

JIS

JAPANESE INDUSTRIAL STANDARD

**General rules of fixed metal
film resistors for use in
electronic equipment**

JIS C 5720—1994

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

General rules of fixed metal film resistors
for use in electronic equipment

C 5720-1994

1. Scope This Japanese Industrial Standard is sectional specification of fixed metal film resistors mainly for use in electronic equipment (hereafter referred to as "resistors"). It specifies general principles for specifying the type designation, ratings, appearance, construction, dimensions, marking, materials, performances and matters to be covered in detail specification.

Remarks 1. The standards cited in this Standard are as follows:

- | | |
|------------|---|
| JIS C 0802 | Colour code for fixed resistors for electronic equipment |
| JIS C 0805 | Packaging of electronic components on continuous tapes (components with axial type and radial wire lead terminals) |
| JIS C 0806 | Packaging of electronic components on continuous tapes (surface mounting devices) |
| JIS C 5001 | General rules for electronic components |
| JIS C 5003 | General test procedure of failure rate for electronic components |
| JIS C 5010 | General rules for printed wiring boards |
| JIS C 5201 | General rules of fixed resistors for use in electronic equipment |
| JIS C 5202 | Test methods of fixed resistors for electronic equipment |
| JIS C 5700 | General rules for reliability assured electronic components |
| JIS Z 8601 | Preferred numbers |
| JIS Z 9015 | Sampling inspection procedures and tables by attributes with severity adjustment (receiving inspection where a consumer can select suppliers) |
2. The International standards corresponding to this Standard are as follows:
- | | |
|------------------|---|
| IEC 115-2 (1982) | Fixed resistors for use in electronic equipment. Part 2: Sectional specification: Fixed low-power non-wirewound resistors |
| IEC 115-5 (1982) | Fixed resistors for use in electronic equipment. Part 5: Sectional specification: Fixed precision resistors |

2. Definitions For the purposes of this Standard and relevant detail specifications, the definitions specified in JIS C 5201 apply.

3. Priority of standards If there is any conflict among the specifications, the following order of decreasing precedence shall be adopted.

- (1) Detail specification
- (2) Sectional specification (JIS C 5720)
- (3) Generic specification (JIS C 5201)
- (4) Basic specification (JIS C 5001 and JIS C 5700)

4. Type designation

4.1 Structure of type designation The type designation shall be structured by the following arrangement.

Symbol denoting kind of resistor 4.2.1	Symbol denoting style 4.2.2	Symbol denoting char- acteristics 4.2.3	Symbol denot- ing rated diss- ipation 4.2.4	Symbol denot- ing nominal resistance 4.2.5
---	--------------------------------------	--	--	---

Example:

RN 05 C 2E 1002

Symbol denot- ing tolerance on resistance 4.2.6	Symbol denoting grade 4.2.7	Symbol denoting failure rate level or stability class 4.2.8 or 4.2.9	Symbol denot- ing other nec- essary items 4.2.10
--	--------------------------------------	---	---

Example:

D A M H

4.2 Symbol

4.2.1 Kind of resistor The symbol denoting the kind of resistor shall be RN based on 4.2.1 of JIS C 5201.

4.2.2 Style The symbol denoting the style shall consist of two numerals based on 4.2.2 of JIS C 5201 as given in Attached Table 1. If necessary, the detail specification may prescribe addition of one numeral or one English capital letter, thus expressing with three numerals or two numerals plus one English capital letter.

4.2.3 Characteristics The symbol denoting characteristics shall consist of one English capital letter excluding I and O, and shall be given in Table 1. If necessary, the detail specification may prescribe addition of one English capital letter.

Table 1. Symbol denoting characteristics

Symbol	A	B	C	D	E	F	G	H	K
Temperature coefficient of resistance ppm/°C	± 1	± 5	± 10	± 15	± 20	± 25	± 50	± 100	± 250

4.2.4 Rated dissipation The symbol denoting rated dissipation shall consist of two characters based on 4.2.4 of JIS C 5201 as given in Table 2.

The first character is power of 10 by which the value indicated by an English capital letter is multiplied. The second character corresponds to R10 preferred number specified in JIS Z 8601.

The unit of the second character value is milliwatt (mW).

Table 2. Symbol denoting rated dissipation

Symbol	Rated dissipation W	Symbol	Rated dissipation W
1F	0.0315 (0.03)	2E	0.25
1J	0.063	2H	0.5
2A	0.1	3A	1
2B	0.125	3D	2

Remarks: The numeral in parenthesis may be used.

4.2.5 Nominal resistance The symbol denoting nominal resistance shall consist of three numerals (for E3, E6, E12 and E24 series numbers) or four numerals (for E48, E96 and E192 series numbers) based on 4.2.5 of JIS C 5201.

For the three numerals, the first and second numerals are the significant figures in ohm (Ω). The third numeral is the number of zeros which follow the significant figures.

For the four numerals, the first, second and third numerals are the significant figures in ohm (Ω). The fourth numeral is the number of zeros which follow the significant figures.

If there is a decimal point, it shall be expressed by an English capital letter R. In this case, all the numerals shall be significant figures.

Example: Examples of symbols denoting nominal resistances for three and four numerals are as follows:

Three numerals		Four numerals	
R10 0.10 Ω	150 15 Ω	R100 0.100 Ω	15R2 15.2 Ω
R47 0.47 Ω	101 100 Ω	R475 0.475 Ω	1000 100 Ω
1R0 1.0 Ω	151 150 Ω	1R00 1.00 Ω	1001 1.00 k Ω
1R5 1.5 Ω	102 1.0 k Ω	4R75 4.75 Ω	1003 100 k Ω
100 10 Ω	154 150 k Ω	10R0 10.0 Ω	1523 152 k Ω

4.2.6 Tolerance on resistance The symbol denoting the tolerance on resistance shall be an English capital letter based on 4.2.6 of JIS C 5201 as shown in Table 3.

Table 3. Symbol denoting tolerance on resistance

Symbol	E	L	P	W	B	C	D	F	G	J	K	M	N
Tolerance on resistance %	± 0.005	± 0.01	± 0.02	± 0.05	± 0.1	± 0.25	± 0.5	± 1	± 2	± 5	± 10	± 20	± 30

Informative reference: The symbol W was formerly symbol A in JIS C 5201-1988. By IEC 62 (1992), the symbols E to W were added. So, it has been changed to W.

4.2.7 Grade The symbol denoting the grade shall be an English capital letter based on 4.2.7 of JIS C 5201 as shown in Table 4.

Table 4. Symbol denoting grade

Symbol	Grade	Explanation
A	Requiring quality assessment of special level	Special level specified in JIS C 5700, with failure rate specified.
B	Requiring quality assessment of general level 1	General level specified in JIS C 5700.
C	Requiring quality assessment of simplified level	Simplified level specified in JIS C 5700.
E	Requiring quality assessment of general level 2	Equivalent to assessment level E specified in IEC 115-2, IEC 115-4, IEC 115-5, IEC 115-6, IEC 115-7 and IEC 115-8.
E ₁	Requiring quality assessment of level higher than E	Not specified in IEC Standards.
E ₂	Requiring quality assessment of level higher than E ₁	
F	Requiring quality assessment of level lower than E	Equivalent to IEC assessment level F.
X	Not requiring quality assessment of any level	Quality assurance specified in Annex is not applied.

4.2.8 Failure rate level (to be applied to grade A) The symbol denoting the failure rate level shall be an English capital letter based on 4.2.8 of JIS C 5201 as shown in Table 5.

Table 5. Symbol denoting failure rate level

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

Remarks: If any failure rate level is not specified, type designation shall have no such symbol.

4.2.9 Stability class The symbol denoting the stability class shall be based on 4.2.9 of JIS C 5201 as shown in Table 6. Designation shall not duplicate with the failure rate level.

Resistors of stability classes W, B, C and D shall be the precision resistors. Other resistors shall be the universal resistors.

Table 6. Symbol denoting stability class

Symbol	Class %	Change in resistance after short-time test	Change in resistance after long-time test	Classification
W	± 0.05	± (0.01 % + 0.01 Ω)	± (0.05 % + 0.01 Ω)	Precision resistor
B	± 0.1	± (0.02 % + 0.01 Ω)	± (0.1 % + 0.01 Ω)	
C	± 0.25	± (0.05 % + 0.01 Ω)	± (0.25 % + 0.05 Ω)	
D	± 0.5	± (0.1 % + 0.01 Ω)	± (0.5 % + 0.05 Ω)	
F	± 1.0	± (0.25 % + 0.05 Ω)	± (1.0 % + 0.05 Ω)	Universal resistor
G	± 2.0	± (0.5 % + 0.05 Ω)	± (2.0 % + 0.1 Ω)	
H	± 3.0	± (0.5 % + 0.05 Ω)	± (3.0 % + 0.1 Ω)	
J	± 5.0	± (1.0 % + 0.05 Ω)	± (5.0 % + 0.1 Ω)	
K	± 10	± (2.0 % + 0.1 Ω)	± (10 % + 0.5 Ω)	
L	± 15	± (2.0 % + 0.1 Ω)	± (15 % + 0.5 Ω)	

Informative reference: Symbols W, B, C and D are based on IEC 115-5. Other symbols, F to L, are based on IEC 115-2.

4.2.10 Other necessary items The symbol denoting other necessary items is applicable to express the performance, construction, materials and other necessary items, which are not expressed by the symbols given in 4.2.1 to 4.2.8. Such symbol shall be suffixed to the type designation. It shall be English capital letters or numerals as specified in the detail specification. However, the symbols specified in Tables 5 and 6 shall not be used.

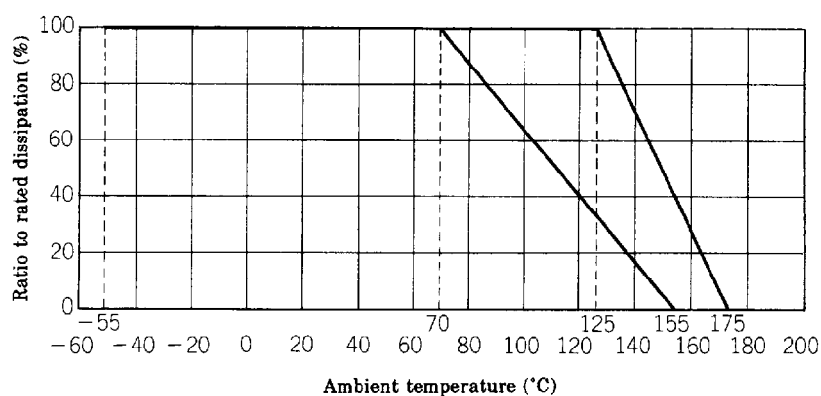
5. Rating

5.1 Rated dissipation The rated dissipation shall be specified in the detail specification based on Table 2. The rated ambient temperature shall be 70°C or 125°C, which shall be specified in the detail specification.

5.2 Maximum dissipation The maximum dissipation at an ambient temperature not exceeding the rated ambient temperature shall have the same value as that of the rated dissipation. The maximum dissipation at an ambient temperature exceeding the rated ambient temperature shall have a value derated by the derating curve given in Fig. 1.

In any event, the applied voltage shall not exceed the limiting element voltage specified in the detail specification.

Fig. 1. Derating curve



5.3 Category temperature range The category temperature range shall be - 55°C to + 155°C or - 55°C to + 175°C ⁽¹⁾ and be specified in detail specifications.

Note ⁽¹⁾ To be applied only to grade A.

5.4 Nominal resistance The nominal resistance shall be given by one of numerals among E3 to E192 series in Attached Table 2 multiplied by 10ⁿ (n is an integer).

The unit shall be ohm (Ω), kilohm (kΩ) or megohm (MΩ).

5.5 Tolerance on resistance The tolerance on resistance shall be expressed in percent (%), and classified into 12 classes as shown in Table 3.

Table 7 shows the preferred combination of tolerance on resistance and number series for nominal resistance.

Table 7. Combination of tolerance on resistance and number series for nominal resistance.

Symbol for tolerance on resistance	Number series for nominal resistance
N, M, K, J, G, F	E12
	E24
G, F, D	E48
F, D, C, B	E96
D, C, B, W, P, L, E	E192

6. Performance and test method

6.1 Test method The test method for resistors shall be as specified in JIS C 5202 and Annex 1.

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

6.2 Performance The performance of resistors shall be specified by grade, stability class, provisions in Annexes 2 to 6 and detail specifications.

Table 8 shows separate items for short-time and long-time tests.

Table 8. Classification of short-time and long-time tests

Universal resistor		Precision resistor	
Short-time test items	Long-time test items	Short-time test items	Long-time test items
Overload	Climatic sequence	Robustness of termination	Climatic sequence
Robustness of termination	Resistance to damp (steady state)	Resistance to soldering heat	Resistance to damp (steady state)
Resistance to soldering heat	Endurance (rated load)	Change of temperature	Endurance (rated load)
Change of temperature	Stability	Bump	Stability
Resistance to vibration		Shock	Overload
		Resistance to vibration	

Remarks: The items for universal resistor are based on IEC 115-2. Those for precision resistor are based on IEC 115-5.

7. Quality assessment and assurance For all the resistors except grade X in 4.2.7, the quality assurance program shall be established according to Annex 1 of JIS C 5201. Furthermore, the quality of these resistors shall be assured according to Annex 2.

8. Appearance, construction and dimensions

8.1 Appearance When the appearance is visually tested, it shall be free from remarkable scratches, cracks and other abnormalities.

8.2 Construction The construction shall satisfy the following requirements and the detail specification.

If radiographic examination is specified, the specimen shall be tested according to 6.8 of JIS C 5202 to check for abnormalities of resistor element.

(1) Resistor element The resistor element shall be a thin metal film (including plating).

The element shall be free from adhesion or mixing of impurities other than materials for the resistor element, or other dirt.

(2) Enclosure The enclosure, excluding lead wires and terminations for connection with external circuit, shall be covered with moisture-resistant insulating materials to protect the element from moisture.

The enclosure shall be metal materials, synthetic resin, other adequate insulating materials or the combination thereof, be classified as in Table 9, and satisfy the performance specified in the detail specifications.

The surface of metal case, if liable to be corroded, shall be adequately treated for corrosion prevention.

(3) Termination The termination of a resistor shall be firmly connected with the resistance element or its terminations electrically and mechanically.

The lead wire and termination intended to be soldered shall be adequately treated so that the soldering becomes easy.

Table 9. Enclosure

Classification of enclosure	Enclosing method
Metal case	All or major parts of a case are made of metal materials.
Non-metal case	A case is made of synthetic resin, ceramic and other non-metallic materials (including mold).
Non-metal enclosure	Enclosure is made by dipping into resin, thick coating of resin, or insulating tape with the ends sealed.
No enclosure	Resistor is coated with materials which do not guarantee insulation, or is not coated at all.

8.3 Principal dimensions

8.3.1 External dimensions The external dimensions shall use the numerical values in R10 preferred numbers of JIS Z 8601. However, only in special cases, the values in R20 preferred numbers may be used.

8.3.2 Spacing between terminations The spacing between terminations of a resistor having parallel terminations in the same direction shall comply with 4.1.1 of JIS C 5010. It shall be a positive integral multiple of 2.5 mm.

8.3.3 Diameter and length of lead wire termination The nominal diameter and length of lead wire termination shall be selected among the values given in Table 10.

Table 10. Dimensions of lead wire termination

Unit: mm

Nominal value of wire diameter	Tolerance on wire diameter	Length
0.3	+ 0.03 − 0.05	4.5 $\begin{smallmatrix} +1 \\ -0.5 \end{smallmatrix}$ 10 or over
0.4	+ 0.04 − 0.05	20 or over
0.45		38 $\pm$ 3
0.5	$\pm$ 0.05	
0.6	+ 0.06 − 0.05	
0.65		
0.7	+ 0.07 − 0.05	
0.8	+ 0.08 − 0.05	
1.0	+ 0.1 − 0.05	
1.2		

9. Materials The materials shall meet both the following requirements and the detail specification. If the materials are not specified, they shall be capable of manufacturing resistors which meet the detail specification.

- (1) Enclosure materials If necessary, the materials for enclosures of resistors shall be mildew-proof or adequately treated to prevent the mildew growth.

When metals are used for the enclosure, they shall be corrosion-resistant, or adequately treated to prevent corrosion.

The degree of corrosion resistance shall be such that the appearance is not remarkably changed by the damp heat test.

- (2) Termination materials The termination materials shall be those specified in the Japanese Industrial Standards or at least equivalent.

Materials for soldered terminations shall have enough solderability, when they are tested by the same solderability test method as that for resistors.

10. Marking

10.1 Marking on product The surface of a resistor shall be marked with the following items indelibly and clearly. However, the detail specification shall specify the details of marking items, and items which may be omitted due to limitations by construction, size, etc.

- (1) Class of resistor
- (2) Style
- (3) Characteristics
- (4) Rated dissipation
- (5) Nominal resistance
- (6) Tolerance on resistance
- (7) Grade
- (8) Failure rate level or stability class
- (9) Other necessary items specified in 4.2.10
- (10) Year and month, or year and week of manufacture or their abbreviation
- (11) Manufacture lot number
- (12) Manufacturer's name or abbreviation

10.1.1 Method of marking The items specified in 10.1 shall be marked with letters or symbols. When marking is done with symbols, the symbols specified in 4.2 shall be used. When marking is done with color code, it shall be done according to 10.1.2.

10.1.2 Color coding When color coding is done with dots or lines, it shall be done according to JIS C 0802, Table 17 and Table 18 of JIS C 5201 and the related figure.

Except for color coding of temperature coefficient of resistance, color coding shall not be combined with symbols or letters.

10.2 Marking on package The following items shall be marked on package (for each package).

- (1) Type designation
- (2) Year and month, or year and week of manufacture or their abbreviation
- (3) Manufacture lot number

(4) Manufacturer's name or abbreviation

(5) Quantity

11. Packaging Resistors shall be packaged to protect against damage and moisture during transportation and storage.

12. Taping Taping of resistors shall be carried out according to the detail specification or an agreement between the parties concerned with delivery. The method of taping shall be as specified in JIS C 0805 and JIS C 0806.

Attached Table 1. Style symbol

Symbol	Style			Informative reference drawing
01	Cylindrical	Metal case	Lead wire termination	
05	Cylindrical	Non-metal case	Lead wire termination	
14	Cylindrical	Non-metal enclosure	Lead wire termination	
11	Cylindrical	Non-metal enclosure	Lead wire termination Forming finish	
12	Cylindrical	Non-metal case	Lead wire termination Forming finish	
07	Cylindrical	Non-metal case	Lead wire termination (cylinder diameter direction)	
16	Cylindrical	Non-metal enclosure	Lead wire termination (cylinder diameter direction)	
23	Cylindrical	Non-metal case	Lug terminal	
26	Cylindrical	Non-metal enclosure	Lug terminal	

Attached Table 1. (continued)

Symbol	Style			Informative reference drawing
27	Cylindrical (chip)	Non-metal enclosure	Surface mounting terminations or electrodes	Opposite direction
28	Cylindrical (chip)	Non-metal case	Surface mounting terminations or electrodes	Opposite direction
72	Square (chip)	No enclosure	Surface mounting terminations or electrodes	Opposite direction
73	Square (chip)	Non-metal enclosure	Surface mounting terminations or electrodes	Opposite direction
77	Square (chip)	Non-metal case	Surface mounting terminations or electrodes	Opposite direction
92	Square	Non-metal enclosure	Lead wire termination	Same direction
97	Square	No enclosure	Lead wire termination	Same direction
99	Square	Non-metal case	Lead wire termination	Same direction

- Remarks
1. The "non-metal case" includes resin molding. The "no enclosure" means bare element or the one coated without guarantee of insulation. The "non-metal enclosure" means an enclosure formed by dipping into insulating paints, thick coating of insulating paints, or taping.
 2. Square type includes rectangular board (including flat rectangular board). Cylindrical type includes cylindrical column.
 3. The lug termination includes plate termination and lapping termination.
 4. The lead wire termination includes lead frame termination.
 5. Lead wire terminations of styles 11 and 12 may be subdivided by forming according to the detail specification. The style symbol may be suffixed by a third numeral or letter.
 6. Chips of styles 27, 28, 72, 73 and 77 may be subdivided by the surface mounting terminations (or electrodes) according to the detail specification. The style symbol may be suffixed by a third numeral or letter.

14
C 5720-1994

Attached Table 2. E series basic number

E 3 series	E 6 series	E 12 series	E 24 series	E48 series						E96 series						E192 series					
1.0	1.0	1.0	1.0	1.00	1.47	2.15	3.16	4.64	6.81	1.00	1.47	2.15	3.16	4.64	6.81	1.00	1.47	2.15	3.16	4.64	6.81
			1.1													1.01	1.49	2.18	3.20	4.70	6.90
			1.2							1.02	1.50	2.21	3.24	4.75	6.98	1.02	1.50	2.21	3.24	4.75	6.98
			1.3													1.04	1.52	2.23	3.28	4.81	7.06
			1.5	1.05	1.54	2.26	3.32	4.87	7.15	1.05	1.54	2.26	3.32	4.87	7.15	1.05	1.54	2.26	3.32	4.87	7.15
	1.5	1.5	1.6													1.06	1.56	2.29	3.36	4.93	7.23
			1.8							1.07	1.58	2.32	3.40	4.99	7.32	1.07	1.58	2.32	3.40	4.99	7.32
			2.0													1.09	1.60	2.34	3.44	5.05	7.41
			2.2	1.10	1.62	2.37	3.48	5.11	7.50	1.10	1.62	2.37	3.48	5.11	7.50	1.10	1.62	2.37	3.48	5.11	7.50
			2.4													1.11	1.64	2.40	3.52	5.17	7.59
2.2	2.2	2.2	2.7							1.13	1.65	2.43	3.57	5.23	7.68	1.13	1.65	2.43	3.57	5.23	7.68
			3.0													1.14	1.67	2.46	3.61	5.30	7.77
			3.3	1.15	1.69	2.49	3.65	5.36	7.87	1.15	1.69	2.49	3.65	5.36	7.87	1.15	1.69	2.49	3.65	5.36	7.87
			3.6													1.17	1.72	2.52	3.70	5.42	7.96
			3.9							1.18	1.74	2.55	3.74	5.49	8.06	1.18	1.74	2.55	3.74	5.49	8.06
	4.7	4.7	4.3													1.20	1.76	2.58	3.79	5.56	8.16
			5.1	1.21	1.78	2.61	3.83	5.62	8.25	1.21	1.78	2.61	3.83	5.62	8.25	1.21	1.78	2.61	3.83	5.62	8.25
			5.6							1.24	1.82	2.67	3.92	5.76	8.45	1.24	1.82	2.67	3.92	5.76	8.45
			6.2													1.26	1.84	2.71	3.97	5.83	8.56
			6.8	1.27	1.87	2.74	4.02	5.90	8.66	1.27	1.87	2.74	4.02	5.90	8.66	1.27	1.87	2.74	4.02	5.90	8.66
4.7	6.8	6.8	7.5													1.29	1.89	2.77	4.07	5.97	8.76
			8.2							1.30	1.91	2.80	4.12	6.04	8.87	1.30	1.91	2.80	4.12	6.04	8.87
			9.1													1.32	1.93	2.84	4.17	6.12	8.98
				1.33	1.96	2.87	4.22	6.19	9.09	1.33	1.96	2.87	4.22	6.19	9.09	1.33	1.96	2.87	4.22	6.19	9.09
										1.37	2.00	2.94	4.32	6.34	9.31	1.37	2.00	2.94	4.32	6.34	9.31
	8.2	8.2														1.38	2.03	2.98	4.37	6.42	9.42
				1.40	2.05	3.01	4.42	6.49	9.53	1.40	2.05	3.01	4.72	6.49	9.53	1.40	2.05	3.01	4.42	6.49	9.53
										1.43	2.10	3.09	4.53	6.65	9.76	1.43	2.10	3.09	4.53	6.65	9.76
																1.45	2.13	3.12	4.59	6.73	9.88

Annex 1. Cold operation, cold storage and power conditioning

1. Cold operation (applicable only to resistors of grades A and B)

1.1 Mounting The specimen resistor shall be so mounted to be surrounded by free space of at least 25.4 mm. It shall be mounted by lead wires. It shall be mounted not to disturb the air flow around the specimen.

1.2 Test Measure the resistance of specimen according to 5.1 of JIS C 5202, put the specimen in a test chamber, cool it down gradually to $-65 \pm 0.5^\circ\text{C}$ in 1 h and half, maintain it at this temperature for another 1 h. Then, keep the specimen with the rated voltage applied for 45 min.

Remove the voltage and wait for 15 ± 0.5 min. Raise the temperature in the chamber gradually to room temperature within 8 h. Take the specimen out of the chamber.

Allow the specimen to stand at $25 \pm 5^\circ\text{C}$ for about 24 h, measure the resistance again according to 5.1 of JIS C 5202. Calculate the difference between resistances measured before and after the test.

After the test, check for any remarkable abnormalities of the appearance and legibility of markings of the specimen.

2. Cold storage Cold storage shall be as specified in 7.1 of JIS C 5202. Resistors of grade A shall be exposed at $-65 \pm 2^\circ\text{C}$ for 24 ± 4 h. Resistors of other grades shall be exposed at $-55 \pm 3^\circ\text{C}$ for 24 ± 4 h.

3. Power conditioning3.1 Mounting and ambient conditions

3.1.1 For qualification approval test The specimen shall be horizontally mounted in free space, where only the mounting base is placed within 50.8 mm and nothing is placed beyond 50.8 mm and within 76.2 mm. The ambient temperature shall be 20°C to 45°C . The specimen shall be placed in still air without air circulation, except for that due to heat emitted from the specimen.

3.1.2 For lot quality inspection Application of the mounting provision given in 3.1.1 is remittable, if the manufacturer so requires.

The forced air cooling may be carried out to maintain the ambient temperature at 20°C to 45°C . However, the air velocity shall not exceed 152.4 m/min. The air shall not hit the specimen directly.

3.2 Test Allow the specimen to stand at $25 \pm 2^\circ\text{C}$ for 2 h or longer. Measure its resistance according to 5.1 of JIS C 5202. Keep the ambient temperature at 20°C to 45°C . Apply a d.c. or a.c. (power frequency, r.m.s. value) corresponding to 1.5 times the rated dissipation for 24 h. After application of voltage, allow the specimen to stand at $25 \pm 2^\circ\text{C}$ for 2 h or longer again. Measure the resistance according to 5.1 of JIS C 5202. Calculate the difference between resistance measured before and after the test. After the test, check for any remarkable abnormalities of the appearance and legibility of markings of the specimen.

Annex 2. Procedure of quality assurance

1. Scope This Annex specifies procedures of quality assurance in which manufacturers acquire approval for their resistors and carry out quality assessment after approval.
2. Approval test This test is carried out by approval authorities and/or manufacturers to demonstrate, for approval of their resistors, compliance of their resistors with the relevant specifications. This test shall consist of the following:
 - (1) Qualification approval test This test shall be as specified in Annex 3.
 - (2) Failure rate approval test (applicable when the failure rate is specified)
It shall be as specified in Annex 4.
3. Quality conformance inspection This inspection is carried out to assure that the resistors manufactured by the approved manufacturers conform to the relevant quality specifications. It shall be as specified in Annex 5.
4. Periodic qualification maintenance test This test is carried out by approval authorities and/or manufacturers to periodically ascertain that resistors maintain the quality demonstrated by the approval test. It shall be as specified in Annex 6.

Annex 3. Quality approval test

1. Test items The test items shall be specified in Annex 3 Attached Tables 1 to 5. However, the detail specification may call for omission, alteration or addition of some test items.

2. Primary stage of manufacture The primary stage of manufacture of resistor is to form metal film on the substrate.

3. Sample The sample for this test shall be as specified below:

- (1) The sample shall be, under the quality assurance program, manufactured in accordance with the specified specification, condition and control.
- (2) The sample size shall be specified as follows:
 - (2.1) The sample size of resistors of grades A, B and C shall be as specified in Annex 3 Attached Tables 1 to 4, according to the style, rated dissipation, characteristics and grade specified in detail specification.
 - (2.2) The sample size of resistors of grades E, E₁, E₂ and F shall be as specified in Annex 3 Attached Table 5 and in the following provisions according to the style, rated dissipation, characteristics and grade specified in detail specification.
 - (a) The resistance of samples shall be the minimum resistance, maximum resistance, and the critical resistance or the resistance close to the above. The quantity shall be specified in Annex 3 Attached Table 5.
 - (b) To replace the permissible defective in Group 0A of Annex 3 Attached Table 5, one spare resistor for each resistance value may be used.

To replace the defectives which are not due to manufacturers' failure, one spare resistor for each resistance value may be used.

4. Sequence of test The sequence of test shall be specified as follows:

- (1) Resistors of grades A, B and C shall be subjected to Group 1 of any one of Annex 3 Attached Tables 1 to 4. Then, they are distributed to Group 2 and onward, and shall be subjected to respective test. Within each group, the tests shall be carried out in the sequence in which they are listed.
- (2) Resistors of grades E, E₁, E₂ and F shall be subjected to Groups 0A and 0B of Annex 3 Attached Table 5. The samples which have not passed the tests of Groups 0A and 0B shall not be used for subsequent tests.

5. Criteria of acceptance The samples shall not be accepted, when the number exceeds the acceptance number specified in any one of Annex 3 Attached Tables 1 to 5.

When one resistor fails to pass more than one test item of the same group, the number of defectives shall be counted as "one".

The marking shall be defective only when it is not legible.

6. Extent of approval An approval covers all the resistors which are identical in style, rated dissipation and grade. Other items are subjected to Annex 3 Table 1 "Extent of approval". However, the extent of approval for groups shall be specified in detail specifications.

Annex 3 Table 1. Extent of approval

Item	Extent of approval of characteristics, resistance and tolerance on resistance
Characteristics	Resistors whose characteristics are the same as those of approved resistors. Resistors whose characteristics are of lower grade in the detail specifications.
Resistance	The approved resistance ranges from the minimum resistance to the maximum resistance of the samples which have passed the test. Even when the critical resistance falls in this range, if the manufacturers fail to submit the sample whose resistance is equal to or approximate to the critical resistance, the range is not approved. In this case, approval is limited to the two resistances which have been submitted. Example: Assume that the critical resistance is 270 kΩ and that the specimen submitted were only those of 100 kΩ and 330 kΩ. Only these two values are to be approved, and the range between two resistances is not to be approved.
Tolerance on resistance	The tolerances on resistance of the sample which has passed the test, or the tolerances on resistance with less accuracy than the former shall be approved.

Annex 3 Attached Table 1. Qualification approval test of resistors
of style symbols 01 and 05, grade A

Group	Test item	Test method (JIS C 5202)	Sample size	Acceptance number
1	Appearance, construction, marking and dimension Change of temperature Short-time overload Resistance Sealing (when applied)	4.1, 4.2 and 4.3 7.4 Comply with detail specification 5.1 6.6	100 %	0
1A	Solderability Resistance to solvent	6.5 6.9	12	0
2	Temperature characteristic of resistance Cold storage Cold operation Robustness of termination Sealing	5.2 2. of Annex 1 of this Standard (JIS C 5720) 1. of Annex 1 of this Standard (JIS C 5720) 6.1 6.6	30 { Maximum resistance 10 Critical resistance 10 Minimum resistance 10	1
3	Voltage proof Insulation resistance Resistance to soldering heat Resistance to damp heat (cyclic)	5.7 5.6 6.4 7.6	30 { Maximum resistance 10 Critical resistance 10 Minimum resistance 10	
4	Shock Resistance to vibration Sealing (when applied)	6.7 6.3 6.6	30 { Maximum resistance 10 Critical resistance 10 Minimum resistance 10	

Annex 3 Attached Table 1. (continued)

Group	Test item	Test method (JIS C 5202)	Sample size	Acceptance number
5	Endurance (rated load)	7.10	(¹) { 102 { Maximum resistance 34 Critical resistance 34 Minimum resistance 34	1
5A	Endurance at 70°C (rated load)	7.10	{ 102 { Maximum resistance 34 Critical resistance 34 Minimum resistance 34	1
6	Stability	7.11	{ 102 { Maximum resistance 34 Critical resistance 34 Minimum resistance 34	1
7	Voltage coefficient (applicable to 1 kΩ or more)	5.3	10 Maximum resistance	0

Note (¹) This sample size corresponds to level M given in Annex 4 Table 1.

Remarks: Critical resistance includes the value close to critical resistance from E series basic numbers according to detail specification.