INCH-POUND
MIL-R-26F
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SUPERSEDING
MIL-R-26E
11 July 1967

MILITARY SPECIFICATION

RESISTORS, FIXED, WIRE-WOUND (POWER TYPE) GENERAL SPECIFICATION FOR

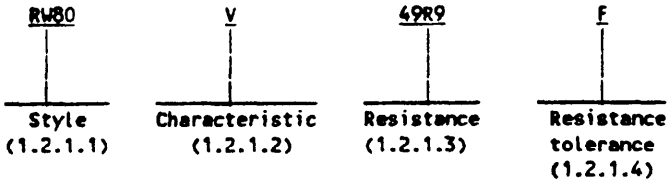
This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for power type, wire-wound, fixed resistors for use in electrical, communications, and associated equipment. Included are general purpose styles of 5 percent initial resistance tolerance with power ratings ranging from 3 to 240 watts at 25°C, derated to 0 power at 350°C (characteristics N and V) and precision axial lead types of .1, .5, and 1 percent initial resistance tolerances with power ratings ranging from 1 to 10 watts at 25°C, derated to 0 power at 275°C (characteristic U). Table I of supplement 1 provides a summary of performance characteristics for these resistors.

1.2 Classification.

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



1.2.1.1 Style. The style is identified by the two-letter symbol "RW" followed by a two-digit number; the letters identify power type, wire-wound, fixed resistors, and the number identifies the size, wattage rating, and construction of the resistors (see 3.1).

1.2.1.2 Characteristic. The characteristic is identified by a single letter that identifies the maximum continuous operating temperature (surface hot spot), the high ambient temperature derating (see 3.1), the minimum insulation resistance value, and the degree of moisture resistance in accordance with the applicable detail specification (see 3.1).

1.2.1.3 Resistance. The nominal resistance expressed in ohms is identified by a three or four digit number in accordance with the applicable detail specification (see 3.1).

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

AMSC N/A
FSC 5905

1.2.1.4 Resistance tolerance. The resistance tolerance, when applicable, shall be identified by a single letter in accordance with the applicable detail specification (see 3.1).

1.2.2 Power ratings. The nominal power ratings for the various styles and characteristics shall be as specified (see 3.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

SPECIFICATIONS

MILITARY

MIL-R-39007 - Resistors, Fixed, Wirewound, Power Type (ER).
MIL-R-39032 - Resistors, Packaging of.
MIL-C-45662 - Calibration Systems Requirements.

STANDARDS

MIL-STD-202 - Tests Methods for Electronic and Electrical Components Parts.
MIL-STD-1276 - Leads for Electronic Component Parts.

(See supplement 1 for list of associated specifications.)

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

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

3. REQUIREMENTS

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

3.2 Qualification. Resistors furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for the opening of the bids (see 4.4 and 6.2). Not applicable for styles covered by MIL-R-26/1 (see 3.1).

3.2.1 Production testing. Resistors furnished under MIL-R-26/1 shall pass the production tests as specified (see 3.1).

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

3.4 Design and construction. Resistors shall be of the design, construction, and physical dimensions specified (see 3.1). Characteristic N resistors shall be wound by the Ayrton-Perry method in order to minimize inductance; other resistors shall be wound with a single layer of resistance wire (round, flat-wound ribbon, or edgewise-wound ribbon), and protected, insofar as necessary, by an enclosure or coating of insulating, moisture-resistant material. The design of the resistors shall be such as to preclude shorting of turns and to obtain a minimum voltage drop between adjacent turns.

3.4.1 Windings.

3.4.1.1 Wire. The wire shall have no joints, welds, or bonds, except at end terminals where welding, brazing, or silver solder only shall be employed. The wire shall possess a uniform cross section of conductor and insulation (if employed), and shall be as free as practicable from particles or impurities, grain growth, or other factors contributing to spot weakness. The cross sectional area of the wire shall be the maximum consistent with other requirements specified herein, and in no case shall the nominal diameter be less than specified (see 3.1).

3.4.1.2 Pitch. The average winding pitch shall not exceed five times the wire diameter.

3.4.1.3 Effective wire coverage. Effective wire coverage is the winding length on the tube between points of departure from the normal winding pitch. The effective wire coverage shall be such that not more than 20 percent of the overall winding area shall remain uncovered (by wire). In center tapped resistors, an additional .5 inch may remain uncovered for the tap.

3.4.1.4 Protective coating or enclosure. The resistance element of completed resistors shall be protected by a coating or enclosure which shall completely cover the exterior of the resistance element, except that resistors wound with wire of 642 circular mils or over shall have the winding securely anchored by a coating which need not completely cover the winding. The protective coating shall be free from holes, fissures, chips, and other faults for units of less than 642 circular mils. The protective coating need not completely cover the junction caused by silver soldering or welding of the resistance element to the terminals, provided that no portion of any resistance element wound with wire of 101 circular mils or less is exposed.

3.4.1.5 Terminals. All terminals shall be solder-coated or otherwise treated to facilitate soldering. When a coating containing tin is used, the tin content shall range between 40 percent and 70 percent (see 3.9).

3.4.1.5.1 Solder dip (retinning) leads. Only the manufacturer or his authorized MIL-R-39007 category B or category C distributor who has previously been approved may solder dip/retin the leads of product supplied to this specification provided the solder dip/retin process has been approved by the qualifying activity.

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

a. When the original lead finish qualified was hot solder dip lead finish 52 of MIL-STD-1276 (NOTE: The 200 microinch maximum thickness is not applicable). The manufacturer shall use the same solder dip process for retinning as is used in the original manufacture of the product.

b. When the lead originally qualified was not hot solder dip lead finish 52 of MIL-STD-1276 as prescribed in 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 manufacturing's solder dip process. Following the solder dip process, the resistors are subjected to the dc resistance test and other group A electricals. No defects are allowed.

(2) Ten of the thirty 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.

c. The manufacturers may designate and authorize a MIL-STD-790, category B or category C distributor listed under MIL-R-39007 QPL to solder dip/retin MIL-R-26 resistors as long as the procedure is one qualified in a. or b. above and is identified and approved by the manufacturer.

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

a. After the group A tests: Following the solder dip/retinning process, the electrical measurements required in group A, subgroup 1 shall be repeated on the lot. The group A, subgroup 1, lot rejection criteria shall be used. Following this test, the manufacturer shall submit the lot to the group A solderability test as specified in 4.6.5.

b. As a corrective action if the lot fails the group A solderability test.

3.4.1.6 Ferrule-terminal resistors. Lead wires from windings to ferrules shall be so arranged and connected that they will be protected from being cut by, or placed in contact with the mounting clip at any angle of rotation. The sides of ferrules for any angle of rotation, and for a distance of .375 inch (9.53 mm) from the outer edges, shall not depart from a true parallelism by more than a total of .005 inch (0.13 mm). The outside section of ferrules shall not depart from a true circular form by more than a total of 5 percent of the mean outside diameter. The ferrules shall be so aligned with respect to each other and the resistor body that resistors comply with figure 1. The type of metal used in the ferrules shall be adequate for the purpose intended. The metal used in the contact portion of the ferrule shall have a thickness of not less than .016 inch (0.41 mm) (no. 25 AWG). If the ferrules are not reinforced by some means to prevent a deforming of the ferrules when pressed into mounting clips, the minimum metal thickness of the ferrules shall be .031 inch (0.79 mm). All ferrule edges shall be free from burrs. In no case shall the body diameter of the resistors be greater than the ferrule-guard ring diameter.

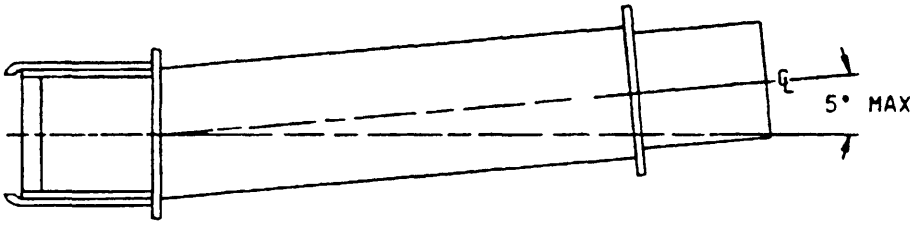


FIGURE 1. Alignment of ferrules.

3.4.1.7 Flat (stack mounting) and tubular, tab-terminal resistors. These terminals shall be so designed as to permit the secure crimping or hooking of .064 inch (1.63 mm) (size AWG 14) wire without depending upon soldering for mechanical strength. They shall support the wire without deformity. All tabs or taps shall be radially straight and within 10° of a plane passing through one of the terminals and the longitudinal axis of the resistor. If used, the center tap tab shall not exceed the dimensions given for the end tabs.

3.5 Voltage rating. Resistors shall have a rated direct-current (dc), continuous working voltage, or an approximate sine-wave root-mean-square (rms) continuous working voltage at commercial-line frequency corresponding to the power rating (see 3.1), as determined from the following formula:

$$E = \sqrt{PR}$$

Where: E = rated dc or rms continuous working voltage.
P = power rating in watts
R = nominal resistance in ohms

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

3.6 DC resistance. When resistors are tested as specified in 4.6.1, the dc resistance shall be within the specified tolerance of the nominal resistance (see 3.1).

3.7 Thermal shock. When tested as specified in 4.6.3, resistors shall not change in resistance in excess of the value specified (see 3.1), nor show any evidence of mechanical damage. There shall be no change in resistor coating, enclosure or other part which will result in degradation in performance.

3.8 Short-time overload. When resistors are tested as specified in 4.6.4, there shall be no evidence of arcing, burning, or charring; the change in resistance shall not exceed the value specified (see 3.1).

3.9 Solderability (when applicable). When resistors are tested as specified in 4.6.5, the dipped surface of the lead shall be at least 95 percent covered with continuous new solder coating. The remaining 5 percent of the lead surface may 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.

3.10 Terminal strength. When resistors are tested as specified in 4.6.6, there shall be no evidence of breaking or loosening of terminals from the resistor form, or chipping of coating or other evidence of mechanical damage. Chipping of the coating on the leads is permissible as long as the end caps are not exposed. The change in resistance shall not exceed the values specified (see 3.1).

3.11 Resistance-temperature characteristic. When resistors are tested as specified in 4.6.7, the resistance temperature characteristic referred to an ambient temperature of 25°C shall not exceed the values specified (see 3.1).

3.12 Dielectric withstanding voltage. When resistors are tested as specified in 4.6.8, there shall be no evidence of flashover, mechanical damage, arcing, or insulation breakdown. The change in resistance shall not exceed the values specified (see 3.1).

3.13 Insulation resistance. When resistors are tested as specified in 4.6.9, the insulation resistance shall be not less than 1,000 megohms.

3.14 High-temperature exposure. When resistors are tested as specified in 4.6.10, there shall be no damage or loosening under a mounting bolt. The change in resistance shall not exceed the values specified (see 3.1).

3.15 Moisture resistance. When resistors are tested as specified in 4.6.11, there shall be no evidence of breaking or loosening of terminals from the resistor form or chipping of coating or other evidence of mechanical damage. The change in resistance shall not exceed the values specified (see 3.1). The insulation resistance shall be 100 megohms, minimum.

3.16 Low-temperature storage. 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 and final resistance measurements at 25°C ±5°C shall not exceed the values specified (see 3.1).

3.17 Mechanical strength (not applicable to axial-terminal resistors). When tested as specified in 4.6.13, resistors shall show no mechanical damage.

3.18 Shock, specified pulse (applicable to axial-lead resistors, only). When resistors are tested as specified in 4.6.14, there shall be no evidence of mechanical or electrical damage. The change in resistance shall not exceed the values specified (see 3.1). There shall be no electrical discontinuity during the test.

3.19 Vibration, high frequency (applicable to axial-lead resistors, only). When resistors are tested as specified in 4.6.15, there shall be no evidence of mechanical damage. The change in resistance shall not exceed the values specified (see 3.1). There shall be no electrical discontinuity during the test.

3.20 Life.

3.20.1 Qualification inspection. When resistors are tested as specified in 4.6.16, there shall be no evidence of mechanical damage. The change in resistance between the initial measurement and any of the succeeding measurements shall not exceed the values specified (see 3.1).

3.20.2 Quality conformance inspection. When resistors are tested as specified in 4.6.16, there shall be no evidence of mechanical damage. The change in resistance between the initial measurement and the final measurement shall not exceed the values specified (see 3.1).

3.21 Marking. Resistors shall be marked as specified in 3.21 to 3.21.3, inclusive. Marking shall remain legible at the end of all tests.

3.21.1 All resistors except ferrule and edgewise-wound styles. The type designation and the manufacturer's name or trademark, or both, shall be marked on the body of the resistor, parallel to the longitudinal axis. There shall be no space between the symbols which comprise the PIN (see 3.1). If lack of space requires it, the PIN may appear on two lines. In this event, the PIN shall be divided between the style, and the characteristic designation, as shown in the following example:

RW20
V100

For the RW70 and RW80 series, the PIN shall be as follows:

RW70U
1002F

For resistor style RW81, the following reduced marking is optional:

ABCD - manufacturer's name or trademark
W81F - abbreviated PIN and resistance tolerance
1000 - resistance designation

In any case, full marking shall be included on the resistor package.

For resistors having a body more than 2 inches long, the resistance value in ohms preceded by the abbreviation for "Resistance", and the power rating value in watts, followed by the abbreviation for the word "Nominal", shall also be marked as shown in the following example:

RW33V162
Res 1600
26 W Nom
Manufacturer's name or trademark, or both.

3.21.2 Edgewise-wound or heavy round wire styles of 642 circular mils or over. These resistors shall be marked with the PIN, manufacturer's name or trademark, or both, the resistance value in ohms, preceded by the abbreviation for "Resistance" and power rating in watts, followed by the abbreviation for the word "Nominal", on the periphery of the portion of the resistor body ends not covered by wire. The PIN and the manufacturer's name or trademark, or both, shall be marked on one end and the remaining information shall be marked on the other end as shown in the following example:

RW29V161
Manufacturer's name or trademark, or both

Res 160
11W Nom

All markings shall be approximately centered on a common longitudinal axis. If lack of space requires it, only the PIN may be marked, divided as shown 3.21.1.

3.21.3 Ferrule-terminal resistors. The PIN, manufacturer's name or trademark, or both, the resistance value in ohms, preceded by the abbreviation for "Resistance" and the power rating value in watts, followed by the abbreviation for the word "Nominal", shall be marked on the periphery of the ferrules. Considering the resistors as mounted vertically, the PIN and the manufacturer's name or trademark, or both, shall be marked on the lower ferrule and the remaining information shall be marked on the upper ferrule, as shown in the following example:

Lower ferrule
RW16V161
Manufacturer's name or trademark, or both.

Upper ferrule
Res. 160
20 W. Nom.

All markings shall be approximately centered on a common longitudinal axis.

3.21.4 Beryllium oxide (BeO). Manufacturers which use beryllium oxide in their construction shall mark each resistor body and resistor package with the symbol "BeO".

3.22 Workmanship. Resistors shall be manufactured and processed in a careful and workmanlike manner, in accordance with good design and sound practice.

3.22.1 Soldering. Where soldering is employed, only noncorrosive flux shall be used unless it can be shown that corrosive elements have been satisfactorily removed after soldering. Solder shall not be used for obtaining mechanical strength. Electrical connections shall be mechanically secure before soldering and electrically continuous after soldering. Except for solder used to coat terminals, the solder used shall in no case start to melt at a temperature of less than 360°C, or at the maximum temperature reached when the resistor is operating at rated wattage, whichever is higher.

4. QUALITY ASSURANCE PROVISIONS

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

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

4.1.2 Test equipment and inspection facilities. The supplier shall establish and maintain a calibration system in accordance with MIL-C-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 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 moisture-resistance test.

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

4.4.1 Sample. The number of sample units comprising a sample of resistors to be submitted for qualification inspection shall be as specified in the appendix to this specification.

TABLE I. Qualification inspection.

Inspection	No. of sample units for inspection	Requirement paragraph	Method paragraph	Number of defectives allowed 1/
Group I				
DC resistance	All sample units except groups II and VI 5/	3.6	4.6.1	1
Visual and mechanical inspection 2/		3.1, 3.3 to 3.4.1.7 incl., 3.21 to 3.22.1 incl.	4.6.2	
Thermal shock		3.7	4.6.3	
Short-time overload		3.8	4.6.4	
Group II				
Solderability (when applicable) 4/	5 high 5 low	3.9	4.6.5	1
Terminal strength		3.10	4.6.6	
Group III				
Resistance temperature characteristics 3/	5 high 5 low	3.11	4.6.7	1
Dielectric withstanding voltage 3/		3.12	4.6.8	
Insulation resistance 3/		3.13	4.6.9	
High temperature exposure		3.14	4.6.10	
Moisture resistance		3.15	4.6.11	
Low temperature storage		3.16	4.6.12	
Mechanical strength (not applicable to axial -terminal resistors)		3.17	4.6.13	
Group IV				
(Applicable to axial -terminal resistors only)	5 high 5 low	3.18	4.6.14	1
Shock, medium impact		3.19	4.6.15	
Vibration, high frequency				
Group V				
Life	5 high 5 low	3.20	4.6.16	1
Group VI				
Visual and mechanical inspection	2 unenclosed or uncoated units	3.1, 3.3 to 3.4.1.7 incl., 3.21 to 3.22.1 incl.		

1/ Failure of an individual resistor in one or more tests 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 one failure shall be permitted in groups I through V combined.
2/ Marking shall be considered defective only if the marking or any portion thereof is illegible. Marking shall remain legible at the end of all tests.
3/ Nondestructive examinations and tests.
4/ This test applicable to both leads.
5/ The exception shall apply only to the solderability test in group II.

4.4.2 Inspection routine. Sample units shall be subjected to the qualification inspection specified in table I, in the order shown. All coated or enclosed sample units, except those for the solderability test in group II and the uncoated or unenclosed for group VI, shall be subjected to the inspection of group I. The 30 tab-terminal sample units, 15 of the highest resistance value and 15 of the lowest resistance value or 10 ohms, whichever is higher, 40 axial-terminal units of the critical value, 10 each for groups II through V (when applicable) (see 20.1.2), and 40 axial-terminal sample units, 20 of the highest resistance value and 20 of the lowest resistance value or 10 ohms, whichever is higher, shall then be divided as specified in table I, for groups II to V, inclusive, and subjected to the inspection of their particular group. The two uncoated, or unenclosed sample units shall then be subjected to the visual and mechanical examination of group VI inspection only.

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

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 products which have passed the group A inspection shall not be delayed pending the results of group B inspection.

4.5.1.1 Inspection lot. An inspection lot, as far as practical, shall include resistors of any style within a given group shown in table V without regard to resistance value or resistance tolerance, produced under essentially uniform conditions and offered for inspection at one time. Resistors which differ in design, construction, materials, and terminal type shall not be included in one lot.

4.5.1.1.1 Production lot. A production lot consists of parts manufactured from the same basic raw materials, processed under the same specifications and procedures, and produced with the same equipment. Each production lot of parts should be a group identified by a common manufacturing record through all significant manufacturing operations.

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

4.5.1.2.1 Sampling plan.

4.5.1.2.1.1 Subgroup 1. A sample of parts from each inspection lot shall be randomly selected in accordance with table III, 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 III, 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.

4.5.1.2.1.2 Subgroup 2. A sample of parts from each inspection lot shall be randomly selected in accordance with table III, 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 III, if one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

4.5.1.2.1.3 Subgroup 3 (solderability).

4.5.1.2.1.3.1 Sampling plan. Five 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.

4.5.1.2.1.3.2 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 4.6.5. 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 3.4.1.5.1. Following the solder dip the electrical measurements required in group A, subgroup 1 tests shall be repeated on 100-percent of the lot. Lot acceptance for the electrical measurements shall be as for the subgroup 1 tests. Five 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 may be reworked a second time and be 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.

4.5.1.2.1.3.3 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 II. Group A inspection.

Test	Requirement paragraph	Method paragraph	Number of samples
Subgroup 1			
DC resistance	3.6	4.6.1	4.5.1.2.1.1
Subgroup 2			
Visual and mechanical inspection	3.1, 3.4, 3.21, 3.24	4.6.2	4.5.1.2.1.2
Subgroup 3			
Solderability	3.9	4.6.5	4.5.1.2.1.3

TABLE III. 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
500000 and over	435	102

4.5.1.3 Group B inspection. Group B inspection shall consist of the tests specified in table IV, in the order shown. They shall be performed on sample units that have been subjected to and have passed the group A inspection, unless the Government considers it more practical to select a separate sample from the lot for group B inspection.

4.5.1.3.1 Sampling plan. A sample of parts 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.

TABLE IV. Group B inspection.

Test	Requirement paragraph	Method paragraph
Thermal shock	3.7	4.6.3
Short-time overload	3.8	4.6.4

TABLE V. Group B sampling plan.

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

4.5.1.3.2 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.

4.5.1.3.3 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.1.4.3), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of these periodic inspections.

4.5.1.4 Group C inspection. Group C inspection shall consist of the tests specified in table VI, in the order shown, for the periods specified in table VI. They shall be performed on sample units (see table VII) selected from lots that have passed groups A and B inspection. If not, the samples shall be tested as in group I of qualification inspection prior to undergoing group C tests.

4.5.1.4.1 Sampling plan.

4.5.1.4.1.1 Monthly. Ten sample units of the same characteristic and style in the style group (see table VII) of the most populous decade value produced during this period, shall be inspected every month. If practicable, a different style shall be used each month.

4.5.1.4.1.1.1 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 4.5.1.4.1.1. 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.

4.5.1.4.1.2 Quarterly. Twenty sample units of the same characteristic and style in the style group (see table VII) shall be inspected quarterly. Ten sample units of any resistance value shall be subjected to the test of subgroup 1 (both ends). Ten sample units of the same characteristic and style in the same style group (see table VII) of the most populous decade value produced during this period shall be subjected to the tests of subgroup 2. If practicable, a different style shall be used every 3 months. One defective unit shall be allowed for each subgroup, but not more than one defective for the two groups combined.

4.5.1.4.1.2.1 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 4.5.1.4.1.2. 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.

4.5.1.4.1.3 Semiannually. Ten sample units of the same characteristic and style in the style group (see table VI) of any resistance value shall be subjected to the semiannual test with one defective unit allowed. If practicable, a different style shall be used every 6 months.

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

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

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

4.5.3 Retention of qualification. To retain qualification, the supplier 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 reworked lots shall be identified and accounted for.

b. The results of tests performed for qualification verification inspection (group C), including the number and mode of failures. The test report shall include results of all qualification verification inspection tests performed and completed during the 6-month period. If the test results indicate nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

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

TABLE VI. Group C inspection.

Test	No. of sample units to be inspected	Requirement paragraph	Method paragraph	No. of defects allowed
Monthly				
Resistance-temperature characteristics	10	3.11	4.6.7	1
Dielectric withstanding voltage		3.12	4.6.8	
Insulation resistance		3.13	4.6.9	
High-temperature exposure		3.14	4.6.10	
Moisture resistance 1/		3.15	4.6.11	
Low-temperature storage		3.16	4.6.12	
Mechanical strength		3.17	4.6.13	
Quarterly Subgroup 1				
Terminal strength	10	3.10	4.6.6	1
Subgroup 2				
Life	10	3.20	4.6.16	1
Semiannually (Applicable to axial-lead resistors only)				
Shock, medium impact	10	3.18	4.6.14	1
Vibration, high frequency		3.19	4.6.15	

1/ The 10 samples shall be evenly divided into two groups of five each, and one group shall be subjected to polarization, and the other group to loading.

TABLE VII. Style groups for group C inspection.

Style groups
RW20 to RW24 inclusive
RW29 to RW39 inclusive, and RW47
RW55 and RW56
RW67 to RW69 inclusive
RW70, RW74, RW78, and RW79
RW80 and RW81

4.5.4 Alternate inspection. For the purpose of retention of qualification and quality conformance inspection (see 4.5 and 4.5.3), test data on identical items covered by MIL-R-39007 may be used.

4.6 Methods of inspection.

4.6.1 DC resistance (see 3.6). Resistors shall be tested in accordance with method 303 of MIL-STD-202. The following details and exceptions shall apply:

a. Measuring apparatus: Bridges or multimeters.

b. Limit of error of measuring apparatus: One-fourth of the specified initial-resistance tolerance or 0.1 percent, whichever is less, +0.002 ohm.

c. Test voltage: Measurements of resistance shall be made by using a dc potential resulting in not more than 5 percent of rated wattage. This same voltage shall be used whenever a subsequent resistance measurement is made.

d. Points of application of test voltage for initial-resistance-tolerance measurement: For axial-lead resistors of 20 ohms or less, .375 ±.062 inch (9.53 ±1.57 mm) from the end of the body. For tab-terminal resistors of 20 ohms or less, locate on tab in line of hole parallel to resistor body. For all resistors above 20 ohms locate wherever practical on lead or tab.

4.6.2 Visual and mechanical inspection. Resistors shall be inspected to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3 to 3.4.1.7 inclusive, and 3.21 to 3.22.1 inclusive).

4.6.3 Thermal shock (see 3.7). Resistance shall be measured as specified in 4.6.1. The resistors shall then be mounted on a rack of low-heat conducting material, and rated power shall be applied until thermal stability has been reached. The power shall then be removed and within 8 to 12 seconds, the resistors shall be subjected to an air temperature of -55°C +0°C, -5°C for a period of not less than 15 minutes. Measurement of resistance shall be made not less than 2 hours after final exposure (see 3.6).

4.6.4 Short-time overload (see 3.8). DC resistance shall be measured as specified in 4.6.1. The resistors shall then be mounted by means other than soldering and shall be subjected to an overload voltage which will result in 10 times rated wattage for 5 seconds or as specified (see 3.1). In no case shall this voltage exceed the value specified (see 3.1). DC resistance shall again be measured after the resistors have cooled to room temperature.

4.6.5 Solderability (applicable to axial leads only) (see 3.9). Resistors shall be tested in accordance with method 208 of MIL-STD-202. The following details shall apply: Both leads shall be tested. The leads shall be dipped within .062 inch (1.57 mm) of the body.

4.6.6 Terminal strength (see 3.10). Tests shall be in accordance with method 211 of MIL-STD 202 with the following exceptions:

a. Test condition letters A and D (pull test and twist test, respectively) for axial lead styles only.

b. Measurement before test: DC resistance as specified in 4.6.1.

c. Method of holding (A): Resistors shall be clamped by one terminal lead.

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d. Applied force (A): Ten pounds (or as specified) (see 3.1).

e. For tab terminals, the resistors shall be firmly clamped and a direct pull of 10 pounds shall be applied at the hole to each terminal, one at a time, for at least 30 seconds, in a direction away from the resistor and parallel to the longitudinal axis.

f. Measurement after test: DC resistance as specified in 4.6.1.

g. Inspection after test: Resistors shall be inspected for evidence of breaking and loosening of terminals and chipping of coating or other evidence of mechanical damage.

4.6.7 Resistance-temperature characteristic (see 3.11). Resistors shall be tested in accordance with method 304 of MIL-STD-202. The following detail shall apply. Test temperature: In accordance with table VIII

4.6.8 Dielectric withstanding voltage (see 3.12).

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

a. Special preparations:

(1) Tab terminals: Flat (stack mounting) resistors shall be completely equipped with mounting hardware, but without supplementary mounting insulation.

(2) Tab terminals: Tubular resistors shall be mounted without supplementary insulation, between two metal plates normal to the longitudinal axis of the resistor, one plate at each end, held firmly against the end of the resistor core by a through-bolt. These plates shall be of sufficient size to extend beyond the resistor terminal extremities.

(3) Axial lead terminals: Resistors shall be placed in a conductive material which will conform to the resistor surface so that at least 90 percent of the outer periphery is contacted.

TABLE VIII. Temperature for resistance-temperature-characteristic test.

Temperature °C		
Sequence	For qualification inspection	For quality conformance inspection 3/
1	25 1/	25 1/
2	-15	
3	-55	-55
4	25 1/	25 1/
5	125	125
6	200	
7	275	275
8	350 2/	350 2/

1/ This temperature shall be considered the reference temperature for each of succeeding temperatures.
2/ For characteristic N and V only (see 3.1).
3/ At the option of the manufacturer the reverse sequence may be as follows:

1 - 25 1/
2 - 350 2/
3 - 275
4 - 125
5 - 25 1/
6 - -55

b. Initial measurement: DC resistance shall be measured as specified in 4.6.1.

c. Magnitude of test voltage: 1,000 volts rms for all styles except RW70, RW80, and RW81; for styles RW70, RW80, and RW81, the potential shall be 500 volts rms.

d. Nature of potential: AC supply at commercial-line frequency and waveform.

e. Duration of application of test voltage: 1 minute.

f. Rate of application of test voltage: The test voltage shall be raised from zero to 1,000 (500 for RW70, RW80, and RW81) volts rms, as uniformly as practicable, at a rate of approximately 100 volts rms per second.

g. Points of application of test voltage: Between the resistor terminals connected together and the mounting hardware, or the conductive material on the axial-lead resistors, as applicable.

h. Measurement after test: DC resistance shall be measured as specified in 4.6.1.

i. Inspections after test: Resistors shall be inspected for evidence of flashover, mechanical damage, arcing, and insulation breakdown.

4.6.8.2 Barometric pressure (reduced) (as applicable, see 3.1). Resistors shall be tested in accordance with method 105 of MIL-STD-202. The following details and exceptions shall apply:

a. Method of mounting: As specified in 4.6.8.1.

b. Initial measurements: DC resistance shall be measured as specified in 4.6.1.

c. Test condition D (100,000 feet).

d. Test voltage during subjection to reduced pressure: As specified (see 3.1).

e. Nature of potential: As specified in 4.6.8.1d.

f. Duration of test: 1 minute.

g. Points of application of test voltage: As specified in 4.6.8.1g.

h. Final measurements: DC resistance shall be measured as specified in 4.6.1.

i. Inspection after test: As specified in 4.6.8.1i.

4.6.9 Insulation resistance (see 3.13). Resistors shall be tested in accordance with method 302 of MIL-STD-202. The following details shall apply:

a. Test condition letter A.

b. Special preparation: In accordance with 4.6.8.1a.

c. Points of measurement: In accordance with 4.6.8.1g.

4.6.10 High-temperature exposure (see 3.14).

4.6.10.1 Mounting. Resistors shall be mounted by their normal mounting means and no soldering shall be used.

4.6.10.2 Procedure. DC resistance shall be measured as specified in 4.6.1 at room ambient temperature. Resistors shall be exposed to an ambient temperature of 275°C +5°C, -0°C (for characteristic U) and 350°C +5°C, -0°C (for characteristic N and V) for a period of 250 ±8 hours. Not less than 2 hours after the end of the exposure period, the dc resistance shall again be measured as specified in 4.6.1 at room ambient temperature. For axial-terminal resistors, the wire leads may be cleaned before the resistance measurement.

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

a. Mounting: For resistors under load a space of 1 inch minimum shall be maintained for axial-terminal resistors and 2-1/2 inches minimum for all other resistors between test parts and as follows:

(1) Tab-terminal, flat (stack-mounting) resistors: By means of mounting bolts or screws as in normal service.

(2) Tab-terminal, tubular resistors: Four (two high and two low) of the specimens, by means of their associated mounting hardware and supplementary insulation; the remaining six (three high and three low), as specified in 4.6.8.1a.(2).

(3) Axial-terminal resistors: Soldered by their leads to rigid mounts or terminal lugs. The spacing of the mounts or terminal lugs shall be such that the length of each resistor lead is approximately .375 inch (9.53 mm) when measured from the edge of the supporting terminal to the resistor body. Six (three high and three low) 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.

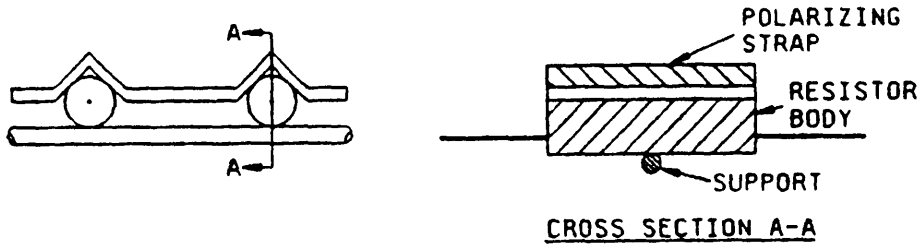

FIGURE 2. Mounting straps for moisture-resistance test.

b. Initial measurement: Immediately following the initial drying period, dc resistance shall be measured as specified in 4.6.1 at test conditions specified in 4.3.1.

c. Polarization and loading voltage: Three units of highest resistance value and three units of lowest resistance value shall be subjected to polarization and two units of highest resistance value and two units of lowest resistance value shall be subjected to loading voltage as follows:

(1) Polarization: During steps 1 to 6 inclusive, a 100 volt dc potential shall be applied with the positive lead connected to the resistor terminals tied together, and the negative lead connected to the mounting hardware or polarizing straps as applicable. This procedure is applicable to 6 of the sample units mounted as follows:

(a) Tab-terminal, tubular resistors: Mounted as specified in 4.6.8.1a.(2).

(b) Axial terminal resistors: Mounted with V-shaped metal straps as specified in 4.6.11a.(3).

(c) All others mounted as specified in 4.6.11a.

(2) Loading voltage: During the first 2 hours of steps 1 and 4, a dc potential equivalent to 85 percent of rated wattage, shall be applied between the terminals of each resistor. The negative terminal shall be electrically grounded. This procedure is applicable to four of the sample units mounted as follows:

(a) Tab-terminal tubular resistors mounted with supplementary insulation as specified in 4.6.11a.(2).

(b) Axial terminal resistors mounted without V-shaped metal straps as specified in 4.6.11a.(3).

(c) All others mounted as specified in 4.6.11a.

(d) Subcycle: Step 7b shall not be applicable. Step 7a shall be performed during any five of the first nine cycles only.

(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 1.5 to 3.5 hours. The same straps used for polarizing the resistors may also be used for the insulation resistance tests. To perform these tests, the resistors shall be removed from the chamber and within .5 hour the insulation resistance, and dc measurement tests shall be performed as specified in 4.6.9 and 4.6.1, respectively.

(f) Inspection after test: Resistors shall be inspected for evidence of mechanical damage.

4.6.12 Low-temperature storage (see 3.16).

4.6.12.1 Mounting. Resistors shall be mounted by their normal mounting means and in such a manner that there is at least 1 inch of free air space around each resistor, and in such a position with respect to the air stream that the mounting offers substantially no obstruction to the flow of air across and around the resistors.

4.6.12.2 Procedure. DC resistance shall be measured as specified in 4.6.1. Within 1 hour after this measurement, the resistors shall be placed in a cold chamber at a temperature of -65°C ±2°C for a period of 24 ±4 hours. The resistors shall then be removed from the chamber and maintained at a temperature of 25°C ±5°C for a period of approximately from 2 to 8 hours; the dc resistance shall again be measured as specified in 4.6.1. Resistors shall then be examined for evidence of mechanical damage.

4.6.13 Mechanical strength (not applicable to axial-terminal resistors). Resistors shall be supported .125 inch (3.18 mm) from each end. All except tab-terminal, stack-mounting resistors shall then be subjected to a transverse load of not less than 50 pounds; tab-terminal, stack-mounting resistors shall be subjected to a load of 25 pounds. For all except tab-terminal, stack-mounting resistors, the load shall be applied at the center of the resistor through a fulcrum having a radius of not less than .25 inch (3.2 mm); for tab-terminal, stack-mounting resistors the load shall be applied normal to the wide surface of the resistor (see 3.17).

4.6.14 Shock, specified pulse (applicable to axial-lead resistors only) (see 3.18). Resistors shall be tested in accordance with method 205 of MIL-STD-202. The following details and exceptions shall apply:

a. Special mounting means: Resistors shall be mounted on appropriate jig fixtures with their bodies restrained from movement and their leads supported at a distance of .250 inch (3.18 mm) from the resistor body. These fixtures shall be constructed in a manner to insure that the points of the resistor-mounting supports shall have the same motion as the shock table. Test leads used during this test shall be no longer than AWG size 22 stranded wire, so that the influence of the test lead on the resistor shall be held to a minimum. The test-lead length shall be no longer than necessary. In all cases, the resistor shall be mounted in relation to the test equipment in such a manner that the stress applied is in the direction which would be considered most detrimental.

b. Measurement before shock: DC resistance shall be measured as specified in 4.6.1.

c. Test condition letter C.

d. Number and direction of applied shocks: The resistor shall be subjected to a total of 10 shocks in each of two mutually perpendicular planes, one perpendicular and one 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 4.6.1.

g. Inspection after test: Resistors shall be inspected for evidence of mechanical and electrical damage.

4.6.15 Vibration, high frequency (applicable to axial-lead resistors only) (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 (3.2 mm) from the resistor body. These fixtures shall be constructed in a manner to insure that the points of the resistor mounting supports shall have the same motion as the vibration test table. The fixtures shall also be of a construction that shall 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 shall 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 4.6.1.

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 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 4.6.1.

g. Inspection after test: Resistors shall be inspected for evidence of mechanical damage.

4.6.16 Life (see 3.20). 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 by their normal mounting means except that axial-terminal resistors shall be mounted on light-weight terminals with an effective minimum lead length of .3125 inch (7.938 mm). Resistors shall be so arranged that the temperature of any one resistor shall not appreciably influence the temperature of any other resistor.

b. Initial measurement: DC resistance shall be measured as specified in 4.6.1.

c. Test temperature: This test shall be conducted at an ambient temperature of 25°C +10°C, -5°C.

d. Operating conditions: Rated dc continuous working or ac rms equivalent voltage shall be applied intermittently, 1.5 hours on and .5 hours off. Each resistor shall dissipate rated wattage. Adequate precautions shall be taken to maintain constant voltage on the resistor.

e. Test condition: 2,000 hours.

f. Measurement during test: Resistance shall be measured at the end of .5 hour-off periods, after 250 +72, -24; 500 +72, -24; 1,000, +72 -24; and 2,000 +96, -0 hours, and compared to the similar reading taken in b.

g. Inspection after test: Resistors shall be inspected for evidence of mechanical damage.

5. PACKAGING

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

6. NOTES

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

6.1 Ordering data. Acquisition documents must specify the following:

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

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

c. Title, number, and date of the applicable detail specification, and the complete type designation (see 1.2.1, 2.1, and 3.1).

d. Levels of packaging and applicable marking (see section 5).

e. Whether bracket assembly is required (see 6.4).

6.2 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable qualified products list whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is U.S. Army Research Laboratory; however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center, Directorate of Engineering Standardization (DESC-E), 1507 Wilmington Pike, Dayton, OH 45444-5270.

6.3 Derating. The intention of this specification is to cover resistors capable of full-load operation at any ambient temperature up to and including 25°C. However, if it is desired to operate these resistors at ambient temperatures greater than 25°C, the resistors should be derated in accordance with figure 2 of the applicable detail specification (see 3.1). For efficient and long-life operation, resistors should be derated by more than 50 percent.

6.4 Mounting. Under conditions of severe shock or vibration, or a combination of both, resistors of all sizes described in this specification should be mounted in such a fashion that the body of the resistor is restrained from movement with respect to the mounting base. It should be noted that if clamps are used, certain electrical characteristics of the resistor shall be altered. The heat-dissipation qualities of the resistor shall be enhanced or retarded depending upon whether the clamping material is a good or poor heat conductor. Under less severe vibration conditions, axial lead styles may be supported by their leads only. The lead lengths should be kept as short as possible, .25 inch (6.4 mm) or less preferred, but not longer than .625 inch (15.88 mm). The longer the lead, the more likely that a mechanical failure will occur.

6.5 High frequency. Resistors should not be used in circuits where their ac performance is of critical importance in the operation of such circuits.

6.6 Power dissipation. When higher ambient temperatures exist or when resistors are mounted in enclosures which limit ventilation, the wattage dissipation of any resistor should be reduced so that the maximum hot-spot temperatures permissible for the resistor is never exceeded under the most severe combination of temperature conditions.

6.7 Spacing. When resistors are mounted in rows or banks, they should be so spaced that, taking into consideration the restricted ventilation and heat dissipation by the nearby resistors, none of the resistors in the bank or row exceeds its maximum permissible hot-spot temperature. An appropriate combination of resistor spacing and resistor power rating must be chosen if this is to be assured.

TABLE IX. Performance characteristics.

Style	RW10	RW11	RW12	RW13	RW14	RW15	RW16	RW20	RW21	RW22	RW23	RW24
Maximum resistance Temperature characteristic in parts/million/°C PPM (Ref to 25°C): 20 ohms and above	±260	±260	±260	±260	±260	±260	±260	±260	±260	±260	±260	±260
Maximum resistance Temperature characteristic in parts/million/°C PPM (Ref to 25°C): below 20 ohms	±400	±400	±400	±400	±400	±400	±400	±400	±400	±400	±400	±400
Maximum ambient temperature at rated wattage (see 3.1)	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C
Maximum ambient temperature at zero wattage derating (see 3.1)	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C
Power rating in watts	203	168	125	72	58	29	20	21	31	53	68	91
Maximum percent change in resistance 1/: Thermal shock (see 3.7)	2	2	2	2	2	2	2	2	2	2	2	2
Short time overload (see 3.8)	2	2	2	2	2	2	2	2	2	2	2	2
Terminal strength (see 3.10)								1	1	1	1	1
Dielectric withstanding voltage (see 3.12)								.1	.1	.1	.1	.1
High temperature exposure (see 3.14)								2	2	2	2	2
Moisture resistance (see (see 3.15)								2	2	2	2	2
Low temperature storage (see 3.16)								2	2	2	2	2
Shock-medium impact (see 3.18)												
Vibration, high frequency (see 3.19)												
Life (see 3.20)								3	3	3	3	3
Resistance tolerance ±percent	see 3.1							see 3.1	see 3.1	see 3.1	see 3.1	see 3.1

See footnotes at end of table.

TABLE IX. Performance characteristics - Continued.

Style	RW29	RW30	RW31	RW32	RW33	RW34	RW35	RW36	RW37	RW38	RW39	RW47
Maximum resistance Temperature characteristic in parts/million/°C PPM (Ref to 25°C): 20 ohms and above	±260	±260	±260	±260	±260	±260	±260	±260	±260	±260	±260	±260
Maximum resistance Temperature characteristic in parts/million/°C PPM (Ref to 25°C): below 20 ohms	±400	±400	±400	±400	±400	±400	±400	±400	±400	±400	±400	±400
Maximum ambient temperature at rated wattage (see 3.1)	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C
Maximum ambient temperature at zero wattage derating (see 3.1)	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C	350°C
Power rating in watts	11	11	14	17	26	43	55	78	113	159	240	210
Maximum percent change in resistance 1/: Thermal shock (see 3.7)	2	2	2	2	2	2	2	2	2	2	2	2
Short time overload (see 3.8)	2	2	2	2	2	2	2	2	2	2	2	2
Terminal strength (see 3.10)	1	1	1	1	1	1	1	1	1	1	1	1
Dielectric withstanding voltage (see 3.12)	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
High temperature exposure (see 3.14)	2	2	2	2	2	2	2	2	2	2	2	2
Moisture resistance (see 3.15)	2	2	2	2	2	2	2	2	2	2	2	2
Low temperature storage (see 3.16)	2	2	2	2	2	2	2	2	2	2	2	2
Shock-medium impact (see 3.18)												
Vibration, high frequency (see 3.19)												
Life (see 3.20)	3 see 3.1	3 see 3.1	3 see 3.1	3 see 3.1	3 see 3.1	3 see 3.1	3 see 3.1	3 see 3.1	3 see 3.1	3 see 3.1	3 see 3.1	3 see 3.1
Resistance tolerance ±percent												

See footnotes at end of table.

TABLE IX. Performance characteristics - Continued.

Style	RW55	RW56	RW67	RW68	RW69	RW70	RW74	RW78	RW79	RW80	RW81
Maximum resistance Temperature characteristic in parts/million/°C PPM (Ref to 25°C) — 20 ohms and above	±260 ±400	±260 ±400	±260 ±400	±260 ±400	±260 ±400	±30 ±50 ±90	±30 ±50 ±90	±30 ±50 ±90	±30 ±50 ±90	±30 ±50 ±90	±30 ±50 ±90
Maximum resistance Temperature characteristic in parts/million/°C PPM (Ref to 25°C) — below 20 ohms											
Maximum resistance Temperature characteristic in parts/million/°C PPM (Ref to 25°C) — 11 ohms and above											
Maximum resistance Temperature characteristic in parts/million/°C PPM (Ref to 25°C) — 1 ohm to 10 ohms											
Maximum resistance Temperature characteristic in parts/million/°C PPM (Ref to 25°C) — below 1 ohm											
Maximum ambient temperature at rated wattage (see 3.1)	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C	25°C
Maximum ambient temperature at zero wattage derating (see 3.1)	350°C	350°C	350°C	350°C	350°C	275°C	275°C	275°C	275°C	275°C	275°C
Power rating in watts	7	14	6.5	11	3	1	5	10	3	2	1
Maximum percent change in resistance 1/ — Thermal shock (see 3.7)	2	2	2	2	2	.2	.2	.2	.2	.2	.2
Short time overload (see 3.8)	2	2	2	2	2	.2	.2	.2	.2	.2	.2
Terminal strength (see 3.10)	1	1	1	1	1	.1	.1	.1	.1	.1	.1
Dielectric withstanding voltage (see 3.12)	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
High temperature exposure (see 3.14)	2	2	2	2	2	.5	.5	.5	.5	.5	.5
Moisture resistance (see 3.15)	2	2	2	2	2	.2	.2	.2	.2	.2	.2
Low temperature storage (see 3.16)	2	2	2	2	2	.2	.2	.2	.2	.2	.2
Shock-medium impact (see 3.18)	.2	.2	.2	.2	.2	.1	.1	.1	.1	.1	.1
Vibration, high frequency (see 3.19)	.2	.2	.2	.2	.2	.1	.1	.1	.1	.1	.1
Life (see 3.20)	3	3	3	3	3	.5	.5	.5	.5	.5	.5
Resistance tolerance ±percent	see 3.1	see 3.1	see 3.1	see 3.1	see 3.1	±.1 .5 1.0	±.1 .5 1.0	±.1 .5 1.0	±.1 .5 1.0	±.1 .5 1.0	±.1 .5 1.0

1/ Total resistance change shall be considered as ±(_____ percent +0.05 ohm).
2/ Not to be used for new design. For replacement purposes only.

6.8 Secondary insulation. Where high voltages are present between resistor circuits and grounded surfaces on which resistors are mounted, secondary insulation capable of withstanding the voltage conditions should be provided between resistors and mountings or between mountings and ground.

6.9 Choice of styles. The styles of resistors to be used in equipment should be so chosen that, when mounted in the equipment, they shall not operate at a temperature in excess of their rating. This should be applicable under the worst possible specified conditions, i.e., with the equipment operating as follows:

a. In the maximum specified ambient temperature.

b. Under conditions producing maximum temperature rise in each resistor.

c. For a sufficient length of time to produce maximum temperature rise, or for the maximum specified time.

d. With all enclosures in place.

e. With natural ventilation only. (This should permit the use of any special ventilating provisions included as a standard part of the equipment).

f. At high altitude.

6.10 Soldering. A solder with a minimum melting temperature of 350°C should be used in soldering characteristic V resistors.

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

6.12 Caution. Certain coating materials used in fabricating resistors to this specification may be subjected to "outgassing" of volatile material when operated at surface temperatures over 200°C. This phenomena should be taken into consideration for equipment design.

6.13 Subject term (key word) listing.

Fixed
Power type
Wirewound

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

APPENDIX

PROCEDURE FOR QUALIFICATION APPROVAL

10. SCOPE

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

20. SUBMISSION

20.1 Sample.

20.1.1 All characteristics. A sample consisting of 15 or 20 sample units, as applicable, each of the highest and lowest or 10 ohms, whichever is higher, values within the resistance range for which qualification is sought, of coated or enclosed resistors using a wire size of not smaller than that specified (see 3.1), shall be submitted in accordance with paragraph 30 and table X. The resistance tolerance for characteristic V shall be ±5 percent, and for characteristic U, ±1 percent or the lowest for which qualification is sought. If 1 percent resistance tolerance is submitted and lower resistance tolerance qualification is also sought, then 10 sample units each of the highest resistance value and lowest or 10 ohms, whichever is higher, in the lower resistance tolerance for which approval is sought shall be submitted and subjected to the inspection of groups I and III. If the same coating and materials are not used, a separate submission shall be furnished in each characteristic in lieu of characteristic submission outlined in 30. Two uncoated or unenclosed resistors (one of the highest value and one of the lowest or 10 ohms, whichever is higher) shall be submitted in each style. If enclosures are used in lieu of coatings, two enclosures shall also be furnished. All submitted samples shall be representative of the supplier's normal production.

20.1.2 Critical value. If the lowest resistance value (see 20.1.1) is below the critical value specified (see 3.1) and the highest resistance value is above the critical value (see 3.1), then 40 sample units of the critical value shall also be submitted and shall consist of 10 each for groups II through V.

20.2 Test data. Each submission shall be accompanied by test data covering nondestructive tests listed in table I which are performed on the submitted specimens. All test data shall be submitted in duplicate.

20.3 Description of items. The supplier shall submit a detail description of the resistors being submitted for test, including a description of the wire used for the resistance element, the type of coating or enclosure, and the material used for the terminals.

TABLE X. Sample of qualification.

Style	Will qualify styles in	
	Characteristic N and V	Characteristic U
RW24	RW20 to RW24 inclusive	---
RW35	RW29 " RW35 "	---
RW36	RW29 " RW36 "	---
RW37	RW29 " RW37 "	---
RW38	RW29 " RW38 "	---
RW39	RW29 " RW39 " , and RW47	---
RW47	RW29 " RW38 " , and RW47	---
RW56	RW55 and RW56	---
RW68	RW67 to RW69 inclusive	---
RW78	---	RW78 and RW74
RW79	---	RW70 and RW79
RW80	---	RW80 and RW81

APPENDIX

30. EXTENT OF QUALIFICATION

30.1 All characteristics. Approval of characteristics, in wire sizes not smaller than the wire tested, shall be in accordance with table XI.

TABLE XI. Extent of approval of characteristics.

Characteristic	Will qualify characteristic
V	V
U	U
W	V and W

Approval of the smaller corresponding styles listed in table X shall be given in wire sizes not smaller than the ones tested.

30.1.1 Characteristic U. The resistance range included in the qualification of any one resistor style shall be between any two adjacent resistance values which pass the qualification inspection. Also, qualification of the lower resistance tolerances shall qualify the higher resistance tolerances in accordance with table XII.

TABLE XII. Extent of approval of resistance tolerances.

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

ation -- A symbol or sequence of symbols from a finite set of possible

Digital inform

CONCLUDING MATERIAL

Custodians:
Army - ER
Navy - EC
Air Force - 85

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

Preparing activity:
Army - ER

Agent:
DLA - ES

(Project 5905-1246)

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.
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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-R-26F	2. DOCUMENT DATE (YYMMDD) 16 November 1993

3. DOCUMENT TITLE

RESISTORS, FIXED, WIRE-WOUND (POWER TYPE) 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 U.S. Army Research Laboratory ATTN: AMSRL-EP-RD	b. TELEPHONE (Include Area Code) (1) Commercial (908) 544-3441 (2) AUTOVON 995-3441
c. ADDRESS (Include Zip Code) 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