

JIS

JAPANESE INDUSTRIAL STANDARD

Fixed metal film resistors for
use in electronic equipment
— form 14, grade A

JIS C 5723—1991

Translated and Published

by

Japanese Standards Association

Printed in Japan

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

JAPANESE INDUSTRIAL STANDARD

J I S

Fixed metal film resistors for use in electronic equipment – form 14, grade A C 5723-1991

1. Scope

This Japanese Industrial Standard specifies fixed metal film resistors – form 14, grade A mainly used in electronic equipment (hereafter referred to as the "resistors"), based on JIS C 5720.

Remarks 1. This resistor is a resistor produced in such a way that the metal film closely fixed on a ceramic bar is employed as the resistor element, terminations are attached thereto, and an insulating enclosure (insulating coating) is applied to this assembly.

2. The cited Standards are given below.

JIS C 3102-Annealed Copper Wires for Electrical Purposes

JIS C 5003-General Test Procedure of Failure Rate for Electronic Components

JIS C 5202-Test Methods of Fixed Resistors for Electronic Equipment

JIS C 5720-General Rules of Fixed Metal Film Resistors for Use in Electronic Equipment

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

2. Definitions

For the purpose of this Standard, the definitions specified in JIS C 5720 shall apply.

3. Type Designation

3.1 Structure of Type Designation The type designation shall be arranged as shown in the following example:

Symbol denoting kind of resistor 3.2.1	Symbol denoting form 3.2.2	Symbol denoting character- istics 3.2.3	Symbol denoting rated dissipation 3.2.4	Symbol denoting nominal resistance 3.2.5
--	-------------------------------------	---	---	--

Example: RN 14 H 2 E 1002

Symbol denoting tolerances on re- sistance 3.2.6	Symbol denoting grade 3.2.7	Symbol denoting failure rate level 3.2.8
---	--------------------------------------	--

Exmample: F A M

3.2 Symbols

3.2.1 Kind of Resistor The symbol denoting kind of resistor shall be RN based on 4.2.1 (kind of resistor) of JIS C 5720.

3.2.2 Form The symbol denoting form of resistor shall be 14, based on 4.2.2 (style) of JIS C 5720.

3.2.3 Characteristics The symbol denoting characteristics shall consist of one English capital letter based on 4.2.3 (characteristics) of JIS C 5720, and shall be as given in Table 1.

Table 1. Characteristics

Characteristic symbol		H
Rated dissipation and maximum working voltage (see 4.1 and 4.6)	Rated dissipation	
	Symbol	Power W
	2 B	0.125
	2 E	0.25
	2 H	0.5
	3 A	1
	3 D	2
Maximum working voltage V		
		200
		250
		350
		500
Rated ambient temperature (see 4.1)		70°C
Category temperature range (see 4.3)		- 55 to + 150°C
Temperature coefficient of resistance (see No. 3 of Table 8) ppm/°C		± 100
Maximum allowable change in resistance	Power conditioning (see No. 1 of Table 8)	± (0.5 % + 0.05 Ω)
	Voltage proof (normal pressure) (see No. 4 of Table 8)	± (0.25 % + 0.05 Ω)
	Short-time overload (see No. 6 of Table 8)	± (0.5 % + 0.05 Ω)
	Robustness of termination (see No. 1 of Table 9)	± (0.25 % + 0.05 Ω)
	Shock ⁽¹⁾ (see No. 2 of Table 9)	± (0.5 % + 0.05 Ω)
	Vibration ⁽¹⁾ (see No. 3 of Table 9)	± (0.5 % + 0.05 Ω)
	Resistance to soldering heat (see No. 4 of Table 9)	± (0.25 % + 0.05 Ω)
	Cold operation (see No. 1 of Table 10)	± (0.25 % + 0.05 Ω)
	Change of temperature (cyclic) (see No. 2 of Table 10)	± (0.25 % + 0.05 Ω)
	Cold storage (see No. 3 of Table 10)	± (0.25 % + 0.05 Ω)

Table 1 (Cont'd)

Characteristic symbol		H
Maximum allowable change in resistance (cont'd)	Resistance to damp heat (cyclic) (see No. 4 of Table 10)	$\pm (1.0 \% + 0.05 \Omega)$ After voltage proof test $\pm (0.25 \% + 0.05 \Omega)$
	Endurance (rated load) (see No. 5 of Table 10)	$\pm (2.0 \% + 0.05 \Omega)$ [$\pm (4.0 \% + 0.05 \Omega)$ (in the case of failure rate test)]
	Stability (see No. 6 of Table 10)	$\pm (2.0 \% + 0.05 \Omega)$ After voltage proof test $\pm (0.25 \% + 0.05 \Omega)$
Tolerance on resistance % (see 3.2.6)		± 1 ± 2
Nominal resistance range (2) (see 4.4)		4.3 Ω to 2.7 M Ω

Notes (1) The rate of change in a series of tests for shock and vibration.

(2) This range varies according to the rated dissipation within the range given in this Table (see Table 5).

3.2.4 Rated Dissipation The symbol denoting rated dissipation shall be as given in Table 2, based on 4.2.4 (rated dissipation) of JIS C 5720.

Table 2. Rated Dissipation

Symbol	Rated dissipation W
2 B	0.125
2 E	0.25
2 H	0.5
3 A	1
3 D	2

3.2.5 Nominal Resistance The symbol denoting nominal resistance shall consist of three numerals (E 24 series) or four numerals (E 96 series), based on 4.2.5 (nominal resistance) of JIS C 5720.

In the case of three numerals, the first and second numerals shall represent the significant figures in the unit of ohm (Ω) and the third numeral shall represent the number of zeros following the significant figures.

In the case of four numerals, the first, second and third numerals shall represent the significant figures in the unit of ohm (Ω) and the fourth numeral shall represent the number of zeros following the significant figures. However, if there is a decimal point the decimal point shall be represented by English capital letter R, and all the numerals are significant figures in this expression.

Example:**For the case of three numerals**

100	10 Ω	150	15 Ω
101	100 Ω	151	150 Ω
102	1 k Ω	152	1.5 k Ω
104	100 k Ω	154	150 k Ω
105	1 M Ω	155	1.5 M Ω

For the case of four numerals

10R0	10 Ω	15R0	15 Ω
1000	100 Ω	1500	150 Ω
1001	1 k Ω	1501	1.5 k Ω
1003	100 k Ω	1503	150 k Ω
1004	1 M Ω	1504	1.5 M Ω

3.2.6 Tolerance on Resistance The symbol denoting tolerance on resistance shall consist of one English capital letter based on 4.2.6 (tolerance on resistance) of JIS C 5720 and shall be as given in Table 3.

Table 3. Tolerance on Resistance

Symbol	F	G
Tolerance on resistance %	± 1	± 2

3.2.7 Grade The symbol denoting grade shall consist of one English capital letter based on 4.2.7 (grade) of JIS C 5720, and the letter shall be A (special level).

3.2.8 Failure Rate Level The symbol denoting failure rate level shall consist of one English capital letter based on 4.2.8 (failure rate level) of JIS C 5720, and shall be as given in Table 4.

Table 4. Failure Rate Level
Reliability level 60 %

Symbol	Failure rate level %/1000 h
M	1.0
P	0.1
R	0.01
S	0.001

4. Ratings

4.1 Rated Dissipation The rated dissipation shall be as given in Table 5. However, for a resistor with a resistance exceeding its critical resistance, this means the dissipation corresponding to its maximum working voltage.

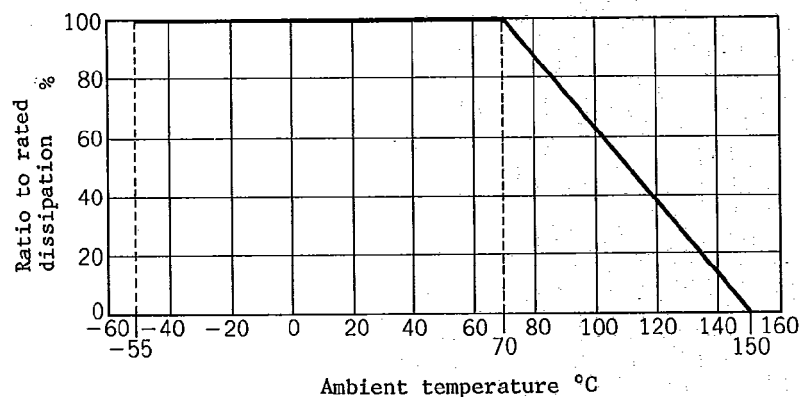
The rated ambient temperature shall be 70°C.

Table 5. Ratings

Rated dissipation		Maximum working voltage	Maximum overload voltage V	Voltage proof V		Nominal resistance range
Symbol	Power W			Normal pressure	Low air pressure	
2 B	0.125	200	400	300	200	4.7 Ω to 300 k Ω
2 E	0.25	250	500	500	250	10 Ω to 2.49 M Ω
2 H	0.5	350	700			4.3 Ω to 1 M Ω
3 A	1	500	1 000	1 000	350	10 Ω to 2.7 M Ω
3 D	2					

4.2 Maximum Dissipation The maximum dissipation shall have the same value as that of rated dissipation at temperatures not exceeding the rated ambient temperature. The maximum dissipation at temperatures exceeding the rated ambient temperature shall have the values obtained by reducing the rated dissipation by means of the derating curve of Fig. 1.

Fig. 1. Derating Curve



4.3 Category Temperature Range The category temperature range shall be - 55 to + 150°C.

4.4 Nominal Resistance The nominal resistance shall be expressed in the unit of ohm (Ω), and the values shall be the numerical values given in Table 6 (E 24 series) and Table 7 (E 96 series) multiplied by 10^n (n is an integer). Table 6 is applicable to resistors with tolerance on resistance of $\pm 2\%$ (G) and Table 7 to resistors with tolerance on resistance of $\pm 1\%$ (F).

Further, the nominal resistance range in relation with the rated dissipation shall be as given in Table 5.

Table 6. Standard Values of Nominal Resistance (E 24 Series)

1.0	1.5	2.2	3.3	4.7	6.8
1.1	1.6	2.4	3.6	5.1	7.5
1.2	1.8	2.7	3.9	5.6	8.2
1.3	2.0	3.0	4.3	6.2	9.1

Table 7. Standard Values of Nominal Resistance (E 96 Series)

1.00	1.21	1.47	1.78	2.15	2.61	3.16	3.83	4.64	5.62	6.81	8.25
1.02	1.24	1.50	1.82	2.21	2.67	3.24	3.92	4.75	5.76	6.98	8.45
1.05	1.27	1.54	1.87	2.26	2.74	3.32	4.02	4.87	5.90	7.15	8.66
1.07	1.30	1.58	1.91	2.32	2.80	3.40	4.12	4.99	6.04	7.32	8.87
1.10	1.33	1.62	1.96	2.37	2.87	3.48	4.22	5.11	6.19	7.50	9.09
1.13	1.37	1.65	2.00	2.43	2.94	3.57	4.32	5.23	6.34	7.68	9.31
1.15	1.40	1.69	2.05	2.49	3.01	3.65	4.42	5.36	6.49	7.87	9.53
1.18	1.43	1.74	2.10	2.55	3.09	3.74	4.53	5.49	6.65	8.06	9.76

4.5 Tolerance on Resistance The tolerance on resistance shall be expressed in percent (%) and shall be as given in Table 3.

4.6 Rated Voltage The rated voltage shall be the d.c. or a.c. (r.m.s. value at power frequency) voltage which corresponds the rated dissipation and the value of which is calculated from the formula below. However, if the rated voltage so obtained exceeds the maximum working voltage given in Table 5, this maximum working voltage shall be taken as the rated voltage.

$$E = \sqrt{P \cdot R}$$

where, E : rated voltage (V)

P : rated dissipation (W)

R : nominal resistance value (Ω)

5. Performances and Test Methods

5.1 Test Methods The test methods for electrical, mechanical and climatic performances shall be as specified in JIS C 5202.

The test methods for failure rate shall be as specified in JIS C 5003.

5.2 Electrical Performances The electrical performances shall be as given in Table 8.

Table 8. Electrical Performances

No.	Item	Performances	Test methods (JIS C 5202)														
1	Power conditioning	No remarkable abnormalities on appearance and marking shall be readable. Change of resistance shall be within $\pm (0.5 \% + 0.05 \Omega)$ and the resistance shall be within its tolerance.	Comply with 3. (power conditioning) of Annex 1 of JIS C 5720. (1) Test temperature shall be 20 to 45°C. (2) Duration of test voltage shall be 24^{+4}_0 h. (3) Test voltage shall be a d.c. or a.c. (r.m.s. value at power frequency) voltage corresponding to 1.5 times the rated dissipation. If the test voltage so obtained exceeds the maximum test voltage below, employ the maximum test voltage as the test voltage. <table><tr><td>Rated dissipation W (symbol)</td><td>0.125 (2B)</td><td>0.25 (2E)</td><td>0.5 (2H) 1 (3A) · 2 (3D)</td></tr><tr><td>Maximum test voltage V</td><td>200</td><td>250</td><td>350</td></tr></table> (4) Measure the resistance before and after this test.	Rated dissipation W (symbol)	0.125 (2B)	0.25 (2E)	0.5 (2H) 1 (3A) · 2 (3D)	Maximum test voltage V	200	250	350						
Rated dissipation W (symbol)	0.125 (2B)	0.25 (2E)	0.5 (2H) 1 (3A) · 2 (3D)														
Maximum test voltage V	200	250	350														
2	Resistance	Within specified tolerance on resistance.	Comply with 5.1 (resistance). Classification of voltage application shall be Class A. <table><tr><th>Nominal resistance range</th><th>Maximum voltage application V</th></tr><tr><td>Under 100 Ω</td><td>0.3</td></tr><tr><td>100 Ω or over to and excluding 1 k Ω</td><td>1</td></tr><tr><td>1 k Ω or over to and excluding 10 k Ω</td><td>3</td></tr><tr><td>10 k Ω or over to and excluding 100 k Ω</td><td>10</td></tr><tr><td>100 k Ω or over to and excluding 1 M Ω</td><td>25</td></tr><tr><td>1 M Ω or over</td><td>50</td></tr></table>	Nominal resistance range	Maximum voltage application V	Under 100 Ω	0.3	100 Ω or over to and excluding 1 k Ω	1	1 k Ω or over to and excluding 10 k Ω	3	10 k Ω or over to and excluding 100 k Ω	10	100 k Ω or over to and excluding 1 M Ω	25	1 M Ω or over	50
Nominal resistance range	Maximum voltage application V																
Under 100 Ω	0.3																
100 Ω or over to and excluding 1 k Ω	1																
1 k Ω or over to and excluding 10 k Ω	3																
10 k Ω or over to and excluding 100 k Ω	10																
100 k Ω or over to and excluding 1 M Ω	25																
1 M Ω or over	50																

Table 8 (Cont'd)

No.	Item	Performances	Test methods (JIS C 5202)																											
3	Temperature characteristic of resistance	Temperature coefficient of resistance shall be within the value specified below. <table><tr><th>Character-istic symbol</th><th>Temperature coefficient of resistance ppm/°C</th></tr><tr><td>H</td><td>± 100</td></tr></table>	Character-istic symbol	Temperature coefficient of resistance ppm/°C	H	± 100	Comply with 5.2 (temperature characteristic of resistance and drift of resistance). (1) Test conditions shall be as given below. Condition B shall be employed for lot quality inspection and condition A for other cases. Unit: °C <table><tr><th rowspan="2">Step</th><th colspan="2">Conditions</th></tr><tr><th>A</th><th>B</th></tr><tr><td>1</td><td>$20^{+5}_{-1}^{(5)}$</td><td>$20^{+5}_{-1}^{(5)}$ (room temperature is allowed.)</td></tr><tr><td>2</td><td>-15 ± 2</td><td>—</td></tr><tr><td>3</td><td>-55 ± 3</td><td>-55 ± 3</td></tr><tr><td>4</td><td>$20^{+5}_{-1}^{(6)}$</td><td>$20^{+5}_{-1}^{(6)}$ (room temperature is allowed.)</td></tr><tr><td>5</td><td>65 ± 3</td><td>—</td></tr><tr><td>6</td><td>150 ± 3</td><td>150 ± 3</td></tr></table> Notes (5) This is reference temperature of lower side only. (6) This is reference temperature of higher side only. (2) Calculate temperature coefficient of resistance (TCR) from following formula. $TCR \text{ (ppm/°C)} = \frac{R - R_0}{R_0} \times \frac{1}{t - t_0} \times 10^6$ where, R: measured value of resistance at t °C (Ω) R_0: measured value of resistance at t_0 °C (Ω) t: measured value of testing temperature (°C) t_0: measured value of reference temperature (°C)	Step	Conditions		A	B	1	$20^{+5}_{-1}^{(5)}$	$20^{+5}_{-1}^{(5)}$ (room temperature is allowed.)	2	-15 ± 2	—	3	-55 ± 3	-55 ± 3	4	$20^{+5}_{-1}^{(6)}$	$20^{+5}_{-1}^{(6)}$ (room temperature is allowed.)	5	65 ± 3	—	6	150 ± 3	150 ± 3
Character-istic symbol	Temperature coefficient of resistance ppm/°C																													
H	± 100																													
Step	Conditions																													
	A	B																												
1	$20^{+5}_{-1}^{(5)}$	$20^{+5}_{-1}^{(5)}$ (room temperature is allowed.)																												
2	-15 ± 2	—																												
3	-55 ± 3	-55 ± 3																												
4	$20^{+5}_{-1}^{(6)}$	$20^{+5}_{-1}^{(6)}$ (room temperature is allowed.)																												
5	65 ± 3	—																												
6	150 ± 3	150 ± 3																												

Table 8 (Cont'd)

No.	Item	Performances	Test methods (JIS C 5202)
4	At normal pressure (air pressure in standard testing conditions)	No abnormalities such as flash-over, burning and dielectric breakdown. Change of resistance: within $\pm (0.25 \% + 0.05 \Omega)$	Comply with 5.7 (voltage proof). (1) Mounting condition shall be D. (2) Test voltage shall be the dielectric withstand voltage (voltage proof) given in Table 5 of this Standard (JIS C 5723). (3) Measure the resistance before and after the test. (4) Calculate the change of resistance.
	At low air pressure		Comply with 5.7. (1) Mounting condition shall be D. (2) Test voltage shall be the dielectric withstand voltage (voltage proof) given in Table 5 of this Standard (JIS C 5723). (3) Low air pressure shall be 1 kPa (10 mbar). (4) Measure the resistance before and after the test. The value after the test at normal pressure may be used as the value before this test. (5) Calculate the change of resistance.