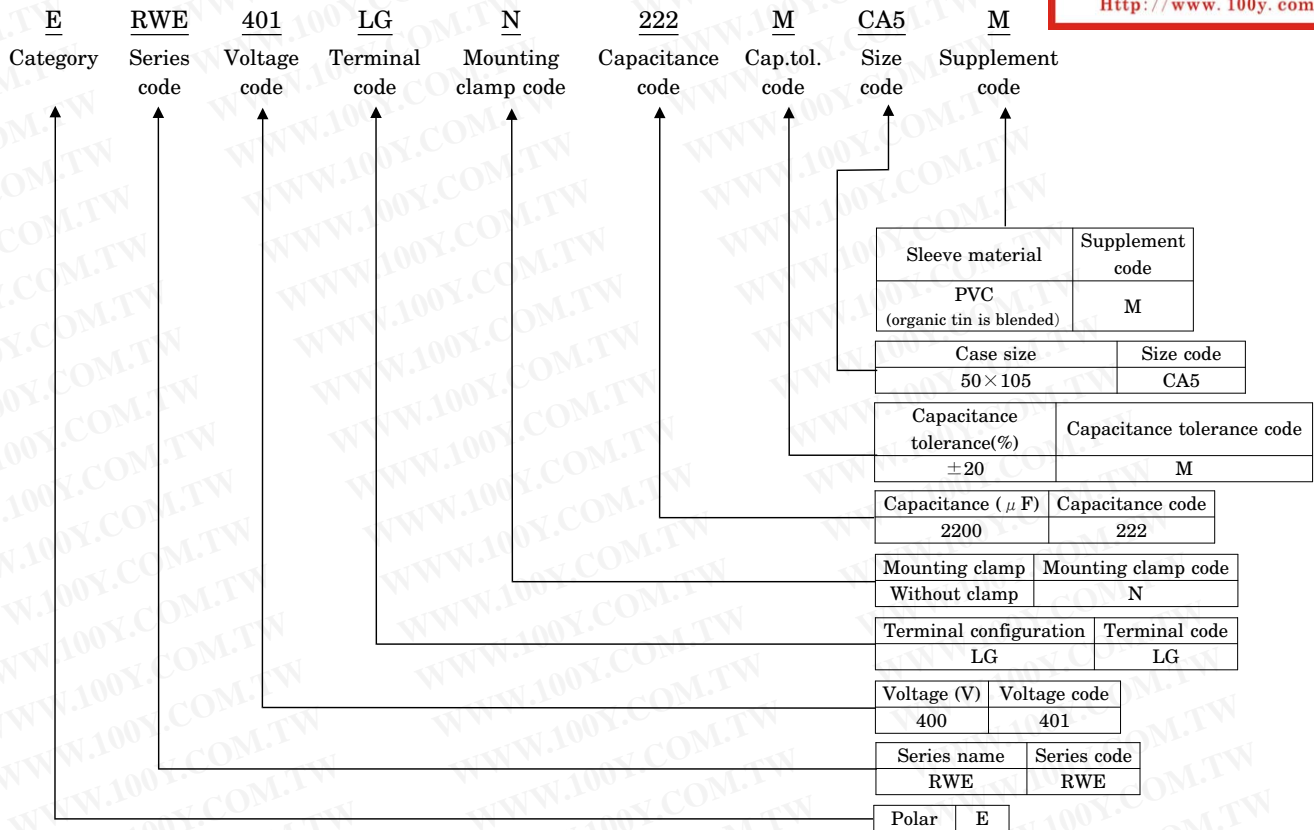


1 Scope

This specification defines the requirements for aluminum electrolytic capacitors that comply with the first symbol W of JIS C 5141-1991.

2 Part Numbering System

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3 Rating

No.	Item	Specification	Conditions
1	Category temperature range	-25 to +85 °C	
2	Rated voltage	400 V _{DC}	
3	Surge voltage	450 V _{DC}	
4	Leakage current	5000 μA MAX	at 20°C after 5 minutes, rated voltage
5	Nominal capacitance	2200 μF	at 20°C, 120Hz
6	Capacitance tolerance	-20 to +20 %	at 20°C, 120Hz
7	Dissipation factor (tan δ)	0.25 MAX.	at 20°C, 120Hz
8	Rated ripple current	7.2 Arms	at 85°C, 120Hz
9	Temperature characteristics	Capacitance ratio Cap(-25°C) / Cap(20°C) ≥ 0.7	120Hz

4 Performance

Unless otherwise specified, the capacitors shall be measured at a temperature of $+15$ to $+35^{\circ}\text{C}$, a humidity of 45 to 75%RH and an atmospheric pressure of 86 to 106kPa. However, if any doubt arises on the judgment, the measurement conditions shall be $20 \pm 2^{\circ}\text{C}$, 60 to 70%RH and 86 to 106kPa. The test conditions shall comply with JIS C 5102-1986.

4.1 Capacitance(Cap.)

[Conditions]	Measuring frequency	: $120\text{Hz} \pm 20\%$
	Measuring voltage	: $0.5\text{V rms max.} +1.5$ to $+2.0\text{V DC}$
	Measuring circuit	: Series equivalent circuit (\bigcirc — — --- — \bigcirc)
[Criteria]	As specified in section 3.	

4.2 Dissipation factor ($\tan \delta$)

[Conditions]	Measuring frequency	: $120\text{Hz} \pm 20\%$
	Measuring voltage	: $0.5\text{V rms max.} +1.5$ to $+2.0\text{V DC}$
	Measuring circuit	: Series equivalent circuit (\bigcirc — — --- — \bigcirc)
[Criteria]	As specified in section 3.	

4.3 Leakage current (L.C.)

[Conditions]	Rated voltage shall be applied to capacitors in series with a resistor of $1000 \pm 10 \Omega$. Then, leakage current shall be measured at the end of a specified period after the capacitors reached the rated voltage across the terminals.	
[Criteria]	As specified in section 3.	

4.4 Temperature characteristics

[Conditions]	Step 1. $20 \pm 2^{\circ}\text{C}$: Measure capacitance (at $120\text{Hz} \pm 10\%$)
	Step 2. Lower category temperature ($\pm 3^{\circ}\text{C}$)	: Measure capacitance (at $120\text{Hz} \pm 10\%$)
[Criteria]	Step 2	: Capacitance ratio (As specified in section 3.)

4.5 Terminal strength

[Conditions]	The following torque shall be applied to the terminals of the capacitor for 10 to 15 seconds with the capacitor body held.	
	Torque (N · m)	: 3.23 (M5)
[Criteria]	The terminals shall neither loosen nor break away.	

4.6 Vibration

[Conditions]	Vibration frequency range	: 10 to 55Hz
	Peak to peak amplitude	: 1.5mm
	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)
	※ The capacitors shall be mounted to test equipment by means of any clamp.	
[Criteria]	Capacitance (during test)	: The reading shall be stable.
	Appearance	: No significant damage
	Capacitance change	: Shall be within $\pm 5\%$ of the initial measured value.

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4.7 Operation of pressure relief vent

[Conditions]	Apply a reverse voltage with DC current.	
	Diameter of capacitor	: over 22.4mm : 10A
[Criteria]	When the vent operates, the capacitor shall not flame although gas discharge or expulsion of 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.	

4.8 Humidity exposure

[Conditions]	Test temperature	: 40±2°C
	Relative humidity	: 90 to 95%RH
	Test time	: 240±8 hours
	Test voltage	: No voltage applied
[Criteria]	Appearance	: No significant damage
	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ±15% of the initial measured value.
	Dissipation factor (tan δ)	: Shall not exceed the initial specified value.

4.9 Endurance

[Conditions]	After the capacitor is subjected to DC voltage with the specified rated ripple current applied for 2000 ⁺⁷² hours at 85±2°C, the following specifications shall be satisfied at 20°C. The sum of DC voltage and peak AC voltage must not exceed the full rated voltage.	
[Criteria]	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ±20% of the initial measured value.
	Dissipation factor (tan δ)	: Shall not exceed 300% of the initial specified value.

4.10 Shelf life

[Conditions]	After the capacitor is subjected to 85±2°C for 500 ⁺²⁴ hours without voltage applied, the following specifications shall be satisfied at 20°C. Before the measurements, the capacitor shall be preconditioned by applying voltage according to Item 4.4 of JIS C 5102.	
[Criteria]	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ±20% of the initial measured value.
	Dissipation factor (tan δ)	: Shall not exceed 300% of the initial specified value.

4.11 Surge test

[Conditions]	Temperature	: +15 to +35°C
	Resistor	: 1000±10Ω
	Test voltage	: Surge voltage
	Test condition	: 30±5 seconds every 6±0.5 minutes.
	Cycle	: 1000 cycle
[Criteria]	Leakage current	: Shall not exceed the initial specified value.
	Capacitance change	: Shall be within ±15% of the initial measured value.
	Dissipation factor (tan δ)	: Shall not exceed the initial specified value.

4.12 Insulation resistance

[Criteria]	When measured between the terminals shorted to each other and the mounting clamp on the insulating sleeve covering the case by using an insulation resistance meter of 500VDC, the insulation resistance shall not be less than 100 MΩ.
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4.13 Insulation withstanding voltage

[Criteria]	When a voltage of 2000VAC is applied for one minute between the terminals shorted to each other and the mounting clamp on the insulating sleeve covering the case, there shall be no significant damage.
------------	--

4.14 Rated ripple current multipliers

The rated ripple current at 85°C, 120Hz is prescribed in the section 3.

When the frequency of the ripple current is not 120Hz, the ripple current that is obtained by multiplying the rated ripple current by the following figures shall be used as a maximum value.

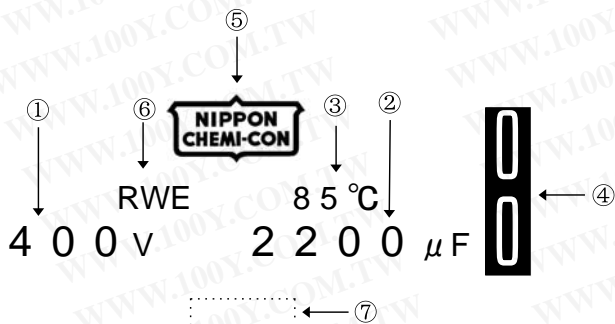
Frequency multipliers

Frequency[Hz]	50	120	300	1k	3k
Coefficient	0.8	1.0	1.1	1.3	1.4

5 Marking

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

- ① Rated voltage
- ② Nominal capacitance
- ③ Upper category temperature
- ④ Negative polarity stripe
- ⑤ Manufacturer's identification mark
- ⑥ Series name
- ⑦ Lot No.



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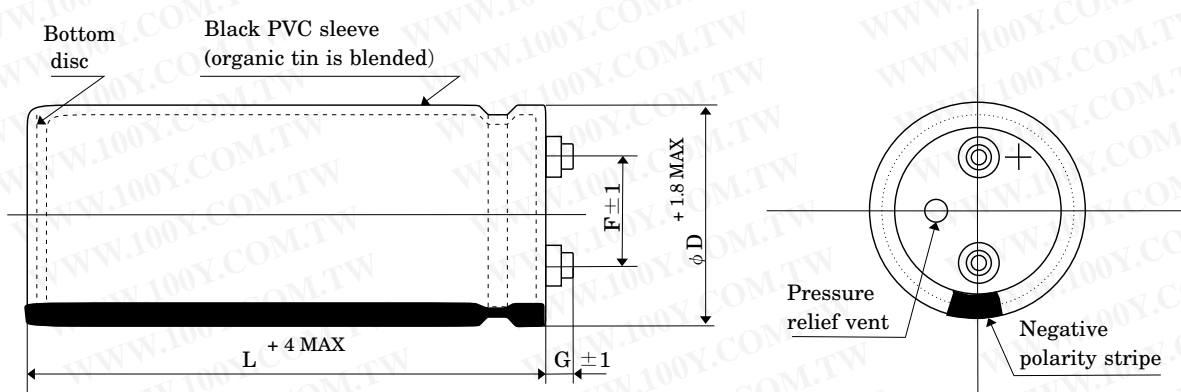
Finish method

- Lot No. shall be marked on sleeve.

6 Dimensions and construction

6.1 Dimensions

Unit(mm)



Dimensions Unit(mm)

D	L	F	G
50	105	22.4	6

<Note>

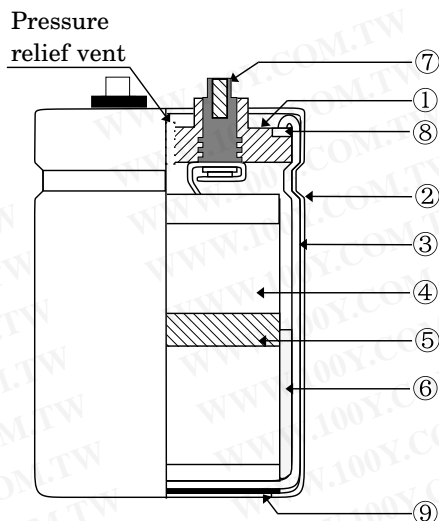
The screw is separately supplied and not attached to the product.

<Screw Specifications>

The maximum screw tightening torque are specified in item 4.5.

Plus hexagon-headed screw M5×0.8×10

6.2 Construction



No.	Components	Materials, Finish / Specifications
①	Seal	Phenol
②	Sleeve	Polyvinylchloride (organic tin is blended.)
③	Case	Aluminum
④	Element	Separator
		Aluminum
		Electrolyte
⑤	Winding tape	P.P
⑥	Fixing material	Atactic polypropylene
⑦	Terminal	Aluminum
⑧	Rubber	EPT Rubber
⑨	Bottom disk	Polyvinylchloride (organic tin is blended.)

※ No ozone depleting substance has been used.

7 Others

(1) These products are not solvent-proof type

(2) Export Trade Control Ordinance (When our products are 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 in (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 export goods can be used in the development of 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 export goods can be potentially used in the development of weapon, 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.

(3) RoHS Directive(2002/95/EC)

Substances banned in the RoHS directive are not used in these products.

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Precautions to User for Non-Solid Aluminum Electrolytic Capacitors

CLASSIFICATION	ITEM
1.Designing device circuits	(1) Make sure that installation and operating environments are within the rated performance limits of capacitors prescribed in their catalogs or product specifications, and select the capacitors to meet the service life of a device. Do not use capacitors at the following conditions, a)High temperature (exceeding the upper category temperature of capacitors) b)Excessive current (more than the rated ripple current of the capacitors) c)Over-voltage (exceeding the rated voltage of the capacitors) d)Reverse voltage or AC voltage. e)In circuits in which charge and discharge are frequently repeated.
	(2) Electrically isolate the outer can case of a capacitor from the positive and negative terminals and the circuits. If the capacitor has a dummy terminal for mounting stability, isolate it as well.
	(3) The outer sleeves of CE62 and CE69 type capacitors are not assured as insulation-functioning parts. Do not use the capacitors for places that require the outer sleeves functioning as insulation.
	(4) Do not use capacitors to devices exposed to the following environment. a)Water, salt water or oil spatters, or dewy places. b)Toxic gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium, etc.) fills into. c)Direct sunlight, ozone, ultraviolet rays or radiation is applied to. d)Severe vibration or mechanical shock exceeding the limits prescribed in the catalogs or product specifications is applied to.
	(5) Design considerations for installing a capacitor to the print circuit board. a)Provide the appropriate hole spacing on the printed circuit board to match the terminal spacing of the capacitor. b)Make an open space over the pressure relief vent of the capacitor. c)Do not locate any wire or copper trace over the vent. d)If mounting the capacitor with its vent face down on the pc board, provide a ventilation hole in the pc board in place. (Application for CE04 type.) e)Do not locate any copper trace under the seal side of a capacitor. f)Avoid locating any heat-producing object around a capacitor or on the reverse side of the print circuit board under the capacitor. g)Do not stand a screw-insert type (CE33 type) capacitor on its sealing cover (terminal side) in setting it to the device. Also,If using the screw-insert type capacitor by laying the body on its side, set the positive terminal upward,the negative terminal downward and the vent sideward.
	(6) Other precautions in designing devices. a)Take account of the changes in the electrical characteristics of capacitors varying with respect to temperature and frequency. b)If using a double-sided printed circuit board, do not locate any via hole within the pc board area under the seal side of the capacitor. c)If using more than one capacitor to connect in parallel, balance the currents flowing into the individual capacitors. d)If using more than one capacitor to connect in series, connect resistors in parallel with the individual capacitors for balancing the voltages. e)Do not over-tighten the screws in the screw-insert terminals and mounting clamps. The maximum tightening torques have been prescribed in the catalogs or product specifications.

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CLASSIFICATION	ITEM
2.Installing capacitors in devices	(1)Follow the instructions below for installing capacitors in devices. a)Do not re-use the capacitors already used in devices. The used capacitors are not reusable, except the case that they are taken from a device for periodic inspection measuring their electrical characteristics and then returned to the device. b)Although discharged at manufacturing process, capacitors may have been re-charged by a recovery voltage phenomenon. In this case, discharge them through a resistor of approximately 1 k Ω before installation. c)The capacitors that has been stored for long periods of time may have high leakage current. In this case, make pre-conditioning by applying a voltage through a resistor of approximately 1 k Ω . d)Make sure of the rated values (nominal capacitance and voltage) and polarity when installation. e)Do not drop capacitors on the floor etc. If they should fall down, do not use them. f)Do not deform capacitors in installing to a device. g)Make sure that the terminal spacing equals the hole spacing of the pc board before installation. h)When installing the snap-in terminal type capacitor on the pc board, insert the terminals into the holes of the pc board and press the capacitor down until the botton of the capacitor body surely reaches the surface of the pc board. . i)Note a mechanical shock that is caused by the component checker of an automatic insertion machine.
	(2) Follow the instructions below for soldering. a)Do not put flux on any part of capacitors other than their terminals. b)Soldering conditions (temperature, time and the number of repeats) should be within the limits prescribed in the catalogs or product specifications. c)Do not dip the bodies of capacitors into the solder bath. d)Do not let other components lean against the capacitors during soldering.
	(3) Do not apply a mechanical stress to the capacitor after soldering to the pc board. a)Do not incline, twist or push the capacitor body. b)Do not take the assembly board by the capacitor in lifting or carrying the assembly board. c)Do not bump or strike any object against the capacitor.
	(4) Do not wash capacitors by using cleaning agents. If it is necessary to wash capacitors, use the only capacitors that are capable of withstanding the cleaning agents and apply the cleaning conditions within the limits prescribed in the product specifications.
	(5) Precautions for the washable capacitors. a)Prevent cleaning agents from being contaminated, by controlling their conductivity, pH, specific gravity, water content, etc. b)After washing the capacitors, do not keep them in an atmosphere of the cleaning agents or a closed container. Remove the residual cleaning agents by drying the assembly board by a forced hot air at temperatures less than the upper category temperature of the capacitors.
	(6) Do not use any adhesive or coating material containing halogenated solvents.
	(7) Precautions for using adhesives and coating materials. a)Do not apply adhesives or coating materials with flux or dirt left on the rubber seal of the capacitor or between the pc board surface and the capacitor seal. b)Before applying the adhesives or coating materials to the capacitors, dry and remove the residual cleaning agents. Also, do not cover up the whole surface of the capacitor rubber seal with the adhesives or coating materials. c)For permissible heat conditions for curing adhesives or coating materials, follow the instructions in the product specifications of capacitors.
3.During operation	(1) Follow the following precautions for a device in operation. a)Do not touch a capacitor directly with bare hands. b)Do not short-circuit the terminals of a capacitor by applying any conductive object.
	(2) Do not use devices at the following environment. a)Water, oil or dew spatters on the capacitors. b)Direct sunlight, ozone, ultraviolet rays or radiation is applied to the capacitors. c)Toxic gas (hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonium, etc.) fills into. d)Severe vibration or mechanical shock, exceeding the limits prescribed in the catalogs or product specifications, is applied to the capacitors.
4.Maintenance inspection	(1) Make periodic inspections for the capacitors that have been used in devices for industrial application. The appearance and electrical characteristics of the capacitors should be checked for the periodic inspections.

CLASSIFICATION	ITEM
5.In the event of venting on capacitors.	(1) If the capacitor should blow out gas with its vent open, turn off or unplug the main power supply of the device.
	(2) When venting, the capacitor blows a hot gas of more than 100°C. Never expose the face close to the venting capacitor. If you should expose your eyes to the spouting gas and inhale it, immediately flush the open eyes and gargle with water. Do not lick the electrolyte of a capacitor. Wash the electrolyte away from the skin with soap and water.
6.Fumigation	(1) Fumigation process may be required when exporting the end electrical product. The process, actually halogenated ions, may cause the aluminum electrolytic capacitor to corrode. The fumigation solvent must not directly adhere to the electrical product and the solvent must be dried completely. Please consult us if solvent adheres to the aluminum electrolytic capacitors or drying condition is not satisfaction.
7.Storage	(1) Store capacitors indoors at a temperature of 5 to 35°C and a humidity of less than 75% RH.
	(2) Do not store capacitors in the environment prohibited with Section 3.(2).
8.Disposal	(1) In the interests of the environment and in order to comply with local disposal regulations ,ask a specialist for the disposal of industrial wastes.

* For other precautions and the details of these precautions, refer to Engineering Bulletin No.634A.
The following technical terms have been changed according to change of reference standard from JIS C 5141-1991 to JIS C 5101-1998.

New standard JIS C 5101-1998	Old standard JIS C 5141-1991
Category temperature	Operating temperature
Rated ripple current	Permissible ripple current
Endurance	Load life

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