

JIS

JAPANESE INDUSTRIAL STANDARD

**Fixed metallized polyester
film capacitors for use in
electronic equipment**

JIS C 5115—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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J I S

Fixed metallized polyester film capacitors
for use in electronic equipment

C 5115-1991

1. Scope

This Japanese Industrial Standard specifies capacitors employing polyester film as the dielectric and metallized film as the electrodes which are used mainly in d.c. circuit (hereafter referred to as "capacitors") based on JIS C 5111.

Remarks 1. 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 2318-Polyester Films for Electrical Purposes

JIS C 2319-Metallized Polyester Film for Capacitors

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

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

JIS C 5111-General Rules of Fixed Paper and Plastic Film Capacitors for Use Electronic Equipment

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

2. Corresponding international standards are given below.

IEC 384-2 (1987) Fixed capacitors for use in electronic equipment. Part 2: Sectional specification: Fixed metallized polyethylene - terephthalate film dielectric d.c. capacitors

IEC 384-2-1 (1987) Fixed capacitors for use in electronic equipment. Part 2: Blank detail specification: Fixed metallized polyethylene - terephthalate film dielectric d.c. capacitors. Assessment level E

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

2. Definitions

For the purpose of this Standard, the principal definitions specified in JIS C 5111 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	Symbol denoting style	Symbol denoting character- istic	Symbol denoting rated voltage	Symbol denoting nominal capacit- ance	Symbol denoting tolerance on capacitance
3.2.1	3.2.2	3.2.3	3.2.4	3.2.5	3.2.6

Example CF 922 MG 2A 155 K

Symbol denoting grade	Symbol denoting failure rate level	Symbol denoting lead wire termina- tion processing
3.2.7	3.2.8	3.2.9

Example C M F

3.2 Symbols

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

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

Table 1. Style

Symbol	Outline	Enclosure		Termination	
				Kind	Direction
91	Square	Non-metal enclosure		Lead wire	Opposite
99		Non-metal case			Same
922		Non-metal case enclosure	Dipping		
924		enclosure	Taping		

Remarks: Square includes square plate (flat square).

3.2.3 Characteristic The symbol denoting characteristic shall consist of the combination of symbol M denoting main material of dielectric (polyester) and the symbol denoting category temperature range as given in Table 2.

Table 2. Characteristic

Symbol	Category temperature range °C
MG	-40 to +85
MF	-40 to +100

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
1H	50
1J	63
2A	100
2E	250
2G	400
2J	630

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: 154 150000 pF (0.15 μ F)

155 1500000 pF (1.5 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	± 5
K	± 10
M	± 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	Defined as
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.

Informative reference: General level II corresponds to Assessment level E for long-life ones specified in IEC 384-2-1.

Table 6. Combination of grade and characteristic

Character- istic symbol	Grade symbol		
	C	X	E
MG	Applicable		-
MF			Applicable

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	C, E
P	0.1	
R	0.01	
X	Not specified	C, E, X

3.2.9 Processing of lead wire termination The symbol denoting processing of lead wire termination shall be used to express lead wire processed products or taped product, 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	Products 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 the two ranges given in Table 2.

4.2 Rated voltage and category voltage The rated voltages shall be as given in Table 3, and the category voltages corresponding to the above shall be as given in Table 9.

Table 9. Relationship between rated voltage and category voltage
Unit: V

Symbol	Rated voltage	Category voltage
1H	50	40
1J	63	50
2A	100	80
2E	250	200
2G	400	320
2J	630	500

- Remarks 1. The category voltage is the temperature derated voltage at 100°C of a capacitor of characteristic MF, and it is equal to 80 % of the rated voltage rounded off at two significant figures.
2. The temperature derated voltage of a capacitor of characteristic MF at an optional temperature exceeding the rated temperature (85°C) (100°C is the upper limit) is obtained from the formula below. The fraction below decimal point shall be discarded.

$$U_T = U_R - \frac{U_R - U_C}{15} (T - 85)$$

where, U_T : temperature derated voltage (V) at temperature T (°C)

U_R : rated voltage (V)

U_C : category voltage (V)

T : an optional temperature exceeding 85°C (°C)

4.3 Nominal capacitance The nominal capacitance shall be expressed in microfarad (μF), the values shall be 10^n (n is an integer) times the preferred number of E12 series given in Table 10, and shall be as given in Attached Tables 1 to 4.

Table 10. E12 series

E12	1	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
-----	---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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

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 and test methods

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)
		Grades C, X	Grade E		
1	Capacitance	Within specified tolerance		As specified in 7.8. Measuring condition: 2 of Table 10	Measuring frequency: 1 kHz ± 20 % Measuring voltage: 5 Vrms max.
2	Tangent of loss angle	0.01 max.		As specified in 7.9. Measuring condition: 2 of Table 10	
		Nominal capacit- ance not exceed- ing 1 µF	0.008 max.		
		Nominal capacit- ance ex- ceeding 1 µF	0.01 max.		

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)
		Grades C, X	Grade E		
3	Voltage proof	No abnormality. However, self-healing (instantaneous breakdown) is allowed.		As specified in 7.1. Measuring conditions:	
				Item	
				Grades C, X	
				Grade E	
				Test voltage and duration of ap- plica- tion	Apply 150 % of rated voltage for rated 60±5 s, or 170 % of rated voltage for 1 to 5 s.
				Between terminations	Apply 160 % of rated voltage for 1 to 5 s in lot quality inspec- tion, for 60±5s in other tests.
				Charging and dis- charging current	1 A max.

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)									
		Grades C, X	Grade E											
	Between termination and enclosure	No abnormality.		<table><tr><th>Item</th><th>Grades C, X</th><th>Grade E</th></tr><tr><td>Test voltage and duration of application</td><td>Apply 200 % of rated voltage for 1 to 5 s.</td><td>Apply 200 % of rated voltage or 200 V whichever is the larger for 1 to 5 s in lot quality inspection, for 60±5 s in other tests.</td></tr><tr><td>Test method</td><td colspan="2">V block method for style 91, metal small ball method for styles 99, 922 and 924.</td></tr></table>	Item	Grades C, X	Grade E	Test voltage and duration of application	Apply 200 % of rated voltage for 1 to 5 s.	Apply 200 % of rated voltage or 200 V whichever is the larger for 1 to 5 s in lot quality inspection, for 60±5 s in other tests.	Test method	V block method for style 91, metal small ball method for styles 99, 922 and 924.		
Item	Grades C, X	Grade E												
Test voltage and duration of application	Apply 200 % of rated voltage for 1 to 5 s.	Apply 200 % of rated voltage or 200 V whichever is the larger for 1 to 5 s in lot quality inspection, for 60±5 s in other tests.												
Test method	V block method for style 91, metal small ball method for styles 99, 922 and 924.													
				Between termination and enclosure										

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)	
		Grades C, X	Grade E			
4	Between terminations	Nominal capacitance not exceeding 0.33 μ F	Rated voltage not exceeding 100 V	9000 M Ω min.	As specified in 7.6. Measuring voltage: As specified in Table 9. However, the voltage shall be 50 V for capacitors of rated voltages 50 V and 63 V. Temperature correction of measured value between terminations: If the measurement is carried out at a temperature other than 20°C and the measured value is disputable, correction shall be made according to Table 12 of this Standard (JIS C 5115). Measuring method of resistance between termination and enclosure: V block method for style 91, metal small ball method for styles 99, 922 and 924.	
			Rated voltage exceeding 100 V	30000 M Ω min.		
	Insulation resistance	Nominal capacitance exceeding 0.33 μ F	Rated voltage not exceeding 100 V	$\frac{3000}{C_R}$ M Ω min.		
			Rated voltage exceeding 100 V	$\frac{5000}{C_R}$ M Ω min.		
	Measuring voltage: Unit: V	Rated voltage	Measuring voltage	100		100
				250		
Measurement: 60 $\pm$ 5 s after initiation of voltage application.	630	500	400			

Remarks: The C_R in the table is the numerical value of nominal capacitance expressed in the unit of microfarad (μ F).

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)								
		Grades C, X	Grade E										
5	Strength of termination	No loosening, cracks or other damage		As specified in 8.1. Initial measurement: For grade E, measure capacitance (at 1 kHz) and tangent of loss angle (not exceeding 1 μ F: at 10 kHz, exceeding 1 μ F: at 1 kHz)	Tensile force: <table><tr><td>Nominal diameter of wire mm</td><td>Tensile force N{kgf}</td></tr><tr><td>0.5</td><td>5 {0.51}</td></tr><tr><td>0.6, 0.8</td><td>10 {1.0}</td></tr><tr><td>1.0</td><td>20 {2.0}</td></tr></table>	Nominal diameter of wire mm	Tensile force N{kgf}	0.5	5 {0.51}	0.6, 0.8	10 {1.0}	1.0	20 {2.0}
	Nominal diameter of wire mm	Tensile force N{kgf}											
	0.5	5 {0.51}											
0.6, 0.8	10 {1.0}												
1.0	20 {2.0}												
	Torsional strength (applied to cable to style 91)			As specified in 8.1. Carry out this test next to tensile strength test. Test condition: Grades C, X Condition 1 Grade E: Condition 2	Condition 1: 360 degrees, 5 times Condition 2: 180 degrees, twice								
	Bending strength (applied to cable to styles 99, 922 and 924)			As specified in 8.1. Carry out this test next to tensile strength test.	Number of times: 2 Mass of weight: <table><tr><td>Nominal diameter of wire mm</td><td>Mass of weight kg</td></tr><tr><td>0.5</td><td>0.25</td></tr><tr><td>0.6, 0.8</td><td>0.51</td></tr><tr><td>1.0</td><td>1.0</td></tr></table>	Nominal diameter of wire mm	Mass of weight kg	0.5	0.25	0.6, 0.8	0.51	1.0	1.0
Nominal diameter of wire mm	Mass of weight kg												
0.5	0.25												
0.6, 0.8	0.51												
1.0	1.0												

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)
		Grades C, X	Grade E		
6	Resistance to soldering heat	No remarkable abnormality		As specified in 8.5. Condition of immersion: Condition B Condition of voltage proof after test: Apply 150 % of rated voltage for 60 ± 5 s.	Flux: Ethanol solution of colophony (25 wt%) Solder: H60A, H60S or H63A Depth of immersion: 1.5 to 2.0 mm from root of termination Temperature of solder: 260 ± 5°C Duration of immersion: 10 ± 1 s Speed of immersion: 25 ± 2.5 mm/s Thermal screen: Used Recovery: 1 to 2 h
	Appearance	-			
	Variation rate of capacitance (applicable to grades C and X)	Within ± 3 % of the value before test			
	Tangent of loss angle (applicable to grades C and X)	To satisfy No. 2.			
	Voltage proof (between terminations (applied cable to grades C and X))	No abnormality. However, self-healing (instantaneous breakdown) is allowed.			

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)					
		Grades C, X	Grade E							
7	Resist- ance to solvent (perfor- mance) (appli- cable to grade E)	-	No abnor- mality	As specified in 8.7. Test method: Use method 1. However, conditions shall be as follows: <table><tr><td>Kind of solvent</td><td>Isopropyl alcohol</td></tr><tr><td>Temperature of solvent</td><td>23 ± 5°C</td></tr><tr><td>Duration of immersion</td><td>5 ± 0.5 min</td></tr></table> Recovery: 48 h Measuring condition of tangent of loss angle: Not exceeding 1 μF: 10 kHz Exceeding 1 μF: 1 kHz	Kind of solvent	Isopropyl alcohol	Temperature of solvent	23 ± 5°C	Duration of immersion	5 ± 0.5 min
			Kind of solvent		Isopropyl alcohol					
		Temperature of solvent	23 ± 5°C							
		Duration of immersion	5 ± 0.5 min							
		Within ± 2 % of initial value in No. 5								
Increment from initial value in No. 5 is not more than 0.003										
Increment of tangent of loss angle										
			Increment from initial value in No. 5 is not more than 0.002							

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)						
		Grades C, X	Grade E								
8	Solderability	At least 3/4 of the peripheral surface immersed of lead wire shall be covered with new solder.		As specified in 8.4. Test method: Method 1 Preconditioning of termination: Allow specimens to stand above boiling distilled water for 60 min. Grade E is not preconditioned.	Flux: Ethanol solution of colophony (25 wt%) Solder: H60A, H60S or H63A Depth of immersion: 1.5 to 2.0 mm from root of termination Temperature of solder: 235 ± 5°C Duration of immersion: 2 ± 0.5 s Speed of immersion: 25 ± 2.5 mm/s Thermal screen: Used						
9	Resistance to solvent (marking)	No remarkable abnormality on appearance, and marking is easily readable.		As specified in 8.7. Test method: Method 2 (2.2). However, conditions shall be as follows: <table><tr><td>Kind of solvent</td><td>Isopropyl alcohol</td></tr><tr><td>Temperature of solvent</td><td>23 ± 5°C</td></tr><tr><td>Duration of immersion</td><td>5 ± 0.5 min</td></tr></table>	Kind of solvent	Isopropyl alcohol	Temperature of solvent	23 ± 5°C	Duration of immersion	5 ± 0.5 min	Completely immerse capacitor under test, take it out of fluid, allow it to stand for 5 min or more for drying, and then rub it with absorbent cotton 10 times (5 times of reciprocation).
Kind of solvent	Isopropyl alcohol										
Temperature of solvent	23 ± 5°C										
Duration of immersion	5 ± 0.5 min										

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)																								
		Grades C, X	Grade E																										
10	Change of temperature	Appearance	No remarkable abnormality and marking is easily readable.	As specified in 9.3. Initial measurement: For grade E, measure capacitance (at 1 kHz) and tangent of loss angle (Not exceeding 1 μF: at 10 kHz, exceeding 1 μF: at 1 kHz) Test temperature: <table><tr><td>Test temperature</td><td>Characteristic MG</td><td>Characteristic MF</td></tr><tr><td>Lower category temperature</td><td colspan="2">- 40 $\pm$ 3°C</td></tr><tr><td>Upper category temperature</td><td>85 $\pm$ 2°C</td><td>100 $\pm$ 2°C</td></tr></table>	Test temperature	Characteristic MG	Characteristic MF	Lower category temperature	- 40 $\pm$ 3 $^{\circ}$ C		Upper category temperature	85 $\pm$ 2 $^{\circ}$ C	100 $\pm$ 2 $^{\circ}$ C	Duration: <table><tr><td>Step</td><td>Temperature</td><td>Duration min</td></tr><tr><td>1</td><td>Lower category temperature</td><td>30 $\pm$ 3</td></tr><tr><td>2</td><td>Ordinary temperature</td><td>3 max.</td></tr><tr><td>3</td><td>Upper category temperature</td><td>30 $\pm$ 3</td></tr><tr><td>4</td><td>Ordinary temperature</td><td>3 max.</td></tr></table> Number of cycles: 5	Step	Temperature	Duration min	1	Lower category temperature	30 $\pm$ 3	2	Ordinary temperature	3 max.	3	Upper category temperature	30 $\pm$ 3	4	Ordinary temperature	3 max.
		Test temperature	Characteristic MG		Characteristic MF																								
		Lower category temperature	- 40 $\pm$ 3 $^{\circ}$ C																										
		Upper category temperature	85 $\pm$ 2 $^{\circ}$ C		100 $\pm$ 2 $^{\circ}$ C																								
		Step	Temperature		Duration min																								
1	Lower category temperature	30 $\pm$ 3																											
2	Ordinary temperature	3 max.																											
3	Upper category temperature	30 $\pm$ 3																											
4	Ordinary temperature	3 max.																											
	Variation rate of capacitance (applicable to grades C and X)	Within $\pm$ 10 % of the value before test	-																										
	Tangent of loss angle (applicable to grades C and X)	Not more than 110 % of the specified value in No. 2																											
	Insulation resistance (between terminations) (applicable to grades C and X)	Not less than 30 % of the specified value in No. 4																											

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)
		Grades C, X	Grade E		
11	Resistance to vibration	No electrical discontinuity of 0.5 ms or more during last 30 min of test. No abnormality on appearance after test.		As specified in 8.2. Class of vibration: Class A Peak-to-peak amplitude: 1.5 mm Mounting method: For style 91, fix the lead wire at a point 6 ± 1 mm from the body. However, a capacitor with a mass not less than 2 g or a body length not less than 25 mm may be fixed by its body. For styles 99, 922 and 924, fix the lead wire at a point not more than 4 mm from the body. However, a capacitor with a mass not less than 2 g or a body length not less than 25 mm may be fixed by its body.	Rate of sweep: 10 to 55 to 10 Hz (1 min) Direction: 3 directions of X, Y and Z axes Duration: 2 h in each direction. 6 h in total.

Table 11. (Continued)

No.	Item	Performance		Test method (JIS C 5102)	Informative reference (essential points of JIS C 5102)
		Grades C, X	Grade E		
12	Resistance to shock (appliance to grade E)	-	No remarkable abnormality	As specified in 8.3. Impulse waveform: Half-sine wave Maximum acceleration: 490 m/s ² {50 G} Duration: 11 ms Measuring frequency for tangent of loss angle: 10 kHz for 1 μ F or less 1 kHz for over 1 μ F	Direction: Positive and negative directions along X, Y and Z axes, 6 in total Number of shocks: 3 in each direction, 18 shocks in total
			No electrical discontinuity of 0.5 ms or more during test		
			Variation rate of capacitance		
			Increment of tangent of loss angle		
			Nominal capacitance not exceeding 1 μ F		
			Nominal capacitance exceeding 1 μ F		
			Increment from initial value in No. 10 is not more than 0.002		