

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

TABLE I. Resistance tolerance.

| Symbol | Resistance tolerance |
|--------|----------------------|
| | Percent (\pm) |
| G | 2 |
| J | 5 |

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

SPECIFICATIONS

- MIL-R-39017 - Resistors, Fixed Film (Insulated) Established Reliability General Specification for.
 MIL-R-39032 - Resistors, Packaging of.

STANDARDS

MILITARY

- MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
 MIL-STD-45662 - Calibration Systems Requirements.

(See supplement 1 for list of associated specifications.)

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, Bldg. 4D (Customer Service), 700 Robbins Avenue, Philadelphia PA 19111-5094.)

2.2 Non-Government publication. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM B 545 - Standard Specification for Electrodeposited Coatings of Tin.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

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

3. REQUIREMENTS

3.1 Detail requirements for individual resistor types. Detail requirements or exceptions applicable to individual types of resistors shall be as specified in the detail specifications listed in supplement 1 to this specification. In the event of any conflict between requirements of this specification and the detail specifications, 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 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 Design, construction, and physical dimensions. Resistors shall be of the design, construction, and physical dimensions specified (see 3.1). Each resistor shall consist of a film-type resistance element protected against exposure to humidity and temperature conditions by an enclosure or a coating of moisture-resistant, insulating material that completely covers the element and end cap down to the resistor lead (see 3.1).

3.4.1 Coating of terminals. At the option of the contractor, the terminals may be solder coated or other wise 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-R-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 has been approved by the qualifying activity.

3.4.3 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., 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 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.)

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

- a. After the group A screening tests: Following the solder dip/retinning process, the electrical measurements required in group A, subgroup 1 shall be repeated on the lot. The group A, subgroup 1, lot rejection criteria shall be used. Following this test, the manufacturer shall submit the lot to the group A solderability test as specified in 4.6.15.
- b. As a corrective action, if the lot fails the group A solderability test.

3.4.5 Tin plated finishes. Use of tin plating is prohibited as a final finish and as an undercoat (see 6.16). Use of tin-lead (Sn-Pb) finishes are acceptable provided that the minimum lead content is 3 percent.

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).

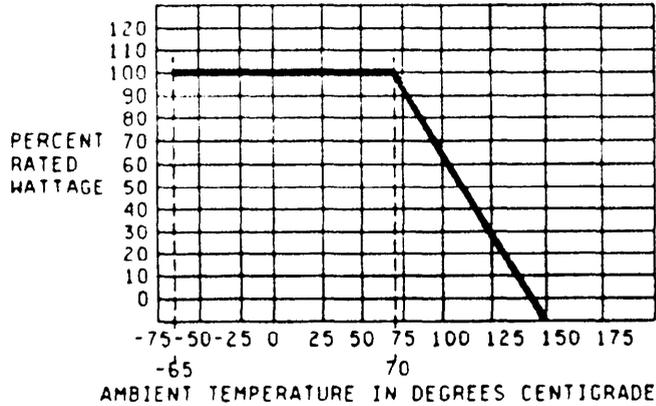


FIGURE 1. Derating curve for high ambient temperatures.

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 II 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 II. 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 |

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

Resistance: Change shall not exceed $\pm(1 \text{ percent} + 0.05 \text{ ohm})$.
 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:

Resistance: Change shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$.
 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:

Resistance: Change shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$.
 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:

Resistance: Change shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$.
 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 $\pm(0.5 \text{ percent} + 0.05 \text{ ohms})$.
 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:

Resistance: Change shall not exceed $\pm(0.5 \text{ percent} + 0.05 \text{ ohm})$.
 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 $\pm 0.02 \text{ percent per degree Celsius (200 PPM/°C)}$.

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:

Resistance: Change in resistance shall not exceed $\pm(0.5$ 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:

Resistance: Change shall not exceed $\pm(0.5$ 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 Workmanship. Resistors shall be processed in such a manner as to be uniform in quality, shall meet the requirements of 3.1, 3.3, 3.4, 3.4.1, and 3.22, as applicable, and shall be free from other defects that will affect life, serviceability, or appearance. The bodies of the resistors shall be free from cracks, holes, chips, malformation, and other defects that will affect life or serviceability. The wire leads shall be unbroken, and not crushed or nicked.

4. QUALITY ASSURANCE PROVISIONS

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

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

4.1.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

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

- a. Qualification inspection (see 4.4).
- b. Quality conformance inspection (see 4.5).

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 III, 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 III shall be cause for refusal to grant qualification approval.

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

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

Failure to submit the report within 30 days after the end of each 6-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 6-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

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

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

4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspection. Delivery of product 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 III. Qualification inspection.

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

- ^{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.

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

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

4.5.1.3.1 Sampling plan.

4.5.1.3.1.1 Subgroup 1. A sample of parts from each inspection lot shall be randomly selected in accordance with table V, 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 V, 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 V, 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 V, if one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

4.5.1.3.1.3 Subgroup 3 (solderability).

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

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

- a. Each production lot that was used to form the failed inspection lot shall be individually submitted to the solderability test as required in 4.5.1.3.1.3.1. 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 in accordance with 3.4.2. Following the solder dip the electrical measurements required in group A, subgroup 1 tests shall be repeated on the lot. Thirteen additional samples shall then be selected and subjected to the solderability test with zero defects allowed. If the lot fails this solderability test the lot shall be reworked a second time and retested. If the lot fails the second rework, the lot shall be considered rejected and shall not be furnished against the requirements of this specification.

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

TABLE IV. Group A inspection.

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

TABLE V. 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 1200 | 125 | 34 |
| 1201 to 3200 | 125 | 42 |
| 3201 to 10000 | 192 | 50 |
| 10001 to 35000 | 294 | 60 |
| 35001 to 150000 | 294 | 74 |
| 150001 to 500000 | 345 | 90 |
| 500001 and over | 435 | 102 |

4.5.1.4 Group B inspection. Group B inspection shall consist of the tests specified in table VI, 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 parts 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.

TABLE VI. Group B inspection.

| Test | Requirement paragraph | Method paragraph |
|--|-----------------------|------------------|
| Resistance-temperature characteristic | 3.16 | 4.6.11 |
| Dielectric withstanding voltage | 3.12 | 4.6.7 |
| Thermal shock | 3.8 | 4.6.3 |
| Short-time overload | 3.10 | 4.6.5 |
| Resistance to solvents (Alpha-numeric marking) | 3.21 | 4.6.16 |

TABLE VII. Group B sampling plan.

| Lot size | Sample size |
|----------------|-------------|
| 2 to 5 | 100% |
| 6 to 90 | 5 |
| 91 to 150 | 6 |
| 151 to 280 | 7 |
| 281 to 500 | 9 |
| 501 to 1,200 | 11 |
| 1,201 to 3,200 | 13 |
| 3,201 and over | 15 |

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

4.5.1.5 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.1.5.4), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of these periodic inspections.

4.5.1.5.1 Group C inspection. Group C inspection shall consist of the tests specified in table VIII in the order shown. They shall be performed on sample units of each style and selected from lots that have passed groups A and B inspections.

4.5.1.5.1.1 Sampling plan.

4.5.1.5.1.2 Monthly. Ten sample units of any resistance value divided between the critical and low values shall be inspected every month. If neither of these values is produced during the month, resistors of the lowest resistance value produced shall be inspected, with one defective unit allowed; if this sample fails, ten additional sample units shall be inspected with no defective units allowed.

Small quantity production. If more than 1,000 resistors of any style in a group are produced over a previous 1-month production period, the monthly group C tests shall be performed as specified in 4.5.1.5.1.2. If the production rate is less than 1,000 resistors for each style in a group over the previous 1-month period, then the monthly group C inspection may be postponed until at least 1,000 resistors of any style in the group are produced. In any case, the monthly tests shall be performed at least once each 3 months on the style in the group with the highest production.

4.5.1.5.1.3 Quarterly. Twenty sample units between the critical and highest resistance values shall be inspected quarterly. For style RL07, 20 sample units of the highest resistance value shall be inspected, ten sample units between the critical and highest resistance values shall be subjected to the tests of subgroup 1, and 10 sample units of the value closest to the value above the critical value shall be subjected to the tests of subgroup 2. One defective shall be allowed for each subgroup, but not more than one defective for the two subgroups combined.

Small quantity production. If more than 1,000 resistors of any style in a group are produced over the previous 3-month period, the quarterly group C tests shall be performed as specified in 4.5.1.5.1.3. If the production rate is less than 1,000 resistors for each style in a group over the previous 3-month period, then the quarterly test may be postponed for 3 months. In any case, the quarterly tests shall be performed at least semiannually on the style with the highest production.

4.5.1.5.1.4 Semiannually. Ten sample units between the critical and highest resistance values shall be subjected to the tests of subgroup 1, except for style RL07, for which the highest value shall be subjected to the tests of subgroup 1. Ten sample units of any resistance value shall be subjected to the tests of subgroup 2. One defective unit shall be allowed for each subgroup, but not more than one defective for the two subgroups combined.

4.5.1.5.2 Defectives. If the number of defectives exceed the number allowed in table VIII, the sample shall be considered to have failed.

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

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

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

TABLE VIII. Group C inspection.

| Inspection | Require- ment paragraph | Method paragraph | Number of samples to be inspected | Number of defectives permitted |
|--|-------------------------------|---------------------|--|--------------------------------------|
| <u>Monthly</u> | | | | |
| 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 | | |
| <u>Quarterly</u> | | | | |
| Subgroup 1 | | | | |
| Dielectric withstanding voltage | 3.12 | 4.6.7 | 10 | 1 |
| Insulation resistance | 3.13 | 4.6.8 | | |
| Thermal shock | 3.8 | 4.6.3 | | |
| Resistance to soldering heat | 3.14 | 4.6.9 | | |
| Moisture resistance | 3.15 | 4.6.10 | | 1 |
| Subgroup 2 | | | | |
| Resistance-temperature characteristic | 3.16 | 4.6.11 | 10 | 1 |
| Life | 3.17 | 4.6.12 | | |
| <u>Semiannually</u> | | | | |
| Shock (specified pulse) | 3.18 | 4.6.13 | 10 | 1 |
| Vibration, high frequency | 3.19 | 4.6.14 | | |

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, 3.21, and 3.22).

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 I of table III 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 inch (25.4 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.
- b. Test condition letter. A, except that 125° +3°, -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 quality 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 +5, -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 +5, -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: Test condition G (260°C \pm 5°C, 10 \pm 2 seconds). 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 \pm .025 inch (1.91 \pm 0.64 mm) 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 \pm .063 inch (9.53 \pm 1.60 mm) 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.

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

- 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.
- 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.

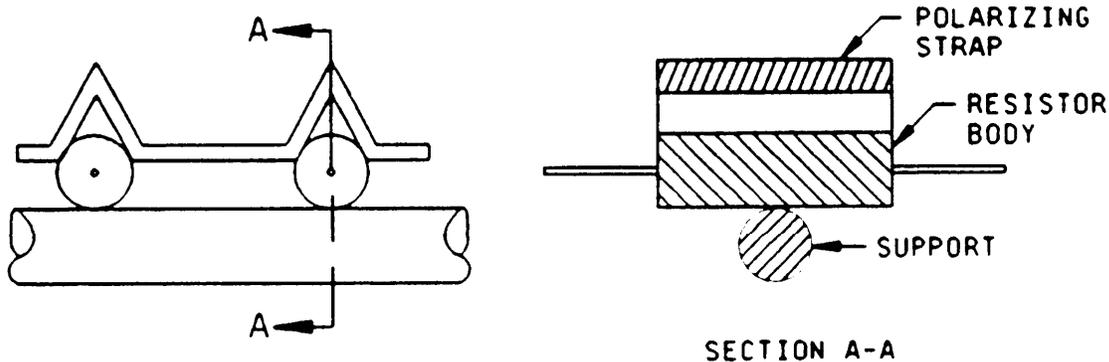


FIGURE 2. Mounting straps for moisture-resistance test for polarized units only.

- 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 $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ 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 IX.

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

| Sequence | Temperature °C | |
|----------|--------------------------|---|
| | Qualification inspection | Groups B and C ^{1/} inspection |
| 1 | 25 ±3 <u>2/</u> | 25 ±3 <u>2/</u> |
| 2 | -15 ±3 | -55 ±3 |
| 3 | -55 ±3 | 25 ±3 <u>2/</u> |
| 4 | 25 ±3 <u>2/</u> | 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 minutes off periods, after 250 +72, -24; 500 +72, -24; 750 +72, -24; 1,000 +72, -24 hours have elapsed.

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 (6.4 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 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 (6.4 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 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: 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 tables III and VI, as applicable.
- b. Resistors shall be examined for mechanical damage and legibility of markings.

5. PACKAGING

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

6. NOTES

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

6.1 Intended use. These film resistors described herein are intended to be used in electronic circuits where semiprecision characteristics and small sizes are required. These resistors are capable of full-load operation at ambient temperature of 70°C derated to zero load at 150°C. Resistor styles are available with voltage ratings of 1/4, 1/2, 1, and 2 watts. These resistors have a resistance temperature characteristic of ± 200 parts per million per °C (PPM/°C) and are available in resistance tolerances of 2 and 5 percent. Operation of these resistors at frequencies above 100 MHz may produce inductive effects on spiral-cut types.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DDDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).
- c. Levels of preservation and packaging and packing, and applicable marking (see 5).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List (QPL) whether or not such products have actually been so listed by that 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 covered by this specification. The activity responsible for the Qualified Products List is the Defense Electronics Supply Center (DESC-EQP), 1507 Wilmington Pike, Dayton, Ohio 45444-5270 and information pertaining to qualification of products may be obtained from that activity. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6".

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 \pm 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 plated finishes. Tin plating is prohibited (see 3.4.5) since it may result in tin whisker growth. Tin whisker growth could adversely affect the operation of electronic equipment systems. For additional information on this matter refer to ASTM B545 (Standard Specification for Electrodeposited Coating of Tin).

6.10 Subject term (key word) listing.

Axial leads

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

APPENDIX A

PROCEDURE FOR QUALIFICATION INSPECTION

10. SCOPE

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

20. APPLICABLE DOCUMENTS. This section is not applicable to this appendix.

30. SUBMISSION

30.1 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 X, 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.

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

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

TABLE X. Critical resistance value for qualification inspection. 1/

| Style | Critical resistance value 2/ |
|-------|------------------------------|
| | Megohms |
| RLR07 | 0.240 |
| RLR20 | 0.240 |
| RLR32 | 0.240 |
| RLR42 | 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.

40. EXTENT OF QUALIFICATION

40.1 Extension of qualification. The resistance range 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.

APPENDIX B

COLOR CODE FOR RESISTORS

10. SCOPE

10.1 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.

20. APPLICABLE DOCUMENTS.

20.1 Government documents.

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

STANDARD

MILITARY

FED-STD-595 - Colors.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, Bldg. 4D (Customer Service), 700 Robbins Avenue, Philadelphia PA 19111-5094.)

20.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this appendix shall take precedence. Nothing in this appendix, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

30. GENERAL REQUIREMENTS

30.1 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 XI.

TABLE XI. 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 |

APPENDIX B

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

30.3 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.

40. DETAIL REQUIREMENTS

40.1 Color coding. The nominal resistance value, resistance tolerance, and terminal type resistors shall be indicated by five bands of color, as shown on figure 3. The applicable colors to be used shall be as specified in table XII.

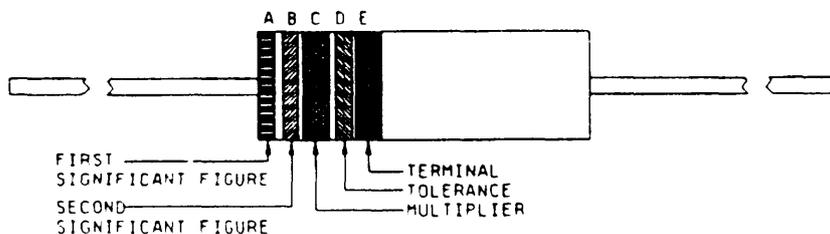


FIGURE 3. Color-code marking for film-type resistors.

TABLE XII. Color code for film-type resistors.

| Band A <u>1/</u> | | Band B <u>2/</u> | | Band C <u>3/</u> | | Band D <u>4/</u> | | Band E <u>5/</u> | |
|------------------|--------------------------|------------------|---------------------------|------------------|------------|------------------|--------------------------------|------------------|------------|
| 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 | 0.01 | | | | |
| Gray | 8 | Gray | 8 | Gold | 0.1 | | | | |
| 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.

APPENDIX B

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).

CONCLUDING MATERIAL

Custodians:

Army - ER
Navy - EC
Air Force - 85

Review activities:

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

Preparing activity:

Army - ER

Agent:

DLA - ES

(Project 5905-1307)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

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

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

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-R-22684D

2. DOCUMENT DATE (YYMMDD)
21 April 1994

3. DOCUMENT TITLE

RESISTORS, FIXED, FILM (INSULATED), GENERAL SPECIFICATION FOR

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)
(1) Commercial
(2) AUTOVON
(If applicable)

7. DATE SUBMITTED
(YYMMDD)

8. PREPARING ACTIVITY

a. NAME

Commander
U.S. Army Research Laboratory

b. TELEPHONE (Include Area Code)
(1) Commercial
(908) 544-3441

(2) AUTOVON
998-3441

c. ADDRESS (include Zip Code)

ATTN: AMSRI EP RD
Fort Monmouth, NJ 07703-5601

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT
Defense Quality and Standardization Office
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 756-2340 AUTOVON 289-2340