INCH-POUND
MIL-PRF-22684F
13 February 2006
SUPERSEDING
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24 September 1999

PERFORMANCE SPECIFICATION

RESISTORS, FIXED, FILM (INSULATED)
GENERAL SPECIFICATION FOR

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 insulated, film, fixed resistors of 2- and 5-percent resistance tolerance. These resistors are capable of full-load operation at an ambient temperature of 70°C and have a resistance-temperature characteristic of ±200 parts per million per degree Celsius (ppm/°C), (see 6.1).

1.2 Classification.

1.2.1 Part or Identifying Number (PIN). Resistors specified herein are identified by the PIN which consists of the basic number, associated specification, and a coded dash number.

M22684/08-	1001
Basic and associated specification number	Coded dash number (see 1.2.1.1)

1.2.1.1 Coded dash number. The coded dash number is a coded value which identifies the resistance value, resistance tolerance, and the terminal (see 3.1).

2. APPLICABLE DOCUMENTS

* 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.

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.

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-22684/1 - Resistors, Fixed, Film, Insulated, Style RL07. INACTIVE FOR NEW DESIGN.

MIL-R-22684/2 - Resistors, Fixed, Film, Insulated, Style RL20. INACTIVE FOR NEW DESIGN.

MIL-R-22684/3 - Resistors, Fixed, Film, Insulated, Style RL32. INACTIVE FOR NEW DESIGN.

MIL-R-22684/4 - Resistors, Fixed, Film, Insulated, Style RL42. INACTIVE FOR NEW DESIGN.

MIL-PRF-22684/8 - Resistors, Fixed, Film, Insulated, Style RL42 - - TX.

MIL-PRF-39017 - Resistors, Fixed, Film, (Insulated), Nonestablished Reliability, and Established Reliability, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-202 - Test Methods for Electronic 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, Meteorological Confirmation System for Measuring.

(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 associated specifications, specification sheets, or MS 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 associated specification sheet. In the event of any conflict between the requirements of this specification and the applicable associated specification sheet, the latter shall govern (see 6.2)

3.2 Qualification. Resistors furnished under this specification shall be products which are qualified and have been listed on or approved for listing on the applicable qualified products list (see 4.4 and 6.3).

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 guarantee of the acceptance of the finished product.

3.4 Interface and physical dimension requirements. Resistors shall meet the interface and physical dimension requirements as specified (see 3.1). Each resistor shall consist of a film-type resistance element protected against exposure to humidity and temperature conditions by an enclosure or a coating of moisture-resistant, insulating material.

3.4.1 Coating of terminals. At the option of the contractor, the terminals may be solder coated or otherwise treated to meet the solderability requirements. When a tin-lead solder coating is used, the tin content shall range between 40 and 70 percent.

3.4.2 Solder dip (retinning) leads. Only the manufacturer or his authorized MIL-PRF-39017 category B or C distributor who has been previously approved may solder dip/retin the leads of the product supplied to this specification provided the solder dip/retin process (see Appendix A) 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 resistor components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see 6.9).

3.5 Power rating. Resistors shall have a power rating as specified (see 3.1), based on continuous full-load operation at an ambient temperature of 70°C. This power rating is dependent on the ability of resistors to meet the life requirements specified in 3.17. For temperatures in excess of those specified above, the load life shall be derated in accordance with figure 1 (see 6.4).

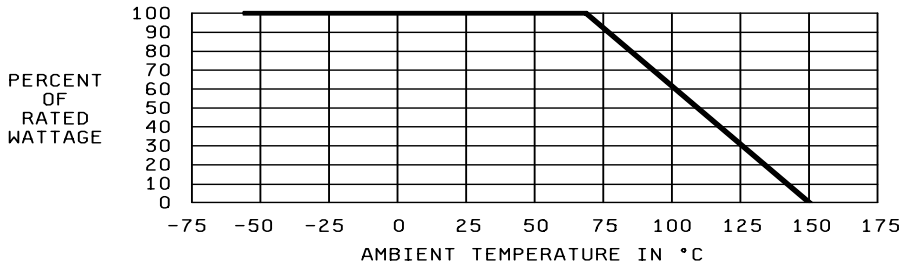


FIGURE 1. Derating curve for high ambient temperatures.

3.6 Voltage rating. Resistors shall have a rated direct current (dc) continuous working voltage or an approximate sine-wave root-mean-square (rms) alternating current (ac) 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 ac continuous working voltage at commercial-line frequency and waveform.
P = Power rating (see 3.1).
R = Nominal resistance (see 3.1).

In no case shall the rated dc or rms ac continuous working voltage be greater than the applicable maximum value (see 3.1, table I and 6.5).

3.7 DC resistance, (see 6.6). When resistors are tested as specified in 4.6.2, the dc resistance shall be within the specified tolerance of the nominal resistance (see 3.1).

TABLE I. Maximum continuous working voltage.

Style	Power rating	Maximum continuous working voltage (dc or rms)
	watts	volts
RL07	1/4	250
RL20	1/2	350
RL32	1	500
RL42	2	500

* 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 Thermal shock. When resistors are tested as specified in 4.6.3, the resistors shall meet the following requirements:

DC resistance: - Change shall not exceed ±(1 percent + 0.05 ohm).
Visual examination: - There shall be no evidence of mechanical damage.

3.9 Low-temperature operation. When tested as specified in 4.6.4, the resistors shall meet the following requirements:

DC resistance: - Change shall not exceed ±(0.5 percent + 0.05 ohm).
Visual examination: - There shall be no evidence of mechanical damage.

3.10 Short-time overload. When resistors are tested as specified in 4.6.5, the resistors shall meet the following requirements:

DC resistance: - Change shall not exceed ±(0.5 percent + 0.05 ohm).
Visual examination: - There shall be no evidence of arcing, burning, or charring.

3.11 Terminal strength.

3.11.1 Pull test. When tested as specified in 4.6.6.1, resistors shall withstand the specified load (see 3.1) without mechanical damage.

3.11.2 Twist. When resistors are tested as specified in 4.6.6.2, the resistors shall meet the following requirements:

DC resistance:	-	Change shall not exceed ±(0.5 percent + 0.05 ohm).
Visual examination:	-	There shall be no evidence of breakage or other mechanical damage.

3.12 Dielectric withstanding voltage. When resistors are tested as specified in 4.6.7, the resistors shall meet the following requirements:

DC resistance:	-	Change shall not exceed ±(0.5 percent + 0.05 ohm).
Leakage current:	-	Shall not exceed 1 milliampere at any time during test.
Visual examination:	-	There shall be no evidence of mechanical damage, arcing, or breakdown

3.13 Insulation resistance. When resistors are tested as specified in 4.6.8, the insulation resistance shall be not less than 1,000 megohms.

3.14 Resistance to soldering heat. When resistors are tested as specified in 4.6.9, the resistors shall meet the following requirements:

DC resistance:	-	Change shall not exceed ±(0.5 percent + 0.05 ohm).
Visual examination:	-	There shall be no evidence of mechanical damage.

3.15 Moisture resistance. When resistors are tested as specified in 4.6.10, the resistors shall meet the following requirements:

Dielectric withstanding voltage (atmospheric):	-	As specified in 3.12.
Insulation resistance:	-	Shall be not less than 100 megohms.
DC resistance:	-	Change shall not exceed the value specified (see 3.1).
Visual examination:	-	There shall be no evidence of mechanical damage.

3.16 Resistance-temperature characteristic. When resistors are tested as specified in 4.6.11, the change in resistance at any temperature, referred to an ambient temperature of 25°C, shall not exceed ±.02 percent per degree Celsius (200 ppm/°C).

3.17 Life. When resistors are tested as specified in 4.6.12, there shall be no evidence of mechanical damage; the change in resistance between the initial measurement and any succeeding measurements shall not exceed the value specified (see 3.1).

3.18 Shock (specified pulse). When resistors are tested as specified in 4.6.13, the resistors shall meet the following requirements:

DC resistance:	-	Change in resistance shall not exceed ±(0.5 percent +0.05 ohm).
Electrical discontinuity:	-	0.1 millisecond or greater duration during test.
Visual examination:	-	There shall be no evidence of mechanical or electrical damage.

3.19 Vibration, high frequency. When resistors are tested as specified in 4.6.14, the resistors shall meet the following requirements:

DC resistance:	-	Change shall not exceed ±(0.5 percent +0.05 ohm).
Electrical discontinuity:	-	0.1 millisecond or greater duration during the test.
Visual examination:	-	There shall be no evidence of mechanical or electrical damage.

3.20 Solderability. When resistors are tested as specified in 4.6.15, the dipped surface of the leads shall be at least 95-percent covered with a new solder coating. The remaining 5-percent of the lead surface shall show only small pinholes or voids; 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 voids shall be determined by actual measurements of these areas, as compared to the total area.

3.21 Resistance to solvents (applicable to alpha-numeric marking). When tested as specified in 4.6.16, there shall be no evidence of mechanical damage and the markings shall remain legible.

3.22 Marking. Resistors shall be legibly and permanently color coded in accordance with appendix B or as specified (see 3.1).

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

3.24 Workmanship. Networks shall be processed in such a manner as to be uniform in quality and shall meet the requirements of 3.3 to 3.4.3, and 3.22 inclusive, and be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspections specified herein are classified as follows:

a. Qualification inspection (see 4.4).

b. Conformance inspection (see 4.5).

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 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 low-temperature operation, thermal shock, and moisture-resistance tests. Precautions shall also be taken to prevent damage by heat when soldering resistor leads to terminals.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory 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 appendix A to this specification.

4.4.2 Inspection routine. Sample units shall be subjected to the qualification inspection specified in table II, in the order shown. All sample units except those designated for solderability shall be subjected to the inspection of group I. Forty sample units shall then be divided equally into four groups for groups II to V inclusive; the remaining 10 units shall be subjected to group VI.

4.4.3 Defectives. Defectives in excess of those allowed in table II shall be cause for refusal to grant qualification approval.

4.4.4 Retention of qualification. Every year, 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 results indicate failure of the qualified product to meet the requirements of the 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 plan.

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.

4.4.5 Alternate inspection. For the purpose of retention of qualification and conformance inspection (see 4.4, 4.4.4, and 4.5) test results on identical items covered by MIL-PRF-39017 may be used.

4.5 Conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A and group B inspection. Delivery of shipment shall not be delayed pending completion of group B testing.

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 and manufactured under essentially the same process and conditions during a manufacturing period of 1 month maximum.

4.5.1.1.1 Production lot. A production lot shall consist of all resistors of the same style, nominal resistance value, resistance tolerance, and termination type.

TABLE II. Qualification inspection.

Inspection	Requirement paragraph	Test method paragraph	Number of sample units to be inspected	Number of failures allowed 1/	
Group I					
Visual and mechanical examination 2/ 3/	3.1, 3.3 to 3.4.1 incl. and 3.22 to 3.24 incl	4.6.1	40	1	
DC resistance 3/	3.7	4.6.2			
Group II					
Thermal shock	3.8	4.6.3	10	1	
Low-temperature operation	3.9	4.6.4			
Short-time overload	3.10	4.6.5			
Terminal strength	3.11	4.6.6			
Group III					
Dielectric withstanding voltage 3/	3.12	4.6.7	10	1	2
Insulation resistance 3/	3.13	4.6.8			
Thermal shock 3/	3.8	4.6.3			
Resistance to soldering heat	3.14	4.6.9			
Moisture resistance	3.15	4.6.10			
Group IV					
Resistance-temperature characteristic	3.16	4.6.11	10	1	
Life	3.17	4.6.12			
Group V					
Shock (specified pulse)	3.18	4.6.13	10	1	
Vibration, high frequency	3.19	4.6.14			
Group VI					
Solderability	3.20	4.6.15	10	1	
Resistance to solvents (applicable to alpha-numeric marking)	3.21	4.6.16			

1/ Failure of an individual resistor in one or more test in groups I to V inclusive, shall be charged as a single failure. Failures for each resistance value shall be permitted as specified in each group, but not more than two failures shall be permitted in groups I through V combined.
2/ Marking shall be considered defective only if the marking is illegible.
3/ Nondestructive.

4.5.1.3 Group A inspection. Group A inspection shall consist of the examination and test specified in table III, and shall be made on the same set of sample units, in the order shown.

TABLE III. Group A inspection.

Examination or test	Requirement paragraph	Method Paragraph	Number of samples
Subgroup 1 DC resistance	3.7	4.6.2	4.5.1.3.1.1
Subgroup 2 Visual and mechanical Examination	3.4, 3.22, 3.23	4.6.1	4.5.1.3.1.2
Subgroup 3 1/ Solderability	3.20	4.6.15	4.5.1.3.1.3

1/ The manufacturer may request the deletion of the Subgroup 3 solderability test, provided an in-line or process control system for assessing and assuring the solderability of terminations can be validated and approved by the qualifying activity. Deletion of the test does not relieve the manufacturer from meeting this test requirement in case of dispute. If the design, material, construction, or processing of the part is changed or if there are any quality problems, the qualifying activity may require resumption of the test.

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 IV, 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 IV, 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 IV, 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 IV, 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 IV. Group A sampling plan.

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

4.5.1.3.1.3 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 4.6.15. 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 (b).

b. The manufacturer submits the failed lot to a 100 percent solder dip using an approved solder dip process (see Appendix A) per 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.

4.5.1.4 Group B inspection. Group B inspection shall consist of the tests specified in table V, 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 its group B inspection. Sample units shall be selected so that no more than three voltages will be required for the short-time overload test.

4.5.1.4.1 Sampling plan. A sample of 13 parts shall be randomly selected, if one or more defects are found, the lot shall be screened 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.

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

TABLE V. Group B inspection. 1/

Test	Requirement paragraph	Method Paragraph	Number of samples
Resistance-temperature characteristic	3.16	4.6.11	
Short-time overload	3.10	4.6.5	4.5.1.4.1
Resistance to solvents (Alpha-numeric marking)	3.21	4.6.16	

1/ If the manufacturer can demonstrate that these tests have been performed five consecutive times with zero failures, the frequency of these tests, 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 quality problems or failures, the qualifying activity may require resumption of the original test frequency.

4.6 Methods of inspection.

4.6.1 Visual and mechanical inspection. 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, 3.4, 3.4.1, 3.22, and 3.24).

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 exceptions 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. Measurement energy: The measurement energy applied to the unit under test shall not exceed 10 percent of the 25°C rated wattage times 1 second.

c. Temperature: The dc resistance test specified in group 1 of table II shall be performed at 25°C ±2°C. For all other tests, unless otherwise specified herein, the temperature at which subsequent and final resistance measurements are made shall be within ±2°C of the temperature at which the first resistance measurement was made.

4.6.3 Thermal shock (see 3.8). Resistors shall be tested in accordance with method 107 of MIL-STD-202. The following details and exceptions shall apply:

a. Special mounting: Resistors shall be mounted by their terminals so that there is at least 1(25.4 mm) 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.

b. Test condition letter: A, except that 125°C +3°C, -0°C (150°C +3°C, -0°C for qualification only) shall be used.

c. Measurements before and after cycling: DC resistance shall be measured as specified in 4.6.2, prior to the first cycle and 1 hour after completion of the fifth cycle and stabilization at room temperature.

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

4.6.4 Low-temperature operation (see 3.9).

a. Mounting: As specified in 4.6.3a.

b. Procedure: Following the final measurement of dc resistance specified in 4.6.3c, the resistors shall be placed in a cold chamber at room temperature. The temperature shall be gradually decreased to -65°C +0°C, -5°C, within a period of not less than 1 hour 30 minutes. 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, the full rated continuous working voltage (see 3.1) 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 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°C ±5°C for 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.

4.6.5 Short-time overload (see 3.10).

a. Test conditions:

(1) Free space: In free space, resistors shall be mounted horizontally, with no object closer than 3 inches (76.2 mm) to the protective coating except the mounting base that shall not be closer than 2 inches (50.8 mm) below the resistor.

(2) Still air: In still air, resistors shall be mounted with no circulation of air other than that created by the heat of the resistors being operated.

b. Procedure: DC resistance shall be measured as specified in 4.6.2. Following this measurement, a potential of 2.5 times the rated continuous working voltage but not to exceed twice the maximum voltage (see 3.1) shall be applied for 5 seconds to the resistor terminals. Thirty minutes +5 minutes, -0 minutes after removal of the test potential, the dc resistance shall again be measured as specified in 4.6.2.

4.6.6 Terminal strength (see 3.11). Resistors shall be tested in accordance with method 211 of MIL-STD-202. The following details and exceptions shall apply:

4.6.6.1 Pull test (see 3.11.1). The following details shall apply:

a. Test condition letter: A Apply load 5 pounds. Resistor shall be clamped by one terminal lead.

b. Initial measurement: DC resistance as specified in 4.6.2.

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

4.6.6.2 Twist test (see 3.11.2). After the test in 4.6.6.1, the following details shall apply:

a. Test condition letter: D.

b. Measurement after test: DC resistance shall be measured as specified in 4.6.2.

c. Examinations after test: Resistors shall be examined for evidence of breakage and other mechanical damage.

4.6.7 Dielectric withstanding voltage (see 3.12).

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

a. Special preparations: Resistors shall be clamped in the trough of a 90° metallic V-block of such size that the body of the resistor does not extend beyond the extremities of the block. The resistor leads shall be positioned so that the distance between the resistor leads and any point of the V-block is not less than the radius of the resistor minus the radius of the lead wire.

b. Initial measurement: DC resistance shall be measured as specified in 4.6.2.

c. Magnitude of test voltage: See 3.1.

d. Nature of potential: An ac supply at commercial-line frequency (not more than 100 cycles per second) and waveform.

e. Duration of application of test voltage: 5 seconds.

f. Rate of application of test voltage: 100 volts per second.

g. Points of application of test voltage: Between the resistor terminals connected together and the V-block.

h. Examinations and measurements: During the tests, the leakage current shall be monitored and the resistors examined for evidence of arcing and breakdown. At the conclusion of the test, resistors shall be examined for evidence of damage.

i. Measurement after test: DC resistance shall be measured as specified in 4.6.2

4.6.7.2 Barometric pressure (reduced) (see 3.12). 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 4.6.7.1a.

b. Initial measurement: DC resistance shall be measured as specified in 4.6.2.

c. Test condition: B

d. Test voltages during subjection to reduced pressure: See 3.1.

e. Nature of potential: As specified in 4.6.7.1d.

f. Duration of application of test voltage: 5 seconds.

g. Rate of application: 100 volts per second.

h. Points of application of test voltage: As specified in 4.6.7.1g.

i. Examinations and measurements: As specified in 4.6.7.1h.

j. Measurement after test: As specified in 4.6.7.1i.

4.6.8 Insulation resistance (see 3.13). 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 4.6.10a.

b. Test condition: A or B, whichever is practicable.

c. Points of measurement: Between the resistor terminals connected together and the mounting strap.

4.6.9 Resistance to soldering heat (see 3.14). Resistors shall be tested in accordance with method 210 of MIL-STD-202. The following details shall apply:

a. Measurement before test: DC resistance shall be measured as specified in 4.6.2.

b. Test condition C: A board with a maximum area of 9 square inches shall be used, and the leads shall not be cut. The parts shall be immersed to within .075 ±.025 (1.91 ±0.64 mm) inch of the body.

c. Measurements after test: After completion of the cleaning process and following a minimum 3-hour cooling period, the dc resistance shall be measured as specified in 4.6.2.

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

4.6.10 Moisture resistance (see 3.15). Resistors shall be tested in accordance with method 106 of MIL-STD-202. The following details and exception shall apply:

a. Mounting: Resistors shall be soldered by their leads to standoff insulators on a suitable panel so that there will be at least 1 inch of free air space around each resistor. 1/ The spacing of the mounts shall be such that the length of each resistor lead is .375 ±.063 inch when measured from the edge of the supporting terminal to the resistor body. Resistor leads may be formed, if necessary, so as not to compromise the seal of the resistor. In addition, one-half of the sample units shall be covered with a V-shaped metal strap whose width is equal to the length of the resistor body as indicated on figure 2. The strap shall be made of a corrosion-resistant metal and shall be kept in contact with the resistor body by supporting the body as indicated on figure 2, with a nonconducting, noncorrosive support whose width is less than that of the body and which shall not act as a moisture trap. The mounting straps may be individual for each resistor or continuous for all resistors. These resistors with strapping shall be subjected to the polarization voltage.

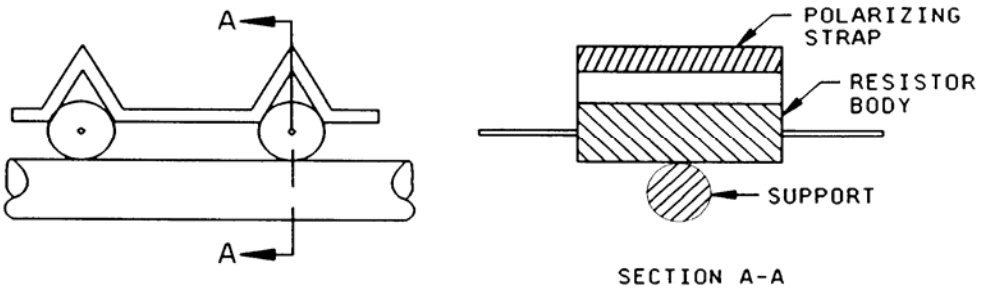


FIGURE 2. Mounting straps for moisture-resistance test for polarized units only.

b. Initial measurement: Following thermal stabilization (within 30 minutes after resistors have been removed from drying oven), dc resistance shall be measured as specified in 4.6.2.

1/ Standoff insulators of polytetrafluoroethylene are preferred for use with resistors of high resistance values.

c. Polarization and loading voltage:

(1) Polarization voltage: During steps 1 to 6 inclusive, a 100-volt dc potential shall be applied only to 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 dc continuous working voltage shall be applied to those resistors which do not have the polarizing strap specified in 4.6.10a.

d. Subcycle: Step 7a shall be performed during any five of the first nine cycles. Step 7b shall not be applicable. All polarizing straps shall be removed to perform step 7a and then be replaced prior to returning the resistors to the humidity chamber.

e. Final measurements: Upon completion of step 6 of the final cycle, the resistors shall be held at the high-humidity condition and a temperature of 25°C ±2°C for a period of 1 hour 30 minutes to 3 hours 30 minutes. Resistors shall be removed from the chamber and within 30 minutes, without any additional handling, the dc resistance, dielectric withstanding voltage, and insulation resistance shall be measured in that order, as specified in 4.6.2, 4.6.7.1, and 4.6.8, respectively. The straps specified in 4.6.7 and figure 2, shall be used for these measurements. Sample units shall not be subjected to forced air drying prior to or during these final measurements.

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

4.6.11 Resistance-temperature characteristic (see 3.16). Resistors shall be tested in accordance with method 304 of MIL-STD-202. The following details and exceptions shall apply:

Test temperature: In accordance with table VI.

TABLE VI. Ambient temperature for resistance-temperature characteristic test.

Sequence	Temperature °C	
	Qualification Inspection	Group B inspections 1/
1	25 ±3 2/	25 ±3 2/
2	-15 ±3	-55 ±3
3	-55 ±3	25 ±3
4	25 ±3 2/	150 ±3
5	65 ±3	---
6	150 ±3	---

1/ At the option of the manufacturer, the reverse sequence may be as follows:
1. - 25 ±3 2/
2. - 150 ±3
3. - 25 ±3 2/
4. - -55 ±3

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

4.6.12 Life (see 3.17). 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 to lightweight terminals. The effective length of each lead shall be 1 inch. Resistors shall be arranged so that the temperature of any one resistor shall 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.

b. Test temperature: +70°C +15°C, -5°C.

c. Initial measurements: Measurements may be made inside or outside the chamber.

(1) Inside chamber: When measurements are to be made inside the chamber, the dc resistance shall be measured at a temperature of 70°C ±5°C after temperature stabilization and within 8 hours of exposure of the resistors to this temperature. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same conditions.

(2) Outside chamber: When measurements are to be made outside the chamber, the measurement shall be made after units have been stabilized at room temperature for at least 8 hours. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same conditions.

d. Operating conditions: Rated continuous working voltage (see 3.1) shall be applied intermittently, 1 hour 30 minutes “on” and 30 minutes “off”, for 1,000 hours. Adequate precautions shall be taken to maintain constant voltage on resistors.

e. Test condition letter: D.

f. Measurements during test: Measurements may be made inside or outside the chamber. DC resistance shall be measured at the end of the 30 minute “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. Measurements shall be made as near as possible to the specified time but may be adjusted so that measurements need not be made during other than normal weekdays.

(1) Measurements outside of chamber: When measurements are made outside the chamber, resistors shall be outside of the chamber for a minimum of 45 minutes and stabilized before measurement.

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

4.6.13 Shock (specified pulse) (see 3.18). 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 mounted on approximate jig fixtures with their bodies restrained from movement and their leads supported at a distance of .25 inch from the resistor body. These fixtures shall be constructed in a manner to insure that the points of the resistor-mounting supports will have the same motion as the shock table. Test leads used during this test shall be no larger than AWG size 22 stranded wire, so that the influence of the test lead on the resistor will be held to a minimum. The test-lead length shall be no longer than necessary. In all cases, the resistors shall be mounted in relation to the test equipment in such a manner that the stress applied is in the direction which would be considered most detrimental.

b. Measurements 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 10 shocks in each of two mutually perpendicular planes, one perpendicular and the other parallel to the longitudinal axis of the resistor.

e. Measurement during shock: Each resistor shall be monitored to determine electrical discontinuity by a method which shall at least be sensitive enough to monitor or register, automatically, any electrical discontinuity of 0.1 millisecond or greater duration.

f. Measurement after shock: DC resistance shall be measured as specified in 4.6.2.

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

4.6.14 Vibration, high frequency (see 3.19). 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 body. These fixtures shall be constructed 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: D.

d. Direction of motion: In each of two mutually perpendicular directions, one perpendicular, and the other is parallel to the longitudinal axis of the resistor. Six hours in each direction for a total of 12 hours.

e. Measurement during test: Each resistor shall be monitored to determine electrical discontinuity by a method which shall at least be sensitive enough to monitor or register, automatically, any electrical discontinuity of 0.1 millisecond or greater duration.

f. Measurement after vibration: DC resistance shall be measured as specified in 4.6.2.

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

4.6.15 Solderability (see 3.20). Resistors shall be tested in accordance with method 208 of MIL-STD-202. The following detail shall apply:

a. One or two terminal leads of each resistor shall be tested.

4.6.16 Resistance to solvents (applicable to alpha-numeric marking)(see 3.21). Resistors shall be tested in accordance with method 215 of MIL-STD-202. The following details shall apply:

a. The number of sample units shall be as specified in table II and table III, as applicable.

b. Resistors shall be examined for mechanical damage and legibility of markings.

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. The film resistors described herein are intended to be used in electronic circuits where semiprecision characteristics and small sizes are required. These resistors are unique due to the fact that they must be able to operate satisfactorily in military systems that have passed tests as described in MIL-STD-202. Commercial components are not designed to withstand these military environmental conditions.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification.

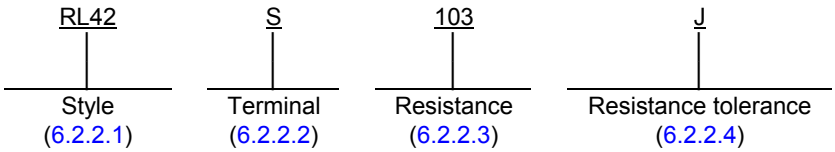
* b. If not otherwise specified (see 2.1), the versions of the individual documents referenced will be those in effect on the date of release of the solicitation.

c. Packaging requirements (see 5.1).

6.2.1 PIN This specification requires a PIN that describes technology and appropriate references to associated documents (see 1.2.1 and 3.1).

6.2.2 Type designation. The type designation for identifying these parts is as follows:

NOTE: This is for information only. For the correct PIN, see 3.1.



6.2.2.1 Style. The style is identified by the two-letter symbol "RL" followed by a two-digit number; the letters identify insulated, film, fixed resistors, and the number identifies the size and power rating of the resistors.

6.2.2.2 Terminal. The terminal is identified by the single letter "S" indicating solderable.

6.2.2.3 Resistance. The nominal resistance value expressed in ohms is identified by a three digit number; the first two digits represent significant figures and the last digit specifies the number of zeros to follow. Minimum and maximum resistance values are as specified (see 3.1). The standard value for every decade follows the sequence demonstrated for the “10 to 100” decade table.

6.2.2.4 Resistance tolerance. The resistance tolerance is identified by a single letter in accordance with table VII.

TABLE VII. Resistance tolerance.

Symbol	Resistance tolerance Percent (±)
G	2
J	5

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.

6.4 Derating. The intention of this specification is to cover resistors capable of full-load operation at any ambient temperature up to 70°C. However, if it is desired to operate these resistors at ambient temperatures greater than 70°C, the resistors should be derated in accordance with figure 1.

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

6.6 Resistance tolerance. Designers should bear in mind that operation of these resistors under the ambient conditions for which military equipment is designed, may cause permanent or temporary changes in resistance sufficient to throw them out of their initial tolerance. In particular, operation at extreme temperatures may cause relatively large temporary changes in resistance.

6.7 Shelf life. Resistors are not expected to change in resistance more than 0.2 (average) percent per year under normal storage conditions (25°C ±10°C with a relative humidity not exceeding 90 percent).

6.8 Flammability. It should be noted that this specification contains no requirements concerning the flammability of the material used in the construction of the resistors. Users should take this into consideration when a particular application involves this requirement.

* 6.9 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems (see 3.4.3) 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).

* 6.10 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. Table VIII 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 VIII. EPA top seventeen hazardous materials.

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

6.11 Subject term (key word) listing.

Axial leads
Core
Film-type resistance element
Small size

* 6.12 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.

APPENDIX A

PROCEDURE FOR QUALIFICATION INSPECTION

A.1 SCOPE

A.1.1 Scope. This appendix describes the procedure for submission of samples, with the results, 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. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance only.

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 associated specifications, specification sheets, or MS 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.

A.3 SUBMISSION

A.3.1 Sample. A sample consisting of 50 sample units, each of the lowest and highest resistance values in each style, terminal, and resistance tolerance for which qualification is sought, shall be submitted. When the lowest and highest resistance values submitted are respectively below and above the critical value specified in table A-I, 50 sample units of the critical value shall also be submitted in each style. One additional sample unit of each resistance value shall be submitted to permit substitution for the allowable defect in group I inspection.

APPENDIX A

TABLE A-I. Critical resistance value for qualification inspection. 1/

Style	Critical resistance value 2/
	Megohms
RL07	0.240
RL20	0.240
RL32	0.240
RL42	0.120

1/ Maximum continuous working voltage shall be applied (see 3.1).

2/ The critical resistance value is the maximum standard resistance value which will dissipate full wattage when the maximum continuous working voltage is applied.

A.4 EXTENT OF QUALIFICATION

A.4.1 Extension of qualification. The resistance ranges include in the qualification of any one style and terminal shall be between any two adjacent-resistance values which pass the required qualification inspection. Qualification of G resistance-tolerance resistors will also qualify J resistance-tolerance resistors.

A.5 SOLDER DIP (RETINNING) LEADS

A.5.1 Solder dip (retinning) leads. The manufacturer (or their authorized category B or category C distributor) may solder dip/retin the leads of product supplied to this specification provided the solder dip process (see A.5.2 of this appendix) or an equivalent 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 lead 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 manufacturers 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. No defects are allowed.

(NOTE: Solder dip of gold plated leads is not allowed.)

APPENDIX A

A.5.3 Solder dip/retinning options. The manufacturer may solder dip/retin as follows:

a. After the 100 percent group A screening tests: Following the solder dip/retinning 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/retin 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 the subgroup 1 tests.

b. As a corrective action, if the lot fails the group A solderability test: The lot may be retinned no more than two times. The lot after retinning shall be 100 percent screened for group A electrical requirements (dc resistance). Any parts failing (lot not exceeding PDA for group A, subgroup 1, see 4.5.1.3.1.1) these screens shall not be supplied to this specification. If electrical failures exceeding 1 percent of the lot are detected after the second retinning operation, the lot shall not be supplied to this specification.

c. After the group A inspection has been completed: Following the solder dip/retinning process, the electrical measurements required in group A, subgroup 1, 100 percent screening test 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 4.5.1.3.1.3.

APPENDIX B

COLOR CODE FOR RESISTORS

B.1 SCOPE

B.1.1 Scope. This appendix establishes a uniform color code for insulated, axial-lead, film-type resistors. This color code has been prepared to identify the nominal resistance value, resistance tolerance, and type of terminal leads.

B.2 REFERENCED DOCUMENTS

B.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 STANDARD

FED-STD-595 - Colors.

(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.)

B.3 GENERAL REQUIREMENTS

B.3.1 Code colors. Colors used for color coding shall conform to FED-STD-595, and shall be permanent and nonfading. The color-code marking shall remain legible after the resistor has been subjected to all the tests specified in the individual resistor specification. Colors shall conform to standard colors of table B-I.

TABLE B-I. Standard colors.

Color	Number	Color	Number
Black	17038	Blue	15123
Brown	10080	Violet	27144
Red	11105	Gray	16187
Orange	12246	White	17875
Yellow	13655	Gold	17043
Green	14187	Silver	17178

B.3.2 Body colors (background). The exterior body color of resistors shall be any color other than black; tan is preferred.

B.3.3 Conflict of colors. When the body color is the same as any of the band colors, then either the body color or the band color shall be differentiated by shade or gloss.

B.4 DETAIL REQUIREMENTS

B.4.1 Color coding. The nominal resistance value, resistance tolerance, and terminal type resistors shall be indicated by five bands of color, as shown on figure B-1. The applicable colors to be used shall be as specified in table B-II.

APPENDIX B

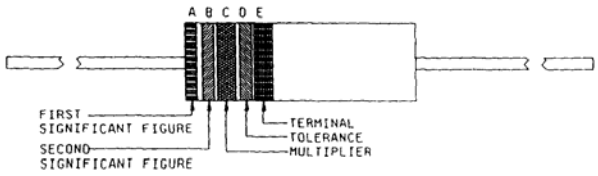


FIGURE B-1. Color-code marking for film-type resistors.

TABLE B-II. Color code for film-type resistors.

Band A 1/		Band B 2/		Band C 3/		Band D 4/		Band E 5/	
Color	First significant figure	Color	Second significant figure	Color	Multiplier	Color	Resistance Tolerance (Percent)	Color	Terminal
Black	0	Black	0	Black	1	Gold	±5	White	Solderable
Brown	1	Brown	1	Brown	10	Red	±2		
Red	2	Red	2	Red	100				
Orange	3	Orange	3	Orange	1,000				
Yellow	4	Yellow	4	Yellow	10,000				
Green	5	Green	5	Green	100,000				
Blue	6	Blue	6	Blue	1,000,000				
Purple (Violet)	7	Purple (Violet)	7	Silver Gold	0.01 0.1				
Gray	8	Gray	8						
White	9	White	9						

1/ The first significant figure of the resistance value. (Bands A through D shall be of equal width).
2/ The second significant figure of the resistance value.
3/ The multiplier. (The multiplier is the factor by which the two significant figures are multiplied to yield the nominal resistance value).
4/ The resistance tolerance.
5/ On film resistors, this band shall be approximately 1-1/2 times the width of other bands, and indicates a solderable terminal.

Examples of color coding for film-type resistors:

5100 ohms ±5 percent, solderable leads:
Band A, green; Band B, Brown; Band C, red; Band D, gold;
Band E, white (1-1/2 width of other bands).

5600 ohms ±2 percent, solderable leads:
Band A, green; Band B, blue; Band C, red; Band D, red;
Band E, white (1-1/2 width of other bands).

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

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

Preparing activity:
DLA - CC

(Project 5905-2005-006)

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.