

MIL-R-10509F  
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SUPERSEDING  
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3 September 1963

MILITARY SPECIFICATION  
RESISTORS, FIXED, FILM (HIGH STABILITY),  
GENERAL SPECIFICATION FOR

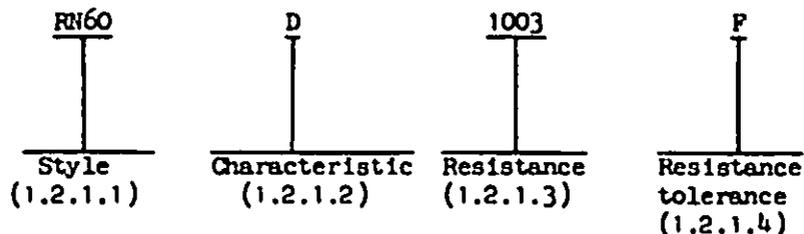
This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for high-stability, film, fixed resistors of  $\pm 0.10$ -,  $\pm 0.25$ -,  $\pm 0.50$ -, and  $\pm 1.00$ -percent resistance tolerances, which are relatively stable with respect to time, temperature, and humidity.

1.2 Classification.

1.2.1 Type designation. The type designation shall be in the following form (see 6.1):



1.2.1.1 Style. The style is identified by the two-letter symbol "RN" followed by a two-digit number; the letters identify high-stability, film, fixed resistors, and the number identifies the size of the resistors.

1.2.1.2 Characteristic. The characteristic is identified by a single letter in accordance with table I.

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Table 1. Characteristic.

	B	C	D	E	F	g <sub>1</sub>
Maximum resistance-temperature characteristic (see 3.17).	+0.05 ±500	+0.005 ±50	+0.02, -0.06 +300, -600	+0.0025 ±25	±0.005 ±50	+0.02, -0.05 +200, -600
Maximum ambient temperature at rated wattage (see fig. 1).	70° C	125° C	70° C	125° C	125° C	70° C
Maximum ambient temperature at zero wattage derating (see fig. 1).	150° C	175° C	165° C	175° C	175° C	165° C
Style RN50 RN55 RN60 RN65 RN70 RN75 RN80	2/ 3/ 3/ 3/ 2/ 1 W, 500 V 2 W, 750 V	1/20 W, 200 V 1/10 W, 200 V 1/8 W, 250 V 1/4 W, 300 V 1/2 W, 350 V 1 W, 500 V 2 W, 750 V	2/ 1/8 W, 200 V 1/4 W, 200 V 1/2 W, 250 V 3/4 W, 300 V 1 W, 350 V	1/20 W, 200 V 1/10 W, 200 V 1/8 W, 250 V 1/4 W, 300 V 1/2 W, 350 V 1 W, 500 V 2 W, 750 V	2/ 2/ 2/ 1/2 W, 250 V 3/4 W, 300 V 1 W, 350 V	2/ 1/10 W, 200 V 1/8 W, 250 V 1/4 W, 300 V 1/2 W, 350 V 1 W, 500 V 2 W, 750 V
Power rating in watts and maximum dc or rms voltage						
Maximum percent change in resistance:						
Temperature cycling (see 3.9). Low-temperature operation (see 3.10).	0.5 0.5	0.25 0.25	0.5 0.5	0.25 0.25	0.25 0.25	0.25 0.25
Short-time overload (see 3.11).	0.5	0.25	0.5	0.25	0.25	0.25
Dielectric withstanding voltage (see 3.13).	0.5	0.25	0.5	0.20	0.25	0.25
Resistance to soldering heat (see 3.15).	0.5	0.1	0.5	0.1	0.1	0.1
Moisture resistance (see 3.16).	1.5	0.5	1.5	0.5	0.5	0.5
Life (see 3.18).	1.0	0.8	1.0	0.5	0.5	0.5
Shock, medium impact (see 3.20).	0.5	0.25	0.5	0.20	0.25	0.25
Vibration, high frequency (see 3.21).	0.5	0.25	0.5	0.25	0.25	0.25
Resistance tolerances, percent (see table IV).	1.0	1.0, 0.5, 0.25, 0.1	1.0	1.0, 0.5, 0.25, 0.1	1.0, 0.5, 0.25, 0.1	1.0

1/ Hermetically sealed only (see 3.8).  
 2/ Not available.  
 3/ Formerly rated at 1 watt and is the direct replacement for style RN70 of MIL-R-10609D (see 6.10).

1.2.1.3 Resistance. The nominal resistance expressed in ohms is identified by four digits; the first three digits represent significant figures and the last digit specifies the number of zeros to follow. When the value of resistance is less than 100 ohms, or when fractional values of an ohm are required, the letter "R" shall be substituted for one of the significant digits to represent the decimal point. When the letter "R" is used, succeeding digits of the group represent significant figures. The resistance-value designations are shown in table II. Minimum and maximum resistance values shall be as specified (see 3.1). The standard values for every decade shall follow the sequence demonstrated for the "10 to 100" decade in table III. Although resistance tolerances B and C (see 1.2.1.4) normally require more than three significant figures to adequately describe the true resistance value, for the purpose of this specification, the nominal value shall be three significant figures followed by the fourth digit to signify the number of zeros to follow. The resistance values for 0.10-percent resistance tolerance (B) may be of any value, but it is preferred that the values be chosen from the 192-value series decade specified for resistance tolerances C and D.

TABLE II. Designation of resistance values.

Designation	Resistance	
	<u>Ohms</u>	
10R0 to 97R6 incl - - - - -	10.0 to	97.6 incl
1000 to 9760 incl - - - - -	100 to	976 incl
1001 to 9761 incl - - - - -	1,000 to	9,760 incl
1002 to 9762 incl - - - - -	10,000 to	97,600 incl
1003 to 9763 incl - - - - -	100,000 to	976,000 incl
1004 to 9764 incl - - - - -	1,000,000 to	9,760,000 incl
1005 - - - - -	10,000,000	

TABLE III. Standard resistance values for the 10 to 100 decade.

Resistance tolerance											
C, D (0.25, 0.5)	F (1.0)	C, D (0.25, 0.5)	F (1.0)	C, D (0.25, 0.5)	F (1.0)	C, D (0.25, 0.5)	F (1.0)	C, D (0.25, 0.5)	F (1.0)	C, D (0.25, 0.5)	F (1.0)
10.0	10.0	14.7	14.7	21.5	21.5	31.6	31.6	46.4	46.4	68.1	68.1
10.1	.....	14.9	.....	21.8	.....	32.0	.....	47.0	.....	69.0	.....
10.2	10.2	15.0	15.0	22.1	22.1	32.4	32.4	47.5	47.5	69.8	69.8
10.4	.....	15.2	.....	22.3	.....	32.8	.....	48.1	.....	70.6	.....
10.5	10.5	15.4	15.4	22.6	22.6	33.2	33.2	48.7	48.7	71.5	71.5
10.6	.....	15.6	.....	22.9	.....	33.6	.....	49.3	.....	72.3	.....
10.7	10.7	15.8	15.8	23.2	23.2	34.0	34.0	49.9	49.9	73.2	73.2
10.9	.....	16.0	.....	23.4	.....	34.4	.....	50.5	.....	74.1	.....
11.0	11.0	16.2	16.2	23.7	23.7	34.8	34.8	51.1	51.1	75.0	75.0
11.1	.....	16.4	.....	24.0	.....	35.2	.....	51.7	.....	75.9	.....
11.3	11.3	16.5	16.5	24.3	24.3	35.7	35.7	52.3	52.3	76.6	76.6
11.4	.....	16.7	.....	24.6	.....	36.1	.....	53.0	.....	77.7	.....
11.5	11.5	16.9	16.9	24.9	24.9	36.5	36.5	53.6	53.6	78.7	78.7
11.7	.....	17.2	.....	25.2	.....	37.0	.....	54.2	.....	79.6	.....
11.8	11.8	17.4	17.4	25.5	25.5	37.4	37.4	54.9	54.9	80.6	80.6
12.0	.....	17.6	.....	25.8	.....	37.9	.....	55.6	.....	81.6	.....
12.1	12.1	17.8	17.8	26.1	26.1	38.3	38.3	56.2	56.2	82.5	82.5
12.3	.....	18.0	.....	26.4	.....	38.8	.....	56.9	.....	83.5	.....
12.4	12.4	18.2	18.2	26.7	26.7	39.2	39.2	57.6	57.6	84.5	84.5
12.6	.....	18.4	.....	27.1	.....	39.7	.....	58.3	.....	85.6	.....
12.7	12.7	18.7	18.7	27.4	27.4	40.2	40.2	59.0	59.0	86.6	86.6
12.9	.....	18.9	.....	27.7	.....	40.7	.....	59.7	.....	87.6	.....
13.0	13.0	19.1	19.1	28.0	28.0	41.2	41.2	60.4	60.4	88.7	88.7
13.2	.....	19.3	.....	28.4	.....	41.7	.....	61.2	.....	89.8	.....
13.3	13.3	19.6	19.6	28.7	28.7	42.2	42.2	61.9	61.9	90.9	90.9
13.5	.....	19.8	.....	29.1	.....	42.7	.....	62.6	.....	92.0	.....
13.7	13.7	20.0	20.0	29.4	29.4	43.2	43.2	63.4	63.4	93.1	93.1
13.8	.....	20.3	.....	29.8	.....	43.7	.....	64.2	.....	94.2	.....
14.0	14.0	20.5	20.5	30.1	30.1	44.2	44.2	64.9	64.9	95.3	95.3
14.2	.....	20.8	.....	30.5	.....	44.8	.....	65.7	.....	96.5	.....
14.3	14.3	21.0	21.0	30.9	30.9	45.3	45.3	66.5	66.5	97.6	97.6
14.5	.....	21.3	.....	31.2	.....	45.9	.....	67.3	.....	98.8	.....

1.2.1.4 Resistance tolerance. The resistance tolerance is identified by a single letter in accordance with table IV.

TABLE IV. Resistance tolerance.

Symbol	Resistance tolerance
	Percent ( $\pm$ )
B <sup>1</sup> / <sub>-----</sub>	0.10
C <sup>1</sup> / <sub>-----</sub>	0.25
D <sup>1</sup> / <sub>-----</sub>	0.50
F -----	1.00

<sup>1</sup>/<sub>-----</sub> Applicable only to characteristics C, E, and F.

## 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

### SPECIFICATIONS

#### FEDERAL

- PPP-B-566 - Boxes, Folding, Paperboard.
- PPP-B-636 - Box, Fiberboard.
- PPP-B-676 - Boxes, Set-Up, Paperboard.
- PPP-T-60 - Tape: Pressure-Sensitive Adhesive, Waterproof, for Packaging.

#### MILITARY

- MIL-P-116 - Preservation, Methods of.

(See supplement 1 for list of applicable detail specifications.)

### STANDARDS

#### MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

## 3. REQUIREMENTS

3.1 Detail specifications. The individual part requirements shall be as specified herein and in accordance with the applicable detail specifications. In the event of any conflict between requirements of this specification and the detail specifications, the latter shall govern (see 6.1).

3.2 Qualification. Resistors furnished under this specification shall be a product which has been tested, and passed the qualification tests specified in 4.4, and has been listed on or approved for listing on the applicable qualified products list (see 6.2).

3.3 Material. The material shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the resistors to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.4 Design and construction. Resistors shall be of the design, construction, and physical dimensions specified (see 3.1). Each resistor shall consist of a film-type resistance element protected against exposure to humidity by an enclosure or a coating of moisture-resistant insulating material.

3.4.1 Terminals. All terminals shall be suitably treated to facilitate soldering.

3.5 Power rating. The resistors shall have a power rating based on continuous full-load operation at an ambient temperature of 70°C for characteristics B, D, and G, and 125°C for characteristics C, E, and F (see 3.1). This power rating is dependent on the ability of resistors to meet the life requirements specified in 3.18. For temperatures in excess of those specified above, the load shall be derated in accordance with figure 1.

3.6 Voltage rating. Resistors shall have a rated direct-current (dc) continuous working voltage or an approximate sine-wave root-mean-square (rms) continuous working voltage at commercial-line frequency and wave-form corresponding to the power rating, as determined from the following formula:

$$E = \sqrt{PR}$$

Where:

- E = Rated dc or rms ac continuous working voltage.
- P = Power rating (see 3.1).
- R = Nominal resistance.

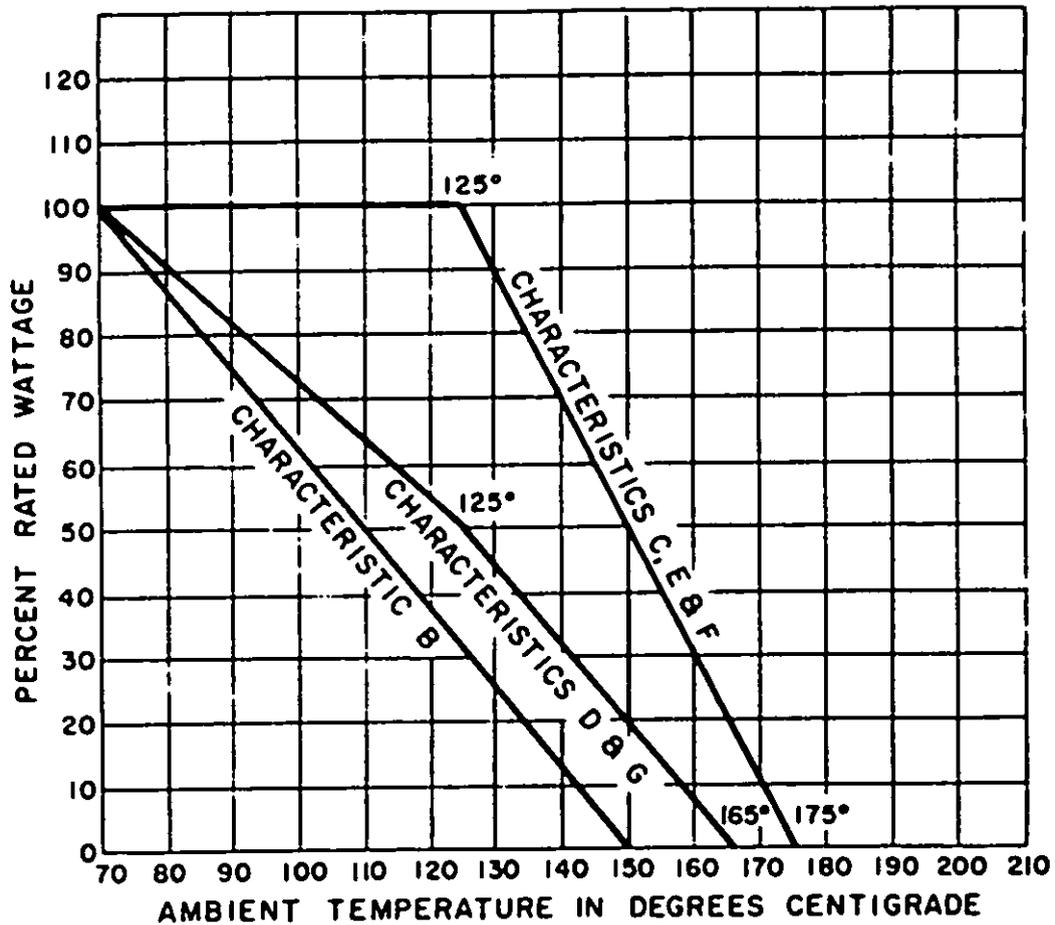
In no case shall the rated dc or rms continuous working voltage be greater than the applicable maximum value (see 3.1 and table I).

3.7 DC resistance. When resistors are tested as specified in 4.6.2, the dc resistance shall be within the specified tolerance of the nominal resistance (see 1.2.1.4).

3.8 Seal (applicable only to hermetically sealed resistors). When resistors are tested as specified in 4.6.3, there shall be no continuous visible stream of bubbles. For the purpose of this specification, an hermetically sealed resistor is one which shall be capable of passing the seal test specified in 4.6.3, or one which shall have a leakage rate of not more than  $1.76 \times 10^{-6}$  cubic centimeter per second, when determined by any other method having sensitivity equal to or better than the stated limit. Materials used for this enclosure shall be ceramic, metal, or glass, or combinations thereof.

3.9 Temperature cycling. When resistors are tested as specified in 4.6.4, there shall be no evidence of mechanical damage; the change in resistance shall not exceed  $\pm$  (0.5 percent + 0.05 ohm) for characteristics B and D, and  $\pm$  (0.25 percent + 0.05 ohm) for characteristics C, E, F, and G.

3.10 Low-temperature operation. When resistors are tested as specified in 4.6.5, there shall be no evidence of mechanical damage; the change in resistance between the initial and the final measurements at  $25^\circ \pm 5^\circ$  C, shall not exceed  $\pm$  (0.5 percent + 0.05 ohm) for characteristics B and D, and  $\pm$  (0.25 percent + 0.05 ohm) for characteristics C, E, F, and G.

**NOTE:**

These curves indicate the percentage of nominal wattage to be applied at temperatures higher than 70°C and 125°C. However, at no time shall the applied voltage exceed the maximum for each style (See Table I):

**FIGURE 1. Derating curves for high ambient temperatures.**

3.11 Short-time overload. When resistors are tested as specified in 4.6.6, there shall be no evidence of arcing, burning, or charring; the change in resistance shall not exceed  $\pm$  (0.5 percent + 0.05 ohm) for characteristics B and D, and  $\pm$  (0.25 percent + 0.05 ohm) for characteristics C, E, F, and G.

3.12 Terminal strength. When resistors are tested as specified in 4.6.7, there shall be no evidence of breaking or loosening of terminals from the resistor form, or other mechanical damage; the change in resistance shall not exceed  $\pm$  (0.2 percent + 0.05 ohm). Loosening of terminals is indicated by instantaneous instability of resistance during the resistance measurement.

3.13 Dielectric withstanding voltage. When resistors are tested as specified in 4.6.8, there shall be no evidence of flashover, mechanical damage, arcing, or insulation breakdown; the change in resistance shall not exceed  $\pm$  (0.5 percent + 0.05 ohm) for characteristics B and D, and  $\pm$  (0.25 percent + 0.05 ohm) for characteristics C, E, F, and G.

3.14 Insulation resistance. When resistors are tested as specified in 4.6.9, the insulation resistance shall be not less than 10,000 megohms.

3.15 Resistance to soldering heat. When resistors are tested as specified in 4.6.10, there shall be no evidence of mechanical damage; the change in resistance shall not exceed  $\pm$  (0.5 percent + 0.05 ohm) for characteristics B and D, and  $\pm$  (0.1 percent + 0.05 ohm) for characteristics C, E, F, and G.

3.16 Moisture resistance. When resistors are tested as specified in 4.6.11, there shall be no evidence of mechanical damage; the change in resistance between the initial and final measurements shall not exceed the applicable value specified in table I. In addition, the dielectric withstanding voltage shall be as specified in 3.13, and the insulation resistance shall be 100 megohms, minimum.

3.17 Resistance-temperature characteristic. When resistors are tested as specified in 4.6.12, the resistance-temperature characteristic, at each of the temperatures specified in table X, referred to room ambient temperature, shall not exceed the value specified in table I for the applicable characteristic.

3.18 Life. When resistors are tested as specified in 4.6.13, there shall be no evidence of mechanical damage; the change in resistance between the initial measurement and any of the succeeding measurements shall not exceed  $\pm$  (1.0 percent + 0.05 ohm) for characteristics B and D, and  $\pm$  (0.5 percent + 0.05 ohm) for characteristics C, E, F, and G.

3.19 Solderability. When resistors are tested as specified in 4.6.14, the dipped surface of the leads shall be at least 95-percent covered with a new, smooth, solder coating. The remaining 5 percent of the lead surface shall show only small pinholes or rough spots; these shall not be concentrated in one area. Bare base metal and areas where the solder dip failed to cover the original coating are indications of poor solderability, and shall be cause for failure. In case of dispute, the percent of coverage with pinholes or rough spots shall be determined by actual measurement of these areas, as compared to the total area.

3.20 Shock, medium impact. When resistors are tested as specified in 4.6.15, there shall be no evidence of mechanical or electrical damage; the change in resistance shall not exceed  $\pm$  (0.5 percent + 0.05 ohm) for characteristics B and D, and  $\pm$  (0.25 percent + 0.05 ohm) for characteristics C, E, F, and G. There shall be no electrical discontinuity during the test.

3.21 Vibration, high frequency. When resistors are tested as specified in 4.6.16, there shall be no evidence of mechanical or electrical damage; the change in resistance shall not exceed  $\pm$  (0.5 percent + 0.05 ohm) for characteristics B and D, and  $\pm$  (0.25 percent + 0.05 ohm) for characteristics C, E, F, and G. There shall be no electrical discontinuity during the test.

3.22 Marking. Resistors shall be marked with the type designation and the manufacturer's name, trademark, or code symbol. At the option of the manufacturer, the type designation may appear on two lines. In this event, the type designation shall be divided between the characteristic letter and the first digit of the resistance value as shown in the following example:

RN60D  
1003F

If lack of space on styles RN50, RN55, RN60, and RN65 requires it, marking may consist only of the resistance value. Marking shall remain legible at the end of all tests.

3.23 Workmanship. Resistors shall be processed in such a manner as to be uniform in quality and shall meet the requirements of 3.3 to 3.4.1 inclusive, 3.22, and 3.23.1, as applicable, and be free from other defects that will affect life, serviceability, or appearance.

3.23.1 Soldering. When soldering is employed, only noncorrosive fluxes shall be used, unless it can be shown that corrosive elements have been satisfactorily removed after soldering. Electrical connections shall be mechanically secure before and electrically continuous after soldering.

#### 4. QUALITY ASSURANCE PROVISIONS

##### 4.1 Responsibility for inspection.

4.1.1 Supplier. The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1.1 Test equipment and inspection facilities. Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The supplier shall establish calibration of inspection equipment to the satisfaction of the Government.

4.2 Classification of inspection. The examination and testing of resistors shall be classified as follows:

- (a) Qualification inspection (see 4.4).
- (b) Quality conformance inspection (see 4.5).
  - 1. Inspection of product for delivery (see 4.5.1).
  - 2. Inspection of preparation for delivery (see 4.5.2).

4.3 Inspection conditions and precautions.

4.3.1 Conditions. Unless otherwise specified herein, all inspection shall be made in accordance with the general requirements of MIL-STD-202.

4.3.2 Precautions. Adequate precautions shall be taken during inspection to prevent condensation of moisture on resistors, except during the moisture resistance and temperature cycling tests. Precautions shall also be taken to prevent damage by heat when soldering resistor leads to terminals.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory designated by the Government (see 6.2).

4.4.1 Sample. The number of sample units comprising a sample of resistors to be submitted for qualification inspection shall be as specified in the appendix to this specification. The sample shall be from a production run, and shall be produced with equipment and procedures normally used in production.

4.4.2 Test routine. Sample units shall be subjected to the qualification inspection specified in table V, in the order shown. All sample units shall be subjected to the inspection of group I. The 40 sample units shall then be divided as specified in table V for groups II to V inclusive, and subjected to the inspection for their particular group.

TABLE V. Qualification inspection.

Examination or test	Requirement paragraph	Method paragraph	Number of defectives allowed <sup>1/</sup>
<u>Group I - all sample units</u>			
Visual and mechanical examination <sup>2/</sup> - - - - -	3.1, 3.3 to 3.4.1 incl, and 3.22 to 3.23.1 incl	4.6.1	0
DC resistance <sup>3/</sup> - - - - -	3.7	4.6.2	
Seal (as applicable) <sup>3/</sup> - - - - -	3.8	4.6.3	
<u>Group II - 10 sample units</u>			
Temperature cycling <sup>3/</sup> - - - - -	3.9	4.6.4	1
Low-temperature operation - - - - -	3.10	4.6.5	
Short-time overload <sup>3/</sup> - - - - -	3.11	4.6.6	
Terminal strength - - - - -	3.12	4.6.7	
Seal (as applicable) <sup>3/</sup> - - - - -	3.8	4.6.3	
<u>Group III - 10 sample units</u>			
Electric withstanding voltage <sup>3/</sup> - - - - -	3.13	4.6.8	1
Insulation resistance - - - - -	3.14	4.6.9	
Temperature cycling - - - - -	3.9	4.6.4	
Resistance to soldering heat - - - - -	3.15	4.6.10	
Moisture resistance - - - - -	3.16	4.6.11	
<u>Group IV - 10 sample units</u>			
Resistance-temperature characteristic <sup>3/</sup> - - - - -	3.17	4.6.12	1
Life - - - - -	3.18	4.6.13	
Seal (as applicable) <sup>3/</sup> - - - - -	3.8	4.6.3	
<u>Group V - 10 sample units</u>			
Solderability - - - - -	3.19	4.6.14	1
Shock, medium impact - - - - -	3.20	4.6.15	
Vibration, high frequency - - - - -	3.21	4.6.16	
Seal (as applicable) <sup>3/</sup> - - - - -	3.8	4.6.3	

<sup>1/</sup> Failure of a resistor in one or more tests of a group shall be charged as a single defective.

Marking shall be considered defective only if the marking is illegible.

<sup>3/</sup> Nondestructive tests.

4.4.3 Defectives. Defectives in excess of those allowed in table V will be cause for refusal to grant qualification.

4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A, B, and C.

4.5.1.1 Inspection lot. An inspection lot, as far as practicable, shall consist of all the resistors of the same style, characteristic, and protective enclosure or coating.

4.5.1.2 Rejected lots. If an inspection lot is rejected, the supplier shall withdraw the lot, and may then rework it to correct the defects, or screen out the defective units. Such lots shall be kept separate from new lots, and shall be clearly identified as lots to be reinspected. Such lots shall be reinspected using tightened inspection.

4.5.1.3 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table VI, and shall be made on the same set of sample units, in the order shown.

4.5.1.3.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for ordinary inspection. The acceptable quality levels (AQL) shall be as specified in table VI. Major and minor defects shall be as defined in MIL-STD-105. Resistance values and tolerances in the samples shall be representative, and where possible, in proportion to the resistors in the lot.

TABLE VI. Group A inspection.

Examination or test	Requirement paragraph	Method paragraph	AQL (percent defective)	
			Major	Minor
Visual and mechanical examination:	---	4.6.1	} 1.0	} 4.0
Body dimensions - - - - -	3.4	---		
Diameter and length of leads - -	3.4	---		
Marking - - - - -	3.22	---		
Workmanship - - - - -	3.23 to 3.23.1 incl	---	} 1.0	} ---
DC resistance - - - - -	3.7	4.6.2		
Seal (as applicable) - - - - -	3.8	4.6.3		

1/ Marking defects shall be charged only for illegible, incorrect, or incomplete marking. Any subsequent electrical defect shall not be charged as a marking defect.

4.5.1.4 Group B inspection. Group B inspection shall consist of the tests specified in table VII, in the order shown. They shall be performed on sample units that have been subjected to and have passed the group A inspection, unless the Government considers it more practical to select a separate sample from the lot for group B inspection. Sample units shall be selected so that no more than three voltages will be required for the short-time overload test.

TABLE VII. Group B inspection.

Test	Requirement paragraph	Method paragraph
Resistance-temperature characteristic - - - - -	3.17	4.6.12
Dielectric withstanding voltage - -	3.13	4.6.8
Temperature cycling - - - - -	3.9	4.6.4
Short-time overload - - - - -	3.11	4.6.6
Seal (as applicable) - - - - -	3.8	4.6.3

4.5.1.4.1 Sampling plan. The sampling plan shall be in accordance with MIL-STD-105 for Special Inspection Levels. Unless otherwise specified herein, normal inspection shall be used at the start of the contract. The AQL shall be 6.5 (percent defective), and the inspection level shall be S-4.

4.5.1.4.2 Disposition of sample units. Sample units which have passed all the group B inspection may be delivered on the contract or order, at the option of the supplier, provided the resistor terminals were not soldered during any of the tests.

4.5.1.5 Group C inspection. Group C inspection shall consist of the tests specified in table VIII, in the order shown. They shall be performed on sample units of each style, characteristic, and body enclosure of any resistance value that have passed groups A and B inspection.

4.5.1.5.1 Sampling plan.

4.5.1.5.1.1 Monthly. Every month, 10 sample units of each style, characteristic, and body enclosure of any resistance value between the critical and lowest values shall be inspected. If none of these resistance values are produced during the month, resistors of the lowest resistance value produced shall be inspected with one defective allowed. If this sample fails, 10 additional sample units shall be inspected with no defectives allowed, but no more than two defectives allowed for all 20 sample units combined.

4.5.1.5.1.2 Quarterly. Every 3 months, 20 sample units of each style, characteristic, and body enclosure of any resistance value between the critical and highest values shall be inspected. Ten sample units of any resistance value between the critical and highest resistance values shall be subjected to the inspection of subgroup 1, and 10 sample units of the value closest to the value above the critical value shall be subjected to the inspection of subgroup 2. One defective will be allowed for each subgroup, but not more than one defective for the two groups combined.

4.5.1.5.1.3 Semiannually. Every 6 months, 10 sample units of each style, characteristic, and body enclosure of any resistance value between the critical and highest resistance values shall be inspected with one defective allowed.

TABLE VIII. Group C acceptance inspection.

Test	Number of sample units to be inspected	Requirement paragraph	Method paragraph
<u>Monthly</u>			
Temperature cycling - - - - -	} 10	3.9	4.6.4
Low-temperature operation - - - - -		3.10	4.6.5
Short-time overload - - - - -		3.11	4.6.6
Terminal strength - - - - -		3.12	4.6.7
Seal (as applicable) - - - - -		3.8	4.6.3
<u>Quarterly</u>			
<u>Subgroup 1</u>			
Dielectric withstanding voltage - -	} 10	3.13	4.6.8
Insulation resistance - - - - -		3.14	4.6.9
Temperature cycling - - - - -		3.9	4.6.4
Resistance to soldering heat - - -		3.15	4.6.10
Moisture resistance - - - - -		3.16	4.6.11
<u>Subgroup 2</u>			
Resistance-temperature characteristic - - - - -	} 10	3.17	4.6.12
Life - - - - -		3.18	4.6.13
Seal (as applicable) - - - - -		3.8	4.6.3
<u>Semiannually</u>			
Solderability - - - - -	} 10	3.19	4.6.14
Shock, medium impact - - - - -		3.20	4.6.15
Vibration, high frequency - - - -		3.21	4.6.16
Seal (as applicable) - - - - -		3.8	4.6.3

4.5.1.5.2 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract or order.

4.5.1.5.3 Noncompliance. If a sample fails to pass group C inspection, the supplier shall take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). Groups A and B inspection may be reinstated; however, final acceptance shall be withheld until the group C reinspection has shown that the

corrective action was successful. In the event of failure after re-inspection, information concerning the failure and the corrective action taken shall be furnished to the contracting officer.

4.5.2 Inspection of preparation for delivery. Sample items and packs shall be selected and inspected in accordance with MIL-P-116 to verify conformance with requirements in section 5 of this specification.

4.5.3 Retention of qualification. In order to retain qualification, the supplier shall forward via the government inspector at 6-month intervals, to the activity responsible for qualification, a summary of the results of groups A and B tests, indicating as a minimum the number of lots which passed and the number which failed, and a summary of the results of group C tests, including the number and type of any part failures. The summary shall include those tests performed during that 6-month period. If the summary of the test results indicates non-conformance with specification requirements, action will be taken to remove the failing product from the qualified products list. Failure to submit the summary will result in loss of qualification for that product. In addition to the periodic submission of inspection data, the supplier shall immediately notify the qualifying activity at any time during the 6-month period that the inspection data indicates failure of the qualified product to meet the requirements of the specification.

#### 4.6 Methods of examination and test.

4.6.1 Visual and mechanical examination. Resistors shall be examined to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3 to 3.4.1 inclusive, and 3.22 to 3.23.1 inclusive).

4.6.2 DC resistance (see 3.7). The dc resistance shall be measured in accordance with method 303 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Measuring apparatus - The same measuring instrument shall be used for any one test, but not necessarily for all tests.
- (b) Test voltage - Measurements of resistance shall be made by using the test voltages specified in table IX. The test voltage chosen, whether it be the maximum or a lower voltage which would still provide the sensitivity required, shall be applied across the terminals of the resistor. This same voltage shall be used whenever a subsequent resistance measurement is made.

- (c) Temperature - The dc resistance test specified in group I of table V shall be performed at  $25^{\circ} \pm 2^{\circ}$  C. For all other tests, unless otherwise specified herein, the temperature at which subsequent and final resistance measurements are made in each test shall be within  $\pm 2^{\circ}$  C of the temperature at which the initial resistance measurement was made.

TABLE IX. DC resistance test voltages.

Resistance, nominal	Maximum test voltage	
	1/2, 3/4, 1, and 2 watt	1/20, 1/10, 1/8, and 1/4 watt
<u>Ohms</u>	<u>Volts</u>	<u>Volts</u>
10 to 98.8 incl -	1	1
100 to 988 incl -	3	3
1,000 to 9,880 incl -	10	3
10,000 to 98,800 incl -	30	10
100,000 or higher - - - -	100	30

4.6.3 Seal (applicable only to hermetically sealed resistors) (see 3.8). Resistors shall be tested in accordance with method 112 of MIL-STD-202. The following details shall apply:

- (a) Test condition letter - A.
- (b) After test - Resistors shall be cleaned in alcohol, or other suitable degreaser, and allowed to dry thoroughly.

4.6.4 Temperature cycling (see 3.9). Resistors shall be tested in accordance with method 102 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Mounting - Resistors shall be mounted by means other than soldering.
- (b) Measurement before cycling - DC resistance shall be measured as specified in 4.6.2.
- (c) Test condition letter - C, except that the extreme high temperature shall be  $150^{\circ} +3^{\circ} -0^{\circ}$  C.
- (d) Measurement after cycling - Within 3 hours after completion of the final cycle and as soon as the resistors stabilize at room temperature, dc resistance shall again be measured as specified in 4.6.2.

Following the test, resistors shall be examined for evidence of mechanical damage.

#### 4.6.5 Low-temperature operation (see 3.10).

4.6.5.1 Mounting. Resistors shall be mounted by their terminals so that there is at least 1 inch of free air space around each resistor and the mounting is in such a position with respect to the air that it offers substantially no obstruction to the flow of air across and around the resistors.

4.6.5.2 Procedure. Following the final dc resistance measurement specified in 4.6.4 (d), the resistors, mounted as specified in 4.6.5.1, shall be placed in a cold chamber at room temperature. The temperature shall be gradually decreased to  $-65^{+0}_{-5}$ ° C, within a period of no not less than 1-1/2 hours. For acceptance inspection only, and at the option of the manufacturer, the resistors may be placed in the cold chamber when the chamber is already at the extreme low temperature. After 1 hour of stabilization at this temperature, full rated continuous working voltage as specified in 3.6 shall be applied for 45 minutes. The resistors may be loaded individually or in parallel. Fifteen  $^{+5}_{-0}$  minutes after the removal of the voltage, the temperature in the chamber shall be gradually increased to room temperature within a period of not more than 8 hours. The resistors shall be removed from the chamber and maintained at a temperature of  $25^{\circ} \pm 5^{\circ}$  C for a period of approximately 24 hours; the dc resistance shall then be measured as specified in 4.6.2. Resistors shall then be examined for evidence of mechanical damage.

4.6.6 Short-time overload (see 3.11). DC resistance shall be measured as specified in 4.6.2. A dc test potential, 2.5 times the rated continuous working voltage but not exceeding twice the maximum voltage specified (see 3.1), shall then be applied for 5 seconds to the resistor terminals, under the following conditions:

- (a) In free space, mounted horizontally, with no object closer than 3 inches to the protective coating except the mounting base which shall be not closer than 2 inches below the resistors.
- (b) In still air, with no circulation other than that created by the heat of the resistors being operated.

Thirty  $^{+15}_{-0}$  minutes after removal of the test potential, the dc resistance shall again be measured as specified in 4.6.2. Resistors shall then be examined for evidence of arcing, burning, and charring.

4.6.7 Terminal strength (see 3.12). Resistors shall be tested in accordance with method 211 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Test condition letters - A and D.
  - 1. Direct load (condition A) shall be as specified (see 3.1) - Resistor clamped by one terminal lead and load applied to the other terminal lead.
- (b) Measurement before and after test - DC resistance shall be measured as specified in 4.6.2.

Following the test, resistors shall be examined for evidence of loosening of terminals, breakage, and other mechanical damage.

4.6.8 Dielectric withstanding voltage (see 3.13).

4.6.8.1 Atmospheric pressure. Resistors shall be tested in accordance with method 301 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Special preparations - Resistors shall be clamped in the trough of a 90° metallic V-block of such size that the body of the resistor does not extend beyond the extremities of the block. The resistor leads shall be so positioned that the distance between the resistor leads and any point of the V-block is not less than the radius of the resistor minus the radius of the lead wire.
- (b) Initial measurement - DC resistance shall be measured as specified in 4.6.2.
- (c) Magnitude of test voltage - With the exception of style RN55, resistors of 1/8 watts shall have a sine wave test potential of 750 volts applied. For style RN55, a potential of 450 volts shall be applied. For style RN50, a potential of 250 volts shall be applied. For all other resistors, a potential of 900 volts shall be applied.
- (d) Nature of potential - An alternating current (ac) supply at commercial-line frequency (not more than 100 cycles per second (cps) and waveform.
- (e) Duration of application of test voltage - 1 minute.
- (f) Rate of application of test voltage - 100 volts per second.

- (g) Points of application of test voltage - Between the resistor terminals connected together and the V-block.
- (h) Measurement after test - DC resistance shall be measured as specified in 4.6.2.

Following the test, resistors shall be examined for evidence of flashover, mechanical damage, arcing, and insulation breakdown.

4.6.8.2 Barometric pressure. Resistors shall be tested in accordance with method 105 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Method of mounting - As specified in 4.6.8.1 (a).
- (b) Initial measurement - DC resistance shall be measured as specified in 4.6.2.
- (c) Test condition letter - B.
- (d) Test voltage during subjection to reduced pressure- 450 volts rms for all resistors except for styles RN50, and RN55, which shall have 100 and 200 volts rms applied respectively.
- (e) Nature of potential - As specified in 4.6.8.1 (d).
- (f) Duration of test - 1 minute.
- (g) Points of application of test voltage - As specified in 4.6.8.1 (g).
- (h) Measurement after test - DC resistance shall be measured as specified in 4.6.2.

Following the test, resistors shall be examined for evidence of flashover, mechanical damage, arcing, and insulation breakdown.

4.6.9 Insulation resistance (see 3.14). Resistors shall be tested in accordance with method 302 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Special preparations - As specified in 4.6.8.1 (a).
- (b) Test condition letter - A or B, whichever is practicable, except that test condition A only shall be used for style RN50.
- (c) Points of measurement - Between the resistor terminals connected together and the V-block.

4.6.10 Resistance to soldering heat (see 3.15). Resistors shall be tested in accordance with method 210 of MIL-STD-202. The following details shall apply:

- (a) Measurement before test - DC resistance shall be measured as specified in 4.6.2.
- (b) Special preparation of specimen - Sample units shall not have been soldered during any of the previous tests.
- (c) Depth of immersion in the molten solder - To a point 1/8 inch from the resistor body.
- (d) Test condition-letter - A.
- (e) Cooling time prior to final examinations and measurements - A minimum of 3 hours.
- (f) Examination and measurement after test - Resistors shall be examined for evidence of mechanical damage and dc resistance shall be measured as specified in 4.6.2.

4.6.11 Moisture resistance (see 3.16). Resistors shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Mounting:
  - 1. All styles except style RN80 - Soldered by their leads to rigid mounts or terminal lugs. The spacing of the mounts or terminal lugs shall be such that the length of each resistor lead is approximately 3/8 inch when measured from the edge of the supporting terminal to the resistor body. One-half of the sample units shall be covered with a V-shaped metal strap whose width is equal to that of the resistor body as indicated in figure 2. The strap shall be made of a corrosion-resistant metal and shall be kept in contact with the resistor body by supporting the body as indicated in figure 2, with a nonconducting, noncorrosive support whose width is less than that of the body and which will not act as a moisture trap. The mounting straps may be individual for each resistor or continuous for all resistors.

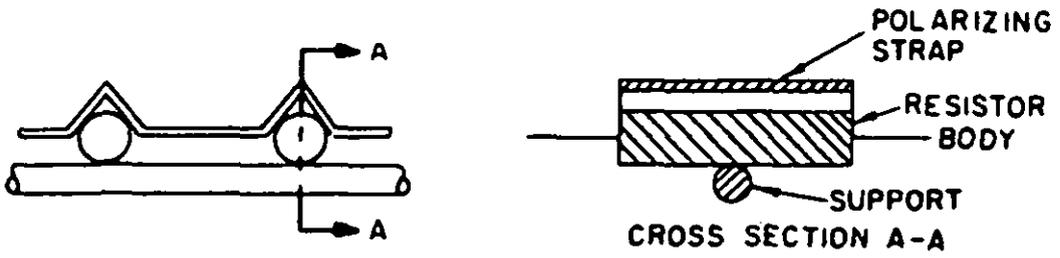


FIGURE 2. Mounting straps for all styles, except style RN80.

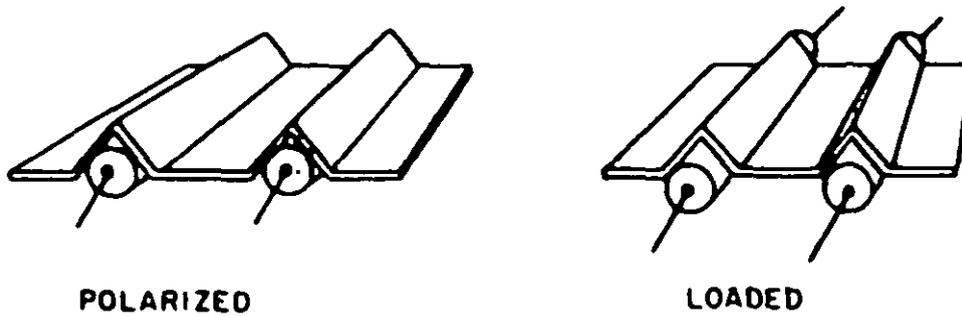


FIGURE 3. Mounting straps for style RN80.

2. Style RN80, only - By means of mounting straps. The mounting straps used shall be a corrosion-resistant metal and be of the shape shown in figure 3. One-half of the sample units shall be mounted with a strap whose outer edges are flush with the ends of the resistor body; the remaining half shall be mounted with a strap whose width is such that the ends of the resistor body extend  $1/8$  inch beyond the outer edges of the strap. For all sample units, the resistor leads shall be supported approximately  $3/8$  inch from the edge of the resistor body. The mounting straps may be individual for each resistor or continuous for all resistors.
- (b) Initial measurement - Immediately following the initial drying period, dc resistance shall be measured as specified in 4.6.2.
- (c) Polarization and loading voltage:
1. Polarization - During steps 1 to 6 inclusive, a dc potential of 50 volts for style RN50, and 100 volts for all other styles shall be applied only to those resistors which have a polarizing strap (for style RN80, those units with straps flush with edge of the resistor). This potential shall be applied with the positive lead connected to the resistor terminals tied together, and the negative lead connected to the polarizing straps.
  2. Loading voltage - During the first 2 hours of steps 1 and 4, a dc test potential equivalent to 100-percent rated wattage but not exceeding the maximum rated voltage shall be applied to those resistors which are mounted by their leads without the polarizing straps specified in 4.6.11 (a) 1, and to those mounted so that their bodies extend  $1/8$  inch beyond the edges of the mounting straps specified in 4.6.11 (a) 2.
- (d) Subcycle - Steps 7a and 7b shall be performed during any five of the first eight cycles only. All polarizing straps, except those on style RN80, shall be removed to perform steps 7a and 7b and shall then be replaced prior to returning the resistors to the humidity chamber.

- (e) Final measurements - Upon completion of step 6 of the final cycle, the resistors shall be held at the high-humidity conditions and a temperature of  $25^{\circ} \pm 2^{\circ}$  C for a period of 1-1/2 to 3-1/2 hours. The same straps used for polarizing the resistors may also be used for the dielectric withstanding voltage and insulation resistance tests. Resistors shall be removed from the chamber and within 1/2 hour, the dielectric withstanding voltage, insulation resistance, and dc measurement tests shall be performed as specified in 4.6.8.1, 4.6.9 and 4.6.2 respectively. The sample units shall not be subjected to forced circulating air during the tests.
- (f) Examination after test - Resistors shall be examined for evidence of mechanical damage.

4.6.12 Resistance-temperature characteristic (see 3.17). Resistors shall be tested in accordance with method 304 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Reference temperature - Room ambient temperature.
- (b) Test temperature - In accordance with table X.
- (c) Accuracy of temperature measurement - Resistors shall be maintained for 30 to 45 minutes within  $1^{\circ}$  C at each of the test temperatures listed in table X. This tolerance shall be maintained on the established test temperatures.

TABLE X. Resistance-temperature characteristic.

Sequence	Temperature	
	Qualification inspection and group C acceptance inspection	Group B acceptance inspection
	<u>°C</u>	<u>°C</u>
1	Room temperature <sup>1/</sup>	Room temperature <sup>1/</sup>
2	-15 ±3	-55 ±3
3	-55 ±3	Room temperature <sup>1/</sup>
4	Room temperature <sup>1/</sup>	<sup>2/</sup> 150 ±3
5	65 ±3	<sup>3/</sup> 165 ±3
6	<sup>2/</sup> 150 ±3	<sup>4/</sup> 175 ±3
7	<sup>3/</sup> 165 ±3	---
8	<sup>4/</sup> 175 ±3	---

<sup>1/</sup> This temperature shall be considered the reference temperature for each of the succeeding temperatures.

<sup>2/</sup> Characteristic B, only.

<sup>3/</sup> Characteristic D and G, only.

<sup>4/</sup> Characteristics C, E, and F, only.

4.6.13 Life (see 3.18). Resistors shall be tested in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Method of mounting - Resistors shall be mounted and soldered on lightweight terminals (see fig. 4). The effective length of each terminal shall be 1 inch. Resistors shall be so arranged that the temperature of any one resistor will not appreciably influence the temperature of any other resistor. There shall be no undue draft over the resistors.
- (b) Test temperature and tolerance - 70° ±5° C for characteristics B, D, and G, and 125° ±5° C for characteristics C, E, and F.

- (c) Initial measurement - DC resistance shall be measured at the applicable test temperature after temperature stabilization and within 8 hours of exposure of the resistors to the test temperatures.
- (d) Operating conditions - Rated dc continuous working voltage shall be applied intermittently, 1-1/2 hours on and 1/2 hour off, for 1,000 hours, at the applicable test temperature.
- (e) Test condition letter - D.
- (f) Measurements during test - DC resistance shall be measured at the end of the 1/2-hour-off periods, after 50 ±8, 100 ±8, 250 ±8, 500 ±12, 750 ±12, and 1,000 ±12 hours have elapsed.

Following the test, resistors shall be examined for evidence of mechanical damage.

4.6.14 Solderability (see 3.19). Resistors shall be tested in accordance with method 208 of MIL-STD-202. The following detail shall apply:

- (a) Both terminal leads of each resistor shall be immersed to within 0.062 inch of the resistor body.

4.6.15 Shock, medium impact (see 3.20). Resistors shall be tested in accordance with method 205 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Special mounting means - Resistors shall be rigidly mounted on appropriate jig fixtures with their bodies restrained from movement and their leads supported at a distance of 1/4 inch from the resistor body. These fixtures shall be constructed in a manner to insure that the points of the resistor-mounting supports will have the same motion as the shock table. Test leads used during this test shall be no larger than AWG size 22 stranded wire, so that the influence of the test lead on the resistor will be held to a minimum. The test-lead length shall be no longer than necessary. In all cases, the resistors shall be mounted in relation to the test equipment in such a manner that the stress applied is in the direction which would be considered most detrimental.
- (b) Measurement before shock - DC resistance shall be measured as specified in 4.6.2.
- (c) Test condition letter - C.

- (d) Number and direction of applied shocks - The resistors shall be subjected to a total of 10 shocks in each of two mutually perpendicular planes, one perpendicular and the other parallel to the longitudinal axis of the resistor.
- (e) Measurement during shock - Each resistor shall be monitored to determine electrical discontinuity by a method which shall at least be sensitive enough to monitor or register, automatically, any electrical discontinuity of 0.1 millisecond or greater duration.
- (f) Measurement after shock - DC resistance shall be measured as specified in 4.6.2.

Following the test, resistors shall be examined for evidence of mechanical and electrical damage.

4.6.16 Vibration, high frequency (see 3.21). Resistors shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply:

- (a) Mounting of specimens - Resistors shall be mounted on appropriate jig fixtures with their bodies restrained from movement and their leads supported at a distance of 1/4 inch from the resistor body. These fixtures shall be constructed in a manner to insure that the points of the resistor mounting supports will have the same motion as the vibration test table. The fixtures shall also be of a construction that will preclude any resonance in the fixture when subjected to vibration within the test frequency range, and the fixture shall be monitored for these features on the vibration table. Test leads used during this test shall be no larger than AWG size 22 stranded wire, so that the influence of the test lead on the resistor will be held to a minimum. The test lead length shall be no greater than is absolutely necessary. A shielded cable which may be necessary because of the field surrounding the vibration table, shall be clamped to the resistor mounting jig.
- (b) Initial measurement - DC resistance shall be measured as specified in 4.6.2.
- (c) Test condition letter - B.
- (d) Direction of motion - In each of two mutually perpendicular directions, one perpendicular and the other parallel to the longitudinal axis of the resistor.

- (e) Measurements during test - Each resistor shall be monitored to determine electrical discontinuity by a method which shall at least be sensitive enough to monitor or register, automatically, any electrical discontinuity of 0.1 millisecond or greater duration.
- (f) Measurement after vibration - DC resistance shall be measured as specified in 4.6.2.

Following the test, resistors shall be examined for evidence of mechanical and electrical damage.

## 5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C, as specified (see 6.1).

### 5.1.1 Level A.

5.1.1.1 Cleaning. Resistors shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. The procedure used shall not be injurious to the item.

5.1.1.3 Preservative application. None required.

5.1.1.4 Unit packaging. Resistors shall be adequately cushioned and individually packaged in accordance with MIL-P-116, method IAB.

5.1.1.5 Intermediate packaging. Resistors, packaged as described in 5.1.1.4, shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate containers shall be uniform in size and shape, shall be of minimum cube and tare, and shall contain multiples of five unit packages, not to exceed 100 packages or ten pounds. No intermediate packaging is required when the total quantity shipped is less than 100 units.

5.1.2 Level C. Resistors shall be preserved and packaged in a manner that will afford adequate protection against corrosion, deterioration, and physical damage during shipment from supply source to the first receiving activity for immediate use. This package may conform to the suppliers commercial practice for retail distribution when such meets the requirements of this level.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.1).

5.2.1 Level A. The packaged item (s) shall be packed in fiberboard containers conforming to PPP-B-636, weather resistant, style optional, special requirement. In lieu of the closure and waterproof requirement in the Appendix of PPP-B-636, closures and waterproofing shall be accomplished by sealing the center seams, ends, edges, and manufacturer's joints with waterproof tape, 3 inches wide, conforming to PPP-T-60, class 1. Banding (reinforcement requirements), shall be applied in accordance with the Appendix to PPP-B-636. Metal banding shall not be used.

5.2.2 Level B. The packaged item (s) shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style and use requirements optional.

5.2.3 Level C. The packaged item (s) shall be packed in a manner that will afford adequate protection against damage during direct shipment from the supply source to the first receiving activity for immediate use. This pack shall conform to the applicable carrier rules and regulations and may be the supplier's commercial practice when such conforms to the requirements of this level.

5.3 Marking (see 6.1). In addition to any special marking required by the contract or order, each unit package, intermediate and exterior containers shall be marked in accordance with MIL-STD-129.

5.4 General. Exterior containers shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical items to the greatest extent possible.

## 6. NOTES

6.1 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Title, number, and date of the applicable detail specification, and the complete type designation (see 1.2.1 and 3.1).
- (c) Levels of preservation and packaging and packing, and applicable marking (see section 5).
- (d) Method of preservation and packaging of MIL-P-116, if other than method IA8 (see 5.1.1.4).
- (e) Number of unit packages if other than that specified in 5.1.1.5.

6.1.1 Indirect shipments. The packaging, packing, and marking specified in section 5 apply only to direct purchases by or direct shipments to the Government and are not intended to apply to contracts or orders between the supplier and the prime contractor.

6.2 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable qualified products list whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is Army, Electronic Command; however, information

pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC), Engineering Standardization Directorate, 1507 Wilmington Pike, Dayton, Ohio 45401.

6.3 Resistance tolerance. See MIL-STD-199, section 102.

6.4 Maximum voltage. The maximum continuous working voltage specified for each of the styles (see 3.1) should in no case be exceeded, regardless of the theoretically calculated rated voltage (see 3.6).

6.5 Derating. The intention of this specification is to cover resistors capable of full-load operation with a high degree of stability at any ambient temperature up to and including 70° C for characteristics B, D, and G, and 125° C for characteristics C, E, and F. However, if it is desired to operate these resistors at ambient temperatures greater than 70° C or 125° C, the resistors should be derated in accordance with figure 1. It should be recognized that resistors with a resistance tolerance of 0.5, 0.25, and 0.10 percent should be derated if high-performance stability, comparable to the tolerance, is desired.

6.6 Mounting for style RN80. Mounting should not depend on the terminal leads; mounting straps should be used.

6.7 Mounting for styles other than RN80. Under conditions of severe shock or vibration, or a combination of both, resistors of all sizes described in this specification should be mounted in such a fashion that the body of the resistor is restrained from movement with respect to the mounting base. It should be noted that if clamps are used, certain electrical characteristics of the resistor will be altered. The heat-dissipating qualities of the resistor will be enhanced or retarded depending on whether the clamping material is a good or poor heat conductor. Under less severe vibration conditions, styles RN50, RN55, RN60, RN65, and RN70 may be supported by their leads only. The lead lengths should be kept as short as possible, 1/4 inch or less preferred, but no longer than 5/8 inch. The longer the lead, the more likely that a mechanical failure will occur.

6.8 Flammability. See MIL-STD-199.

6.9 Deletion of acceleration test. Since this test was originally specified, test data and experience have shown that no failures have been attributed to acceleration testing. As a result, the acceleration test has not been included in this specification.

6.10 Superseded styles. The styles of MIL-R-10509F which supersede the the styles in MIL-R-19074C (NAVY) and earlier issues of MIL-R-10509 are listed in table XI.

TABLE XI. Styles.

Styles in MIL-R-10509F	Supersede styles in MIL-R-10509E	Supersede styles in MIL-R-10509D	Supersede styles in MIL-R-10509B	Supersede styles in MIL-R-10509A	Supers styles MIL-R-190 (NAVY)
RN50 - -	---	---	---	---	---
RN55 - -	RN55	RN55	---	---	---
RN60 - -	RN60	RN60 <sup>2/</sup>	RN10	---	RI90 <sup>1/</sup>
RN65 - -	RN65	RN65 <sup>2/</sup>	RN20	RN15	RI92 <sup>1/</sup>
RN70 <sup>3/</sup>	RN70	RN70 <sup>2/</sup>	RN25	---	RI94 <sup>1/</sup>
RN75 - -	RN75	RN75	---	---	RI96 <sup>1/</sup>
RN80 - -	RN80	RN80	---	---	---

<sup>1/</sup> Replaced by characteristics C and E.

<sup>2/</sup> Characteristic B in these styles is replaced by characteristic D.

<sup>3/</sup> RN70 of MIL-R-10509F is now rated at 3/4 watt and is the direct replacement for RN70 of MIL-R-10509D.

6.10.1 Superseded styles within the specification. Although styles RN60, RN65, and RN70 were altered dimensionally in MIL-R-10509D, they are still considered to be the same as their corresponding styles in the superseded MIL-R-10509C. Similarly, although requirements in this specification are tighter than requirements of MIL-R-10509C, and the same as MIL-R-10509D, for purposes of supply and maintenance, resistors previously supplied in characteristic C under MIL-R-10509C and MIL-R-10509D are interchangeable with resistors supplied in characteristic C under this specification. The resistors previously supplied in characteristic B of MIL-R-10509C and MIL-R-10509D are replaced with resistors supplied in characteristic D under this specification.

6.11 Standard resistor types. Equipment designers should refer to MIL-STD-199, "Resistors, Selection and Use of" for standard resistor types and selected values chosen from this specification. MIL-STD-199 provides a selection of standard resistors for new equipment design.

Custodians:  
 Army - EL  
 Navy - SH  
 Air Force - 11

Preparing activity:  
 Army - EL  
 (Project 5905-0422)

Review activities:  
 Army - MJ, EL, MI  
 Navy - WP, SH  
 Air Force - 11-17-85

User activities:  
 Navy - MC

## APPENDIX

## PROCEDURE FOR QUALIFICATION INSPECTION

## 10. SCOPE

10.1 This appendix details the procedure for submission of samples, with related data, for qualification inspection of resistors covered by this specification. The procedure for extending qualification of the required sample to other resistors covered by this specification is also outlined herein.

## 20. SUBMISSION

20.1 Sample. A sample consisting of 40 sample units, each of the lowest and highest resistance values having a resistance tolerance of 1 percent, in each style and characteristic for which qualification is sought, shall be submitted. If the lowest resistance value is below the critical value listed in table XII, and the highest resistance value is above the critical value, then 40 sample units of the critical value shall also be submitted. If approval for a lower tolerance is desired, an additional 10 sample units, each of the lowest resistance tolerance for which approval is sought, shall be submitted to the inspection of group 1 in table V. At the option of the supplier, a sample consisting of 40 sample units, each of the lowest and highest resistance values having a lower (tighter) resistance tolerance than 1 percent in each style and characteristic for which qualification is sought, shall be submitted.

TABLE XII. Critical resistance values.

Style	Resistance (megohms)		
	Characteristics B, C, E, and G	Characteristics	
		D	F
RN50 - - - - -	---	---	---
RN55 - - - - -	---	---	---
RN60 - - - - -	0.499	0.357	---
RN65 - - - - -	0.348	0.243	0.243
RN70 - - - - -	0.237	0.320	0.320
RN75 - - - - -	0.237	---	---
RN80 - - - - -	0.280	---	---

20.2 Test data. When tests are to be performed at a Government laboratory, prior to submission, all sample units shall be subjected to all of the tests indicated as nondestructive in table V. Each submission shall be accompanied by the test data obtained from these tests. The performance of the destructive tests by the supplier on a duplicate set of sample units is encouraged, although not required. All test data shall be submitted in duplicate.

20.3 Description of items. The supplier shall submit a detailed description of the resistors being submitted for inspection, including materials used for the resistance element and the protective enclosure or coating.

30. EXTENT OF QUALIFICATION.

30.1 The resistance range included in the qualification of any one resistor style and characteristic will be between any two adjacent resistance values which pass the qualification inspection. Qualification will cover only the resistor types covered by the description of paragraph 20.3. Separate submissions are required for each type protective enclosure or coating used. Qualification of one characteristic is basis for qualification of another characteristic, as indicated in table XIII. Also, qualification of the lower resistance tolerances will qualify the higher resistance tolerances in accordance with table XIV.

TABLE XIII. Extent of approval of characteristics.

Characteristic submitted	Characteristic qualified
B - - - - -	B
D - - - - -	D, B
C - - - - -	C
E - - - - -	E, C
G - - - - -	G, B <sup>1/</sup>
F - - - - -	F

<sup>1/</sup> When hermetically sealed.

TABLE XIV. Extent of approval of resistance tolerances.

Resistance tolerance submitted	Resistance tolerance qualified
B - - - - -	B, C, D, F
C - - - - -	C, D, F
D - - - - -	D, F
F - - - - -	F

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