

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

<p>Inactive for new design after 21 April 1994 For new design use MIL-R-55182.</p>
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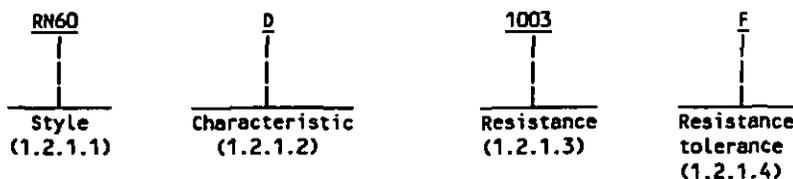
This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. Scope.

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

1.2 Classification.

1.2.1 Part or Identifying Number (PIN). The PIN shall be in the following form (see 3.1):



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 (see 3.1).

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

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. Resistance values not listed in table III for tolerances F and D shall be considered as not conforming to the specification.

<p>Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Research Laboratory, ATTN: AMSRL-EP-RD, Fort Monmouth, NJ 07703-5601 by using the self addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.</p>
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AMSC N/A

FSC 5905

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TABLE I. Characteristics.

	B	C	D	E	F	G 1/
Maximum resistance-temp. char. (see 3.17)	± 0.05 ± 500	± 0.005 ± 50	$+0.02, -0.05$ $+200, -500$	± 0.0025 ± 25	± 0.005 ± 50	$+0.02, -0.05$ $+200, -500$
Maximum ambient temperature at rated wattage (see figure 1)	70°C	125°C	70°C	125°C	125°C	70°C
Maximum ambient temperature at zero wattage derating (see figure 1)	150°C	175°C	165°C	175°C	175°C	165°C
Power rating in watts and maximum dc or rms voltage. Style:						
RN50	2/	1/20 W, 200 V	2/	1/20 W, 200 V	2/	2/
RN55	2/	1/10 W, 200 V	1/8 W, 200 V	1/10 W, 200 V	2/	1/10 W, 200 V
RN60	2/	1/8 W, 250 V	1/4 W, 300 V	1/8 W, 250 V	2/	1/8 W, 250 V
RN65	2/	1/4 W, 300 V	1/2 W, 350 V	1/4 W, 300 V	1/2 W, 350 V	1/4 W, 300 V
RN70	2/	1/2 W, 350 V	3/4 W, 500 V	1/2 W, 350 V	3/4 W, 500 V	1/2 W, 350 V
RN75	1 W, 500 V	1 W, 500 V	2/	1 W, 500 V	2/	1 W, 500 V
RN80	2 W, 750 V	2/	2/	2/	2/	2 W, 750 V
Maximum percent change in resistance \pm :						
Temperature cycling (see 3.9)	0.5	0.25	0.5	0.25	0.25	0.25
Low temperature operation (see 3.10)	0.5	0.25	0.5	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	0.25	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	0.5	1.0	0.5	0.5	0.5
Shock, medium impact (see 3.20)	0.5	0.25	0.5	0.25	0.25	0.25
Vibration, high frequency (see 3.21)	0.5	0.25	0.5	0.25	0.25	0.25
Resistance tolerances \pm 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.

TABLE II. Designation of resistance values.

Designation	Resistance
1R00 to 9R88	10 to 98.8 ohms included
1000 to 9880	100 to 988 ohms included
1001 to 9881	1 to 9.88 kilohms included
1002 to 9882	10 to 98.8 kilohms included
1003 to 9883	100 to 988 kilohms included
1004 to 9884	1 to 9.88 megohms included

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

Resistance tolerance											
B,C,D .1,.25,.5	F 1.0	B,C,D .1,.25,.5	F 1.0	B,C,D .1,.25,.5	F 1.0	B,C,D .1,.25,.5	F 1.0	B,C,D .1,.25,.5	F 1.0	B,C,D .1,.25,.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	76.8	76.8
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	----	36.8	----	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 1/	0.10
C 1/	0.25
D 1/	0.50
F	1.00

1/ Applicable only to characteristics C, E, and F.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-R-39032 - Resistors, Preparation for delivery of.

STANDARDS

MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
 MIL-STD-1276 - Leads for Electronic Component Parts.
 MIL-STD-1285 - Marking of Electrical and Electronic Parts.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets, or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

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.

3.4.2 Solder dip (retinning) leads. Only the manufacturer or his authorized MIL-R-55182 category B or category C distributor who has previously been approved may solder dip/retin the leads of product supplied to this specification provided the solder dip/retin process has been approved by the qualifying activity.

3.4.3 Qualifying activity approval. Approval of the solder dip/retin process will be based on one of the following options:

- a. When the original lead finish qualified was hot solder dip lead finish 52 of MIL-STD-1276 (NOTE: The 200 microinch maximum thickness is not applicable). The manufacturer shall use the same solder dip process for retinning as is used in the original manufacture of the product.
- b. When the lead originally qualified was not hot solder dip lead finish 52 of MIL-STD-1276 as prescribed in 3.4.3a, approval for the process to be used for solder dip shall be based on the following test procedure:
 - (1) Thirty samples of any resistance value for each style and lead finish are subjected to the manufacturing's solder dip process. Following the solder dip process, the resistors are subjected to the dc resistance test and other group A electricals. No defects are allowed.
 - (2) Ten of the 30 samples are then subjected to the solderability test. No defects are allowed.
 - (3) The remaining 20 samples are subjected to the resistance to solder heat test followed by the moisture resistance test (or hermetic seal test if the device is hermetically sealed). No defects are allowed. (NOTE: Solder dip of gold-plated leads is not allowed).

3.4.4 Solder dip/retinning options. The manufacturer may solder dip/retin as follows.

- a. After the group A tests: Following the solder dip/retinning process, the electrical measurements required in group A, subgroup 1 shall be repeated on the lot. The group A, subgroup 1 lot rejection criteria shall be used. Following this test, the manufacturer shall submit the lot to the group A solderability test as specified in 4.6.14.
- b. As a corrective action, if the lot fails the group A solderability test.

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.

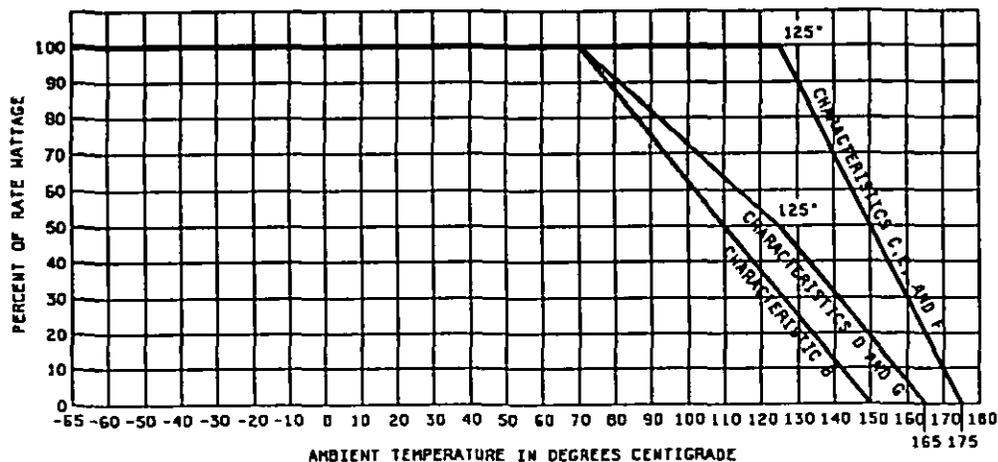
In no case shall the rated dc or rms continuous working voltage be greater than the applicable maximum value (see 3.1 and table 1).

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, a 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 1.76×10^{-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 combination thereof.

3.9 Thermal shock. 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 $\pm(0.5\% + 0.05 \text{ ohm})$ for characteristics B and D, and $\pm(0.25\% + 0.05 \text{ ohm})$ 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 $25^\circ\text{C} \pm 5^\circ\text{C}$, shall not exceed $\pm(0.5\% + 0.05 \text{ ohm})$ for characteristics B and D, and $\pm(0.25\% + 0.05 \text{ ohm})$ 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 1).

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 $\pm(0.5\% + 0.05 \text{ ohm})$ for characteristics B and D, and $\pm(0.25\% + 0.05 \text{ ohm})$ 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 $\pm(0.2\% + 0.05 \text{ ohm})$. 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 $\pm(0.5\% + 0.05 \text{ ohm})$ for characteristics B and D, and $\pm(0.25\% + 0.05 \text{ ohm})$ 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 $\pm(0.5\% + 0.05 \text{ ohm})$ for characteristics B and D, and $\pm(0.1\% + 0.05 \text{ ohm})$ 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 the 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 $\pm(1.0\% + 0.05 \text{ ohm})$ for characteristics B and D, and $\pm(0.5\% + 0.05 \text{ ohm})$ for characteristic 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 (specified pulse). 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 $\pm(0.5\% + 0.05 \text{ ohm})$ for characteristics B and D, and $\pm(0.25\% + 0.05 \text{ ohm})$ for characteristics C, E, F, and G. There shall be no electrical discontinuity during 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 $\pm(0.5\% + 0.05 \text{ ohm})$ for characteristics B and D, and $\pm(0.25\% + 0.05 \text{ ohm})$ 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 "JAN" marking and 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
1003FJ

If lack of space on styles RN50 and RN55 require it, marking may consist of the resistance value, tolerance, and "JAN" marking as shown in the following example.

1003
FJ

If this method is used, the complete marking shall be marked on the package. Marking on the units shall remain legible at the end of all tests.

3.22.1 JAN and J marking. The United States Government has adopted, and is exercising legitimate control over the certification marks "JAN" and "J", respectively, to indicate electrical equipment, namely, resistors, capacitors, electron tubes and the like, procured by, or manufactured for use by, the Government in accordance with standard government specifications. Accordingly, resistors procured to, and meeting all of the criteria specified herein and in applicable detail specification shall bear the certification mark "JAN", except that resistors too small to bear the certification mark "JAN" shall bear the letter "J". The "JAN" or "J" shall be placed immediately before the type number except that if such location would place a hardship on the manufacturer in connection with such marking, the "JAN" or "J" may be located on the first line above or below the type designation. Resistors furnished under contract or orders which either permit or require deviation from the conditions or requirements specified herein and in applicable detail specifications shall not bear "JAN" or "J". In the event a resistor sample fails to meet the requirements of this specification and applicable detail specification, the manufacturer shall remove the "JAN" or the "J" from the sample tested and also from all resistors represented by sample. The United States Government has obtained Certificate of Registration No. 504,860 for the Certification mark "JAN" or "J".

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 any 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.

3.24 Resistance to solvents. When resistors are tested as specified in 4.6.17, there shall be evidence of mechanical damage and the marking shall remain legible.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.1.1 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.

4.1.1.2 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 inspections 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 thermal shock tests. Precautions shall also be taken to prevent damage by heat when soldering leads to terminals.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.2) on sample units produced with equipment and procedures normally used in production.

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 routing. 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.

4.4.3 Defectives. Defectives in excess of those allowed in table X shall 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 and B. Delivery of shipment shall not be delayed pending completion of group B testing.

TABLE V. Qualification inspection.

Inspection	Requirements paragraph	Method paragraph	Number of defectives allowed ^{1/}
<u>Group I - all sample units</u>			
Visual and mechanical inspection ^{2/}	3.1, 3.3 to 3.4.1 inclusive and 3.22 to 3.23.1 inclusive	4.6.1	0
DC resistance ^{3/}	3.7	4.6.2	0
Seal (as applicable) ^{3/}	3.8	4.6.3	
<u>Group II - 10 sample units</u>			
Thermal shock ^{3/}	3.9	4.6.4	1
Low-temperature operation	3.10	4.6.5	
Short-time overload ^{3/}	3.11	4.6.6	
Terminal strength	3.12	4.6.7	
Seal (as applicable) ^{3/}	3.8	4.6.3	
<u>Group III - 10 sample units</u>			
Dielectric withstanding voltage	3.13	4.6.8	1
Insulation resistance	3.14	4.6.9	
Thermal shock	3.9	4.6.4	
Resistance to soldering heat	3.15	4.6.10	
Moisture resistance	3.16	4.6.11	
			2
<u>Group IV - 10 sample units</u>			
Resistance-temperature characteristic	3.17	4.6.12	1
Life	3.18	4.6.13	
Seal (as applicable) ^{3/}	3.8	4.6.3	
<u>Group V - 10 sample units</u>			
Solderability	3.19	4.6.14	1
Resistance to solvents	3.24	4.6.17	
Shock (specified pulse)	3.20	4.6.15	
Vibration, high frequency	3.21	4.6.16	
Seal (as applicable) ^{3/}	3.8	4.6.3	

^{1/} Failure of a resistor in one or more tests of a group shall be charged as a single defective.

^{2/} Marking shall be considered defective only if the marking is illegible.

^{3/} Nondestructive tests.

4.5.1.1 Inspection lot. An inspection lot, as far as practical, 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.

4.5.1.3 Group A inspection. Group A inspection shall consist of the examination and test 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.

4.5.1.3.1.1 Subgroup 1. A sample of parts from each inspection lot shall be randomly selected in accordance with table VIa. If one or more defects are found, the lot shall be rescreened and defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected in accordance with table VIa. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification. Resistance values in the samples shall be representative, and where possible, in proportion to the resistors in the inspection lot.

4.5.1.3.1.2 Subgroup 2. A sample of parts from each inspection lot shall be randomly selected in accordance with table VIa. If one or more defects are found, the lot shall be rescreened and defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected in accordance with table VIa. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

4.5.1.3.1.3 Subgroup 3 (solderability).

4.5.1.3.1.3.1 Sampling plan. Thirteen samples shall be selected randomly from each inspection lot and subjected to the subgroup 3 solderability test. If there are one or more defects, the lot shall be considered to have failed.

4.5.1.3.1.3.2 Rejected lots. In the event of one or more defects, the inspection lot is rejected. The manufacturer may use one of the following options to rework the lot:

- a. Each production lot that was used to form the failed inspection lot shall be individually submitted to the solderability test as required in 4.6.14. Production lots that pass the solderability test are available for shipment. Production lots failing the solderability test can be reworked only if submitted to the solder dip procedure in 4.5.1.3.1.3.2b.
- b. The manufacturer submits the failed lot to a 100 percent solder dip using an approved solder dip process in accordance with 3.4.2. Following the solder dip, the electrical measurements required in group A, subgroup 1 tests shall be repeated on the lot. Thirteen additional samples shall then be selected and subjected to the solderability test with zero defects allowed. If the lot fails this solderability test the lot shall be reworked a second time and retested. If the lot fails the second rework, the lot shall be considered rejected and shall not be furnished against the requirements of this specification.

4.5.1.3.1.3.3 Disposition of samples. The solderability test is considered a destructive test and samples submitted to the solderability test shall not be supplied on the contract.

TABLE VI. Group A inspection.

Inspection	Requirement paragraph	Method paragraph	Number of samples
<u>Subgroup 1</u>			
DC resistance	3.7	4.6.2	4.5.1.3.1.1
<u>Subgroup 2</u>			
Visual and mechanical examination..	3.4, 3.22, 3.23, 3.23.1	4.6.1	4.5.1.3.1.2
Seal.....	3.8	4.6.3	4.5.1.3.1.2
<u>Subgroup 3</u>			
Solderability	3.19	4.6.14	4.5.1.3.1.3

TABLE VIa. Group A inspection.

Lot size	Subgroup 1 sample size	Subgroup 2 sample size
2 to 13	100%	100%
14 to 125	100%	13
126 to 150	125	13
151 to 280	125	20
281 to 500	125	29
501 to 1,200	125	34
1,201 to 3,200	125	42
3,201 to 10,000	192	50
10,001 to 35,000	294	60
35,001 to 150,000	294	74
150,001 to 500,000	345	90
500,001 and over	435	102

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	Number of samples
Resistance-temperature characteristic	3.17	4.6.12	4.5.1.4.1
Dielectric withstanding voltage	3.13	4.6.8	"
Thermal shock	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. A sample of parts shall be randomly selected in accordance with table VIIa, if one or more defects are found, the lot shall be rescreened and defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected in accordance with table VIIa, if one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

TABLE VIIa. Group B sampling plan.

Lot size	Sample size
2 to 5	100%
6 to 50	5
51 to 90	7
91 to 150	11
151 to 280	13
281 to 500	16
501 to 1,200	19
1,201 to 3,200	23
3,201 to 10,000	29
10,001 to 35,000	35
35,001 to 150,000	40
150,001 to 500,000	40
500,001 and over	40

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 purchase order, at the option of the supplier, provided the resistor terminals were not soldered during any of the tests.

4.5.1.5 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.1.5.3), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of these periodic inspections.

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

4.5.1.5.1.1 Sampling plan.

4.5.1.5.1.2 Monthly. Every month, ten 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, ten additional sample units shall be inspected with no defectives allowed, but no more than two defectives allowed for 20 sample units combined.

4.5.1.5.1.3 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 ten sample units of the value closest to the value above the critical value shall be subjected to the inspection of subgroup 2. If none of these resistance values are produced during the quarter, resistors of the highest resistance value produced shall be inspected. One defective will be allowed for each subgroup, but not more than one defective for the two groups combined.

4.5.1.5.1.4 Semiannually. Every 6 months, ten sample units of each style, characteristic, and body enclosure of any resistance value between the critical and highest resistance value shall be inspected. If none of these resistance values are produced during this period, resistors of the highest resistance value produced shall be inspected with one defective allowed.

TABLE VIII. Group C inspection.

Test	Requirement paragraph	Method paragraph	Number of samples	Number of defects allowed
<u>Monthly</u>				
Thermal shock	3.9	4.6.4	10	1
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	3.13	4.6.8	10	1
Insulation resistance	3.14	4.6.9		
Thermal shock	3.9	4.6.4		
Resistance to soldering heat	3.15	4.6.10		
Moisture resistance	3.16	4.6.11		

TABLE VIII. Group C inspection - Continued.

Test	Requirement paragraph	Method paragraph	Number of samples	Number of defects allowed
<u>Subgroup 2</u>				
Resistance-temperature characteristic	3.17	4.6.12	10	1
Life	3.18	4.6.13		
Seal (as applicable)	3.8	4.6.3		
<u>Semiannually</u>				
Shock, specified pulse	3.20	4.6.15	10	1
Vibration, high frequency	3.21	4.6.16		
Seal (as applicable)	3.8	4.6.3		

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

4.5.1.5.3 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall immediately notify the qualifying activity and cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all of the inspection, or the inspection which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstated; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of a failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5.2 Inspection of packaging. The sampling and inspection of the preservation, packaging, and container marking shall be in accordance with the requirements of MIL-R-39032.

4.5.3 Retention of qualification. To retain qualification, the contractor shall forward a report at 6 month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting data. The report shall consist of:

- a. A summary of the results of the tests performed for inspection of product for delivery (groups A and B), indicating as a minimum the number of lots that have failed. The results of tests of all reworked lots shall be identified and accounted for.
- b. A summary of the results of tests performed for qualification verification inspection (group C), including the number and mode of failures. The summary shall include results of all qualification verification inspection tests performed and completed during the 6 month period. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 30 days after the end of each 6 month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor 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 this specification.

In the event no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit his qualified products to testing in accordance with the qualification inspection requirements.

4.5.4 Alternate inspection. For the purpose of retention of qualification and quality conformance inspection (see 4.4, 4.5, and 4.5.3), test data on identical items covered by MIL-R-10509 may be used.

4.6 Methods of examination and tests.

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, 3.4.1 inclusive, and 3.22 to 3.23.1 inclusive).

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

- a. Measuring apparatus: Different types of measuring test equipment (multimeters, bridges, or equivalent) are permitted to be used on the initial and final readings of this test, provided the equipment is the same style, model, or if it can be shown that the performance of the equipment is equivalent or better.
- b. Test voltage: Measurements of resistance shall be made by using the test voltages specified in table IX. The test voltage chosen, whether it is 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 performed at 25°C ±2°C. For all other tests, unless otherwise specified herein, the temperature at which subsequent and final measurements are made in each test shall be within ±2°C of the temperature at which initial measurement was made.

TABLE IX. DC resistance test voltages.

Resistance, nominal	Maximum test voltage	
	1/2, 3/4, 1, and 2 watts	1/20, 1/10, 1/8 and 1/4 watt
<u>Ohms</u>	<u>volts</u>	<u>volts</u>
10 to 98.8 inclusive	1	1
100 to 988 inclusive	3	3
1,000 to 9,880 inclusive	10	3
10,000 to 98,800 inclusive	30	10
0.1 megohm 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 and exceptions 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 Thermal shock (see 3.9). Resistors shall be tested in accordance with method 107 of MIL-STD-202. The following details and exception 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: F.
- 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 4.6.4d, 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 $-65^{\circ}\text{C} \pm 0^{\circ}\text{C} - 5^{\circ}\text{C}$, within a period of not less than 1.5 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 minutes ± 5 minutes, -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 $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ 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 minutes ± 15 minutes, -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. 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 placed in a conductive material which will conform to the resistor surface so that between 90 and 100 percent of the outer periphery is contacted. The conductive material shall be centered on the resistor body. Care should be taken that any part of the resistor lead is as far away from the conductive material as possible (see figure 2).
- b. Initial measurement: DC resistance shall be measured as specified in 4.6.2.
- c. Magnitude of test voltage: Sine wave test potential of 900 volts rms, except that for styles RN50, RN55, and RN60, the potential shall be 450 volts rms.
- d. Nature of potential: An ac supply at commercial line frequency (not more than 100 hertz (Hz)) and waveform.
- e. Rate of application of test voltage: 100 volts per second.
- f. Duration of application of test voltage: 1 minute.
- 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.
- i. Examination after test: Resistors shall be examined for evidence of flashover, mechanical damage, arcing, and insulation breakdown.

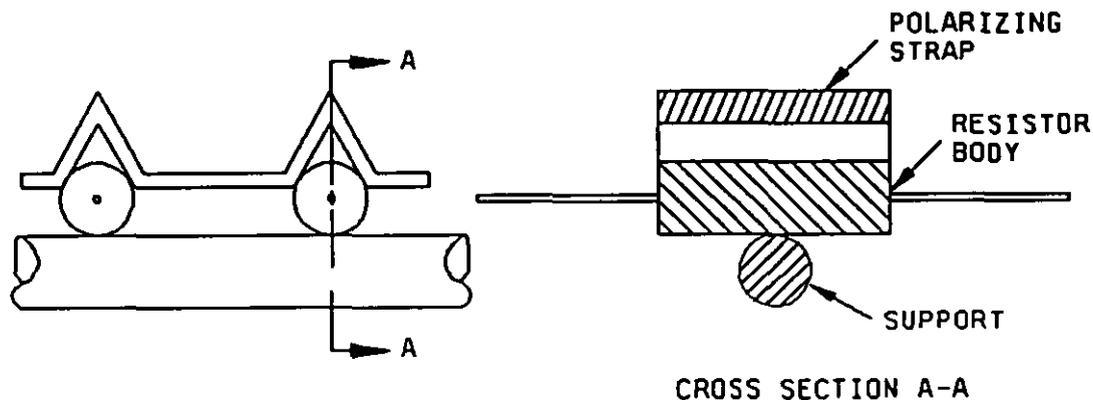


FIGURE 2. Mounting straps for all styles, except style RN80.

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 4.6.8.1a.
- b. Initial measurement: DC resistance shall be measured as specified in 4.6.2.
- c. Test condition: B.
- d. Test voltage during subjection to reduced pressure: 450 volts rms for all resistors except for styles RN50, RN55, and RN60 which shall have 200 volts applied, respectively.
- e. Nature of potential: As specified in 4.6.8.1d.
- f. Duration of test: 1 minute.
- g. Points of application of test voltage: As specified in 4.6.8.1g.
- 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 4.6.8.1a.
- b. Test condition letter: A or B, whichever is practical, except that test condition A only shall be used for style RN50.
- c. Points of measurements: 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 and exceptions 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: 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 3. The strap shall be made from corrosion-resistant metal and shall be kept in contact with the resistor body by supporting the body as indicated in figure 3, with a nonconducting, noncorrosive support whose width is less than that of the resistor body and which will not act as a moisture trap. The mounting straps may be individual for each resistor or continuous for all resistors.

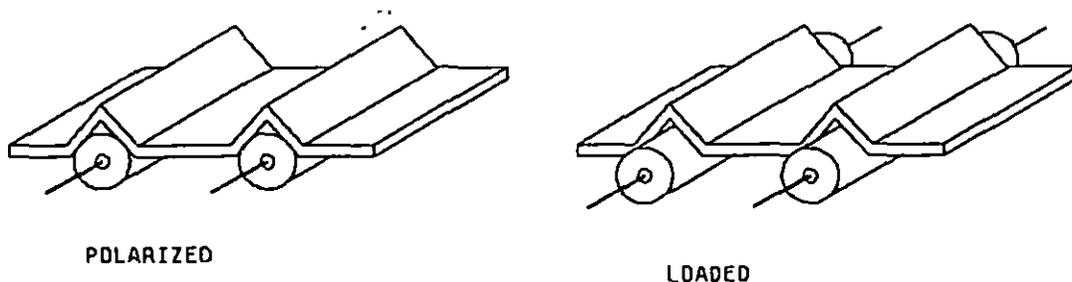


FIGURE 3. Mounting straps for style RN80.

- 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: The resistance value selected shall be divided equally as possible for polarization and load.
- (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. 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 do not have the polarizing strap specified in 4.6.11a.
- d. Subcycle 7b shall not be applicable. Step 7a shall be performed during any five of the first nine cycles only. All polarization straps shall be removed to perform steps 7a and shall then be replaced prior to starting the next cycle.
- e. Final measurements: Upon completion of step 6 of the final cycle, the resistors shall be held at the high humid conditions and at a temperature of $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for a period of 1.5 to 3.5 hours. The same straps used for polarizing the resistors may also be used for the dielectric withstanding voltage test and insulation resistance tests. Resistors shall be removed from the chamber and within 0.5 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 circulation air during the tests.
- f. Examination after test: Resistors shall be examined for evidence of mechanical damage.
- 4.6.12 Resistance-temperature characteristics (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°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 (°C)	
	Qualification inspection and group C acceptance inspection	Group B acceptance inspection ^{1/}
1	Room temperature ^{2/}	Room temperature ^{2/}
2	-15 ±3	-55 ±3
3	-55 ±3	Room temperature ^{2/}
4	Room temperature ^{2/}	150 ±3 ^{3/}
5	65 ±3	165 ±3 ^{4/}
6	150 ±3 ^{3/}	175 ±3 ^{5/}
7	165 ±3 ^{4/}	
8	175 ±3 ^{5/}	

^{1/} At the option of the manufacturer, the reverse sequence may be as follows:

1. Room temperature ^{2/}
2. 175 ±3 ^{5/}
3. 165 ±3 ^{4/}
4. 150 ±3 ^{3/}
5. Room temperature ^{2/}
6. -55 ±3

^{2/} This temperature shall be considered the reference temperature for each of the succeeding temperatures.

^{3/} Characteristic B only.

^{4/} Characteristic D and G only.

^{5/} Characteristic 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 light-weight terminals (see figure 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°C ±5°C for characteristics B, D, and G, and 125°C ±5°C for characteristics C, E, and F.
- c. Initial measurements: Measurements may be made inside or outside the chamber.
 - (1) Inside the chamber: When measurements are to be made inside the chamber, the initial dc resistance shall be measured after mounting at the applicable test temperature, after stabilization, and within 8 hours of exposure of the resistors to the test temperature. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same condition.
 - (2) Outside the chamber: When measurements are to be made outside the chamber, initial dc resistance shall be measured after mounting at the room temperature. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same condition.
- 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 250 +72 -24, 500 +72 -24, and 1,000 +72 -24 hours have elapsed.

g. Examination after test: Resistors shall be examined for evidence of mechanical damage.

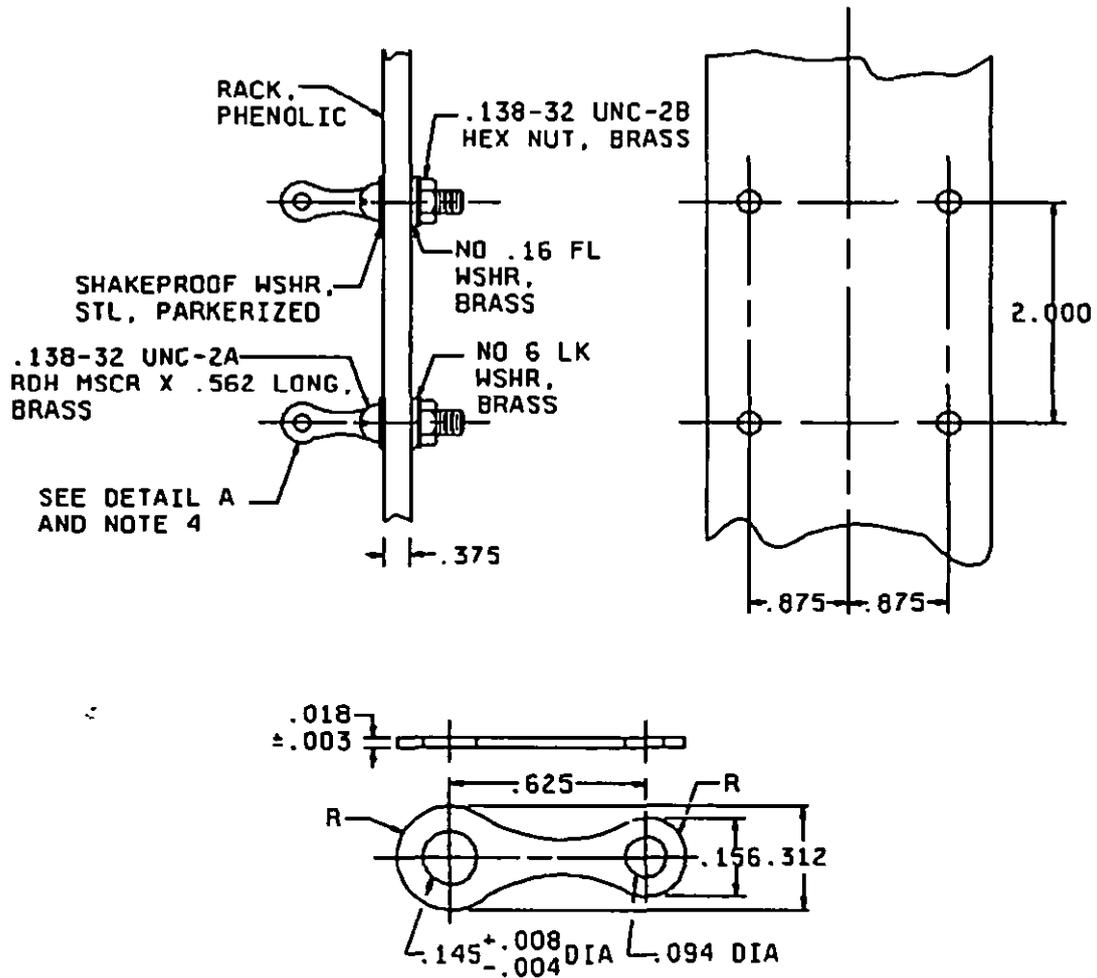
4.6.14 Solderability (see 3.19). Resistors shall be tested in accordance with method 208 of MIL-STD-202. The following detail shall apply: Both terminal leads of each resistor shall be immersed to within 0.062 inch of the resistor body.

4.6.15 Shock, specified pulse (see 3.20). Resistors shall be tested in accordance with method 213 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 greater 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: I.
- d. Number and direction of applied shocks: The resistors shall be subjected to a total of ten 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 (ms) or greater duration.
- f. Measurement after shock: DC resistance shall be measured as specified in 4.6.2.
- g. Examination after 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. 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: 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 ms or greater duration.
- f. Measurement after vibration: DC resistance shall be measured as specified in 4.6.2.
- g. Examination after test: Resistors shall be examined for evidence of mechanical and electrical damage.



Inches	mm	Inches	mm	Inches	mm
.003	0.08	.138	3.50	.502	14.27
.004	0.10	.145	3.68	.625	15.88
.008	0.20	.156	3.96	.875	22.23
.018	0.46	.312	7.92	2.000	50.80
.094	2.39	.375	9.53		

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance shall be ±.015 inch (0.38 mm).
4. Solder lug, tinned brass, shall be in accordance with catalog number 2441; Cinch Manufacturing Corporation, Chicago, IL, or equal.

FIGURE 4. Suggested mounting-lug arrangement for life test.

4.6.17 Resistance to solvents (see 3.24). Resistors shall be tested in accordance with method 215 of MIL-STD-202. The following details shall apply.

- a. The marked portion of the resistor body shall be brushed.
- b. The number of sample units shall be as specified in tables V and VIII as applicable.
- c. Resistors shall be examined for mechanical damage and legibility of markings.

5. PACKAGING.

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-R-39032.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Ordering data. Procurement documents should specify the following:

- a. Title, number, and date of the specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).
- c. Title, number, and date of the applicable detail specification, and the complete type designation (see 1.2.1, 2.1, and 3.1).
- d. Levels of packaging and applicable marking (see section 5).
- e. Lead length: Specify 1.000 inch $+0.625$ inch, -0.000 inch for tape and reel packaging. If not specified, the lead length shall be in accordance with the appropriate detail specification.

6.2 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening bids, qualified for inclusion in the applicable qualified products list (QPL) whether or not such products have actually been so listed by that date. The attention of the manufacturers 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 the US Army Research Laboratory; however, information pertaining to qualification of products may be obtained from Defense Electronics Supply Center (DESC-ELS), 1507 Wilmington Pike, Dayton, OH 45444-5764.

6.3 Selection and use information. Equipment designers should refer to MIL-STD-199, "Resistors, Selection and Use of," for a selection of standard resistor types and values for any new equipment design. All applications and use information concerning these resistors are also provided in MIL-STD-199.

6.4 Key word listing. The key word listing shall be as follows:

Resistance
Axial leads

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

CONCLUDING MATERIAL

Custodians:

Army - ER
Navy - EC
Air Force - 85

Review activities:

Army - AR, AT, AV, ME
Navy - AS, CG, MC, OS
Air Force - 17, 19, 99
DLA - ES

Preparing activity:

Army - ER

Agent:

DLA - ES

(Project 5905-1273)

APPENDIX

PROCEDURE FOR QUALIFICATION INSPECTION

10. SCOPE

10.1 Scope. 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%, 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 samples 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% in each style and characteristic for which qualification is sought, shall be submitted.

TABLE XI. 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	---	---

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 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 XII. Also, qualification of the lower resistance tolerances will qualify the higher resistance tolerances in accordance with table XIII.

APPENDIX

TABLE XII. Extent of approval of characteristics.

Characteristic submitted	Will qualify characteristic
B	B
D	D, B
C	C
E	E, C
G	G, B <u>1/</u>
F	F

1/ When hermetically sealed.TABLE XIII. Extension of approval of resistance tolerances.

Resistance tolerance submitted	Will qualify resistance tolerance
B	B, C, D, F
C	C, D, F
D	D, F
F	F

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-R-10509G	2. DOCUMENT DATE (YYMMDD) 21 April 1994
3. DOCUMENT TITLE RESISTORS, FIXED, FILM (HIGH STABILITY), GENERAL SPECIFICATION FOR		
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)		
5. REASON FOR RECOMMENDATION		
6. SUBMITTER		
a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (include Zip Code)	d. TELEPHONE (include Area Code) (1) Commercial (2) AUTOVON (if applicable)	e. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY		
a. NAME Commander U.S. Army Research Laboratory	b. TELEPHONE (include Area Code) (1) Commercial (2) AUTOVON (908) 544-3441 995-3441	
c. ADDRESS (include Zip Code) ATTN: AMSRL-EP-RD Fort Monmouth, NJ 07703-5601	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	