

JIS

JAPANESE INDUSTRIAL STANDARD

**Fixed tantalum electrolytic
capacitors with solid electrolyte
for use in electronic equipment**

Ⓔ **JIS C 5142**—1991

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Fixed tantalum electrolytic capacitors
with solid electrolyte for use
in electronic equipment

C 5142-1991

1. Scope

This Japanese Industrial Standard specifies polarized fixed tantalum electrolytic capacitors with solid electrolyte employing tantalum oxide film as the dielectric which are used mainly in d.c. circuits (hereafter referred to as the "capacitors") based on JIS C 5140.

Remarks 1. For tantalum electrolytic capacitors of chip style for surface mounting, this Standard is not applied.

2. The following Standards are cited in this Standard:

JIS C 0805-Packaging of Electronic Components on Continuous Tapes (Components with Axial Type and Radial Wire Lead Terminals)

JIS C 5101-General Rules of Fixed Capacitors for Electronic Equipment

JIS C 5102-Test Methods of Fixed Capacitors for Electronic Equipment

JIS C 5140-General Rules of Fixed Electrolytic Capacitors for Use in Electronic Equipment

JIS C 5700-General Rules for Reliability Assured Electronic Components

JIS Z 9015-Sampling Inspection Procedures and Tables by Attributes with Severity Adjustment (Receiving Inspection Where A Consumer Can Select Suppliers)

3. Corresponding international standards are given below.

IEC 384-15 (1982) Fixed capacitors for use in electronic equipment. Part 15: Sectional specification: Fixed tantalum capacitors with non-solid electrolyte

IEC 384-15-3 (1984) Fixed capacitors for use in electronic equipment. Part 15: Blank detail specification: Fixed tantalum capacitors with solid electrolyte and porous anode. Assessment level E

4. The units and numerical values given in { } in this Standard are based on the traditional unit system and are appended for informative reference.

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2. Definitions

For the purpose of this Standard the principal definitions specified in JIS C 5140 shall apply.

3. Type designation

3.1 Structure of type designation The type designation shall be structured by arranging the symbols as given below.

Symbol denoting kind of capacitor 3.2.1	Symbol denoting style 3.2.2	Symbol denoting character- istic 3.2.3	Symbol denoting rated voltage 3.2.4	Symbol denoting nominal capacit- ance 3.2.5	Symbol denoting tolerance on capacitance 3.2.6
Example CS	02	HB	1A	336	K

Symbol denoting grade 3.2.7	Symbol denoting failure rate level 3.2.8	Symbol denoting external dimensions 3.2.9	Symbol denoting processing of lead wire termina- tion 3.2.10
Example E	M	B	T

3.2 Symbols

3.2.1 Kind of capacitor The symbol denoting kind of capacitor shall be CS.

3.2.2 Style The symbol denoting style shall be as given in Table 1.

Table 1. Style

Symbol	Outline	Enclosure	Termination		Remarks
			Kind	Direction	
02	Cylindrical	Metal case	Lead wire	Opposite	With insulation sleeve
15		Non-metal case (dipp)		Same	-

3.2.3 Characteristic The symbol denoting characteristic shall consist of the combination of a symbol denoting performance and a symbol denoting category temperature range that is expressed by two English capital letters as given in Table 2.

Table 2. Characteristic

Item		Characteristic symbol				
		JB	HB	LB	LD	WD
Performance	Change of temperature and voltage aging	o	-	-	-	-
	Voltage proof (insulation sleeve)	o	-	-	-	-
	Insulation resistance (insulation sleeve)	o	-	-	-	-
	Resistance to shock	o	o	o	-	-
	Sealing	o	-	-	-	-
	Radiography	o	-	-	-	-
	Change of temperature	-	o	o	-	-
	Change of temperature and immersion (cyclic)	o	-	-	-	-
	Resistance to damp heat	-	Steady state	o ⁽¹⁾	o	o
			Cyclic	-	-	-
	Salt mist	o	-	-	-	-
	Climatic sequence	-	o ⁽¹⁾	o	-	-
Category temperature range °C		-55 to + 125			-55 to +85	

Note ⁽¹⁾ The performances of resistance to damp heat (steady state) and climatic sequence in capacitors of characteristic HB differ from those of characteristic LB.

Remarks 1. In addition to the items shown in Table 2, the performance of a capacitor differs according to the characteristic of the capacitor in the items of leakage current, variation rate of capacitance, tangent of loss angle, variation of characteristic by temperature, etc. (see Table 11).

2. In this table "o" indicates that the item is applied, and "-" indicates that the item is not applied.

3.2.4 Rated voltage The symbol denoting rated voltage shall be as given in Table 3.

Table 3. Rated voltage

Symbol	Rated voltage V
0F	3.15
0G	4.0
0J	6.3
1A	10
1C	16
1D	20
1E	25
1V	35
1H	50

3.2.5 Nominal capacitance The symbol denoting nominal capacitance shall consist of three numerals, picofarad (pF) being the unit. The first and second numerals shall represent the significant figures of nominal capacitance and the third numeral shall represent the number of zeros following the significant figures.

Examples: 104..... 100000 pF (0.10 μ F)
 105..... 1000000 pF (1.0 μ F)
 336..... 33000000 pF (33 μ F)
 157..... 150000000 pF (150 μ F)

3.2.6 Tolerance on capacitance The symbol denoting tolerance on capacitance shall be as given in Table 4.

Table 4. Tolerance on capacitance

Symbol	Tolerance on capacitance %
J	$\pm$ 5
K	$\pm$ 10
M	$\pm$ 20

3.2.7 Grade The symbol denoting grade shall be as given in Table 5.

The combination of grade and characteristic shall be as given in Table 6.

Table 5. Grade

Symbol	Contents of grade
A	A grade that needs quality assessment of special level.
C	A grade that needs quality assessment of simplified level.
E	A grade that needs quality assessment of general level II.
X	A grade for which quality assessment is not specified.

Remarks: The special level and simplified level shall be as specified in 3. (Classification of reliability assurance level) of JIS C 5700.

Informative reference: General level II corresponds to assessment level E specified in IEC 384-15-3.

Table 6. Combination of grade and characteristic

Grade symbol	Characteristic symbol				
	JB	HB	LB	LD	WD
A	o	-	-	-	-
C	-	-	-	-	o
E	-	o	o	o	-
X	-	-	-	-	o

Remarks: In this table "o" indicates that the item is applied, and "-" indicates that the item is not applied.

Informative reference: Capacitors of grade E characteristic HB correspond to the long-life grade capacitors specified in IEC 384-15, and capacitors of characteristics LB and LD correspond to the general-purpose grade capacitors specified in IEC 384-15.

3.2.8 Failure rate level The symbol denoting failure rate level shall be as given in Table 7.

Table 7. Failure rate level

Symbol	Failure rate %/1000 h	Applicable grade
M	1.0	A, C, E
P	0.1	
R	0.01	
X	Not specified	A, C, E, X

3.2.9 External dimensions The symbol denoting external dimensions (hereafter referred to as the "size symbol") shall consist of one English capital letter as shown in Attached Fig. 1 for style 02, and in Attached Fig. 2 for style 15.

3.2.10 Processing of lead wire termination The symbol denoting processing of lead wire termination shall be used to express lead wire processed products or taped products, and shall consist of an English capital letter as given in Table 8.

Table 8. Processing of lead wire termination

Symbol	Classification of lead wire termination processing
F	Product with processed lead wire termination
T	Taped product

4. Ratings

4.1 Rated temperature and category temperature range The rated temperature shall be 85°C, and the category temperature ranges shall be as given in Table 2.

4.2 Rated voltage, surge voltage and category voltage The surge voltages and category voltages corresponding to the rated voltages shall be as given in Table 9.

Table 9. Surge voltage and category voltage corresponding to rated voltage

Unit: V

Rated voltage		Surge voltage	Category voltage (temperature derated voltage at 125°C)	Surge voltage at 125°C
Symbol	Voltage			
0F	3.15	4	2	2.5
0G	4.0	5	2.5	3.2
0J	6.3	8	4	5
1A	10	13	6.3(7)	8
1C	16	20	10	13
1D	20	26	13	16
1E	25	32	16	20
1V	35	44(46)	22(23)	28
1H	50	63(65)	32(33)	40

Remarks 1. The temperature derated voltage at an optional temperature exceeding rated temperature (85°C) (125°C is the upper limit) or the surge voltage corresponding to the above is obtained from the formula below.

The second decimal place and below shall be discarded.

$$U_T = U_r - \frac{U_r - U_d}{40} (T - 85)$$

where, T : optional temperature exceeding rated temperature (°C)

U_T : temperature derated voltage at optional temperature T or surge voltage corresponding to the above (V)

U_r : rated voltage or surge voltage corresponding to the above (V)

U_d : category voltage or surge voltage at 125°C corresponding to the above (V)

2. The numerical values given in parentheses in this table are applicable only to capacitors of characteristic JB.
3. The ripple voltage which can be applied to a capacitor shall have a very small value.

4.3 Nominal capacitance The nominal capacitance shall be expressed in microfarad (μF) and the values shall be 10^n (n is an integer) times the preferred number of E6 series given in Table 10.

Table 10. E6 series

Series	Numerical value					
E6	1.0	1.5	2.2	3.3	4.7	6.8

4.4 Tolerance on capacitance The tolerance on capacitance shall be as given in Table 4.

4.5 Combination of rated voltage and nominal capacitance for each style, characteristic and grade The combination of rated voltage and nominal capacitance for each style, characteristic and grade shall be as given in Attached Tables 1 to 3.

5. Performances and test methods

5.1 Test methods The test methods shall be as specified in JIS C 5102. However, the test method of taping shall be as specified in JIS C 0805. The test method when JIS C 0805 is not applicable and the test method of processed lead wire termination are subjected to agreement between the parties concerned with acceptance.

5.2 Performances The performances shall be as specified in Table 11. However, performances relating to taping and lead wire termination processing of taped and processed products shall be as specified in JIS C 0805 or as agreed between the parties concerned with acceptance.

Table 11. Performances

No.	Item		Performance			
			JB	HB	LB	L
	Characteristic	Grade	A	E		
1	Leakage current		Not more than $0.005 C_R \cdot U_R$ μA or $0.3 \mu\text{A}$ whichever is the larger	Not more than $0.01 C_R \cdot U_R$ μA or $0.5 \mu\text{A}$ whichever is the larger	Not more than $0.02 U_R$ μA or $1 \mu\text{A}$ whichever is the lar	
2	Capacitance		Within specified tolerance			
3	Tangent of loss angle	Nominal capacitance	Not more than the appropriate val			
		1 μF max.	0.02	0.04	0.04	
		1.5 to 4.7 μF	0.04	0.06	0.08	
		6.8 to 68 μF	0.06			
		100 to 330 μF	0.08	0.08	0.12	

Performances and test methods

Performance			Test method (JIS C 5102)	Informative reference (Essential points of JIS C 5102)
	LB	LD		
E	C, X			
C_R 0.5 ver rger	Not more than $0.02 C_R$ $U_R \mu A$ or 1 μA whichever is the larger	Not more than $0.04 C_R$ $U_R \mu A$ or 2 μA whichever is the larger	As specified in 7.7. Resistance of standard resistor in voltage drop method: $1000 \pm 10 \Omega$	D.C. protective resistor: Approximately $1 k\Omega$. However, a resistor smaller than $1 k\Omega$ may be used for such a purpose that applied voltage reaches rated voltage within 1 min. Applied voltage: Rated voltage Time of measurement: Five minutes after rated voltage is attained. However, decision may be made earlier, if the current decreases below the specified value and further decreases or stabilizes.
nce			As specified in 7.8 Measuring condition: 4 of Table 10	Measuring frequency: 120 Hz $\pm 20\%$ Measuring circuit: Series equivalent circuit () Measuring voltage: 0.5 Vrms max. + 1.5 to 2.0 V DC However, if there is no dispute on decision, super- position of d.c. voltage may be omitted.
ppropriate value given below			As specified in 7.9 Measuring condition: 4 of Table 10	
	0.04	0.05		
	0.08	0.10		
	0.12	0.15		

Table 11. (Continued)

No.	Item		Performance				
			Characteristic	JB	HB	LB	LD
			Grade	A	E		
4	Change of temperature and voltage aging (applicable to grade A)	Appearance		No abnormality	—		
		Leakage current		To satisfy No. 1			
		Capacitance		To satisfy No. 2			
		Tangent of loss angle		To satisfy No. 3			
5	Voltage proof (applicable to grade A)			No abnormality	—		

Remarks: In this table, symbol C_r means the nominal capacitance in the unit of microvolt (V).

1. (Continued)

Ince			Test method (JIS C 5102)	Informative reference (Essential points of JIS C 5102)															
LB	LD	WD																	
		C, X																	
—			Repeat change of temperature by 5 cycles and then carry out voltage aging. Change of temperature: As specified in 9.3 Lowest temperature: $-65 \begin{smallmatrix} 0 \\ -5 \end{smallmatrix}^{\circ}\text{C}$ Highest temperature: $125 \begin{smallmatrix} +3 \\ 0 \end{smallmatrix}^{\circ}\text{C}$ Dratation of step 2 and step 4: Not more than 5 min Voltage aging: Test temperature: $85 \pm 2^{\circ}\text{C}$ Applied voltage: Rated voltage Duration of aging: Not less than 40 h Supply impedance: Not more than $3\ \Omega$	Change of temperature: <table><tr><th>Step</th><th>Temperature</th><th>Duration min</th></tr><tr><td>1</td><td>Lowest temperature</td><td>30 ± 3</td></tr><tr><td>2</td><td>Ordinary temperature</td><td>5 max.</td></tr><tr><td>3</td><td>Highest temperature</td><td>30 ± 3</td></tr><tr><td>4</td><td>Ordinary temperature</td><td>5 max.</td></tr></table>	Step	Temperature	Duration min	1	Lowest temperature	30 ± 3	2	Ordinary temperature	5 max.	3	Highest temperature	30 ± 3	4	Ordinary temperature	5 max.
Step	Temperature	Duration min																	
1	Lowest temperature	30 ± 3																	
2	Ordinary temperature	5 max.																	
3	Highest temperature	30 ± 3																	
4	Ordinary temperature	5 max.																	
—			As specified in 7.1. Test method: V block method Test voltage: 2000 V d.c. Duration of appli- cation: $60 \pm 5\text{ s}$ Rate of rise of test voltage: Approximately 500 V/s	—															

the unit of microfarad (μF) and U_R means the rated voltage in the unit of

Table 11. (Continued)

No.	Item		Performance					
			Characteristic	JB	HB	LB	LD	
			Grade	A	E			C
6	Insulation resistance (Applicable to grade A)		Not more than 1000 MΩ		-			
7	Variation of characteristic by temperature	Step 2	Variation rate of capacitance		Within $_{-10}^0$ % of the value in step 1		Within $_{-12}^0$ % of the step	
			Tangent of loss angle (applicable to grades A and E)		Not more than the specified value in No. 3 plus 0.02			
	Steps 4 and 5	Leakage current	85°C	Not more than 20 times the specified value in No. 1	Not more than 10 times the specified value in No. 1			
			125°C	Not more than 25 times the specified value in No. 1	Not more than 12.5 times the specified value in No. 1			

1. (Continued)

name			Test method (JIS C 5102)	Informative reference (Essential points of JIS C 5102)
LB	LD	WD		
C, X				
-			As specified in 7.6. Test method: V block method Measuring voltage: 500 + 10 V d.c. Number of measurements: Measure at 5 positions by rotating the body.	Initiation of measurement: 60 + 5 s after application of measuring voltage
Within $\pm 12\%$ of the value in step			As specified in 7.12. The condition of temperature change shall be as follows:	Duration of each step: Time to reach thermal equilibrium (temperature stability) (until the change between capacitances measured at intervals of 5 min is almost not recognized)
value in		-		
0 times the specified				
2.5	-			
0.1				
</				

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Table 11. (Continued)

No.	Item		Performance						
			Characteristic	JB	HB	LB	LD		
			Grade	A	E				
		Variation rate of capacitance	85°C	+8 0 % of the value at step 1	+10 0 % of the value at step 1	+12 0 % of the value at step 1			
			125°C	+12 0 % of the value at step 1		+15 0 % of the value at step 1			
			Tangent of loss angle (applicable to grades A and E)	85°C	Not more than the specified value in No.3 plus 0.02				
				125°C	Not more than the specified value in No. 3 plus 0.03				
		Step 6	Leakage current		To satisfy No. 1				
			Variation rate of capacitance		Within <u>±</u> 3 % of the value in step 1				
			Tangent of loss angle		To satisfy No. 3				
		8	Surge voltage	Appearance		No remarkable abnormality			
				Leakage current		To satisfy No. 1			
				Variation rate of capacitance		Within <u>±</u> 2 % of the value before test	Within <u>±</u> 5 % of the value before test		
Tangent of loss angle				To satisfy No. 3					

e 11. (Continued)

Performance			Test method (JIS C 5102)	Informative reference (Essential points of JIS C 5102)
LB	LD	WD		
E		C, X		
$+12_0$ % of the value at step 1		$+15_0$ % of the value at step 1		
$+15_0$ % of the value at step 1	-			
value in		-		
	-			
n step 1				
of the value			As specified in 7.14. Test temperature: 85 $\pm$ 2°C Protective resistor and discharge resistor: 33Ω $\pm$ 10 % Surge voltage: Surge voltage in Table 9 of this Standard (JIS C 5142)	Duration of charge and discharge: 1000 cycles with a period of 6 $\pm$ 0.5 min each consisting of 30 $\pm$ 5 s charging and 5 min 30 s discharge.

Table 11. (Continued)

No.	Item	Performance					
		Characteristic	JB	HB	LB	LD	WD
		Grade	A	E			C, X
9	Robus- tness of termi- nation	Tensile strength of termination	No abnormalities such as break and loosening of termination.				
		Tortional strength of lead wire termination (applic- able to grade A)	No abnormali- ties such as break and loosening of termination.	-			
		Bending strength of lead wire termination (appli- cable to grades E, C and X)	-	No abnormalities such as break and loosening of termination.			