

INCH-POUND

MIL-R-10509J
 20 September 2007
 SUPERSEDING
 MIL-R-10509H
 10 August 2001

MILITARY SPECIFICATION

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

INACTIVE FOR NEW DESIGN AFTER 21 APRIL 1994.
 FOR NEW DESIGN USE [MIL-PRF-55182](#).

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 that are relatively stable with respect to time under environmental condition.

1.2 Classification.

* 1.2.1 Part or Identifying Number (PIN). PINs to be used for resistors acquired to this specification are created as follows:

RN60	D	1003	F
Style (1.2.1.1)	Characteristic (1.2.1.2)	Resistance (1.2.1.3)	Resistance tolerance (1.2.1.4)

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](#).

Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center, Columbus, ATTN: DSCC-VAT, Post Office Box 3990, Columbus, Ohio 43218-3990, or emailed to resistor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

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TABLE I. Characteristic.

Maximum resistance temperature characteristic (see 3.17)	C	D	E	F	G 1/
— Percent/°C →	±0.005	+0.02, -0.05	±0.0025	±0.005	+0.02, -0.05
— ppm/°C →	±50	+200, -500	±25	±50	+200, -500
Maximum ambient temperature at rated wattage (see figure 1)	125°C	70°C	125°C	125°C	70°C
Maximum ambient temperature at zero wattage derating (see figure 1)	175°C	165°C	175°C	175°C	165°C
Power rating in watts and maximum dc or rms voltage.					
RN50	0.05 W, 200 V	2/	0.05 W, 200 V	2/	2/
RN55	0.1 W, 200 V	0.125 W, 200 V	0.1 W, 200 V	2/	0.1 W, 200 V
RN60	0.125 W, 250 V	0.25 W, 300 V	0.125 W, 250 V	2/	0.125 W, 250 V
RN65	0.25 W, 300 V	0.5 W, 350 V	0.25 W, 300 V	0.5 W, 350 V	0.25 W, 300 V
RN70	0.5 W, 350 V	0.75 W, 500 V 3/	0.5 W, 350 V	0.75 W, 500 V 3/	0.5 W, 350 V
Maximum percent change in resistance ±:					
Thermal shock (see 3.9)	0.25	0.5	0.25	0.25	0.25
Low temperature operation (see 3.10)	0.25	0.5	0.25	0.25	0.25
Short time overload (see 3.11)	0.25	0.5	0.25	0.25	0.25
Dielectric withstanding voltage (see 3.13)	0.25	0.5	0.25	0.25	0.25
Resistance to soldering heat (see 3.15)	0.1	0.5	0.1	0.1	0.1
Moisture resistance (see 3.16)	0.5	1.5	0.5	0.5	0.5
Life (see 3.18)	0.5	1.0	0.5	0.5	0.5
Shock, specified pulse (see 3.20)	0.25	0.5	0.25	0.25	0.25
Vibration, high frequency (see 3.21)	0.25	0.5	0.25	0.25	0.25
Resistance tolerances ± percent (see table IV)	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 RN70 of MIL-R-10509D.

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" is 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 are as specified (see 3.1). The standard values for every decade follows the sequence demonstrated for the "0 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 are 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 the 192 value series decade specified for resistance tolerances C and D. Resistance values not listed in table III for tolerance F and D are considered as not conforming to this specification.

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TABLE II. Designation of resistance values.

Designation	Resistance
1R00 to 98R8	1 to 98.8 ohms inclusive
1000 to 9880	100 to 988 ohms inclusive
1001 to 9881	1kilohm to 9.88 kilohms inclusive
1002 to 9882	10 kilohms to 98.8 kilohms inclusive
1003 to 9883	100 kilohms to 988 kilohms inclusive
1004 to 9884	1 megohm to 9.88 megohms inclusive

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

B .1	C .25	D .5	F 1.0	B .1	C .25	D .5	F 1.0	B .1	C .25	D .5	F 1.0	B .1	C .25	D .5	F 1.0	B .1	C .25	D .5	F 1.0
	10.0		10.0		15.8		15.8		24.9		24.9		39.7		63.4				63.4
	10.1				16.0				25.2				40.2		64.2				
	10.2		10.2		16.2		16.2		25.5		25.5		40.7		64.9				64.9
	10.4				16.4				25.8				41.2		65.7				
	10.5		10.5		16.5		16.5		26.1		26.1		41.7		66.5				66.5
	10.6				16.7				26.4				42.2		67.3				
	10.7		10.7		16.9		16.9		26.7		26.7		42.7		68.1				68.1
	10.9				17.2				27.1				43.2		69.0				
	11.0		11.0		17.4		17.4		27.4		27.4		43.7		69.8				69.8
	11.1				17.6				27.7				44.2		70.6				
	11.3		11.3		17.8		17.8		28.0		28.0		44.8		71.5				71.5
	11.4				18.0				28.4				45.3		72.3				
	11.5		11.5		18.2		18.2		28.7		28.7		45.9		73.2				73.2
	11.7				18.4				29.1				46.4		74.1				
	11.8		11.8		18.7		18.7		29.4		29.4		47.0		75.0				75.0
	12.0				18.9				29.8				47.5		75.9				
	12.1		12.1		19.1		19.1		30.1		30.1		48.1		76.8				76.8
	12.3				19.3				30.5				48.7		77.7				
	12.4		12.4		19.6		19.6		30.9		30.9		49.3		78.7				78.7
	12.6				19.8				31.2				49.9		79.6				
	12.7		12.7		20.0		20.0		31.6		31.6		50.5		80.6				80.6
	12.9				20.3				32.0				51.1		81.6				
	13.0		13.0		20.5		20.5		32.4		32.4		51.7		82.5				82.5
	13.2				20.8				32.8				52.3		93.5				
	13.3		13.3		21.0		21.0		33.2		33.2		53.0		84.5				84.5
	13.5				21.3				33.6				53.6		85.6				
	13.7		13.7		21.5		21.5		34.0		34.0		54.2		86.6				86.6
	13.8				21.8				34.4				54.9		87.6				
	14.0		14.0		22.1		22.1		34.8		34.8		55.6		88.7				88.7
	14.2				22.3				35.2				56.2		89.8				
	14.3		14.3		22.6		22.6		35.7		35.7		56.9		90.9				90.9
	14.5				22.9				36.1				57.6		92.0				
	14.7		14.7		23.2		23.2		36.5		36.5		58.3		93.1				93.1
	14.9				23.4				37.0				59.0		94.2				
	15.0		15.0		23.7		23.7		37.4		37.4		59.7		95.3				95.3
	15.2				24.0				37.9				60.4		96.5				
	15.4		15.4		24.3		24.3		38.3		38.3		61.2		97.6				97.6
	15.6				24.6				36.8				61.9		98.8				
									39.2		39.2		62.6						

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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)
B <u>1/</u>	0.10
C <u>1/</u>	0.25
D <u>1/</u>	0.50
F	1.00

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

2. APPLICABLE DOCUMENTS

- * 2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

- * 2.2.1 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

- [MIL-R-10509/1](#) - Resistors, Fixed, Film (High Stability), Style RN60.
INACTIVE FOR NEW DESIGN.
- [MIL-R-10509/2](#) - Resistors, Fixed, Film (High Stability), Style RN65.
INACTIVE FOR NEW DESIGN.
- [MIL-R-10509/3](#) - Resistors, Fixed, Film (High Stability), Style RN70.
INACTIVE FOR NEW DESIGN.
- [MIL-R-10509/7](#) - Resistors, Fixed, Film (High Stability), Style RN55.
INACTIVE FOR NEW DESIGN.
- [MIL-R-10509/8](#) - Resistors, Fixed, Film (High Stability), Style RN50.
INACTIVE FOR NEW DESIGN.
- [MIL-PRF-55182](#) - Resistors, Fixed, Film, Nonestablished Reliability, Established Reliability,
and Space Level, General Specification For.

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DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-202](#) - Electronics and Electrical Components Parts.

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil> or from the Standard Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia PA 19111-5094.)

- * 2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are those listed in the solicitation or contract.

INTERNATIONAL ORGANIZATION for STANDARDS (ISO)

[ISO 10012-1](#) - Equipment, Quality Assurance Requirements for Measuring - Part 1, Meteorological Confirmation System for Measuring Equipment.

- * (Copies of this document are available from <http://www.iso.org/> or from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCSL)

[NCSL Z540.1](#) - Calibration Laboratory and Measuring and Test Equipment, General Requirements for.

(Copies of this document are available from <http://www.ncsli.org/> or from the National Conference of Standards Laboratories (NCSL) International, 1800 30th Street, Suite 305, Boulder, CO 80301-1026.)

- * 2.4 Order of precedence. In the event of a conflict between the text of this document, and the references cited herein (except for related specification sheets); the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

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 6.3).

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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.

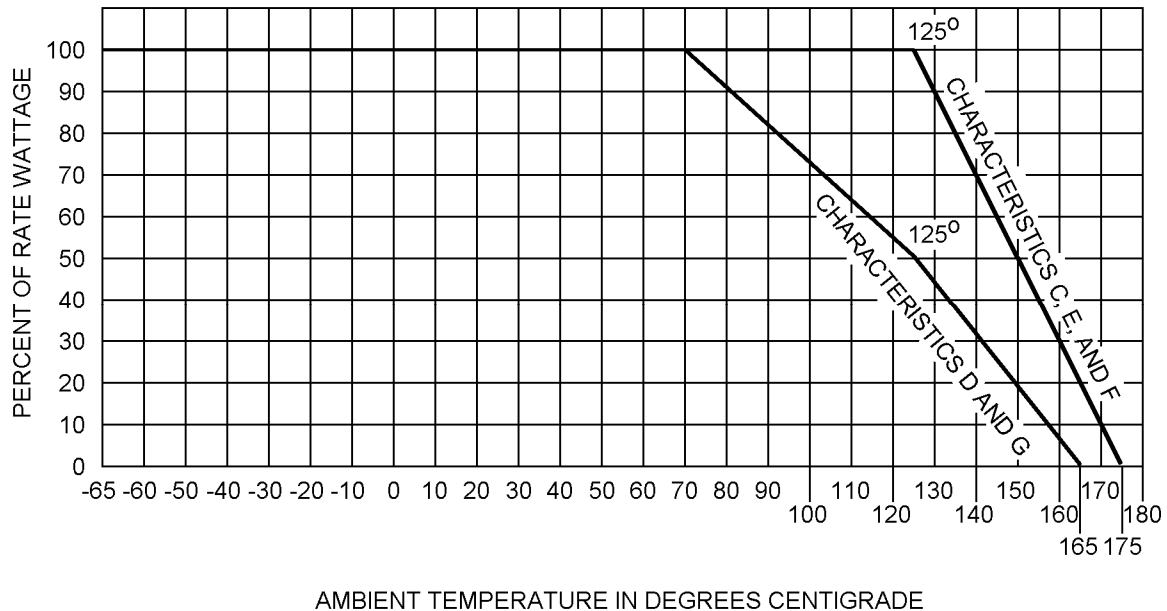
3.4 Interface and physical dimensions. The resistors shall meet the interface and physical dimensions specified (see 3.1).

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

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

* 3.4.3 Pure tin. The use of pure tin, as an underplate or final finish is prohibited both internally and externally. Tin content of resistors components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see 6.4).

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 characteristic D, and characteristic G, and 125°C for characteristic C, characteristic E, and characteristic 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.



NOTE: These curves indicate the percentage of nominal wattage to be applied at temperature 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.

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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 waveform corresponding to the power rating, as determined from the following formula:

$$E = \sqrt{PR}$$

Where: E = rated dc or rms continuous working voltage.
 P = power rating (see 3.1).
 R = nominal resistance.

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

3.7 DC resistance. When resistors are tested as specified in 4.7.2, the dc resistance shall be within the specified tolerance of the nominal resistance (see 1.2.1.4).

* 3.7.1 Resistance value deviations. All maximum deviations as specified in this section are to be considered absolute limits with the exception of the contact resistance adjustments.

3.8 Seal (applicable only to hermetically sealed resistors). When resistors are tested as specified in 4.7.3, 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 4.7.3, 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 a combination thereof.

3.9 Thermal shock. When resistors are tested as specified in 4.7.4, there shall be no evidence of mechanical damage. The change in resistance shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$ for characteristic D, and $\pm(0.25 \text{ percent} + 0.05 \text{ ohm})$ for characteristic C, characteristic E, characteristic F, and characteristic G.

3.10 Low temperature operation. When resistors are tested as specified in 4.7.5, 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 $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$ for characteristic D, and $\pm(0.25 \text{ percent} + 0.05 \text{ ohm})$ for characteristic C, characteristic E, characteristic F, and characteristic G.

3.11 Short time overload. When resistors are tested as specified in 4.7.6, there shall be no evidence of arcing, burning, or charring. The change in resistance shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$ for characteristic D, and $\pm(0.25 \text{ percent} + 0.05 \text{ ohm})$ for characteristic C, characteristic E, characteristic F, and characteristic G.

3.12 Terminal strength. When resistors are tested as specified in 4.7.7, there shall be no evidence of breaking or loosening of terminals from form, or other mechanical damage. The change in resistance shall not exceed $\pm(0.2 \text{ percent} + 0.05 \text{ ohm})$. 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 4.7.8, there shall be no evidence of flashover, mechanical damage, arcing, or insulation breakdown. The change in resistance shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$ for characteristic D, and $\pm(0.25 \text{ percent} + 0.05 \text{ ohm})$ for characteristic C, characteristic E, characteristic F, and characteristic G.

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3.14 Insulation resistance. When resistors are tested as specified in 4.7.9, the insulation resistance shall not be less than 10,000 megohms.

3.15 Resistance to solder heat. When resistors are tested as specified in 4.7.10, there shall be no evidence of mechanical damage. The change in resistance shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$ for characteristic D, and $\pm(0.1 \text{ percent} + 0.05 \text{ ohm})$ for characteristic C, characteristic E, characteristic F, and characteristic G.

3.16 Moisture resistance. When resistors are tested as specified in 4.7.11, there shall be no evidence of mechanical damage. The change in resistance between the initial and the final measurements shall not exceed 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 4.7.12, the resistance temperature characteristic, at each of the temperature specified in 4.7.12b, 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 4.7.13, 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 $\pm(1.0 \text{ percent} + 0.05 \text{ ohm})$ for characteristic D, and $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$ for characteristic C, characteristic E, characteristic F, and characteristic G.

3.19 Solderability. When resistors are tested as specified in 4.7.14, 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 this area, as compared to the total area.

3.20 Shock (specified pulse). When resistors are tested as specified in 4.7.15, there shall be no evidence of mechanical or electrical damage. The change in resistance shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$ for characteristic D, and $\pm(0.25 \text{ percent} + 0.05 \text{ ohm})$ for characteristic C, characteristic E, characteristic F, and characteristic G. There shall be no electrical discontinuity during the test.

3.21 Vibration, high frequency. When resistors are tested as specified in 4.7.16, there shall be no evidence of mechanical or electrical damage. The change in resistance shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$ for characteristic D, and $\pm(0.25 \text{ percent} + 0.05 \text{ ohm})$ for characteristic C, characteristic E, characteristic F, and characteristic G. There shall be no electrical discontinuity during the test.

3.22 Resistance to solvents. When resistors are tested as specified in 4.7.17, there shall be evidence of mechanical damage and the marking shall remain legible.

3.23 Soldering. Electrical connections shall be mechanically secure before and electrically continuous after soldering.

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3.24 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 the 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.

3.24.1 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 that items so marked or identified are manufactured to, and meet all the requirements of specifications. Accordingly, items acquired to, and meeting all of the criteria specified herein and in applicable specifications shall bear the certification mark “JAN” except that items too small to bear the certification mark “JAN” shall bear the letter “J”. The “JAN” or “J” shall be placed immediately before the part 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 part number. Items furnished under contracts or orders which either permit or require deviation from the conditions or requirements specified herein or in applicable specifications shall not bear “JAN” or “J”. In the event an item fails to meet the requirements of this specification and the applicable associated specifications, the manufacturer shall remove completely the military part number and the “JAN” or “J” from the sample tested and also from all items represented by the sample. The “JAN” or “J” certification mark shall not be used on products acquired to contractor drawings or specifications. The United States Government has obtained Certificate of Registration Number 504,860 for the certification mark “JAN” and Registration Number 1,586,261 for the certification mark “J”.

3.25 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the materials meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle cost.

3.26 Workmanship. Resistors shall be processed in such a manner as to be uniform in quality and shall be free from any defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspection.

- a. Qualification inspection (see 4.4).
- b. Conformance inspection (see 4.6).

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4.2 Test equipment and inspection facilities. The manufacturer shall establish and maintain a calibration system in accordance with [NCSL Z540-1](#), [ISO 10012-1](#), or equivalent system as approved by the qualifying activity.

4.3 Inspection conditions and precautions.

4.3.1 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in 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 [6.3](#)) 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 A](#) of this specification. The sample shall be from a production run and shall be produced with equipment and produces 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 samples 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 V](#) shall be cause for refusal to grant qualification.

4.5 Retention of qualification. Every 6 months, the manufacturer shall verify the retention of qualification to the qualifying activity. In addition, the manufacturer shall immediately notify the qualifying activity whenever the group B inspection results indicate failure of the qualified product to meet the requirements of this specification. Verification shall be based on meeting the following requirements:

- a. The manufacturer has not modified the design of the item.
- b. The specification requirements for the item have not been amended so far as to affect the character of the item.
- c. Lot rejection for group A inspection does not exceed the group A sampling.
- d. The requirements for group B inspection are met.

When group B requirements were not met and the manufacturer has taken corrective action satisfactory to the Government, group B inspection retesting shall be instituted.

4.5.1 Alternate inspection. For the purpose of retention of qualification and conformance inspection, (see [4.4](#) and [4.6](#)) test results on identical items covered by [MIL-PRF-55182](#) may be used.

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TABLE V. Qualification inspection.

Inspection	Requirements paragraph	Method paragraph	Number of samples	Number of defects allowed <u>1/</u>
<u>Group I</u> Visual and mechanical inspection <u>2/</u> DC resistance Seal (as applicable)	3.1, 3.3 to 3.4.1 incl. and 3.24 to 3.26 incl. 3.7 3.8	4.7.1 4.7.2 4.7.3	100 percent	0
<u>Group II</u> Thermal shock Low temperature operation Short time overload Terminal strength Seal (as applicable)	3.9 3.10 3.11 3.12 3.8	4.7.4 4.7.5 4.7.6 4.7.7 4.7.3	10	1
<u>Group III</u> Dielectric withstanding voltage Insulation resistance Thermal shock Resistance to soldering heat Moisture resistance	3.13 3.14 3.9 3.15 3.16	4.7.8 4.7.9 4.7.4 4.7.10 4.7.11	10	
<u>Group IV</u> Resistance temperature characteristic Life Seal (as applicable)	3.17 3.18 3.8	4.7.12 4.7.13 4.7.3	10	
<u>Group V</u> Solderability Shock (specified pulse) Vibration, high frequency Resistance to solvents Seal (as applicable)	3.19 3.20 3.21 3.22 3.8	4.7.14 4.7.15 4.7.16 4.7.17 4.7.3	10	

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.

4.6 Conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A and group B inspections.

4.6.2 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.

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4.6.3 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.

TABLE VI. Group A inspection.

Inspection	Requirement paragraph	Method paragraph	Number of samples
<u>Subgroup 1</u> DC resistance	3.7	4.7.2	4.6.3.1.1
<u>Subgroup 2</u> Visual and mechanical inspection Seal	3.4 , 3.24 , 3.26 3.8	4.7.1 4.7.3	4.6.3.1.2
<u>Subgroup 3</u> Solderability	3.19	4.7.14	4.6.3.1.3

4.6.3.1 Sampling plan.

4.6.3.1.1 Subgroup 1. A sample of parts from each inspection lot shall be randomly selected in accordance with [table VII](#). 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 VII](#). 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.

TABLE VII. Group A sampling plan.

Lot size	Subgroup 1 sample size	Subgroup 2 sample size
2 to 13	100 percent	100 percent
14 to 125	100 percent	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

4.6.3.1.2 Subgroup 2. A sample of parts from each inspection lot shall be randomly selected in accordance with [table VII](#). 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 VII](#). If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

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4.6.3.1.3 Subgroup 3 (solderability).

4.6.3.1.3.1 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.

4.6.3.1.3.2 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 4.7.14. 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 4.6.3.1.3.2b.
- 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.

4.6.3.1.3.3 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.

4.6.4 Group B inspection. Group B inspection shall consist of the tests specified in table VIII, 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.

TABLE VIII. Group B inspection. 1/

Inspection	Requirement paragraph	Method paragraph	Number of samples
Resistance temperature characteristic	3.17	4.7.12	
Seal (as applicable)	3.8	4.7.3	4.6.4.1

1/ If the manufacturer can demonstrate that this test has been performed five consecutive times with zeros failures, the frequency of this test(s), with the approval of the qualifying activity, can be performed on an annual basis. If the design, material, construction, or processing of the part is changed, or if there are any qualifying problems or failures the qualifying activity may require resumption of the original test frequency.

4.6.4.1 Sampling plan. A sample of 13 parts shall be randomly selected, 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 13 parts shall be randomly selected, if one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

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4.6.4.2 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.

4.6.5 Inspection of packaging. The sampling and inspection of the preservation, packaging, and container marking shall be in accordance with the requirements of [section 5](#).

4.7 Methods of examinations and tests.

4.7.1 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 [3.24](#) to [3.26](#) inclusive).

4.7.2 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.

*

TABLE IX. DC resistance test voltages.

Resistance, nominal (Ohms)	Maximum test voltage (volts)	
	0.5 Watt	0.05, 0.1, 0.125 and 0.25 Watt
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

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

4.7.3 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 a degreaser, and allowed to dry thoroughly.

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4.7.4 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. Measurements before cycling: DC resistance shall be measured as specified in 4.7.2.
- 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 4.7.2.

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

4.7.5 Low temperature operation (see 3.10).

4.7.5.1 Mounting. Resistors shall be mounted by their terminals so that there is at least 1 inch (2.54 mm) 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.

4.7.5.2 Procedure. Following the final dc resistance measurement specified in 4.7.4d, the resistors mounted as specified in 4.7.5.1, shall be placed in a cold chamber at room temperature. The temperature shall be gradually decreased to $-65^{\circ}\text{C} +0^{\circ}\text{C}$, -5°C , within a period of not less than 1.5 hours. For conformance 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 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 4.7.2. Resistors shall then be examined for evidence of mechanical damage.

4.7.6 Short time overload (see 3.11). DC resistance shall be measured as specified in 4.7.2. 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 circulation other than that created by the heat of the resistors being operated.
- 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 4.7.2. Resistors shall then be examined for evidence of arcing, burning, and charring.

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4.7.7 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 4.7.2.

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

4.7.8 Dielectric withstanding voltage (see 3.13).

4.7.8.1 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).

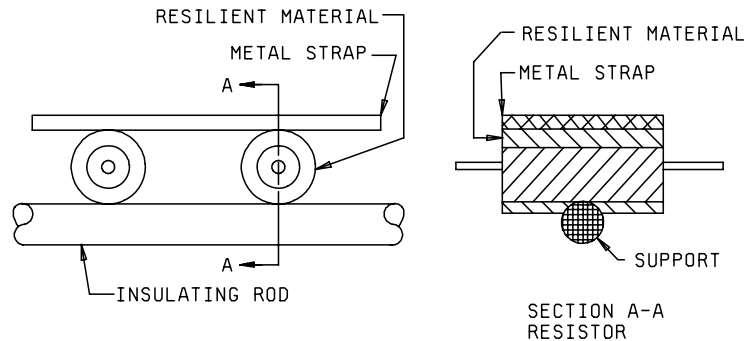


FIGURE 2. Resistor- contacting assembly for dielectric strength.

- b. Initial measurement: DC resistance shall be measured as specified in 4.7.2.
- 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.

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- h. Measurement after test: DC resistance shall be measured as specified in [4.7.2](#).
- i. Examination after test: Resistors shall be examined for evidence of flashover, mechanical damage, arcing, and insulation breakdown.

4.7.8.2 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 [4.7.8.1a](#).
- b. Initial measurement: DC resistance shall be measured as specified in [4.7.2](#).
- 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 [4.7.8.1d](#).
- f. Duration of test: 1 minute.
- g. Points of application of test voltage: As specified in [4.7.8.1g](#).
- h. Measurement after test: DC resistance shall be measured as specified in [4.7.2](#).

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

4.7.9 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 [4.7.8.1a](#).
- 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.

4.7.10 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 [4.7.2](#).
- b. Special preparation of specimen: Sample units shall not have been soldered during any of the previous tests.
- c. Test condition letter: B.
- d. Examination and measurement after test: Resistors shall be visually examined under 10X magnification and dc resistance shall be measured as specified in [4.7.2](#).

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4.7.11 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: Soldering 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 .375 inch (9.53 mm) 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 in 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.

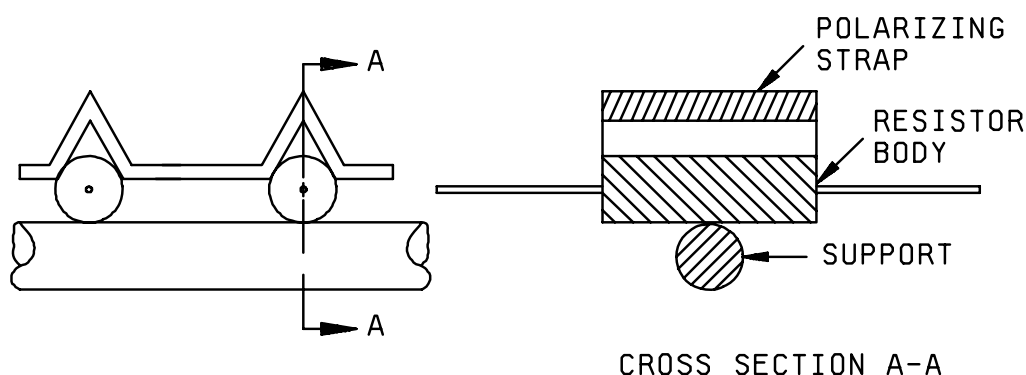


FIGURE 3. Mounting straps for all styles.

- b. Initial measurement: Immediately following the initial drying period, dc resistance shall be measured as specified in 4.7.2.
- 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 styles 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 4.7.11a.
- 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.

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- 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 hours 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 4.7.8.1, 4.7.9, and 4.7.2 respectively. The sample units shall not be subjected to forced circulation air during tests.
- f. Examination after test: Resistors shall be examined for evidence of mechanical damage.

4.7.12 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.

TABLE X. Resistance temperature characteristic.

Sequence	Temperature ($^{\circ}\text{C}$)	
	Qualification inspection	Group B inspection <u>1/</u>
1	Room temperature <u>2/</u>	Room temperature <u>2/</u>
2	-15 ± 3	-55 ± 3
3	-55 ± 3	Room temperature <u>2/</u>
4	Room temperature <u>2/</u>	165 ± 3 <u>3/</u>
5	65 ± 3	175 ± 3 <u>4/</u>
6	165 ± 3 <u>3/</u>	
7	175 ± 3 <u>4/</u>	

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

1. Room temperature 2/.
2. 175 ± 3 4/
3. 165 ± 3 3/
4. Room temperature 2/
5. -55 ± 3

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

3/ Characteristic G only.

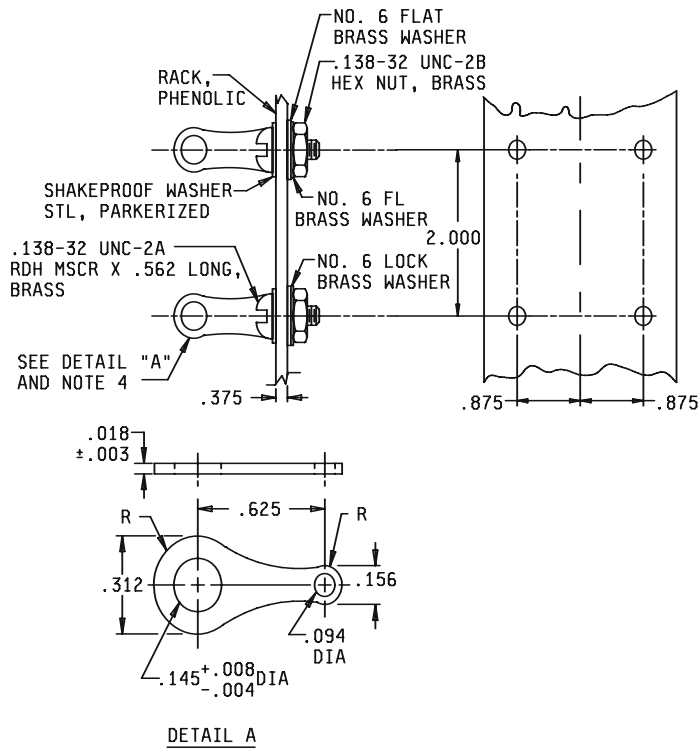
4/ Characteristic C, D, E, and F only.

- 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.

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4.7.13 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 (25.4 mm). 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 circulation of air over the resistors other than that caused by the heat of the resistors.



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 ± 0.015 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.

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- b. Test temperature and tolerance: 70°C ±5°C for characteristics 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, 1.5 hours "on" and 0.5 hour "off", for 1,000 hours, at the applicable test temperature.
- e. Test condition letter: D.
- f. Measurement during test: DC resistance shall be measured at the end of the 0.5 hour "off" periods after 250 hours +72 hours, -24 hours; 500 hours +72 hours, -24 hours; and 1,000 hours +72 hours, -24 hours have elapsed.
- g. Examination after test: Resistors shall be examined for evidence of mechanical damage.

4.7.14 Solderability (see [3.19](#)). Resistors shall be tested in accordance with method 208 of [MIL-STD-202](#). The following detail apply: Both terminal leads of each resistor shall be immersed to within .062 inch (1.57 mm) of the resistor body.

4.7.15 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 .25 inch (6.35 mm) 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 [4.7.2](#).
- 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 parallel to the longitudinal axis of the resistor.

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- 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 [4.7.2](#).
- g. Examination after test: Resistors shall be examined for evidence of mechanical and electrical damage.

4.7.16 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 .25 inch (6.35 mm) 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 [4.7.2](#).
- 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 [4.7.2](#).
- g. Examination after test: Resistors shall be examined for evidence of mechanical and electrical damage.

4.7.17 Resistance to solvents (see [3.22](#)). 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 [table V](#).
- c. Resistors shall be examined for mechanical damage and legibility of markings.

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5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. Resistors covered by this specification are intended for use in electronic equipment, and are used for matching, balancing, adjusting circuit variables in computers, telemetering equipment, and other critical applications. Resistors covered by this specification are unique due to the fact that these devices must be able to operate satisfactorily in military systems under the following demanding conditions: 20 Gs of high frequency vibration, 100 Gs of shock (specified pulse), undergo moisture resistance, and resistance to soldering heat. In addition these military requirements are verified under a qualification system. Commercial components are not designed to withstand these military environmental conditions.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this date of this specification, the applicable associated specification, and the complete PIN.
- * b. If not otherwise specified (see 2.1), the versions of the individual documents referenced will be those in effect on the date of release of the solicitation.
- c. Packaging requirements (see 5.1).
- d. Lead length: Specify 1.000 inch +.625 inch, -.000 inch (25.40 mm + 15.88 mm, -0.00 mm) for tape and reel packaging. If not specified, the lead length shall be in accordance with the appropriate associated specification sheet.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products that are, at the time of award of contract, qualified for inclusion in the applicable QPL whether or not such products have actually been so listed by the date. The attention of the contractors is called to these requirements, 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 purchase orders for the products cover by this specification. The activity responsible for the QPL and, information pertaining to qualification of products may be obtained from the Defense Supply Center, Columbus, (DSCC-VQP) Post Office Box 3990, Columbus, OH 43218-3990.

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- * 6.4 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to [ASTM-B545](#) (Standard Specification for Electrodeposited Coatings of Tin).
- * 6.5 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. [Table XI](#) lists the Environmental Protection Agency (EPA) top seventeen hazardous materials targeted for major usage reduction. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see [section 3](#)).

TABLE XI. EPA top seventeen hazardous materials.

Benzene	Dichloromethane	Tetrachloroethylene
Cadmium and Compounds	Lead and Compounds	Toluene
Carbon Tetrachloride	Mercury and Compounds	1,1,1 – Trichloroethane
Chloroform	Methyl Ethyl Ketone	Trichloroethylene
Chromium and Compounds	Methyl Isobutyl Ketone	Xylenes
Cyanide and Compounds	Nickel and Compounds	

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

Axial leads
 Humidity
 Relatively stable
 Temperature

- * 6.7 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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APPENDIX A

PROCEDURE FOR QUALIFICATION INSPECTION

A.1. SCOPE

A.1.1 Scope. This appendix details the procedure for submission of sample, with test results, for qualification inspection of resistors covered by this specification. The procedure for extending qualification required sample to other resistors covered by this specification is also outlined herein. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

A.2. APPLICABLE DOCUMENTS

- * A.2.1 General. The documents listed in this section are specified in sections 3, 4, and 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, and 5 of this specification, whether or not they are listed.
- * A.2.2 Government documents.
- * A.2.2.1 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-1276](#) - Leads for Electronic Component Parts.

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil> or from the Standard Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia PA 19111-5094.)

- * A.2.3 Order of precedence. In the event of a conflict between the text of this document, and the references cited herein (except for related specification sheets); the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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A.3. SUBMISSION

A.3.1 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 A-I](#), 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 unit, each of the lowest resistance tolerance for which approval is sought, shall be submitted to the inspection of group I 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 A-I. Critical resistance values.

Style	Resistance (megohms)		
	Characteristics 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

A.4. EXTENT OF QUALIFICATION

A.4.1 Extent of qualification. 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 [3.1](#). 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 A-II](#). Also, qualification of the lower resistance tolerances will qualify the higher resistance tolerances in accordance with [table A-III](#).

TABLE A-II. Extent of approval of characteristics.

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

1/ When hermetically sealed.

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TABLE A-III. 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

A.5. SOLDER DIP (RE TINNING) LEADS

A.5.1 Solder dip (retinning) leads. The manufacturer may solder dip/retin the leads of product supplied to this specification provided the solder dip process has been approved by the qualifying activity.

A.5.2 Qualifying activity approval. Approval of the solder dip 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 finish 52 of [MIL-STD-1276](#) as prescribed in [A.5.2a](#), 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 manufacturer'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 allowed.
 - (2) Ten of the 30 samples are then subjected to the solderability test. No defects allowed.
 - (3) The remaining 20 samples are subjected to the resistance to soldering heat test followed by the moisture resistance test. No defects allowed.

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A.5.3 Solder dip reflowing options. The manufacture may solder dip/reflow as follows:

- a. After the 100 percent group A screening tests: Following the solder dip/reflowing process, the electrical measurements required in group A, subgroup 1, 100 percent screening tests shall be repeated on 100 percent of the lot. (NOTE: The manufacturer may solder dip/reflow prior to the 100 percent electrical measurements of the group A, subgroup 1 tests). The percentage defective allowable (PDA) for the electrical measurements, shall be as for the subgroup 1 tests.
- b. As a corrective action, if the lot fails the group A solderability test, the lot may be reflowed no more than two times. The lot after reflowing shall be 100 percent screened for group A electrical requirements (dc resistance) and parts failing (lot not exceeding PDA for group A, subgroup 1, see [4.6.3.1.1](#)) these screens shall not be supplied to his specification, if electrical failures are detected after the second reflowing operation exceeding 1 percent of the lot, the lot shall not be supplied to this specification.
- c. After group A inspection has been completed. Following the solder dip/reflowing process, the electrical measurements required in group A, subgroup 1, 100 percent screening tests shall be repeated on 100 percent of the lot. The PDA for the electrical measurements shall be as for the subgroup 1 tests. Following these tests, the manufacturer shall submit the lot to the group A solderability test as specified in [4.7.14](#).

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Custodians:

Army - CR
Navy - EC
Air Force - 11
DLA - CC

Preparing activity:

DLA - CC

(Project 5905-2006-001)

Review activities:

Army - AR, AT, AV, CR4
Navy - AS, CG, MC, OS
Air Force - 19, 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil>.