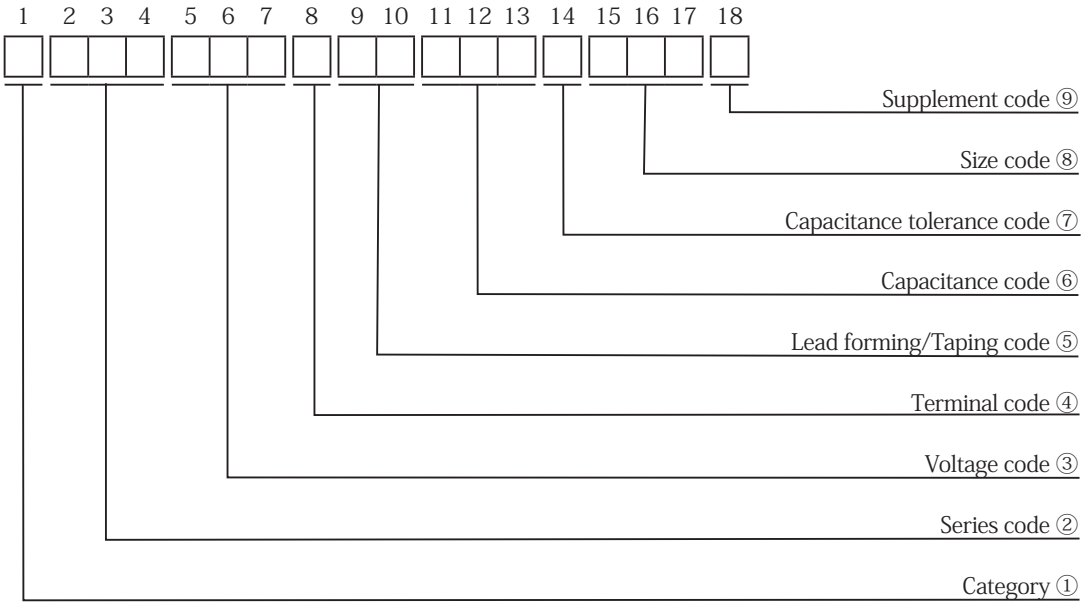
Change history of specifications

Specifications No.	Revision date	Pages/section revised	Changes made	Reasons for changes
G210390A0002Z1	Jan.13.2021	—	First issue	—

1 Scope

This specification defines the requirements for aluminum electrolytic capacitors KXJ series.

2 Part Numbering System



① Category

Category	Code
	1st
Polar	E

② Series code

Series name	Series code		
	2nd	3rd	4th
KXJ	K	X	J

③ Voltage code

Voltage[V]	Voltage code		
	5th	6th	7th
160	1	6	1
200	2	0	1
220	2	2	1
250	2	5	1
350	3	5	1
400	4	0	1
420	4	2	1
450	4	5	1

④ Terminal code

Terminal configuration	Terminal code
	8th
Radial lead	E

⑤ Lead forming/Taping code

Type	Shape/contents	Lead forming/Taping code	
		9th	10th
Lead forming (Radial lead/Bulk)	Straight	L	L
Taping (Radial lead)	Straight	T	D
	Straight (Skip a hole : Applicable to only ϕ 12.5)	T	E
	Straight (Styrofoam-less : Applicable to only ϕ 16 and ϕ 18)	T	S

⑥ Capacitance code

Capacitance[μ F]	Capacitance code		
	11th	12th	13th
6.8	6	R	8
10	1	0	0
12	1	2	0
15	1	5	0
18	1	8	0
22	2	2	0
27	2	7	0
33	3	3	0
39	3	9	0
47	4	7	0
56	5	6	0
68	6	8	0
82	8	2	0
100	1	0	1
120	1	2	1
150	1	5	1
180	1	8	1
220	2	2	1
270	2	7	1
330	3	3	1
390	3	9	1
470	4	7	1
560	5	6	1
680	6	8	1

⑦ Capacitance tolerance code

Capacitance tolerance [%]	Capacitance tolerance code
	14th
± 20	M

⑧ Size code

φ D	Size code
	15th
10	J
12.5	K
14.5	U
16	L
18	M

L	Size code	
	16th	17th
16	1	6
20	2	0
25	2	5
30	3	0
31.5	N	3
35	3	5
35.5	P	1
40	4	0
45	4	5
50	5	0

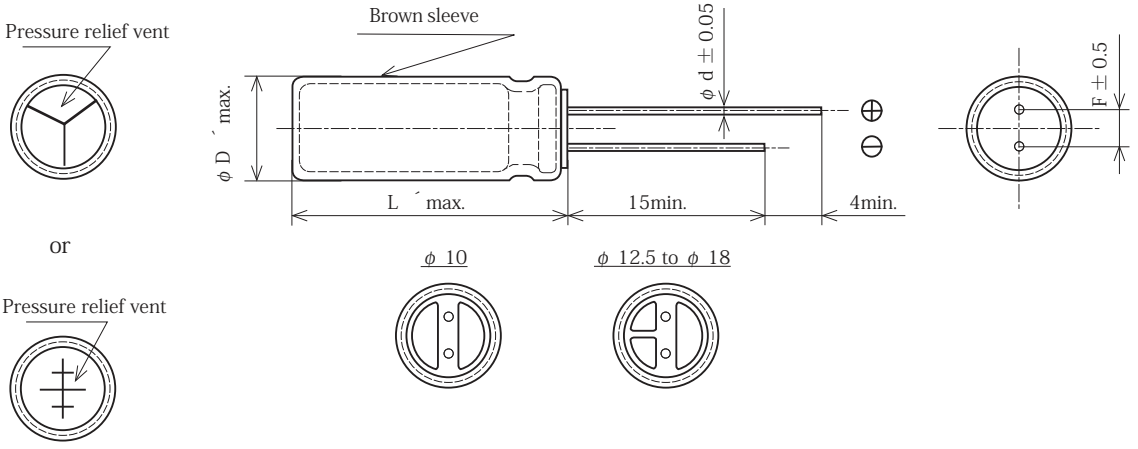
⑨ Supplement code

Sleeve material	Terminal plating material	Supplement code
		18th
PET	Sn	S

3 Appearance and dimensions

Long lead

Lead forming code : L L

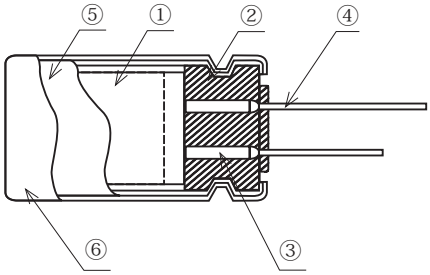


Dimension [mm]

φ D	10	12.5	14.5	16	18
L	16 to 50				
φ d	0.6		0.8		
F	5.0		7.5		
L ´	L + 1.5 ※ 1				
φ D ´	φ D + 0.5 ※ 1				

※ 1 φ D , L : Nominal case size

4 Construction



No.	Compositions		Materials
①	Element	Anode foil	Aluminum
		Cathode foil	Aluminum
		Separator	Paper
		Fixing tape	Polypropylene(PP)
②	Seal		Rubber
③	Aluminum tab		Aluminum
④	Lead wire		Tinned copper clad steel
⑤	Case		Aluminum
⑥	Sleeve		Polyester

※ No ozone depleting substance has been used.
Compliant to the RoHS Directive (2011/65/EU) and the revisions (2015/863/EU)

5 Rating and characteristics

No.	Item	Specification
1	Category temperature range	− 40 to + 105℃
2	Rated voltage range	160 to 450V_{DC}
3	Surge voltage	Table-1
4	Rated capacitance range	See the standard rating table
5	Capacitance tolerance	− 20 to + 20%
6	Dissipation factor(tan δ)	See the standard rating table
7	Leakage current	See the standard rating table
8	Rated ripple current	See the standard rating table

Table-1 Surge voltage

Rated voltage [V_{DC}]	160	200	220	250	350	400	420	450
Surge voltage [V_{DC}]	184	230	253	288	385	440	462	495

Rated ripple current multipliers
Frequency multipliers

Frequency [Hz] / Capacitance [μ F]	120	1k	10k	100k
6.8 to 82	1.00	1.75	2.25	2.50
100 to 680	1.00	1.67	2.05	2.25

When a frequency is different from the specified condition shown in the table of standard ratings, do not exceed the value obtained by multiplying the permissible maximum ripple current by the multiplier above.

6 Marking

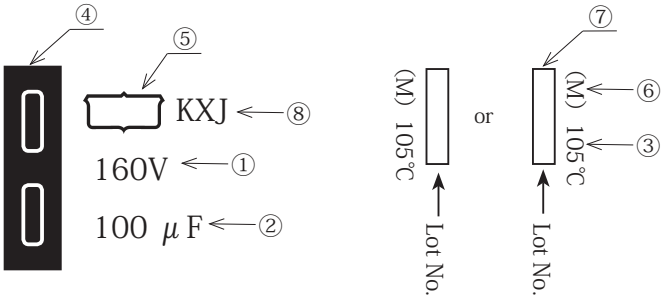
The following items shall be marked on each capacitor. (White marking)

① Rated voltage	⑤ Manufacturer's identification mark
② Rated capacitance	⑥ Capacitance tolerance code
③ Upper category temperature	⑦ Lot No.
④ Negative polarity marking	⑧ Series name

Finish method

The negative polarity marking (stripe) is maked to disinguish the negative lead.

(Example)



(Front) (Back)

7 Performance

Unless otherwise specified, the capacitors shall be measured at a temperature at + 15 to + 35℃ , a humidity of 45 to 75%RH and a atmospheric pressure of 86 to 106kPa. However, if any doubt arises on the judgment, the measurement conditions shall be + 20 ± 2℃ , 60 to 70%RH and 86 to 106kPa.

7.1 Leakage current (L.C.)

〔Conditions〕 Rated voltage shall be applied to capacitors in series with a resistor of 1000 ± 10 Ω .Then leakage current shall be measured at the end of a specified period after the capacitors reached the rated voltage across the terminals.

〔Criteria〕 Shall not exceed the values specified in the table of Standard Ratings.

7.2 Capacitance (Cap.)

〔Conditions〕 Measuring frequency : 120Hz ± 20%
Measuring voltage : 0.5Vrms max. + 1.5 to 2.0V_{DC}
Measuring circuit : Series equivalent circuit( )

〔Criteria〕 Shall be within the specified capacitance tolerance.

7.3 Dissipation factor (tan δ)

〔Conditions〕 Measuring frequency : 120Hz ± 20%
Measuring voltage : 0.5Vrms max. + 1.5 to 2.0V_{DC}
Measuring circuit : Series equivalent circuit( )

〔Criteria〕 Shall not exceed the values specified in the table of Standard Ratings.

7.4 Terminal strength

(1) Pull strength

〔Conditions〕 The capacitor body shall be held. A force shall be gradually applied to the lead wire in the direction of the axis of the lead wire up to the specified pull force, and retained for 10 ± 1 seconds.

Nominal lead diameter [mm]	Pull force [N]
Over 0.5 to 0.8 incl.	10

〔Criteria〕 The lead wire shall neither loosen nor break away.

(2) Lead bending strength

〔Conditions〕 The capacitor shall be held so that the normal axis of the lead wire can be in a vertical position. A weight equivalent to the specified load shall be hung on the end of the lead wire. The capacitor body shall be inclined through 90° and returned to its normal position within 2 to 3 seconds. The consecutive bend shall then be in the opposite direction in the same manner.

Nominal lead diameter [mm]	Bending load [N]
Over 0.5 to 0.8 incl.	5

〔Criteria〕 The lead wire shall neither loosen nor break away.

7.5 Soldering heat

〔Conditions〕	Type of solder	: Sn-3Ag-0.5Cu
	Flux	: Ethanol solution(25 wt.% rosin)
	Solder temperature/immersion time	: + 260 ± 5℃ for l0 ± 1 seconds or + 380 ± 10℃ for 3 ± 0.5 seconds.
	Depth of immersion	: Up to 1.5 to 2.0mm from the root of the lead wire covered with a thermal shield plate
	Speed of immersion	: 25 ± 2.5mm/sec.
〔Criteria〕	Appearance	: No significant damage, legible marking, and no electrolyte leakage.
	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ± 10% of the initial measured value.
	Tan δ	: Shall not exceed the initial specified value.

7.6 Solderability

〔Conditions〕	Type of solder	: Sn-3Ag-0.5Cu
	Flux	: Ethanol solution (25 wt.% rosin)
	Solder temperature	: + 245 ± 3℃
	Depth of immersion	: Up to 1.5 to 2.0mm
	Immersion time	: 2 to 3sec.
〔Criteria〕	Solder shall cover at least 3/4 of the lead surface immersed.	

7.7 Vibration

〔Conditions〕	Vibration frequency range	: 10 to 55Hz
	Amplitude or Acceleration	: 0.75 mm (Half amplitude)or 98m/s^2(Whichever is less severe)
	Sweep rate	: 10 to 55 to 10Hz in about 1 minute
	Direction and period of motion	: 2 hours in each of 3 mutually perpendicular directions (total of 6 hours)
Note :	Capacitors shall be mounted on the pc board with their lead wires anchored at 4mm max. of their bodies, except for the capacitors with the case size φ 16 x30L, whose lead wire shall be anchored at 1mm max. of their bodies The body of the capacitor with 12.5mm or larger in diameter or 25mm or longer in length, in addition, shall be anchored to the pc board with a fixture.	
〔Criteria〕	Appearance	: No significant damage, legible marking, and no electrolyte leakage.
	Capacitance change	: Shall be within ± 5% of the initial measured value.

7.8 Damp heat

〔Conditions〕	Test temperature	: + 40 ± 2℃
	Relative humidity	: 90 to 95%RH
	Test time	: 240 ± 8 hours
〔Criteria〕	Appearance	: No significant damage, legible marking, and no electrolyte leakage.
	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ± 20% of the initial measured value.
	Tan δ	: Shall not exceed 120% of the initial specified value.

7.9 Endurance

〔Conditions〕	After the capacitors are put to a DC voltage with the rated ripple current within the rated voltage for the specified test of time at + 105 ± 2℃ , the following specifications shall be satisfied when the capacitors are restored to + 20℃ . The sum of a DC voltage and a peak AC voltage must not exceed their full rated voltage.	
	Specified test time	: 10,000 $^{+72}_{0}$ hours (20L max.)
		: 12,000 $^{+72}_{0}$ hours
〔Criteria〕	Appearance	: No significant damage, legible marking, and no electrolyte leakage.
	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ± 20% of the initial measured value.
	Tan δ	: Shall not exceed 200% of the initial specified value.

7.10 Surge voltage test

〔Conditions〕	Test temperature	: + 15 to + 35℃
	Series protective resistor	: 1000 ± 10 Ω
	Test voltage	: Surge voltage shown in Table-1
	Applying of voltage	: 30 ± 5 seconds every 6 ± 0.5minutes.
	Test cycle	: 1000cycle.
〔Criteria〕	Appearance	: No significant damage and no electrolyte leakage.
	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ± 20% of the initial measured value.
	Tan δ	: Shall not exceed 200% of the initial specified value.

7.11 Pressure relief vent

〔Conditions〕 Apply a reverse voltage with the DC current of 1 amp.(DC reverse voltage test)

〔Criteria〕 When the pressure relief vent operated, the capacitor shall not flame although emission of gas or a part of the inside element is allowable.
If the vent does not operate with the voltage applied for 30 minutes, the test is considered to be passed.

7.12 High Temperature Storage

〔Conditions〕 The following specifications shall be satisfied when the capacitors are restored to + 20℃ after exposing them for 1,000 $^{+48}_{0}$ hours at + 105 ± 2℃ without an applied voltage. Before the measurements, the capacitor shall be preconditioned by applying voltage according to Item 4.1 of JIS C 5101-4.

〔Criteria〕

Appearance	: No significant damage, legible marking, and no electrolyte leakage.
Leakage current	: Shall not exceed 500% of the initial specified value.
Capacitance change	: Shall be within ± 20% of the initial measured value.
Tan δ	: Shall not exceed 200% of the initial specified value.

7.13 High and Low Temperature characteristics

〔Conditions〕

Step	Temperature [℃]
1	+ 20 ± 2
2	− 25 ± 3, − 40 ± 3
3	+ 105 ± 2

Step 1：Measure capacitance , tan δ and impedance
Step 2：Measure impedance
Step 3：Measure capacitance, tan δ and a leakage current.

〔Criteria〕 Step 2 : Impedance ratio・・・Shall not exceed the values shown in the table below.

[120Hz]

Rated voltage [V_{DC}]	160	200	220	250	350	400	420	450
Z − 25℃ /Z + 20℃	3	3	3	3	5	5	6	6
Z − 40℃ /Z + 20℃	6	6	6	6	6	6	—	—

Step 3：Leakage current : Shall not increase 8 times more than the initial specified value.
Capacitance change : Shall be within ± 25% of the initial measured value.
Tan δ :Shall not exceed the initial specified value.

8 Reference standard

KXJ series is applicable to general-purpose grade capacitors of JIS C 5101-4-1-1998.
The othes test conditions shall comply with JIS C 5101-4-1998 and JIS C 5101-1998.

9 Others

9.1 Export Trade Control Ordinance (When our product our is exported from Japan)

(1) Export Trade Control Ordinance (Section 1 through 15 of Appendix Table 1)
Export regulation of the capacitors for pulse use (750V or higher) and the capacitors for high voltage (5,000V or higher) is carried out sccording to (item 41-4) in Section 2 of Appendix Table 1 (Section 49 in Chapter 1 of METI's Ordinance) and (item 7) in Section 7 of Appendix Table 1 (Section 6 in Chapter 6 of METI's Ordinance). However, the aluminum electrolytic capacitors, which are described in this specification, don't fulfill the regulated level. Therefore, the aluminum electrolytic capacitors are not applicable to Export Trade Control Ordinance.

(2) Export Trade Control Ordinance (Section 16 of Appendix Table 1)
The aluminum electrolytic capacitors, which are described in this specification, applicable to goods under Export Regulations (Category 85 of Appendix Table in Customs Tariff Law) based on Section 16 of Appendix Table 1 in Export Trade Control Ordinance. If the exporter got information that their exporting goods are used to any development of massive weapon, the exporter must apply for exporting permission to Ministry of Economy, Trade and Industry (METI), and get METI's approval.
Regardless of the above, if the exporter is notified by METI that his/her exporting goods are potentially used to any development of extensive destructive weapons, the exporter must seek permission from METI to export, and get METI's approval. When Nippon Chemi-Con receives such notice from METI, we will inform your company of that.

9.2 Cleaning PC board

(1) Alcohol system

Higher alcohol system / Isopropyl alcohol cleaning agents

Recommended cleaning agents:

Pine Alpha ST-100S (Arakawa Chemical)

Clean Through 750H, 750K, 750L, and 710M (Kao)

Technocare FRW-14,15,16,17 (Momentive performance materials)

Cleaning conditions:

Using these cleaning agents, capacitors are capable of withstanding immersion or ultrasonic cleaning for 10 minutes at a maximum liquid temperature of 60℃ . Find optimum conditions for washing, rinsing, and drying. Be sure not to rub off the marking of the capacitors by coming in contact with any other components or the PC board. Note that shower cleaning adversely affects the markings on the sleeve.

It is necessary to maintain a flux content in the cleaning liquid in of 2 Wt.% or less, and to control for alkaline components not to remain in the final cleaning process.

9.3 Manufacturing plant

CHEMI–CON EAST JAPAN CORPORATION IWATE PLANT (JAPAN)
P.T. INDONESIA CHEMI-CON (INDONESIA)
TAIWAN CHEMI-CON (TAIWAN)
SAMYOUNG ELECTRONICS CO., LTD. (KOREA)
QINGDAO SAMYOUNG ELECTRONICS CO., LTD. (CHINA)
CHEMI-CON (WUXI) CO., LTD. (CHINA)

9.4 For aluminum electrolytic capacitors, please refer to PRECAUTIONS AND GUIDELINES.

10 Taping

10.1 Scope

This specification is applied to radial lead type aluminum electrolytic capacitors which are taped according to JIS C 0805-1989.

10.2 Taping configurations

Figure1
TDtype
ϕ 10
TDtype
ϕ 12.5

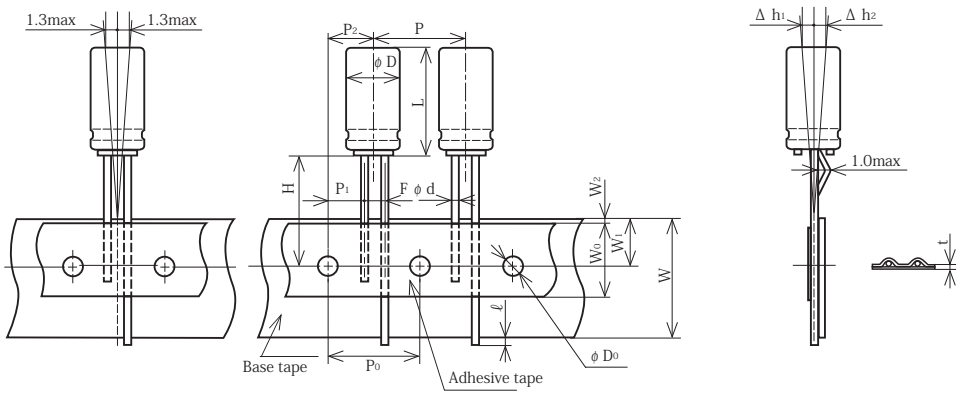
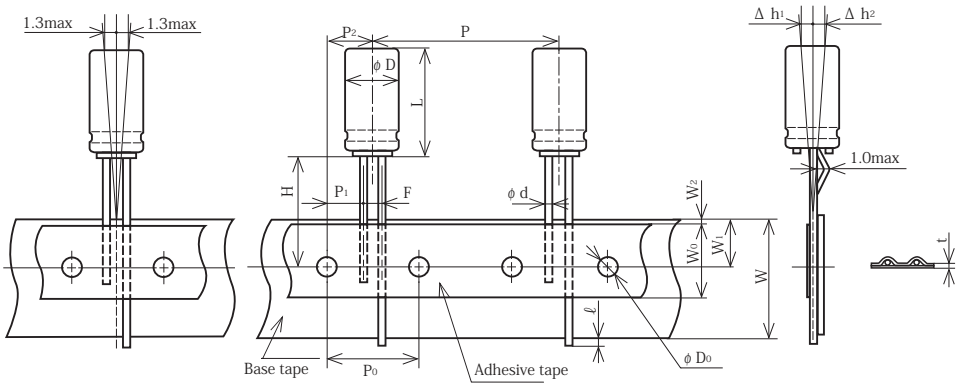


Figure2
TE type
ϕ 12.5
TD type
ϕ 14.5
ϕ 16, ϕ 18
TS type
ϕ 16, ϕ 18



10.3 Taping dimensions

[mm]

Symbol	Tolerance	Nominal value						Remarks
ϕ D	−	10	12.5		14.5	16	18	
L	−	16 to 30	20 to 25		20 to 25	20 to 25	20 to 25	
ϕ d	± 0.05	0.6	0.6		0.8	0.8	0.8	
P	± 1.0	12.7	15	25.4	30	30	30	
P_0	± 0.3	12.7	15	12.7	15	15	15	※ 1
P_1	± 0.7	3.85	5.0	3.85	3.75	3.75	3.75	※ 2
P_2	± 1.3	6.35	7.5	6.35	7.5	7.5	7.5	
F	− 0.2/ + 0.8	5.0	5.0		7.5	7.5	7.5	※ 2
W	± 0.5	18.0	18.0		18.0	18.0	18.0	
W_0	min.	12.5	12.5		12.5	12.5	12.5	※ 3
W_1	± 0.5	9.0	9.0		9.0	9.0	9.0	
W_2	max.	1.5	1.5		1.5	1.5	1.5	※ 3
H	− 0/ + 2.0	18.0	18.0		18.0	18.0	18.0	
ϕ D_0	± 0.2	4.0	4.0		4.0	4.0	4.0	
ℓ	max.	1.0	1.0		1.0	1.0	1.0	
t	± 0.2	0.7	0.7		0.7	0.7	0.7	
Δ h_1, Δ h_2	max.	2.0	2.0		2.0	2.0	2.0	※ 4
Figure		1	1	2	2	2	2	

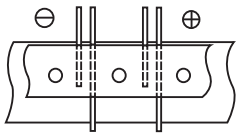
※ 1 Cumulative pitch error shall not exceed ± 1.0mm per 20 pitches.
※ 2 Measurement shall be made at the top of the tape and the center of the lead.
※ 3 Adhesive tape shall not extend beyond the edge of the base tape.
※ 4 Measurement shall be made at the top to the capacitor.

10.4 Taping method and polarity

(1) Taping method

Capacitors shall be taped on the base tape with the adhesive tape so that their lead wires can be perpendicular to the longitudinal direction of the base tape, and their polarities shall be arranged in one orientation.

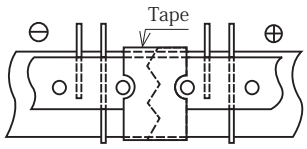
※ The polarity orientation does not apply to non-polarized capacitors.



(2) Splicing of base tape

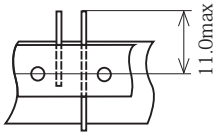
Splicing shall be made with a tape by means of a prescribed tool as shown below. The spliced base tapes shall be aligned within a error of 1.0mm. The splicing joint shall not have capacitors.

※ The polarity orientation does not apply to non-polarized capacitors.



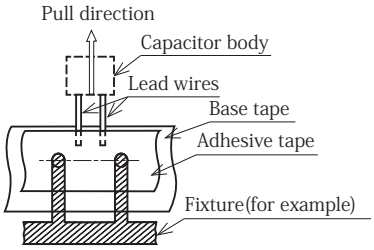
(3) Missing of capacitor

Consecutive missing capacitors shall not exceed 3 pcs after taped. Although quantity of discontinuous missing capacitors is not specified, the total quantity per a box shall be satisfied. When a capacitor is removed from the tape after taped, its lead wires shall be cut off or the capacitor shall be pulled out. Cutting the lead wires shall be made as follows.



(4) Pull strength of taped capacitor

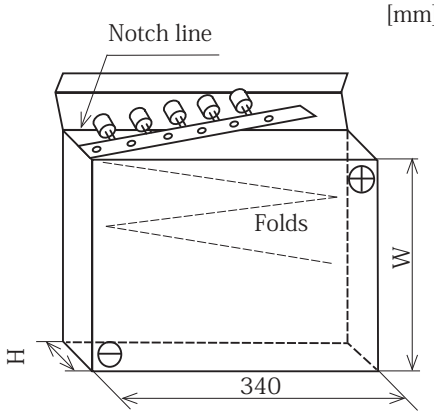
The capacitors which were fixed in between the base tape and adhesive tape shall have adhesion of at least 5N when the capacitor was pulled out in the axis direction of the capacitor as follows.



11 Packaging

11.1 Packaging for taping

[mm]



Case size（φ D × L）		W	H	Quantity packed
[mm]				[pcs]
φ 10	length 16	308	56	800
	length 20	308	62	800
	length 25	308	67	800
	length 30	308	71	500
φ 12.5	length 25 max.	308	67	500
φ 14.5	length 25 max.	350	67	250
φ 16	length 25 max.	350	67	250
φ 18	length 25 max.	350	67	250

Note ; The box dimensions may change slightly.

※ For φ 10 and φ 12.5 with P=15, the capacitors located on folds shall be removed.
（The polarity orientation does not apply to non-polarized capacitors.）

The following items shall be marked on the box.

1）Part Numbering System
2）Lot No.
3）Manufacturer's name
4）Quantity

Standard Ratings

WV [Vdc]	Cap [μ F]	Case size φ D × L[mm]	tan δ Max.	LC [μ A] Max.		Rated ripple current [mArms/105℃]	Part No.
				1minute	5minutes	120Hz	
160	39	10 × 16	0.20	349	149	245	EKXJ161E □□ 390MJ16S
160	56	10 × 20	0.20	458	204	315	EKXJ161E □□ 560MJ20S
160	82	10 × 25	0.20	624	287	415	EKXJ161E □□ 820MJ25S
160	82	10 × 30	0.20	624	287	445	EKXJ161E □□ 820MJ30S
160	100	12.5 × 20	0.20	740	345	575	EKXJ161E □□ 101MK20S
160	120	10 × 35	0.20	868	409	570	EKXJ161E □□ 121MJ35S
160	120	14.5 × 20	0.20	868	409	675	EKXJ161E □□ 121MU20S
160	150	10 × 40	0.20	1060	505	665	EKXJ161E □□ 151MJ40S
160	150	10 × 45	0.20	1060	505	695	EKXJ161E □□ 151MJ45S
160	150	12.5 × 25	0.20	1060	505	765	EKXJ161E □□ 151MK25S
160	180	10 × 50	0.20	1250	601	785	EKXJ161E □□ 181MJ50S
160	180	12.5 × 30	0.20	1250	601	885	EKXJ161E □□ 181MK30S
160	180	14.5 × 25	0.20	1250	601	890	EKXJ161E □□ 181MU25S
160	180	16 × 20	0.20	1250	601	855	EKXJ161E □□ 181ML20S
160	220	12.5 × 35	0.20	1500	729	1040	EKXJ161E □□ 221MK35S
160	220	16 × 25	0.20	1500	729	1020	EKXJ161E □□ 221ML25S
160	220	18 × 20	0.20	1500	729	990	EKXJ161E □□ 221MM20S
160	270	12.5 × 40	0.20	1820	889	1190	EKXJ161E □□ 271MK40S
160	270	12.5 × 45	0.20	1820	889	1230	EKXJ161E □□ 271MK45S
160	270	14.5 × 31.5	0.20	1820	889	1170	EKXJ161E □□ 271MUN3S
160	270	14.5 × 35.5	0.20	1820	889	1210	EKXJ161E □□ 271MUP1S
160	330	12.5 × 50	0.20	2210	1080	1400	EKXJ161E □□ 331MK50S
160	330	14.5 × 40	0.20	2210	1080	1385	EKXJ161E □□ 331MU40S
160	330	16 × 31.5	0.20	2210	1080	1350	EKXJ161E □□ 331MLN3S
160	330	18 × 25	0.20	2210	1080	1290	EKXJ161E □□ 331MM25S
160	390	14.5 × 45	0.20	2590	1270	1545	EKXJ161E □□ 391MU45S
160	390	16 × 35.5	0.20	2590	1270	1500	EKXJ161E □□ 391MLP1S
160	470	14.5 × 50	0.20	3100	1520	1735	EKXJ161E □□ 471MU50S
160	470	16 × 40	0.20	3100	1520	1700	EKXJ161E □□ 471ML40S
160	470	16 × 45	0.20	3100	1520	1730	EKXJ161E □□ 471ML45S
160	470	18 × 31.5	0.20	3100	1520	1660	EKXJ161E □□ 471MMN3S
160	470	18 × 35.5	0.20	3100	1520	1715	EKXJ161E □□ 471MMP1S
160	560	16 × 50	0.20	3680	1810	1920	EKXJ161E □□ 561ML50S
160	560	18 × 40	0.20	3680	1810	1905	EKXJ161E □□ 561MM40S
160	680	18 × 45	0.20	4450	2200	2130	EKXJ161E □□ 681MM45S
160	680	18 × 50	0.20	4450	2200	2145	EKXJ161E □□ 681MM50S
200	27	10 × 16	0.20	316	133	200	EKXJ201E □□ 270MJ16S
200	47	10 × 20	0.20	476	213	290	EKXJ201E □□ 470MJ20S
200	56	10 × 25	0.20	548	249	345	EKXJ201E □□ 560MJ25S
200	68	10 × 30	0.20	644	297	405	EKXJ201E □□ 680MJ30S
200	82	12.5 × 20	0.20	756	353	520	EKXJ201E □□ 820MK20S
200	100	10 × 35	0.20	900	425	520	EKXJ201E □□ 101MJ35S
200	100	12.5 × 25	0.20	900	425	625	EKXJ201E □□ 101MK25S
200	100	14.5 × 20	0.20	900	425	615	EKXJ201E □□ 101MU20S
200	120	10 × 40	0.20	1060	505	595	EKXJ201E □□ 121MJ40S
200	120	10 × 45	0.20	1060	505	620	EKXJ201E □□ 121MJ45S
200	120	12.5 × 30	0.20	1060	505	725	EKXJ201E □□ 121MK30S
200	120	16 × 20	0.20	1060	505	695	EKXJ201E □□ 121ML20S
200	150	10 × 50	0.20	1300	625	720	EKXJ201E □□ 151MJ50S
200	150	12.5 × 35	0.20	1300	625	860	EKXJ201E □□ 151MK35S
200	150	14.5 × 25	0.20	1300	625	810	EKXJ201E □□ 151MU25S
200	180	14.5 × 31.5	0.20	1540	745	955	EKXJ201E □□ 181MUN3S
200	180	16 × 25	0.20	1540	745	925	EKXJ201E □□ 181ML25S
200	180	18 × 20	0.20	1540	745	895	EKXJ201E □□ 181MM20S
200	220	12.5 × 40	0.20	1860	905	1075	EKXJ201E □□ 221MK40S
200	220	12.5 × 45	0.20	1860	905	1110	EKXJ201E □□ 221MK45S
200	220	14.5 × 35.5	0.20	1860	905	1095	EKXJ201E □□ 221MUP1S
200	220	18 × 25	0.20	1860	905	1050	EKXJ201E □□ 221MM25S
200	270	12.5 × 50	0.20	2260	1100	1265	EKXJ201E □□ 271MK50S
200	270	14.5 × 40	0.20	2260	1100	1250	EKXJ201E □□ 271MU40S
200	270	14.5 × 45	0.20	2260	1100	1290	EKXJ201E □□ 271MU45S

□□ : Enter the appropriate lead forming or taping code.

Standard Ratings

WV [Vdc]	Cap [μ F]	Case size φ D × L[mm]	tan δ Max.	LC [μ A] Max.		Rated ripple current [mArms/105℃]	Part No.
				1minute	5minutes	120Hz	
200	270	16 × 31.5	0.20	2260	1100	1220	EKXJ201E □□ 271MLN3S
200	270	16 × 35.5	0.20	2260	1100	1250	EKXJ201E □□ 271MLP1S
200	330	14.5 × 50	0.20	2740	1340	1450	EKXJ201E □□ 331MU50S
200	330	16 × 40	0.20	2740	1340	1425	EKXJ201E □□ 331ML40S
200	330	18 × 31.5	0.20	2740	1340	1395	EKXJ201E □□ 331MMN3S
200	390	16 × 45	0.20	3220	1580	1575	EKXJ201E □□ 391ML45S
200	390	18 × 35.5	0.20	3220	1580	1565	EKXJ201E □□ 391MMP1S
200	470	16 × 50	0.20	3860	1900	1755	EKXJ201E □□ 471ML50S
200	470	18 × 40	0.20	3860	1900	1745	EKXJ201E □□ 471MM40S
200	470	18 × 45	0.20	3860	1900	1770	EKXJ201E □□ 471MM45S
200	560	18 × 50	0.20	4580	2260	1945	EKXJ201E □□ 561MM50S
220	27	10 × 16	0.20	337	143	200	EKXJ221E □□ 270MJ16S
220	39	10 × 20	0.20	443	196	265	EKXJ221E □□ 390MJ20S
220	56	10 × 25	0.20	592	271	345	EKXJ221E □□ 560MJ25S
220	56	10 × 30	0.20	592	271	370	EKXJ221E □□ 560MJ30S
220	68	12.5 × 20	0.20	698	324	475	EKXJ221E □□ 680MK20S
220	82	10 × 35	0.20	821	385	470	EKXJ221E □□ 820MJ35S
220	82	14.5 × 20	0.20	821	385	555	EKXJ221E □□ 820MU20S
220	100	10 × 40	0.20	980	465	545	EKXJ221E □□ 101MJ40S
220	100	10 × 45	0.20	980	465	565	EKXJ221E □□ 101MJ45S
220	100	12.5 × 25	0.20	980	465	625	EKXJ221E □□ 101MK25S
220	120	10 × 50	0.20	1150	553	645	EKXJ221E □□ 121MJ50S
220	120	12.5 × 30	0.20	1150	553	725	EKXJ221E □□ 121MK30S
220	120	14.5 × 25	0.20	1150	553	725	EKXJ221E □□ 121MU25S
220	120	16 × 20	0.20	1150	553	695	EKXJ221E □□ 121ML20S
220	150	12.5 × 35	0.20	1420	685	860	EKXJ221E □□ 151MK35S
220	150	16 × 25	0.20	1420	685	845	EKXJ221E □□ 151ML25S
220	150	18 × 20	0.20	1420	685	815	EKXJ221E □□ 151MM20S
220	180	12.5 × 40	0.20	1680	817	975	EKXJ221E □□ 181MK40S
220	180	12.5 × 45	0.20	1680	817	1005	EKXJ221E □□ 181MK45S
220	180	14.5 × 31.5	0.20	1680	817	955	EKXJ221E □□ 181MUN3S
220	220	12.5 × 50	0.20	2030	993	1145	EKXJ221E □□ 221MK50S
220	220	14.5 × 35.5	0.20	2030	993	1095	EKXJ221E □□ 221MUP1S
220	220	14.5 × 40	0.20	2030	993	1130	EKXJ221E □□ 221MU40S
220	220	16 × 31.5	0.20	2030	993	1100	EKXJ221E □□ 221MLN3S
220	220	18 × 25	0.20	2030	993	1050	EKXJ221E □□ 221MM25S
220	270	14.5 × 45	0.20	2470	1210	1285	EKXJ221E □□ 271MU45S
220	270	14.5 × 50	0.20	2470	1210	1315	EKXJ221E □□ 271MU50S
220	270	16 × 35.5	0.20	2470	1210	1245	EKXJ221E □□ 271MLP1S
220	270	18 × 31.5	0.20	2470	1210	1260	EKXJ221E □□ 271MMN3S
220	330	16 × 40	0.20	3000	1470	1425	EKXJ221E □□ 331ML40S
220	330	16 × 45	0.20	3000	1470	1450	EKXJ221E □□ 331ML45S
220	330	18 × 35.5	0.20	3000	1470	1440	EKXJ221E □□ 331MMP1S
220	390	16 × 50	0.20	3530	1740	1600	EKXJ221E □□ 391ML50S
220	390	18 × 40	0.20	3530	1740	1590	EKXJ221E □□ 391MM40S
220	390	18 × 45	0.20	3530	1740	1620	EKXJ221E □□ 391MM45S
220	470	18 × 50	0.20	4230	2090	1785	EKXJ221E □□ 471MM50S
250	22	10 × 16	0.20	320	135	185	EKXJ251E □□ 220MJ16S
250	33	10 × 20	0.20	430	190	240	EKXJ251E □□ 330MJ20S
250	47	10 × 25	0.20	570	260	315	EKXJ251E □□ 470MJ25S
250	47	10 × 30	0.20	570	260	340	EKXJ251E □□ 470MJ30S
250	56	12.5 × 20	0.20	660	305	430	EKXJ251E □□ 560MK20S
250	68	10 × 35	0.20	780	365	430	EKXJ251E □□ 680MJ35S
250	68	14.5 × 20	0.20	780	365	505	EKXJ251E □□ 680MU20S
250	82	10 × 40	0.20	920	435	495	EKXJ251E □□ 820MJ40S
250	82	10 × 45	0.20	920	435	515	EKXJ251E □□ 820MJ45S
250	82	12.5 × 25	0.20	920	435	565	EKXJ251E □□ 820MK25S
250	100	10 × 50	0.20	1100	525	585	EKXJ251E □□ 101MJ50S
250	100	12.5 × 30	0.20	1100	525	660	EKXJ251E □□ 101MK30S
250	100	14.5 × 25	0.20	1100	525	665	EKXJ251E □□ 101MU25S
250	100	16 × 20	0.20	1100	525	635	EKXJ251E □□ 101ML20S

□□ : Enter the appropriate lead forming or taping code.

Standard Ratings

WV [Vdc]	Cap [μ F]	Case size φ D × L[mm]	tan δ Max.	LC [μ A] Max.		Rated ripple current [mArms/105℃]	Part No.
				1minute	5minutes	120Hz	
250	120	12.5 × 35	0.20	1300	625	770	EKXJ251E □□ 121MK35S
250	120	16 × 25	0.20	1300	625	755	EKXJ251E □□ 121ML25S
250	120	18 × 20	0.20	1300	625	730	EKXJ251E □□ 121MM20S
250	150	12.5 × 40	0.20	1600	775	890	EKXJ251E □□ 151MK40S
250	150	12.5 × 45	0.20	1600	775	920	EKXJ251E □□ 151MK45S
250	150	14.5 × 31.5	0.20	1600	775	870	EKXJ251E □□ 151MUN3S
250	180	12.5 × 50	0.20	1900	925	1035	EKXJ251E □□ 181MK50S
250	180	14.5 × 35.5	0.20	1900	925	990	EKXJ251E □□ 181MUP1S
250	180	14.5 × 40	0.20	1900	925	1020	EKXJ251E □□ 181MU40S
250	180	16 × 31.5	0.20	1900	925	995	EKXJ251E □□ 181MLN3S
250	180	18 × 25	0.20	1900	925	950	EKXJ251E □□ 181MM25S
250	220	14.5 × 45	0.20	2300	1120	1160	EKXJ251E □□ 221MU45S
250	220	14.5 × 50	0.20	2300	1120	1185	EKXJ251E □□ 221MU50S
250	220	16 × 35.5	0.20	2300	1120	1125	EKXJ251E □□ 221MLP1S
250	220	18 × 31.5	0.20	2300	1120	1135	EKXJ251E □□ 221MMN3S
250	270	16 × 40	0.20	2800	1370	1285	EKXJ251E □□ 271ML40S
250	270	16 × 45	0.20	2800	1370	1310	EKXJ251E □□ 271ML45S
250	270	18 × 35.5	0.20	2800	1370	1300	EKXJ251E □□ 271MMP1S
250	330	16 × 50	0.20	3400	1670	1475	EKXJ251E □□ 331ML50S
250	330	18 × 40	0.20	3400	1670	1460	EKXJ251E □□ 331MM40S
250	330	18 × 45	0.20	3400	1670	1485	EKXJ251E □□ 331MM45S
250	390	18 × 50	0.20	4000	1970	1625	EKXJ251E □□ 391MM50S
350	12	10 × 16	0.24	268	109	135	EKXJ351E □□ 120MJ16S
350	22	10 × 20	0.24	408	179	200	EKXJ351E □□ 220MJ20S
350	27	10 × 25	0.24	478	214	240	EKXJ351E □□ 270MJ25S
350	27	10 × 30	0.24	478	214	255	EKXJ351E □□ 270MJ30S
350	33	12.5 × 20	0.24	562	256	330	EKXJ351E □□ 330MK20S
350	39	10 × 35	0.24	646	298	325	EKXJ351E □□ 390MJ35S
350	47	10 × 40	0.24	758	354	375	EKXJ351E □□ 470MJ40S
350	47	12.5 × 25	0.24	758	354	425	EKXJ351E □□ 470MK25S
350	47	14.5 × 20	0.24	758	354	420	EKXJ351E □□ 470MU20S
350	56	10 × 45	0.24	884	417	425	EKXJ351E □□ 560MJ45S
350	56	12.5 × 30	0.24	884	417	495	EKXJ351E □□ 560MK30S
350	56	16 × 20	0.24	884	417	475	EKXJ351E □□ 560ML20S
350	68	10 × 50	0.24	1050	501	485	EKXJ351E □□ 680MJ50S
350	68	12.5 × 35	0.24	1050	501	580	EKXJ351E □□ 680MK35S
350	68	14.5 × 25	0.24	1050	501	545	EKXJ351E □□ 680MU25S
350	68	18 × 20	0.24	1050	501	550	EKXJ351E □□ 680MM20S
350	82	12.5 × 40	0.24	1240	599	655	EKXJ351E □□ 820MK40S
350	82	14.5 × 31.5	0.24	1240	599	645	EKXJ351E □□ 820MUN3S
350	82	16 × 25	0.24	1240	599	625	EKXJ351E □□ 820ML25S
350	100	12.5 × 45	0.24	1500	725	750	EKXJ351E □□ 101MK45S
350	100	12.5 × 50	0.24	1500	725	770	EKXJ351E □□ 101MK50S
350	100	14.5 × 35.5	0.24	1500	725	740	EKXJ351E □□ 101MUP1S
350	100	16 × 31.5	0.24	1500	725	740	EKXJ351E □□ 101MLN3S
350	100	18 × 25	0.24	1500	725	710	EKXJ351E □□ 101MM25S
350	120	14.5 × 40	0.24	1780	865	835	EKXJ351E □□ 121MU40S
350	120	14.5 × 45	0.24	1780	865	860	EKXJ351E □□ 121MU45S
350	120	16 × 35.5	0.24	1780	865	830	EKXJ351E □□ 121MLP1S
350	150	14.5 × 50	0.24	2200	1070	980	EKXJ351E □□ 151MU50S
350	150	16 × 40	0.24	2200	1070	960	EKXJ351E □□ 151ML40S
350	150	16 × 45	0.24	2200	1070	975	EKXJ351E □□ 151ML45S
350	150	18 × 31.5	0.24	2200	1070	940	EKXJ351E □□ 151MMN3S
350	180	16 × 50	0.24	2620	1280	1090	EKXJ351E □□ 181ML50S
350	180	18 × 35.5	0.24	2620	1280	1065	EKXJ351E □□ 181MMP1S
350	180	18 × 40	0.24	2620	1280	1080	EKXJ351E □□ 181MM40S
350	220	18 × 45	0.24	3180	1560	1210	EKXJ351E □□ 221MM45S
350	220	18 × 50	0.24	3180	1560	1220	EKXJ351E □□ 221MM50S
400	10	10 × 16	0.24	260	105	125	EKXJ401E □□ 100MJ16S
400	18	10 × 20	0.24	388	169	180	EKXJ401E □□ 180MJ20S
400	22	10 × 25	0.24	452	201	215	EKXJ401E □□ 220MJ25S

□□ : Enter the appropriate lead forming or taping code.

Standard Ratings

WV [Vdc]	Cap [μ F]	Case size φ D × L[mm]	tan δ Max.	LC [μ A] Max.		Rated ripple current [mArms/105℃]	Part No.
				1minute	5minutes	120Hz	
400	27	10 × 30	0.24	532	241	255	EKXJ401E □□ 270MJ30S
400	27	12.5 × 20	0.24	532	241	300	EKXJ401E □□ 270MK20S
400	33	10 × 35	0.24	628	289	300	EKXJ401E □□ 330MJ35S
400	39	10 × 40	0.24	724	337	340	EKXJ401E □□ 390MJ40S
400	39	10 × 45	0.24	724	337	355	EKXJ401E □□ 390MJ45S
400	39	12.5 × 25	0.24	724	337	390	EKXJ401E □□ 390MK25S
400	39	14.5 × 20	0.24	724	337	385	EKXJ401E □□ 390MU20S
400	47	12.5 × 30	0.24	852	401	455	EKXJ401E □□ 470MK30S
400	47	16 × 20	0.24	852	401	435	EKXJ401E □□ 470ML20S
400	56	10 × 50	0.24	996	473	440	EKXJ401E □□ 560MJ50S
400	56	12.5 × 35	0.24	996	473	525	EKXJ401E □□ 560MK35S
400	56	14.5 × 25	0.24	996	473	495	EKXJ401E □□ 560MU25S
400	56	18 × 20	0.24	996	473	500	EKXJ401E □□ 560MM20S
400	68	12.5 × 40	0.24	1180	569	600	EKXJ401E □□ 680MK40S
400	68	14.5 × 31.5	0.24	1180	569	585	EKXJ401E □□ 680MUN3S
400	68	16 × 25	0.24	1180	569	570	EKXJ401E □□ 680ML25S
400	82	12.5 × 45	0.24	1410	681	680	EKXJ401E □□ 820MK45S
400	82	12.5 × 50	0.24	1410	681	700	EKXJ401E □□ 820MK50S
400	82	14.5 × 35.5	0.24	1410	681	670	EKXJ401E □□ 820MUP1S
400	82	16 × 31.5	0.24	1410	681	670	EKXJ401E □□ 820MLN3S
400	82	18 × 25	0.24	1410	681	640	EKXJ401E □□ 820MM25S
400	100	14.5 × 40	0.24	1700	825	760	EKXJ401E □□ 101MU40S
400	100	14.5 × 45	0.24	1700	825	785	EKXJ401E □□ 101MU45S
400	100	16 × 35.5	0.24	1700	825	760	EKXJ401E □□ 101MLP1S
400	120	14.5 × 50	0.24	2020	985	875	EKXJ401E □□ 121MU50S
400	120	16 × 40	0.24	2020	985	860	EKXJ401E □□ 121ML40S
400	120	16 × 45	0.24	2020	985	875	EKXJ401E □□ 121ML45S
400	120	18 × 31.5	0.24	2020	985	840	EKXJ401E □□ 121MMN3S
400	120	18 × 35.5	0.24	2020	985	870	EKXJ401E □□ 121MMP1S
400	150	16 × 50	0.24	2500	1220	995	EKXJ401E □□ 151ML50S
400	150	18 × 40	0.24	2500	1220	985	EKXJ401E □□ 151MM40S
400	180	18 × 45	0.24	2980	1460	1095	EKXJ401E □□ 181MM45S
400	220	18 × 50	0.24	3620	1780	1220	EKXJ401E □□ 221MM50S
420	6.8	10 × 16	0.24	214	82.1	105	EKXJ421E □□ 6R8MJ16S
420	12	10 × 20	0.24	301	125	150	EKXJ421E □□ 120MJ20S
420	15	10 × 25	0.24	352	151	185	EKXJ421E □□ 150MJ25S
420	18	10 × 30	0.24	402	176	215	EKXJ421E □□ 180MJ30S
420	22	12.5 × 20	0.24	469	209	285	EKXJ421E □□ 220MK20S
420	27	10 × 35	0.24	553	251	275	EKXJ421E □□ 270MJ35S
420	27	10 × 40	0.24	553	251	290	EKXJ421E □□ 270MJ40S
420	27	12.5 × 25	0.24	553	251	340	EKXJ421E □□ 270MK25S
420	27	14.5 × 20	0.24	553	251	335	EKXJ421E □□ 270MU20S
420	33	10 × 45	0.24	654	302	335	EKXJ421E □□ 330MJ45S
420	33	12.5 × 30	0.24	654	302	400	EKXJ421E □□ 330MK30S
420	33	16 × 20	0.24	654	302	385	EKXJ421E □□ 330ML20S
420	39	10 × 50	0.24	755	352	375	EKXJ421E □□ 390MJ50S
420	39	14.5 × 25	0.24	755	352	435	EKXJ421E □□ 390MU25S
420	47	12.5 × 35	0.24	889	419	505	EKXJ421E □□ 470MK35S
420	47	16 × 25	0.24	889	419	500	EKXJ421E □□ 470ML25S
420	47	18 × 20	0.24	889	419	480	EKXJ421E □□ 470MM20S
420	56	12.5 × 40	0.24	1040	495	570	EKXJ421E □□ 560MK40S
420	56	12.5 × 45	0.24	1040	495	590	EKXJ421E □□ 560MK45S
420	56	14.5 × 31.5	0.24	1040	495	560	EKXJ421E □□ 560MUN3S
420	68	12.5 × 50	0.24	1240	596	670	EKXJ421E □□ 680MK50S
420	68	14.5 × 35.5	0.24	1240	596	640	EKXJ421E □□ 680MUP1S
420	68	14.5 × 40	0.24	1240	596	660	EKXJ421E □□ 680MU40S
420	68	16 × 31.5	0.24	1240	596	645	EKXJ421E □□ 680MLN3S
420	68	18 × 25	0.24	1240	596	615	EKXJ421E □□ 680MM25S
420	82	14.5 × 45	0.24	1470	713	750	EKXJ421E □□ 820MU45S
420	82	16 × 35.5	0.24	1470	713	725	EKXJ421E □□ 820MLP1S
420	82	18 × 31.5	0.24	1470	713	730	EKXJ421E □□ 820MMN3S

□□ : Enter the appropriate lead forming or taping code.

Standard Ratings

WV [Vdc]	Cap [μ F]	Case size φ D × L[mm]	tan δ Max.	LC [μ A] Max.		Rated ripple current [mArms/105℃]	Part No.
				1minute	5minutes	120Hz	
420	100	14.5 × 50	0.24	1780	865	845	EKXJ421E □□ 101MU50S
420	100	16 × 40	0.24	1780	865	825	EKXJ421E □□ 101ML40S
420	100	16 × 45	0.24	1780	865	840	EKXJ421E □□ 101ML45S
420	100	18 × 35.5	0.24	1780	865	835	EKXJ421E □□ 101MMP1S
420	120	16 × 50	0.24	2110	1030	935	EKXJ421E □□ 121ML50S
420	120	18 × 40	0.24	2110	1030	930	EKXJ421E □□ 121MM40S
420	120	18 × 45	0.24	2110	1030	945	EKXJ421E □□ 121MM45S
420	150	18 × 50	0.24	2620	1280	1060	EKXJ421E □□ 151MM50S
450	6.8	10 × 16	0.24	222	86.2	105	EKXJ451E □□ 6R8MJ16S
450	12	10 × 20	0.24	316	133	150	EKXJ451E □□ 120MJ20S
450	15	10 × 25	0.24	370	160	185	EKXJ451E □□ 150MJ25S
450	18	10 × 30	0.24	424	187	215	EKXJ451E □□ 180MJ30S
450	18	12.5 × 20	0.24	424	187	255	EKXJ451E □□ 180MK20S
450	22	10 × 35	0.24	496	223	250	EKXJ451E □□ 220MJ35S
450	27	10 × 40	0.24	586	268	290	EKXJ451E □□ 270MJ40S
450	27	10 × 45	0.24	586	268	305	EKXJ451E □□ 270MJ45S
450	27	12.5 × 25	0.24	586	268	340	EKXJ451E □□ 270MK25S
450	27	14.5 × 20	0.24	586	268	335	EKXJ451E □□ 270MU20S
450	33	12.5 × 30	0.24	694	322	400	EKXJ451E □□ 330MK30S
450	33	14.5 × 25	0.24	694	322	400	EKXJ451E □□ 330MU25S
450	33	16 × 20	0.24	694	322	385	EKXJ451E □□ 330ML20S
450	39	10 × 50	0.24	802	376	375	EKXJ451E □□ 390MJ50S
450	39	12.5 × 35	0.24	802	376	460	EKXJ451E □□ 390MK35S
450	39	18 × 20	0.24	802	376	440	EKXJ451E □□ 390MM20S
450	47	12.5 × 40	0.24	946	448	525	EKXJ451E □□ 470MK40S
450	47	14.5 × 31.5	0.24	946	448	515	EKXJ451E □□ 470MUN3S
450	47	16 × 25	0.24	946	448	500	EKXJ451E □□ 470ML25S
450	56	12.5 × 45	0.24	1100	529	590	EKXJ451E □□ 560MK45S
450	56	14.5 × 35.5	0.24	1100	529	580	EKXJ451E □□ 560MUP1S
450	56	16 × 31.5	0.24	1100	529	585	EKXJ451E □□ 560MLN3S
450	56	18 × 25	0.24	1100	529	560	EKXJ451E □□ 560MM25S
450	68	12.5 × 50	0.24	1320	637	670	EKXJ451E □□ 680MK50S
450	68	14.5 × 40	0.24	1320	637	660	EKXJ451E □□ 680MU40S
450	68	14.5 × 45	0.24	1320	637	680	EKXJ451E □□ 680MU45S
450	68	16 × 35.5	0.24	1320	637	660	EKXJ451E □□ 680MLP1S
450	82	14.5 × 50	0.24	1570	763	765	EKXJ451E □□ 820MU50S
450	82	16 × 40	0.24	1570	763	750	EKXJ451E □□ 820ML40S
450	82	16 × 45	0.24	1570	763	760	EKXJ451E □□ 820ML45S
450	82	18 × 31.5	0.24	1570	763	730	EKXJ451E □□ 820MMN3S
450	100	16 × 50	0.24	1900	925	855	EKXJ451E □□ 101ML50S
450	100	18 × 35.5	0.24	1900	925	835	EKXJ451E □□ 101MMP1S
450	120	18 × 40	0.24	2260	1100	930	EKXJ451E □□ 121MM40S
450	120	18 × 45	0.24	2260	1100	945	EKXJ451E □□ 121MM45S
450	150	18 × 50	0.24	2800	1370	1060	EKXJ451E □□ 151MM50S

□□ : Enter the appropriate lead forming or taping code.

Precautions and Guidelines (Aluminum Non-Solid Electrolytic Capacitors)

The circuits described as examples in the catalog and the "specifications" are featured in order to show the operations and usage of our products, however, this fact does not guarantee that the circuits are available to function in your equipment systems.
We are not in any case responsible for any failures or damage caused by the use of information contained herein.
You should examine our products, of which the characteristics are described in the "specifications" and other documents, and determine whether or not our products suit your requirements according to the specifications of your equipment systems. Therefore, you bear final responsibility regarding the use of our products.
Please make sure that you take appropriate safety measures such as use of redundant design and malfunction prevention measures in order to prevent fatal accidents and/or fires in the event any of our products malfunction.

【1】Device circuits design considerations

1) Confirm installation and operating requirements for capacitors, then use them within the performance limits prescribed in this catalog or product specifications.

2) Polarity

Aluminum electrolytic capacitors are polarized.

Never apply a reverse voltage or AC voltage. Connecting with wrong polarity will short-circuit or damage the capacitor with the pressure relief vent opening early on. To identify the polarity of a capacitor, see the relevant diagram in the catalogs or product specifications, or the polarity marking on the body of the capacitor.
Incidentally, the rubber end seal bungs of the radial lead type capacitors have a solder-flux gas escaping configuration, which is nothing to do with the polarity of the capacitors. For circuits where the polarity is occasionally reversed, use a bi-polar type of aluminum electrolytic capacitor. However, note that even bi-polar type capacitors must not be used for AC circuits.

3) Operating voltage

Do not apply an over-voltage that exceeds a rated voltage specified for the capacitors.

The total peak value of the ripple voltage plus the DC voltage must not exceed the rated voltage of the capacitors. Although capacitors specify a surge voltage that exceeds the full rated voltage, it does not assure long-term use but limited use under specific conditions.

4) Ripple current

Do not apply an overcurrent that exceeds the rated ripple current specified for the capacitors.

Excessive ripple current will increase heat production within the capacitors, causing the capacitors to be damaged as follows:

- Shorten lifetime
- Open pressure relief vent
- Short circuit

The rated ripple current is specified along with a specific ripple frequency.
Where using the capacitors at any other ripple frequency other than the specified frequency, calculate the allowable ripple current by multiplying the rated ripple current by a frequency compensation factor (Frequency Multiplier) specified for each product series.

5) Operating temperature (Category temperature)

Do not apply high temperatures that exceed the upper limit of the category temperature range specified for the capacitors.

Using the capacitor at temperatures higher than the upper limit will considerably shorten the lifetime of the capacitor and make the pressure relief vent open.
In other words, lowering ambient temperatures will extend the expected lifetime of the capacitors.

6) Lifetime

Select the capacitors to meet the service life requirements of a device.

7) Charging and discharging

Do not use capacitors in circuits intended for rapid charge and discharge cycle operations.

If capacitors are used in the circuits that repeat a charge and discharge with a large voltage drop or a rapid charge and discharge at a short interval cycle, capacitance will decrease and/or the capacitors will be damaged by internal heat generation.
Consult us for a heavy charge and discharge type of capacitor so that the capacitor will be designed in accordance with requirements of duty cycle of charge and discharge, the number of cycles, discharging resistance and operating temperatures.

8) Failure mode of capacitors

Non-solid aluminum electrolytic capacitors have a limited lifetime which ends in an open circuit failure mode, in general.
Depending on the product type and operating conditions, the failure mode may involve in opening of the pressure relief vent.

9) Capacitor insulation

Electrically isolate the following sections of a capacitor from the negative terminal, the positive terminal and the circuit patterns.

- The outer can case of a non-solid aluminum capacitor.
- The dummy terminal of a snap-in type non-solid aluminum capacitor, which is designed for mounting stability.

10) Outer sleeve

The outer sleeve of a capacitor does not assure electrical insulation (except for screw-terminal type capacitors). It should not be used where electrical insulation is required.

11) Operating conditions

Do not use/expose capacitors to the following conditions:

(1) Direct contact with water, salt water or oil, or high condensation environment.

(2) Direct sunlight.

(3) Toxic gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine and its compounds, bromine and its compounds and ammonium.

(4) Ozone, ultraviolet rays or radiation.

(5) Extreme vibration or mechanical shock that exceeds limits in the catalogs or product specifications.
The standard vibration condition is applicable to JIS C 5101-4.

12) Mounting

(1) Non-solid aluminum electrolytic capacitors contain paper separators and electric-conductive electrolyte that contains organic solvent as main solvent material, both of which are flammable. If the electrolyte leaks onto a printed circuit board, it can erode the device circuit pattern, may short-circuit the copper traces, smoke and burn. Make sure of designing a PC board as follows:

- Provide the appropriate hole spacing on the PC board to match the terminal spacing of a capacitor.
- Provide the following adequate clearance space over the pressure relief vent of a capacitor to avoid blocking the correct opening of the pressure relief vent.

Case diameter	Clearance
ϕ 8(6.3) to ϕ 16mm	: 2mm minimum
ϕ 18 to ϕ 35mm	: 3mm minimum
ϕ 40 mm and above	: 5mm minimum

- Do not locate any wire or circuit pattern over the pressure relief vent of a capacitor.
- If a capacitor is mounted with its pressure relief vent facing down on the PC board, provide a ventilation hole in the board beneath it to let gas escape when the vent opens.
- Do not print any copper trace under the seal (terminal) side of a capacitor. Copper traces should be 1 mm (preferably 2mm or more) spaced apart from the side of the capacitor body.
- Avoid locating any heat source components near capacitors or on the opposite side of the PC board under capacitors.
- In designing a double-sided PC board, do not locate any through-hole via or unnecessary hole underneath a capacitor.
- In designing a double-sided PC board, do not print any circuit pattern underneath a capacitor.

(2) For a screw terminal type capacitor, tightening the terminal screws and the mounting clamp should be within the maximum torque specified in the catalogs or product specifications. Do not mount a screw terminal type capacitor with the terminals facing downward. Also, if the body of a capacitor is installed horizontally such as being laid on its side, do not position the pressure relief vent downward.

(3) For a chip type capacitor, design the land patterns of the PC board in accordance with the recommended footprint dimensions described in the catalogs or product specifications.

13) Using capacitors for significantly safety-oriented applications

Consult with us in advance of usage of our products in the following listed applications. ① Aerospace equipment ② Power generation equipment such as thermal power, nuclear power etc. ③ Medical equipment ④ Transport equipment (automobiles, trains, ships, etc.) ⑤ Transportation control equipment ⑥ Disaster prevention / crime prevention equipment ⑦ Highly publicized information processing equipment ⑧ Submarine equipment ⑨ Other applications that are not considered general- purpose applications.
Note that some products such as photoflash use capacitors which have been designed for specific applications cannot be used for any other application.

14) Others

Design device circuits taking into consideration the following conditions:

(1) Electrical characteristics of a capacitor depend on the temperature and frequency. In designing the device circuits, consider the change in the characteristics.

(2) If using more than one capacitor connected in parallel, design the device circuits to balance the current flow in individual capacitors.

(3) If using more than one capacitor connected in series, connect shunting resistors in parallel with the individual capacitors to balance the voltage.

【2】Installation

1) Assembling

(1) Do not try to reuse the capacitors once assembled and electrified, except only capacitors that are taken from a device for periodic inspection to measure their electrical characteristics.

(2) Capacitors may have been spontaneously recharged with time by a recovery voltage phenomenon. In this case, discharge the capacitors through a resistor of approximately 1k Ω before use.

(3) If non-solid aluminum electrolytic capacitors have been stored at any conditions more than 35℃ and 75%RH for long storage periods of time more than the limits specified in the catalogs or product specifications, they may have high leakage current. In this case, make pre-conditioning by applying the rated voltage through a resistor of approximately 1k Ω .

(4) Confirm the rated capacitance and voltage of capacitors before installation.

(5) Confirm the polarity of capacitors before installation.

(6) Do not try to use the capacitors that were dropped to the floor and so forth.

(7) Do not deform the can case of a capacitor.

(8) Make sure that the terminal spacing of a capacitor equals the holes spacing on the PC board before installing the capacitor. For radial lead type capacitors, some standard pre-formed lead types are also available.

(9) When installing a snap-in type capacitor on the PC board, insert the terminals into the holes and press the capacitor down until the body is settled flush on the surface of the PC board (without the body standing off).

(10) Do not apply excessive mechanical force to capacitors more than the limits prescribed in the catalogs or product specifications. Avoid excessive mechanical force while the capacitors are in the process of vacuum-picking, placing and positioning by automatic mounting machines or cutting the lead wires by automatic insertion machines.

2) Soldering and heat resistance

(1) For soldering using a soldering iron, consider the following conditions:
- Soldering conditions (temperature and time) should be within the limits prescribed in the catalogs or product specifications.
- If it is necessary to pre-form the terminal spacing of a capacitor to match the hole spacing on the PC board before assembly and soldering, do not make mechanical stress reach into the body of the capacitor but only the lead wires.
- Do not touch the body of a capacitor with the hot tip of the soldering iron.

(2) For flow soldering, consider the following conditions:
- Do not dip the body of a capacitor into a solder bath.
  Expose only the terminals to the melt solder with the PC board interposing between the solder and the body of the capacitor. Solder only the reverse side of the PC board where the body of the capacitor is not located.
- Soldering conditions should be within the limits prescribed in the catalogs or product specifications.
- Do not apply flux to any part of a capacitor other than the terminals.
- Do not let any other component lean against nor come into contact with the capacitor while soldering.

(3) For reflow soldering, consider the following conditions:
- Soldering conditions (preheat, reflow temperature and time) should be within the limits prescribed in the catalogs or product specifications.
- When using the infrared heater and setting its temperatures, adjust the heating levels taking into consideration that the color and materials of a capacitor vary in their infrared absorbance.
- The allowable number of reflow passes is specified in the catalogs or product specifications.
- When mounting a capacitor on the double-sided PC board, do not place any wiring pattern underneath the capacitor.
- Please consult us about vapor phase soldering (VPS).

(4) Do not try to reuse the capacitor that was removed from the PC board after soldering.

(5) Only use chip type capacitors for reflow soldering. The other type capacitors are not designed for the reflow.

3) Handling after soldering

After soldering the PC board, do not apply the following mechanical stress to the capacitor:

(1) Do not tilt, push down or twist the body of the capacitor.

(2) Do not grab the body of the capacitor to carry the assembly board.

(3) Do not hit anything against the capacitor. When stacking the assembled boards, do not put any of the PC boards or other components against the capacitor.

(4) Do not drop the assembled board.

4) Cleaning assembly boards

(1) Do not clean capacitors with the following cleaning agents:
- Halogenated solvents : cause capacitor failures due to corrosion.
- Alkali system solvents : corrode (dissolve) the aluminum can case.
- Terpene and petroleum system solvents : deteriorate the rubber seal materials.
- Xylene and toluene : deteriorates the rubber seal materials as well.
- Acetone : erases the markings printed on a capacitor.

Where cleaning is necessary, use only solvent resistant type capacitors that have been assured for the cleaning within the specific cleaning conditions prescriber in the catalogs or product specifications. In particular, carefully set up the conditions for ultrasonic cleaning system.

(2) Where cleaning the solvent resistance type of aluminum electrolytic capacitors, confirm the following conditions:

- Control the contamination (the conductivity, pH, specific gravity, water content, etc.) of the cleaning agents.
- After the cleaning, do not leave the capacitors (assembly boards) in an environment of cleaning agent-rich or in a closed container. Sufficiently evaporate the residual cleaning agent from the assembly boards and the capacitors by forced hot air at temperatures less than the upper limit of category temperature range for more than 10 minutes. In general, aluminum electrolytic capacitors are sensitive to contamination of halogen ions (particularly to chlorine ions). Depending on the properties of the electrolyte and rubber seal materials used in a capacitor, the halogen ions lead up to catastrophic failures on the capacitor. Where the inside of a capacitor has been contaminated with more than a certain amount of halogen ions and the capacitor is in use, the corrosion reaction of aluminum occurs. The corrosion causes the capacitor to have a significant increase in leakage current with heat produced, open the pressure relief vent and become open circuit mode failure. Due to global environmental issues (greenhouse effects and other environmental destruction by depletion of the ozone layer), the conventional cleaning solvents of CFC 113, Trichloroethylene and 1,1,1-tricholoroethylene were replaced by substitutes. The following are some substitute cleaning agents and allowable cleaning conditions:

a) Fatty-alcohol cleaning agents

Pine Alpha ST-100S (Arakawa Chemical)
Clean Through 750H, 750K, 750L and 710M (Kao)
Technocare FRW-14, 15, 16 and 17 (Momentive Performance Materials)

〔Compatible capacitor products〕

Terminal Shape	Subject Series
Surface Mount Type	All Series
Radial Lead Type	All Series
Snap-in Type	All Series (Less and equal 100V_{dc})

[Cleaning conditions]

Either of immersion or ultrasonic cleaning, for a maximum of 10 minutes and at a maximum liquid temperature of 60℃ is acceptable. Make sure that the markings on the capacitor are not rubbed against any other component or the PC board during cleaning. Note that shower cleaning affects the markings on the capacitor.

b) HCFC (Freon 225) as Alternative CFCs

AK225AES (Asahi Glass)

[Cleaning conditions]

Solvent resistant type capacitors, which were originally developed to intend to resist Freon TE or Freon TES, are also capable of withstanding any one of immersion, ultrasonic or vapor cleaning, for a maximum of 5 minutes (or 2 minutes for KRE series capacitors or 3 minutes for SRM series). However, this type of cleaning agent is not recommended to use, as the cleaning materials may be banned in near future in view of global environmental issues.

c) IPA (Isopropyl Alcohol)

Immersion cleaning with a maximum flux concentration of 2 wt% is acceptable.

5) Adhesives and coating materials

(1) Do not use any adhesive or coating materials containing halogenated solvents.

(2) Make sure of the following conditions before applying adhesive or coating materials to a capacitor,

- No flux residue nor stain is left between the rubber seal of a capacitor and PC board.
- Dry the capacitor to remove residual cleaning agents before applying adhesive and coating materials. Do not cover up the entire surface of the rubber seal of the capacitor with adhesives or coating materials.
- Heating and curing conditions for adhesives and coating materials should be followed as prescribed in the catalogs or product specifications.
- Covering up the entire surface of the rubber seal with resin mold materials will obstruct the normal diffusion of internal hydrogen gas from a capacitor and result in serious failures. Also, where the adhesive and coating materials contain a large amount of halogen ions, the halogen ions will contaminate the inside of the capacitor through the rubber seal materials, causing the capacitor to become a failure.
- Depending on solvent materials that the adhesive or coating materials contains, note that the outer sleeve of a capacitor may lose a gloss or whiten in appearance.

6) Fumigation

In exporting or importing electronic devices, they may be exposed to fumigation with halide such as methyl bromide.

Where aluminum electrolytic capacitors are exposed to halide such as methyl bromide, the capacitors will be damaged with the corrosion reaction with halogen ions in the same way as cleaning agents. For the export and import, Nippon Chemi-Con considers using some packaging method and so forth so that fumigation is not required. For customers to export or import electronic devices, semi-assembly products or capacitor components, confirm if they will be exposed to fumigation and also consider final condition of packaging. (Note that either cardboard or vinyl package has a risk of fumigation gas penetration.)

【3】Precautions during operation of devices

1) Never touch the terminals of a capacitor directly with bare hands.
2) Do not short-circuit between the capacitor terminals with anything conductive. Also, do not spill any conductive liquid such as acid or alkaline solution over a capacitor.
3) Confirm environmental conditions where the device will be placed. Do not use the devise in the following environmental conditions:
   (1) Water or oil spatters, or high condensation environment.
   (2) Direct sunlight.
   (3) Ozone, ultraviolet rays or radiation.
   (4) Toxic gases such as hydrogen sulfide, sulfuric acid, nitrous acid, chlorine and its compounds, bromine and its compounds and ammonium.
   (5) Extreme vibration or mechanical shock that exceeds the limits in the catalogs or product specifications.
   The standard vibration condition is applicable to JIS C 5101-4.

【4】Maintenance inspections

1) For industrial use capacitors, make periodic inspections of the capacitors. Before the inspections, turn off the power supply of the device and discharge the electricity of the capacitors. Where checking it by a volt-ohm meter, confirm the polarity beforehand. Do not apply mechanical stress to the terminals of the capacitors during inspection.
2) Characteristics to be inspected
   (1) Significant damage in appearance: vent opening, electrolyte leakage, etc.
   (2) Electrical characteristics: leakage current, capacitance, tan δ and other characteristics prescribed in the catalogs or product specifications
   If finding anything abnormal on the characteristics above, check the specifications of the capacitor and take appropriate actions such as replacement.

【5】Capacitor venting

1) A capacitor with more than a certain case size has the pressure relief vent functioning to escape abnormal gas pressure increase.
   If gas expels from a venting capacitor, disconnect the power supply of the device or unplug the power supply cord. If not disconnecting the power supply, the device circuit may be damaged due to the short circuit failure of the capacitor or short-circuited with the liquid that the gas was condensed to.
   It may cause secondary damages such as device burnout in the worst case scenario.
   The gas that comes out of the open vent is vaporized electrolyte, not smoke.
2) The gas expelled from a venting capacitor is more than100° C.
   Never expose your face to the capacitor. If your eyes are exposed to the gas or you inhale it, immediately flush your eyes and/or gargle with water. If the electrolyte comes in contact with the skin, wash with soap and water.

【6】Storage

1) Do not store capacitors at high temperature or high humidity.
   Store the capacitors indoors at temperatures of 5 to 35℃ and humidities of less than 75%RH.
   In principle, aluminum electrolytic capacitors should be used within three years after production.
2) Keep capacitors packed in the original packaging material wherever possible.
3) Avoid the following storage environmental conditions:
   (1) Water spattering, high temperatures, high humidity or condensation environment.
   (2) Oil spattering or oil mist filled.
   (3) Salt water spattering or salt filled.
   (4) Acidic toxic gases such as hydrogen sulfide, sulfuric acid, nitrous acid, chlorine, bromine and methyl bromide filled.
   (5) Alkaline toxic gases such as ammonium filled.
   (6) Acid or alkaline solutions spattering.
   (7) Direct sunlight, ozone, ultraviolet rays or radiation.
   (8) Extreme vibration or shock loading
4) JEDEC J-STD-020 is not applicable.

【7】Capacitor disposal

Please consult with a local organization for the proper disposal of industrial waste. For incinerating capacitors, apply a hightemperature incineration (over 800 ℃). Incinerating them at temperatures lower than that may produce toxic gases such as chlorine. To prevent capacitors from explosion, punch holes in or sufficiently crush the can cases of the capacitors, then incinerate.

【8】About AEC-Q200

The Automotive Electronics Council (AEC) was originally established by major American automotive related manufactures. Today, the committees are composed of representatives from the sustaining Members of manufacturing companies in automotive electrical components. It has standardized the criteria for "stress test qualification" and "reliability tests" for electronic components.

AEC-Q200 is the reliability test standard for approval of passive components in Automotive applications. It specifies the test type, parameters and quantity, etc. for each component. The criteria of the reliability tests such as for our main products, "Aluminum Electrolytic Capacitors" are described in this standard.

Pursuant to the customer's specific testing requirements, Chemi-Con submits the test results according to AEC-Q200 for Aluminum Electrolytic Capacitors used in automotive applications on request.

An electronic component manufacturer cannot simply claim that their product is "AEC-Q200 Qualified". It can be claimed "Compliant", "Capable", "Available", etc., however each component must be tested per each users "Qualification Test Plan" in order to claim AEC-Q200 status.

Please contact us for more information.

【9】Response to the Substances of Concern

1) Nippon Chemi-Con aims for developing products that meet laws and regulations concerning substances of concern.
(Some products may contain regulated substances for exempted application)
Please contact us for more information about law-compliance status.

2) According to the content of REACH handbook (Guidance on requirements for substances in articles which is published on May 2008), our electronic components are "articles without any intended release". Therefore they are not applicable for "Registration" for EU REACH Regulation Article 7 (1). Reference: Electrolytic Condenser Investigation Society "Study of REACH Regulation in EU about Electrolytic Capacitor"(publicized on 13 March 2008)

【10】Safety Application Guide

For more details, refer to JEITA RCR-2367D (March 2019) with the title of "Safety Application Guide for fixed aluminum electrolytic capacitors for use in electronic equipment".