

JIS

JAPANESE INDUSTRIAL STANDARD

Fixed metal film resistors for
use in electronic equipment
— form 05, grade A

JIS C 5721—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 metal film resistors for use in electronic equipment - form 05, grade A C 5721-1991

1. Scope

This Japanese Industrial Standard specifies fixed metal film resistors - form 05, 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 (mold) 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 dissi- pation 3.2.4	Symbol denoting nominal resistance 3.2.5
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Example: RN 05 F 2E 1002

Symbol denoting tolerances on re- sistance 3.2.6	Symbol denoting grade 3.2.7	Symbol denoting failure rate level 3.2.8
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Example: 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 shall be 05, based on 4.2.2 (form) of JIS C 5720.

3.2.3 Characteristics The symbol denoting characteristics shall be expressed by an English capital letter as shown in Table 1, based on 4.2.3 (characteristics) of JIS C 5720.

Table 1. Characteristics

Characteristic symbol			F	G	H
Rated dissipation and maximum working voltage (see 4.1 and 4.6)	Rated dissipation		Maximum working voltage V		
	Symbol	Power W			
	1H	0.05	200		
	2A	0.1			
	2B	0.125	250		
	2E	0.25	300		
	2H	0.5	350		
Rated ambient temperature (see 4.1)			125°C		
Category temperature range (see 4.3)			- 55 to + 175°C		
Temperature coefficient of resistance ppm/°C (see No.3 of Table 8)			± 25	± 50	± 100
Maximum allowable change in resistance	Change of temperature ⁽¹⁾ (see No.1 a of Table 8)		± (0.2 % + 0.01 Ω)		
	Overload ⁽¹⁾ (see No.1 b of Table 8)				
	Voltage proof (see No. 4 of Table 8)		± (0.15 % + 0.01 Ω)		
	Robustness of termination (see No. 1 of Table 9)		± (0.2 % 0.01 Ω)		
	Resistance to vibration (see No. 2 of Table 9)				
	Resistance to soldering heat (see No. 3 of Table 9)		± (0.1 % + 0.01 Ω)		
	Shock (see No. 5 of Table 9)		± (0.2 % + 0.01 Ω)		
	Cold operation (see No. 1 of Table 10)		± (0.15 % + 0.01 Ω)		
	Cold storage (see No. 2 of Table 10)				
Resistance to damp, heat (cyclic) (see No. 3 of Table 10)		± (0.4 % + 0.01 Ω) After voltage proof test ±(0.15 % + 0.01 Ω)			

Table 1 (Cont'd)

Characteristic symbol		F	G	H
Maximum allowable change in resistance (cont'd)	Endurance (rated load) (see No. 4 of Table 10)	$\pm (0.5 \% + 0.01 \Omega)$ $[\pm (2.0 \% + 0.01 \Omega)]$ (in the case of failure rate test)		
	Stability (see No. 6 of Table 10)	$\pm (0.5 \% + 0.01 \Omega)$ After voltage proof test $\pm (0.15 \% + 0.01 \Omega)$		
Tolerance on resistance % (see 3.2.6)		± 0.1	± 0.25	± 0.5 ± 1
Nominal resistance range (2) (see 4.4)		10 Ω to 1 M Ω		

Notes (1) The rate of change in a series of tests for change of temperature and overload.

(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
1H	0.05
2A	0.1
2B	0.125
2E	0.25
2H	0.5

3.2.5 Nominal Resistance The symbol denoting nominal resistance shall consist of four numerals based on 4.2.5 (nominal resistance) of JIS C 5720. The first, second and third numerals shall represent significant figures in ohms (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:	10R0.....	10 Ω	15R2.....	15.2 Ω
	1000.....	100 Ω	1520.....	152 Ω
	1001.....	1 k Ω	1521.....	1.52 k Ω
	1003.....	100 k Ω	1523.....	152 k Ω

3.2.6 Tolerances on Resistance The symbol denoting tolerances on resistance shall be as shown in Table 3, based on 4.2.6 (tolerances on resistance) of JIS C 5720.

Table 3. Tolerances on Resistance

Symbol	B	C	D	F
Tolerances on resistance %	± 0.1	± 0.25	± 0.5	± 1

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

3.2.8 Failure Rate Level The symbol denoting failure rate level shall, based on 4.2.8 (failure rate level) of JIS C 5720, consist of one English capital letter 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 specified in Table 5. However, for a resistor with a resistance exceeding its critical resistance, this means the dissipation corresponding to its maximum working voltage.

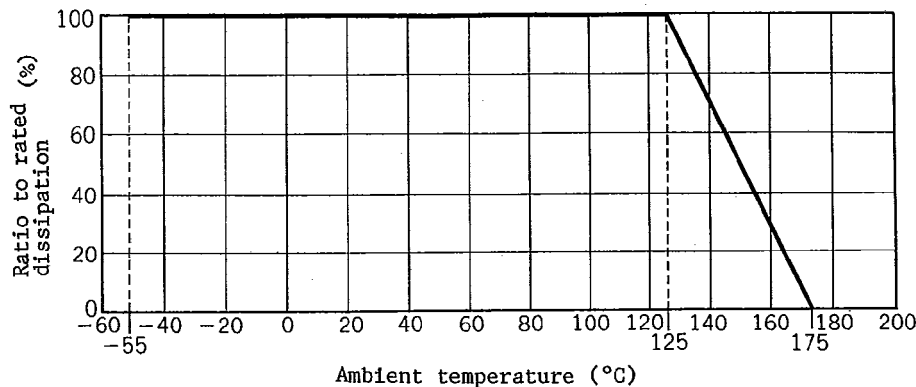
The rated ambient temperature shall be 125°C.

Table 5. Ratings

Rated dissipation		Maximum working voltage V	Maximum overload voltage V	Voltage proof V		Nominal resistance range
Symbol	Power W			Normal pressure	Low air pressure	
1H	0.05	200	500	450	200	10 Ω to 397 kΩ
2A	0.1					
2B	0.125	250				10 Ω to 898 kΩ
2E	0.25	300	600	900	350	10 Ω to 1 MΩ
2H	0.5	350	700			

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 + 175°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 96 series) and Table 7 (E 192 series) multiplied by 10^n (n is an integer). Table 6 is applicable to resistors with tolerance on resistance of $\pm 1\%$ (F), and Table 7 to resistors with tolerances on resistance of $\pm 0.1\%$ (B), $\pm 0.25\%$ (C) or $\pm 0.5\%$ (D).

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 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

Table 7. Standard Values of Nominal Resistance (E 192 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
1.01	1.23	1.49	1.80	2.18	2.64	3.20	3.88	4.70	5.69	6.90	8.35
1.02	1.24	1.50	1.82	2.21	2.67	3.24	3.92	4.75	5.76	6.98	8.45
1.04	1.26	1.52	1.84	2.23	2.71	3.28	3.97	4.81	5.83	7.06	8.56
1.05	1.27	1.54	1.87	2.26	2.74	3.32	4.02	4.87	5.90	7.15	8.66
1.06	1.29	1.56	1.89	2.29	2.77	3.36	4.07	4.93	5.97	7.23	8.76
1.07	1.30	1.58	1.91	2.32	2.80	3.40	4.12	4.99	6.04	7.32	8.87
1.09	1.32	1.60	1.93	2.34	2.84	3.44	4.17	5.05	6.12	7.41	8.98
1.10	1.33	1.62	1.96	2.37	2.87	3.48	4.22	5.11	6.19	7.50	9.09
1.11	1.35	1.64	1.98	2.40	2.91	3.52	4.27	5.17	6.26	7.59	9.20
1.13	1.37	1.65	2.00	2.43	2.94	3.57	4.32	5.23	6.34	7.68	9.31
1.14	1.38	1.67	2.03	2.46	2.98	3.61	4.37	5.30	6.42	7.77	9.42
1.15	1.40	1.69	2.05	2.49	3.01	3.65	4.42	5.36	6.49	7.87	9.53
1.17	1.42	1.72	2.08	2.52	3.05	3.70	4.48	5.42	6.57	7.96	9.65
1.18	1.43	1.74	2.10	2.55	3.09	3.74	4.53	5.49	6.65	8.06	9.76
1.20	1.45	1.76	2.13	2.58	3.12	3.79	4.59	5.56	6.73	8.16	9.88

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

Number	Item	Performance	Test method (JIS C 5202)												
1	1 a	No remarkable abnormalities on appearance and marking shall be readable. Change of resistance shall be within $\pm (0.2 \% + 0.01 \Omega)$ and the resistance shall be within its tolerance.	Comply with 7.4 (change of temperature). (1) Temperature of lower side shall be $-65 \pm 3^{\circ}\text{C}$ and that of higher side $150 \pm 3^{\circ}\text{C}$. (2) Measure the resistance before the test. (3) Immediately carry out test of No. 1 b without measurement of resistance after test.												
	1 b	Overload	Carry out test by the following methods. (1) Carry out test successively to test of No. 1 a. (2) Test power and maximum test voltage shall be as given below. However, if the voltage corresponding to the rated dissipation exceeds the maximum test voltage carry out the test at the maximum test voltage.												
			<table> <tr> <td>Rated dissipation symbol</td><td>1H • 2A • 2B</td><td>2E</td><td>2H</td></tr> <tr> <td>Multiplier for test power</td><td>5</td><td>4</td><td>2.25</td></tr> <tr> <td>Maximum test voltage</td><td>500</td><td>600</td><td>700</td></tr> </table>	Rated dissipation symbol	1H • 2A • 2B	2E	2H	Multiplier for test power	5	4	2.25	Maximum test voltage	500	600	700
Rated dissipation symbol	1H • 2A • 2B	2E	2H												
Multiplier for test power	5	4	2.25												
Maximum test voltage	500	600	700												
			(3) Duration of voltage application shall be 1 h. (4) Kind of voltage d.c. or a.c. (r.m.s. value at power-frequency) (5) Allow the specimen to stand for 2 h or more after test, and then measure the resistance.												

Table 8 (Cont'd)

Number	Item	Performance	Test method (JIS C 5202)														
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)

Number	Item	Performance	Test method (JIS C 5202)								
3	Temperature characteristic of resistance	Temperature coefficient of resistance shall be within the value specified below. <table><tr><th>Characteristic symbol</th><th>Temperature coefficient of resistance ppm/°C</th></tr><tr><td>F</td><td>± 25</td></tr><tr><td>G</td><td>± 50</td></tr><tr><td>H</td><td>± 100</td></tr></table>	Characteristic symbol	Temperature coefficient of resistance ppm/°C	F	± 25	G	± 50	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
			Characteristic symbol	Temperature coefficient of resistance ppm/°C							
			F	± 25							
			G	± 50							
H	± 100										
Step											
Conditions											
A		B									
1	20 ± 3 (3)	20 ± 3 (3) (room temperature is allowed.)									
2	- 15 ± 3	-									
3	- 65 ± 3	- 55 ± 3									
4	20 ± 3 (4)	20 ± 3 (4) (room temperature is allowed.)									
5	65 ± 3	-									
6	175 ± 3	175 ± 3									
Notes (3) This is reference temperature of lower side only. (4) 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)											