

PERFORMANCE SPECIFICATION

RESISTOR, VARIABLE, WIREWOUND (LOW OPERATING TEMPERATURE), GENERAL SPECIFICATION FOR

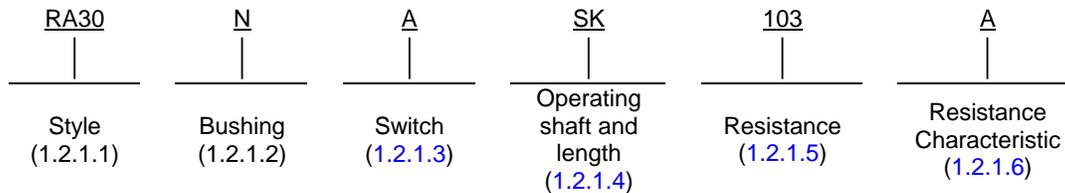
This specification is approved for use by all Department and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for variable resistors having a resistance element of wirewound on an insulating strip shaped in an arc, so that a contact bears uniformly on the resistance element when adjusted by a control shaft. These resistors are capable of full load operation at an ambient temperature of +40°C and are capable of continuous operation when properly derated, at a maximum temperature of +105°C.

1.2 Classification

1.2.1 Part or Identifying Number (PIN). The PIN is identified in the following form and as specified (see 3.1 and 6.2):



1.2.1.1 Style. The style is identified by the two letter symbol "RA" followed by a two-digit number; the letters identify low operating temperature, wirewound, variable resistors and the number identifies the size and power rating.

1.2.1.2 Bushing. The type of bushing is identified by a single letter in accordance with table I.

TABLE I. Bushing.

Symbol	Bushing
N	Standard
L	Locking
S	Shaft and panel-seal (standard)
T	Shaft and panel seal (locking)

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

MIL-PRF-19E
w/Amendment 1

1.2.1.3 Switch. The type of attached switch or absence of a switch is identified by a single letter in accordance with table II.

TABLE II. Switch.

Symbol	Switch
A	No switch
B	Single pool, single throw switch which is actuated to the "on" position at the start of the clockwise rotation.

1.2.1.4 Operating shaft and length. The operating shaft styles are identified by a two letter symbol. The first letter indicates operating shaft in accordance with table III, and the second letter indicates operating shaft length, in accordance with table IV (see 3.1).

TABLE III. Style of operating shaft.

Symbol	Shaft
S	Slotted

TABLE IV. Shaft length

Symbol	Length of shaft from mounting surface, nominal	
	Bushings N and S in inches (± 0.03125)	Bushings L and T in inches (± 0.03125)
A	0.500	
B		0.625
D	0.875	0.875
G	1.250	1.250
K	2.500	

1.2.1.5 Resistance. The nominal total resistance value expressed in ohms is identified by a three digit number; the first two digits represent significant figures and the last specifies the number of zeros to follow. When fractional values of an ohm are required, the letter "R" will be substituted for one of the significant digits to represent the decimal point, and the succeeding digits of the group will represent significant figures; e.g., 3R0 signifies 3.0 ohms.

1.2.1.6 Resistance characteristic. The resistance characteristic is identified by a single letter in accordance with table V.

TABLE V. Resistance characteristic.

Symbol	Resistance taper	Resistance tolerance
A	A	± 10 percent
C	C	± 10 percent
E	F	± 10 percent

MIL-PRF-19E
w/Amendment 1

1.2.1.7 Example of PIN. The PIN "RA20NASK502A" signifies:

- RA20 - A 2 watt, low temperature, wirewound, variable resistor of the dimensions specified (see 3.1).
- N - Standard 0.375 inch long bushing.
- A - No switch.
- SK - Slotted shaft 2.5 inches long.
- 502 - Nominal total resistance value of 5,000 ohms.
- A - Linear taper with resistance tolerance of ± 10 percent.

2. APPLICABLE DOCUMENTS

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

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation (see 6.2).

DEPARTMENT OF DEFENSE SPECIFICATION

- MIL-PRF-19/2 - Resistor, Variable, Wirewound (Low Operating Temperature), Style RA20
- MIL-PRF-19/3 - Resistor, Variable, Wirewound (Low Operating Temperature), Style RA30

DEPARTMENT OF DEFENSE STANDARDS

- MIL-STD-202 - Test Methods Standard Electronics and Electrical Components Parts.
- MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests.

DEPARTMENT OF DEFENSE HANDBOOKS

- FED-STD-H28 - Screw Thread Standards for Federal Services.

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

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents cited in the solicitation or contract (see 6.2).

INTERNATIONAL ORGANIZATION for STANDARDS (ISO)

- ISO 10012-1 - Equipment, Quality Assurance Requirements for Measuring - Part 1: Meteorological Confirmation System for Measuring Equipment.

(Copies of this document are available online at <http://www.iso.org/> or should be addressed to the American National Standards Institute, 11 West 42nd Street New York, NY 10036.)

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCSL)

- NCSL Z540-1 - Laboratories, Calibration, and Measuring and Test Equipment.

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

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

3. REQUIREMENTS

3.1 Associated specifications. The individual part requirements shall be as specified herein and in accordance with the applicable associated specification. In the event of any conflict between requirements of this specification and the associated specification, the latter shall govern (see 6.2).

3.2 Qualification. Resistors furnished under this specification shall be products which are authorized by the qualifying activity for listing on the qualified products list (QPL) before contract award (see 4.4 and 6.3).

3.3 Material. Materials 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.

3.3.1 Ferrous metals. Unless specifically approved by the government, the use of ferrous material, with the exception of corrosion resistant steel in the resistance element, is prohibited.

3.3.2 Pure tin. The use of pure tin, as an underplate or final finish is prohibited both internally and externally. Tin content of resistor components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see 6.8).

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

3.4.1 Windings. The resistance element shall consist of a winding of resistance wire or ribbon, on a form, which shall not char or break down at any combination of temperatures and loads specified herein. The element shall be wound in a manner to conform with the specified taper. Joints, welds, and bonds shall be held to an absolute minimum.

3.4.2 Resistance wire. The resistance wire used shall possess a substantially uniform cross section of conductor. The wire shall be as free as practicable from particles of impurity and grain growth or other factors contributing to stop weakness. In no case shall the wire diameter or ribbon thickness be less than 0.00175 inch (0.0445mm) nominal before winding or less than 0.00156 inch (0.0396mm) absolute minimum after winding.

3.4.3 Operating shafts. Operating shafts shall be made of corrosion resistant metal or metal which has been plated for corrosion resistance, and shall be electrically insulated from current carrying parts. The slot portion, diameter, and length of the operating shaft shall be as specified (see 3.1). In all cases, operating shafts shall be of such length that the slot depth will not interfere with shaft retainers.

3.4.4 Rotation. The total mechanical rotation and electrical rotation shall be defined on figure 1, and as specified (see 3.1). The theoretical electrical rotation of resistors with switches shall be equal to the rotation from the stops at the end opposite the switch to the point where the members just engage to actuate the switch to the "off" position.

3.4.4.1 Clockwise taper. A clockwise taper is resistance taper in which the resistance varies approximately as shown on figure 2, increasing as the rotation angle increases in a clockwise direction as viewed from the operating shaft, and measured between the left terminal and the rotating contact terminal, indicated as 1 and 2, respectively, on figure 1.

MIL-PRF-19E
w/Amendment 1

3.4.4.2 Counterclockwise taper. A counterclockwise taper is a resistance taper in which the resistance varies approximately as shown on figure 3, increasing as the rotation angle increases in a counterclockwise direction as viewed from the operating shaft, and measured between the right terminal and the rotating contact terminal as indicated 3 and 2, respectively on figure 1

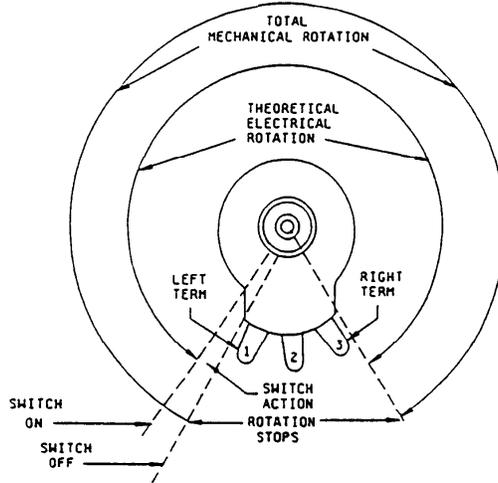


FIGURE 1. Definition of rotation (shaft end view).

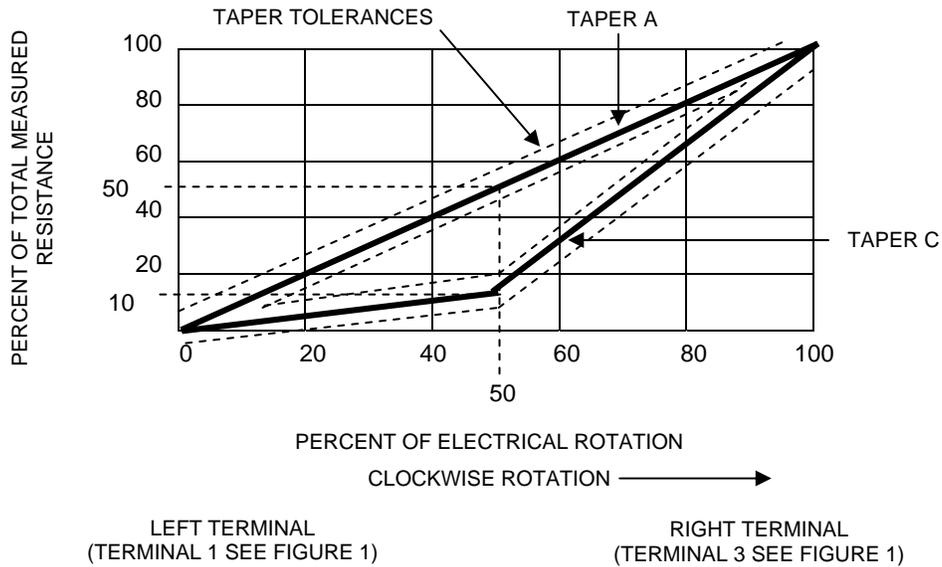


FIGURE 2. Clockwise taper.

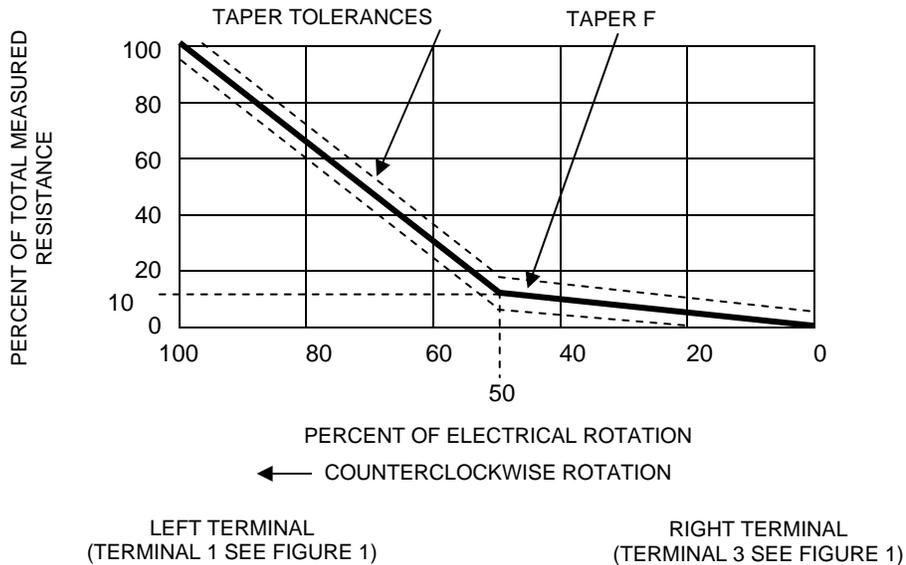


FIGURE 3. Counterclockwise Taper.

3.4.5 Contact-arm assembly. Contact pressure on the resistance element shall be maintained uniformly by positive pressure and shall be such as to permit smooth electrical and mechanical control of the resistor over the entire range of electrical rotation (see 3.1) within the resistance rating. The rotating contact shall have continuous electrical contact with its terminal through the entire mechanical rotation and shall be electrically insulated from the operating shaft, bushing, and resistor housing.

3.4.5.1 Stops. A stop shall be employed to limit the mechanical rotation of the contact arm assembly.

3.4.6 Terminals. Resistors and attached switches shall be supplied with external terminal lugs or terminal lugs of such size and style as to permit accommodating and soldering of three 0.032 inch (0.81mm) diameter (AWG size 20, stranded or equivalent) wires for resistors with 0.250 inch (6.35 mm) diameter operating shaft, and three 0.025 inch (0.64 mm) diameter (AWG 22 solid or equivalent) wires for resistors with 0.125 inch (0.318 mm) diameter operating shafts. Terminal shall be treated to facilitate soldering.

3.4.7 Hardware. Each resistor shall be furnished with a corrosion-resistant, internal tooth lockwasher, a hexagonal mounting nut, and a locking nut of the size specified (see 3.1). Hardware shall not be assembled on the resistor unless otherwise specified (see 6.2). For direct Government orders, hardware shall be assembled on the resistor.

3.4.7.1 Standard bushings. When standard bushings are specified, the bushing shall be as shown for the applicable style of resistor (see 3.1).

3.4.7.2 Locking bushings. When locking bushings are specified, the bushing shall be as shown for the applicable style of resistor (see 3.1).

3.4.7.3 Nonturn device. A nonturn device shall be furnished on resistors, which will prevent their rotation with respect to surface on which they are mounted. The location of the nonturn device and its widest dimension shall be as specified (see 3.1). If the nonturn device is not symmetrical about its vertical axis, it shall be so placed that a plane passed perpendicular to the widest dimension and through its center shall pass through the axis of the operating shaft, and shall be an integral part of the resistor or permanently attached thereto.

3.4.8 Threaded parts. All threaded parts shall be in accordance with [FED-STD-H28](#) and as specified (see 3.1).

3.4.8.1 Securing of screws, nuts, and threaded parts. All screw-thread assemblies shall be made resistant to loosening under vibration.

3.4.9 Protective housing or enclosure (when applicable [see 3.1](#)). The resistance element of the completed resistors shall be protected by a housing, or an enclosure, or both, which shall cover the exterior of the resistance element. The protective housing or enclosure shall be free from holes, fissures, chips, or other faults, and shall be such as to minimize the establishment of leakage paths between terminals, resulting from collection of moisture film on the exterior surface of the housing or enclosure. If the housing is made from an aluminum alloy, it shall be properly protected against corrosion, and all fasteners shall be plated. Unplated copper alloy metals shall not be used in contact with aluminum.

3.4.10 Shaft and panel seals. When shaft and panel seals are specified ([see 3.1](#)), the panel seal may be an integral part of the resistor or may be detachable.

3.5 Voltage Rating. The theoretical calculated rated continuous working voltage or the voltage equivalent to proper rating (rated wattage) shall be determined from the following formula:

$$E = \sqrt{PR}$$

Where:

E = Rated or root mean square (rms) continuous working voltage.

P = Power rating.

R = Nominal total resistance.

3.6 Power rating. The resistors shall have a power rating based on continuous full-load operation at the ambient temperature of +40°C. The power rating is dependent on the ability of the resistors to meet the requirements specified in the life test. For temperatures in excess of that specified, the load shall be derated as shown in [figure 4](#). Power rating as specified ([see 3.1](#)) is applicable only when the maximum resistance is engaged in the circuit. When only a portion of the resistance element is engaged in the circuit, the power rating is reduced in approximately the same proportion as the engaged resistance.

3.7 Dielectric withstanding voltage. When resistors or switches, as required, are tested as specified in [4.7.2](#), there shall be no evidence of damage, arcing, or breakdown. The leakage current shall not exceed 1 milliampere (mA).

3.8 DC resistance ([see 4.7.3](#)).

3.8.1 Total resistance. When resistors are tested as specified in [4.7.3.1](#), the total direct-current (dc) resistance shall equal the nominal resistance value plus or minus the resistance tolerance.

3.8.2 Resistance taper. A linear resistance taper is one having a constant change of resistance with angular rotation. A nonlinear resistance taper is one having variation or lack of constancy in the change of resistance with angular rotation. When resistors are tested as specified in [4.7.3.2](#), the resistance taper shall conform in general shape to the nominal curve shown on figures 2 or 3, as applicable. The angle at which any percent of measured resistance is effective shall be within ±5 percent of the total effective electrical rotation of the specified position as shown on [figure 2](#) and [3](#), for tapers A and C and taper F respectively ([see 3.1](#)).

3.8.3 Minimum resistance. When resistors are tested as specified in [4.7.3.3](#), the resistance measured between the rotating contact arm terminal and the adjacent resistance-element terminal shall not exceed the applicable value listed in [table VI](#).

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

MIL-PRF-19E
w/Amendment 1

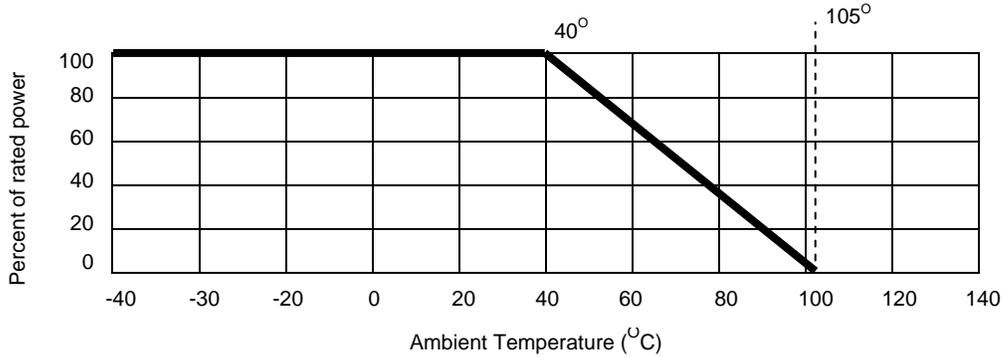


FIGURE 4. Power rating curve for continuous duty.

TABLE VI. Minimum resistance.

Total resistance nominal (in ohms)	Maximum resistance at minimum setting	
	All styles with 0.25 inch diameter shaft (in ohms)	All styles with 0.125 inch diameter shaft (in ohms)
Up to and including 15		5.0
Over 15		3.0
3 to 50 inclusive	0.3	
51 to 100 inclusive	0.5	
over 100	0.2 percent of the nominal resistance value or 1.0 ohm which ever is greater	

3.9 Torque (see 4.7.4).

3.9.1 Operating torque. When resistors are tested as specified in 4.7.4.2, the torque required to rotate the contact arm shall be as specified (see 3.1). An additional torque of 15 ounce-inches shall be permitted for operation of attached switches.

3.9.2 Stop torque. When resistors are tested as specified in 4.7.4.3, resistors shall withstand the stop torque specified (see 3.1) without damage to the contact arm, stop and nonturn device.

3.9.3 Locking torque. When resistors are tested as specified in 4.7.4.4, resistors with locking bushings shall withstand the locking torque specified (see 3.1) without damage to the bushings, threads and nonturn device. The resistance value shall not change in excess of 3 percent of the total resistance value.

3.10 Low temperature storage. When resistors are tested as specified in 4.7.5, the maximum change in resistance shall not exceed ± 4 percent.

3.11 Low temperature operation. When resistors are tested as specified in 4.7.6, the torque required to effect rotation of the contact arm shall not be greater than 40 ounce-inches. This includes switch action if attached. The maximum change in resistance shall not exceed ± 4 percent.

MIL-PRF-19E
w/Amendment 1

3.12 Thermal shock. When resistors are tested as specified in 4.7.7, resistor shall show no evidence of mechanical damage and the change in resistance shall not exceed ± 4 percent.

3.13 Load life. When resistors are tested as specified in 4.7.8, the maximum change in resistance shall not exceed ± 3 percent.

3.14 Salt spray (corrosion). When resistors are tested as specified in 4.7.9, resistors shall show no evidence of marked corrosion. The resistors shall be mechanically operative and electrically continuous through all three terminals, over the total mechanical rotation, and shall show no disturbances of the ground connection to the marking panel.

3.15 Moisture resistance. When resistors are tested as specified in 4.7.10, resistors shall show no evidence of mechanical damage, and the maximum change in resistance shall not exceed 10 percent. The insulation resistance shall be not less than 3.5 megohms.

3.16 Resistance to solder heat. When resistors are tested as specified in 4.7.11, resistors shall show no evidence of mechanical damage and the change in resistance shall not exceed 2 percent.

3.17 Rotational life. When resistors are tested as specified in 4.7.12, the permanent change in resistance shall not exceed 5 percent, nor shall proper contact be broken during or as a result of the test.

3.18 Switch life. When resistors are tested as specified in 4.7.13, switches shall make, carry, and break, without damage, the specified current. The contact resistance shall not exceed 0.05 ohm.

3.19 Insulation resistance. When resistors are tested as specified in 4.7.14, the insulation resistance shall not be less than 100 megohms.

3.20 Shock (specified pulse). When resistors are tested as specified in 4.7.15, there shall be no open circuit or intermittent contact; movement of the contact arm shall not result in a resistance change greater than 10 percent; the total resistance shall not change in excess of 2 percent; and there shall be no evidence of mechanical damage.

3.21 Vibration, high frequency. When resistors are tested as specified in 4.7.16, there shall be no open circuit or intermittent contact; movement of the contact arm shall not result in a resistance change greater than 10 percent; the total resistance shall not change in excess of 2 percent; and there shall be no evidence of mechanical damage.

3.22 Fungus. All external materials shall be nonnutrient to fungus growth or shall be treated to retard fungus growth. The manufacturer shall verify by certification that all external materials are fungus resistant or shall test resistors as specified in 4.7.17. There shall be no evidence of fungus growth on the external surfaces.

3.24 Marking. Resistors shall be permanently marked with the PIN and the manufacturer's name and or trademark. If space permits, the resistance value shall also be marked. The PIN shall be marked on either the rear or the periphery of the resistors. There shall be no space between symbols which comprise the PIN. If lack of space requires it, the PIN may be set in two lines. In this event, the PIN shall be divided between the switch and shaft designations, as shown in the following example:

RA30NA
SK103A

Marking shall remain legible at the end of all tests.

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

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

4. VERIFICATION

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

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

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

4.3 Inspection conditions and precautions.

4.3.1 Inspection conditions. Unless otherwise specified herein, all inspections shall be 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. Precautions shall also be taken to prevent damage by heat when soldering resistor leads to terminals.

4.4 Qualification. 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 size. The number of sample units comprising a sample of resistors to be subjected for qualification inspection shall be as specified in the appendix to this specification. The sample shall be taken from a production run and shall be produced with equipment and procedures normally used in production.

4.4.2 Test routine. Sample units shall be subjected to the qualification inspection specified in [table VII](#) or [table VIII](#), in the order shown. All sample units shall be subjected to the inspection of group I. The specimens shall then be divided into groups in accordance with [table A-II](#) or [table A-III](#) as applicable, and subjected to the inspection for their particular group. For combined-type submission, the inspection routine shall be in accordance with the appendix to this specification.

4.4.3 Defective. Defectives in excess of those allowed in [table VII](#) or [table VIII](#) will be cause for refusal to grant qualification.

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

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

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

MIL-PRF-19E
w/Amendment 1

TABLE VII. Qualification inspection.

Examination or test	Requirements paragraph	Method paragraph	Number of defectives <u>1/</u>
<u>Group I</u> Visual and mechanical examination <u>2/</u> Dielectric withstanding voltage DC resistance Torque	3.3 to 3.4.11 and 3.25 to 3.26 inclusive 3.7 3.8 3.9	4.7.1 4.7.2 4.7.3 4.7.4	0
<u>Group II</u> Low temperature storage Low temperature operation Thermal shock	3.10 3.11 3.12	4.7.5 4.7.6 4.7.7	2 <u>4/</u>
<u>Group III</u> Load life Salt spray (corrosion)	3.13 3.14	4.7.8 4.7.9	
<u>Group IV</u> Moisture resistance	3.15	4.7.10	
<u>Group V</u> Resistance to soldering heat Rotational life Switch life <u>3/</u> Insulation resistance	3.16 3.17 3.18 3.19	4.7.11 4.7.12 4.7.13 4.7.14	
<u>Group VI</u> Shock (specified pulse) Vibration, high frequency	3.20 3.21	4.7.15 4.7.16	
<u>Group VII</u> Fungus	3.22	4.7.17	

1/ Failure of an individual resistor in one or more tests of a test group shall be charged as a single defective.

2/ Marking shall be considered defective only if it is illegible after completion of any of the required inspections.

3/ Not applicable to locking bushing type resistors.

4/ Number of failures allowed in group III, IV, V, and VI is one, with a combined total of two overall.

MIL-PRF-19E
w/Amendment 1

TABLE VIII. Qualification inspection for locking-bushing-type resistors. 1/

Examination or test	Requirements paragraph	Method paragraph	Number of defectives 2/
<u>Group I</u> Visual and mechanical examination 3/ DC resistance Torque	3.3 to 3.4.10 and 3.24 to 3.26 inclusive 3.8 3.9	4.7.1 4.7.3 4.7.4	0
<u>Group II</u> Moisture resistance	3.15	4.7.10	1
<u>Group III</u> Resistance to soldering heat Rotational life Insulation resistance	3.16 3.17 3.19	4.7.11 4.7.12 4.7.14	

1/ This inspection is applicable only to 12 additional locking-bushing-type resistors when submitted with standard-bushing type.

2/ Failure of an individual resistor in one or more test group shall be charged as a single defective.

3/ Marking shall be considered defective only if it is illegible after completion of any of the required inspections.

4.6 Conformance inspection.

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

4.6.1.1 Inspection lot. An inspection lot, as far as practicable, shall consist of all resistors of the same style produced under essentially the same conditions, and offered for inspection at one time. Sealed resistors shall not be included in the same lot with unsealed resistors. A lot may include more than one order.

4.6.2 Group A inspection. Group A inspection shall consist of the examination and test specified in [table IX](#), and shall be made on the same set of sample units, in the same order shown.

4.6.2.1 Sampling plan.

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

4.6.2.1.2 Subgroup 2. A sample of parts from each inspection lot shall be randomly selected in accordance with [table X](#). If one or more defects are found, the lot shall be screened and defectives removed. After screening and removal of defectives a new sample of parts shall be randomly selected in accordance with [table X](#). If one or more defects are found in this second sample, the lot shall be rejected and shall not be supplied to this specification.

MIL-PRF-19E
w/Amendment 1

TABLE IX. Group A inspection.

Examination or test	Requirements paragraph	Method paragraph	Sampling plan
<u>Subgroup 1</u>			
Dielectric withstanding voltage (atmospheric pressure)	3.7	4.7.2.1	See 4.6.2.1.1
Total resistance	3.8.1	4.7.3.1	
<u>Subgroup 2</u>			
Visual and mechanical examination	3.3 to 3.4.10 and 3.24 to 3.26 inclusive	4.7.1	See 4.6.2.1.2

TABLE X. Group A sampling plan.

Lot size	Subgroup 1 sampling plan	Subgroup 2 sampling plan
1 to 12	100 percent	100 percent
13 to 90	100 percent	13
91 to 150	91	13
151 to 280	151	20
281 to 500	192	29
501 to 1,200	192	34
1,201 to 3,200	192	42
3,201 to 10,000	192	50
10,001 to 35,000	294	60
35,001 to 150,000	294	74
150,001 to 500,000	345	90
500,000 and over	435	102

4.6.3 Group B inspection. Group B inspection shall consist of the tests specified in table XI, in the order shown, and the sample shall be selected from inspection lots that have passed group A.

4.6.3.1 Sampling plan. A sample of parts shall be randomly selected in accordance with [table XII](#). If one or more defects are found, the lot shall be screened and defectives removed. After screening and removal of defectives a new sample of parts shall be randomly selected in accordance with [table XII](#). If one or more defects are found in this second sample, the lot shall be rejected and shall not be supplied to this specification.

TABLE XI. Group B inspection.

Examination or test	Requirements paragraph	Method paragraph
Dielectric withstanding voltage (reduced barometric pressure)	3.7	4.7.2.2
Total resistance	3.8.1	4.7.3.1
Torque	3.9	4.7.4

MIL-PRF-19E
w/Amendment 1

TABLE XII Group B sampling plan.

Lot size	Subgroup 1 sampling plan
1 to 25	3
26 to 50	5
51 to 90	6
91 to 150	7
151 to 280	10
281 to 500	11
501 to 1,200	15
1,201 to 3,200	18
3,201 to 10,000	22
10,001 and over	29

4.7 Methods of examination and test.

4.7.1 Visual and mechanical examination. Resistors shall be examined to verify that the materials, design, construction, physical dimension, marking, and workmanship are in accordance with the applicable requirements (see 3.3 to 3.4.6, 3.4.7 to 3.4.10, 3.24 and 3.26).

4.7.2 Dielectric withstanding voltage (see 3.7).

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

- a. Test potential: 900 volts root-mean-square (rms).
- b. Potential: From an alternating current (ac) supply at commercial line frequency and waveform.
- c. Points of application of test voltage: Between the terminals tied together and the external metal portions of the resistors and metal mounting plate.
- d. Examination and measurements: During the tests, the leakage current shall be measured. At the conclusion of the test, resistors shall be examined for evidence of mechanical damage.

4.7.2.2 Barometric pressure. Resistors shall be tested in accordance with method 105 of MIL-STD-202. A potential of 450 volts rms (or as specified, see 3.1), from an alternating-current at commercial line frequency, and waveform of not more than 100 hertz shall be applied for 1 minute between all terminals connected together and bushing.

4.7.3 DC resistance (see 3.8). Resistors shall be tested in accordance with method 303 of MIL-STD-202. The following details shall apply:

- a. Measuring apparatus: Different types of measuring test equipment (multimeter, 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 it can be shown that the performance of the equipment is equivalent. The supplier shall establish and maintain a calibration system in accordance with NCSL Z540-1, ISO 10012-1, or equivalent system as approved by the qualifying activity.
- b. Measurement energy for electronic test equipment: The measurement energy applied to the unit under test shall not exceed 10 percent of the +25°C rated wattage times 1 second.

MIL-PRF-19E
w/Amendment 1

- c. Test voltages for bridges: Measurements of resistance shall be made by using the test voltage specified in [table XIII](#). The test voltage chosen, whether it be the maximum or a lower voltage which would still provide the sensitivity required, shall be applied across the terminals of the resistor. This same voltage shall be used when ever a subsequent resistance measurement is made.

TABLE XIII. DC resistance values.

Total resistance nominal (in ohms)	Maximum test voltage
10 to 100 incl.	1.0
101 to 1,000 incl.	3.0
1,001 to 10,000 incl.	10.0
10,001 and above	30.0

4.7.3.1 Total resistance (see 3.8.1). The total resistance of resistors shall be measured between the terminals of the resistance element with the contact arm against the low resistance end of the taper. The resistance value obtained shall be compared with the specified nominal total resistance.

4.7.3.2 Resistance taper (see 3.8.2). Following the measurement of total resistance, a resistance measurement shall be made at 30, 50, 70, and 100 percent of the electrical rotation. The percent of measured resistance verse percent of electrical rotation shall be determined from values obtained as follows:

Taper A (linear)

(From 0 to 100 percent electrical rotation)

$$\text{Percent measured resistance} = \frac{\text{Resistance} \times 100}{\text{Total resistance measured}}$$

Tapers C and F (nonlinear)

(From 0 to 50 percent electrical rotation)

$$\text{Percent measured resistance} = \frac{\text{Resistance} \times 100}{\text{Measured resistance at 50 percent rotation} \times 10}$$

(From 50 to 100 percent electrical rotation)

$$\text{Percent measured resistance} = \frac{\text{Resistance} \times 100}{\text{Total resistance measured}}$$

4.7.3.3 Minimum resistance (see 3.8.3). The contact arm shall be rotated to its extreme counterclockwise limit of mechanical rotation. With the arm in this position, the resistance between the left terminal and the center contact terminal shall be measured. The contact arm shall then be rotated to its extreme clockwise limit of mechanical rotation. With the arm in this position, the resistance between the right terminal and center contact terminal shall be measured. For resistors with actuated switches, the minimum resistance shall be measured with the switch on the exact point where the shaft actuator makes mechanical contact with the switch actuator when moving so as to begin to turn the switch off. Minimum resistance shall also be measured with the switch at the off position.

4.7.4 Torque (see 3.9)

4.7.4.1 Mounting. The resistors shall be mounted by their normal mounting means, and a maximum of 10 inch-pound torque shall be used in tightening the mounting nut.

MIL-PRF-19E
w/Amendment 1

4.7.4.2 Operating (see 3.9.1). The torque required to rotate the contact arm on the resistance element shall be determined throughout the entire range of mechanical rotation by the torque wrench method or by any other method satisfactory to the qualifying activity.

4.7.4.3 Stop (see 3.9.2). Resistors shall be mounted on a metal panel by their normal mounting means. The contact arm shall then be rotated to each extreme limit of mechanical rotation and the specified torque (see 3.1) applied through the operating shaft to the stops.

4.7.4.4 Locking (see 3.9.3). Resistors shall be mounted on a metal panel by their normal mounting means and set at approximately 40 percent of the resistance value (measured between the counterclockwise end terminal and the center tap). The locking device shall be tightened with a torque not greater than that specified. With the locking device tightened, the operating shaft is to withstand the specified torque (see 3.1). Movement of the shaft shall be checked visually and resistors shall be examined for evidence of damage. The total resistance shall be measured.

4.7.5 Low temperature storage (see 3.10). The total resistance shall be measured at $+25^{\circ}\text{C} +10^{\circ}\text{C}$, -5°C within 1 hour after this measurement, resistors shall be placed in a chamber at a temperature of $+25^{\circ}\text{C} +10^{\circ}\text{C}$, -5°C . The temperature in this chamber shall be lowered to -63°C , $+0^{\circ}\text{C}$, -2°C within a minimum period of 3 hours. Twenty four hours after the resistors have reached this temperature, the temperature of the chamber shall be gradually raised to $+25^{\circ}\text{C} +10^{\circ}\text{C}$, -5°C within a maximum period of 8 hours. Resistors shall then be removed from the chamber and maintained at $+25^{\circ}\text{C} +10^{\circ}\text{C}$, -0°C for a period of approximately 72 hours, after which the total resistance shall be measured.

4.7.5.1 Conformance inspection. At the option of the manufacturer, the sample units may be placed in or removed from the test chamber while the chamber is at the extreme low temperature.

4.7.6 Low temperature operation (see 3.11). The total resistance shall be measured at $+25^{\circ}\text{C} +10^{\circ}\text{C}$, -5°C . The resistors shall then be placed in a chamber at $+25^{\circ}\text{C} +10^{\circ}\text{C}$, -5°C and the temperature in the chamber shall be lowered to $-55^{\circ}\text{C} +10^{\circ}\text{C}$, -5°C within a minimum period of 1 hour and 30 minutes. After 1 hour \pm 15 minutes of stabilization at this low temperature, rated continuous working voltage (see 3.1), shall be applied for 45 minutes across the resistance element between one end terminal and the contact arm, with the contact arm against the opposite stop. The resistors shall then be allowed to stabilize for 1 hour \pm 15 minutes and the torque necessary to effect rotation of the contact arm shall be measured. Following this measurement, the temperature shall be gradually raised to $+25^{\circ}\text{C} +10^{\circ}\text{C}$, 5°C within a period of 24 hours. The resistors shall then be removed from the chamber and maintained at $+25^{\circ}\text{C} +10^{\circ}\text{C}$, -5°C . For approximately 24 hours, after which the total resistance shall be measured.

4.7.6.1 Conformance inspection. At the option of the manufacturer, the extreme low temperature may be -63°C , 0°C , -2°C and the sample units may be placed in or removed from the test chamber while the chamber is at the extreme high or low temperature.

4.7.7 Thermal shock (see 3.12). Resistors shall be tested in accordance with [method 107](#) of MIL-STD-202. The following details and exceptions apply:

- a. Test condition letter: A.
- b. Measurement before cycling: Total resistance shall be measured as specified in [4.7.3.1](#)
- c. Measurements after cycling: Total resistance shall be measured as specified in [4.7.3.1](#), continuity of the contact arm shall be verified by connecting a vacuum tube voltmeter or other indicating device, between the contact arm terminal and the counterclockwise end terminal. The applied voltage shall be in accordance with [table XIII](#).
- d. Examination after test: Resistors shall be examined for evidence of mechanical damage.

4.7.8 Load life (see 3.13).

4.7.8.1 Test conditions. During this test, resistors with a diameter of 2 inches (51 mm) or less shall be mounted with their terminals positioned downward on a 4 inch (102 mm) square, 0.050 inch (1.27 mm) thick, steel panel in still air. Still air is surrounding air with no circulation other than that created by the heat of the resistor being operated. Shielding shall be located no closer than 12 inches (304 mm) from the panel. This test shall be conducted at a temperature of $+40^{\circ}\text{C} \pm 5^{\circ}\text{C}$, whenever possible.

4.7.8.2 Procedure. Following a measurement of resistance within the chamber, at test temperature, rated wattage (see 3.1) shall be applied 1 hour (30 minutes "on", 30 minutes "off") for a total of 1000 hours through the contact arm and one resistance element terminal, so that rated wattage is dissipated across the entire resistive element. Adequate precautions shall be taken to maintain constant wattage on resistors under test. Resistance measurements shall be made at the end of the 30 minute "off" periods after 100 hours ± 8 hours, 200 hours ± 8 hours, 500 hours ± 12 hours, 1000 hours ± 12 hours have elapsed.

4.7.9 Salt spray (corrosion) (see 3.14). Resistors shall be mounted on an aluminum panel (2S), with their terminals positioned downward and tested in accordance with tested [method 101](#), test condition A (salt solution 5 percent) of [MIL-STD-202](#). At the conclusion of the test, resistor covers, if any, shall be removed, the resistors shall be thoroughly rinsed in clear tap water, and then permitted to dry for 24 hours ± 4 hours at $+40^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Resistors shall be then examined for evidence of damage and corrosion. The resistors shall be tested for electrical continuity between the end terminals and contact arm terminal and each end terminal over the total mechanical rotation.

4.7.10 Moisture resistance (see 3.15). Resistance shall be tested in accordance with [method 106](#) of [MIL-STD 202](#). The following details and exceptions shall apply:

- a. Mounting: On a noncorrosive metal panel with operating shaft in a horizontal position and radial terminals pointed downward.
- b. Initial measurements: Resistance shall be measured as specified in [4.7.3](#) and insulation resistance shall be measured as specified in [4.7.14](#).
- c. Load: During steps 1 and 4, a dc voltage corresponding to 65 percent rated wattage (see 3.1) shall be applied for the first 2 hours of each step to all resistors. The voltage shall be applied across the left terminal and contact arm, with the operating shaft rotated to the maximum clockwise position (see figure 1).
- d. Final measurements: At the end of the last cycle and while the resistors are still in the test chamber at the high humidity condition, total resistance shall be measured as specified in b. above. Following this measurement of total resistance and for purposes of performing the insulation resistance and dielectric withstanding voltage tests, the test chamber may be opened in order to make the necessary electrical connections. These tests shall be performed after chamber has been returned to the high humidity condition for at least 1 hour. Insulation resistance shall be measured between all the resistor terminals connected together and the mounting bushing, using a dc potential of 100 volts. Dielectric withstanding voltage shall be tested as specified in [4.7.2.1](#) except that the test potential applied to the resistors shall be 250 volts. The subsequent 24 hour conditioning period and measurements do not apply.

4.7.11 Resistance to soldering heat (see 3.16). 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 [4.7.3](#).
- b. Test condition letter: A.
- c. Depth of immersion in the molten solder: To a point 0.125 to 0.1875 inch (3.18 to 4.763 mm) from the resistor body.
- d. Examination and measurement after test: Four hours \pm 30 minutes after completion of test, the dc resistance shall be measured as specified in [4.7.3](#). Resistors shall be examined for evidence of mechanical damage.

4.7.12 Rotational life (see 3.17).

4.7.12.1 Mounting. During this test, resistors shall be centrally mounted on a 4 inch (102 mm) square, 0.050 inch (1.27 mm) thick, steel panel, with their terminals positioned downward. Care should be taken to insure that side thrust is minimized by the proper alignment of the resistors shafts with the drive shafts. The resistors shall be ganged in pairs and each pair shall be connected in series as shown on [figure 5](#) so that a nominally constant current flows through the resistors irrespective of the contact arm position during oscillation of the shafts. The shafts shall be so connected mechanically that they will turn simultaneously in the same direction. When performing this test on locking bushing type resistors, the locking nut shall be removed.

4.7.12.2 Rotation. A dc potential equivalent to that required to dissipate rated wattage across the entire resistive element of resistors having the same nominal total resistance as those under test, shall then be applied as shown on [figure 5](#). Resistor shafts shall then be continuously oscillated through not less than 98 percent of the total mechanical rotation (see [figure 1](#)), at the rate of approximately 10 ± 2 cycles per minute for not less than 4,000 cycles per day for a total of 25,000 cycles. Locking bushing types shall be rotated for a total of 500 cycles. The contact arm shall oscillate over the end of the element to which connection is made and proper contact of the contact arm with the winding shall be maintained. Total resistance of resistors shall be ascertained at the end of every 5,000 cycles for all resistors except the locking bushing type. The rotational life test shall be conducted at ambient room temperature.

4.7.12.3 Conformance inspection. At the option of the manufacturer, the sample units may be rotated at a rate of 8 to 30 cycles per minute.

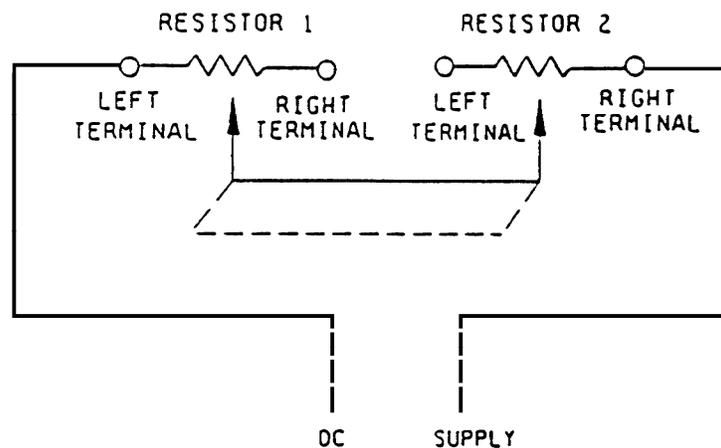


FIGURE 5. Rotational life test circuit.

MIL-PRF-19E
w/Amendment 1

4.7.13 Switch life (see 3.18). A current of 3.0 ampere flowing through a carbon lamp or a wirewound resistor load with an ac rms potential of 117 volts ± 10 percent applied, applied at commercial line frequency and waveform of not more than 100 hertz, shall be interrupted 15,000 times by the operation of the switch. Switch contact resistance shall be measured both before and after the 15,000 cycles of on-off operation. At the conclusion of the test, resistors shall be examined for evidence of damage. This test shall be conducted concurrently with the rotational life test specified in 4.7.12.

4.7.14 Insulation resistance (see 3.19). 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: Resistors shall be mounted on metal plates of sufficient size to extend beyond the resistor extremities, and in such a manner that measurements can be made between the terminals tied together and any other external metal parts.
- c. Points of measurements: Between the terminals connected together and all external metal portions of the resistors and metal mounting plate.

4.7.15 Shock (specified pulse) (see 3.20). Resistors shall be tested in accordance with method 213 of MIL-STD-202. The following details and exceptions shall apply:

- a. Mounting: Resistors shall be mounted by their normal mounting means and affixed on an appropriate mounting fixture. A suggested mounting fixture shall be constructed in such a manner as to insure that the mounting supports remain in a static condition with reference to the shock test table. Test leads used during this test shall be as small a wire size as practicable (e.g., AWG 22 stranded) so 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 a manner that the stress applied is in the direction which would be considered most detrimental. The contact arm shall be positioned at the approximate midpoint of the resistance element.
- b. Measurements after mounting: Total resistance shall be measured as specified in 4.7.3.1; the resistance shall be measured between the contact arm terminal and terminal number one.
- c. Test condition: C.
- d. Motion: Resistors shall be subjected to a total of 20 impacts (five blows in each of two directions in each of two mutually perpendicular planes). One of the test planes used shall be perpendicular and the other parallel to the longitudinal axis of the operating shaft.
- e. Measurement during test: Each resistor shall be monitored to determine momentary discontinuity by a method which shall at least be sensitive enough to monitor or register automatically any momentary discontinuity of 0.1 millisecond or greater duration.
- f. Measurements and examination after test: Total resistance shall be measured as specified in 4.7.3.1; the resistance shall also be measured between the contact arm terminal and terminal number one. Resistors shall then be examined for evidence of mechanical damage.

4.7.16 Vibration, high frequency (see 3.21). Resistors shall be tested in accordance with [method 204](#) of [MIL-STD-202](#). The following details and exceptions shall apply:

- a. Mounting: By normal mounting means and affixed to an appropriate nonresonant mounting fixture. A suggested mounting fixture is shown on figure 6. The mounting fixture shall be constructed in such a manner as to insure that the points of the resistor mounting supports shall have the same motion as the vibration test table. Test leads used during this test shall be as small as practicable (e.g., AWG size 22, stranded) so that the influence of the test lead on the resistor shall be held to a minimum. The test lead lengths shall be no longer than necessary. A shielded cable which may be necessary because of the field surrounding the vibration test table, shall be clamped to the mounting fixture. In all cases, 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 the most detrimental. The contact arm shall be positioned at the approximate midpoint of the resistor element.
- b. Measurements after mounting: Total resistance shall be measured as specified in [4.7.3.1](#); resistance shall also be measured between the contact arm terminal and terminal number one.
- c. Test condition: C, part two.
- d. Motion: In each of two mutually perpendicular directions, one perpendicular and the other parallel to the longitudinal axis of the resistor.
- e. Measurement during test: Each resistor shall be monitored to determine momentary discontinuity by a method which shall at least be sensitive enough to monitor or register automatically any momentary discontinuity of 0.1 millisecond or greater duration. A measurement of transient resistance change between the contact arm terminal and terminal one shall also be made.

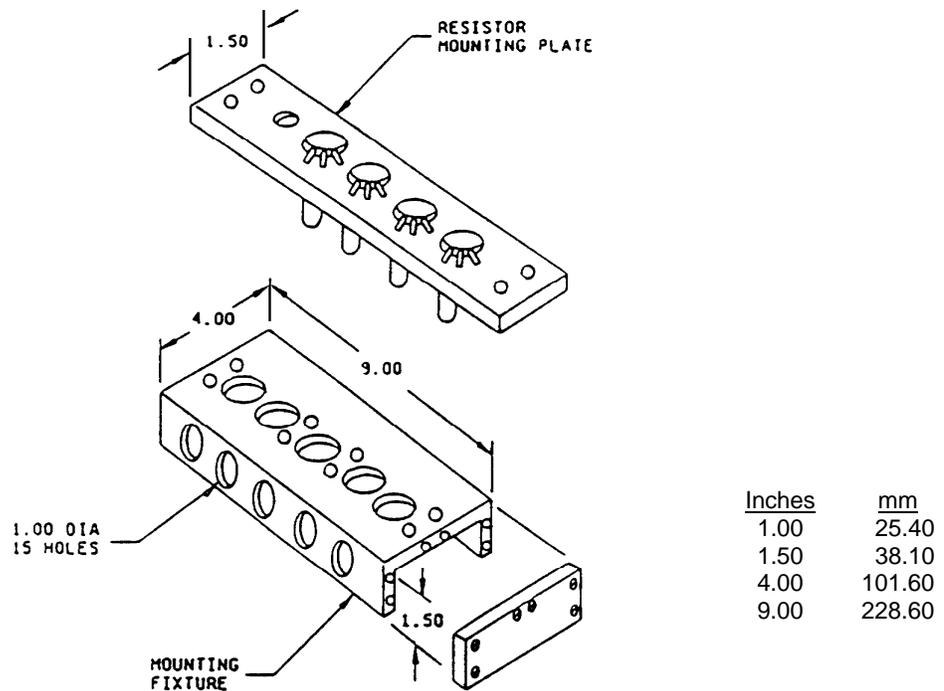


FIGURE 6. Suggested mounting fixture and resistor mounting plate for shock test.

4.7.17 Fungus (see 3.22). Resistors shall be tested in accordance with [method 508](#) of MIL-STD-810. Resistors shall be examined for evidence of mechanical damage.

5. PACKAGING

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

6. NOTES

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

6.1 Intended use. Resistors covered by this specification are intended for use in electronic equipment, and are used for matching, balancing, and adjusting circuit variables in computers, telemetering equipment, and other applications. These devices must be able to operate satisfactorily in military systems under the following demanding conditions: 15 Gs of high frequency vibration, 100 Gs of shock (specified pulse), 25,000 cycles of endurance at the maximum temperature, thermal shock (with no more than 5% deviation in initial resistance), low temperature coefficient of resistance and resistant to salt corrosion. In addition these military requirements are verified under a qualification system. Commercial components are not designed to withstand these military environmental conditions.

6.2 Acquisition documents. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Title, number, and date of the applicable detail specification, and complete PIN (see 1.2 and 3.1).
- c. If not otherwise specified, the version of the individual documents referenced will be those in effect on the date of the solicitation (see 2.1).
- d. Packaging requirements (see 5.1).
- e. Mounting Hardware, whether assembled on resistor (see 3.4.7).
- f. Mounting nut dimension across hexagonal flats, as applicable (see 3.1).
- g. Location at which inspection shall be made if other than suppliers facilities or commercial laboratory (see 4.2).

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 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 orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center, Columbus, ATTN: DSCC-VQP, P.O. Box 3990, Columbus, OH 43218-3990

6.4 PIN. This specification requires a PIN that describes technology and appropriate references to associated documents (see 1.2 and 3.1)

6.5 Dissimilar metals. Unless suitably protected, metals such as brass, copper, or steel should not be used in intimate contact with aluminum alloys.

6.6 Power rating. The power ratings given on the detail specifications (see 3.1) apply at temperatures up to +40°C, with the resistors mounted on metallic panels thermally equivalent to those specified in 4.7.8.1. Resistors operated at ambient temperatures above +40°C should be derated in accordance with figure 4. Satisfactory operation cannot be assumed at any temperature, if the resistor is not mounted on a metallic panel thermally equivalent to that specified in 4.7.8.1. such a panel serves as a "heat sink" and dissipates some of the heat generated in such a resistor.

6.7 Nominal maximum current rating. The nominal maximum current rating of resistors is as shown in table XIV where W is rated wattage for taper A (linear) resistors and R is the nominal total resistance.

TABLE XIV. Maximum permissible current.

Resistor	High resistance section	Low resistance
Taper A (linear)	\sqrt{W} / R	
Taper C and F (nonlinear, 10 percent)	$0.745 \sqrt{W} / R$	$2.24 \frac{W}{R}$

6.7.1 Suggested mounting fixture. A suggested mounting fixture for the shock and high-frequency vibration tests is shown on figure 6.

6.8 Tin whisker growth. The use of alloys with tin content greater than 97 percent, by mass, may exhibit tin whisker growth problems after manufacture. Tin whiskers may occur anytime from a day to years after manufacture and can develop under typical operating conditions, on products that use such materials. Conformal coatings applied over top of a whisker-prone surface will not prevent the formation of tin whiskers. Alloys of 3 percent lead, by mass, have shown to inhibit the growth of tin whiskers. For additional information on this matter, refer to ASTM-B545 (Standard Specification for Electrodeposited Coatings of Tin).

6.9 Subject term (key word) listing.

Control shaft
Potentiometer
Linear taper
Nonlinear taper

6.10 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmentally Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals is available on their website at <http://www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm>. Further information is available at the following EPA site: <http://www.epa.gov/epaoswer/hazwaste/minimize/>. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of the materials on the list should be minimized or eliminated unless needed to meet the requirements specified herein (see section 3).

MIL-PRF-19E
w/Amendment 1

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

APPENDIX A

PROCEDURE FOR QUALIFICATION INSPECTION

A.1. SCOPE

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

A.2 APPLICABLE DOCUMENTS. This section is not applicable to this document.

A.3 SUBMISSION

A.3.1 Sample.

A.3.1.1 Single type submission. A sample consisting of 42 specimens of each type for which qualification is sought shall be submitted.

A.3.1.2 Combined type submission. For qualification of either the standard bushing or the locking bushing type resistors, a sample consisting of the number of sample units specified in table A-I shall be submitted in the highest resistance value for each style and lot coverage for which qualification is sought. To receive qualification of locking bushing type resistors when standard bushing type resistors have been submitted, an additional sample of locking bushing type resistors consisting of the number of specimens specified in table A-II shall be submitted. If resistors are not all of the same basic design, sample resistors of each alternate design shall be submitted.

TABLE A-I. Sample for qualification inspection.

Lot	Quantity ^{1/}	Taper	Switch	Inspection group: Specimen numbers (also see table VII)					
				I	II	III	IV	V	VI
1	30	A	None	1 to 30	1 to 6	7 to 12	13 to 18	19 to 24	25 to 30
2	30	C	None	1 to 30	1 to 6	7 to 12	13 to 18	19 to 24	25 to 30
3 ^{2/}	30	A	None	1 to 30	1 to 6	7 to 12	13 to 18	19 to 24	25 to 30
	30	C	None	1 to 30	1 to 6	7 to 12	13 to 17	19 to 24	25 to 30
4	18	A	None	1 to 18	1 to 4	5 to 8	9 to 12	13 to 15	16 to 18
	15	A	SPST	1 to 15	1 and 2	3 and 4	5 and 6	7 to 12	13 to 15
5	18	C	None	1 to 18	1 to 4	5 to 8	9 to 12	13 to 15	16 to 18
	15	C	SPST	1 to 15	1 and 2	3 and 4	5 and 6	7 to 12	13 to 15
6 ^{2/}	18	A	None	1 to 18	1 to 4	5 to 8	9 to 12	13 to 15	16 to 18
	15	A	SPST	1 to 15	1 and 2	3 and 4	5 and 6	5 and 6	13 to 15
3333	30	C	None	1 to 30	1 to 6	7 to 12	13 to 18	19 to 24	25 to 30

^{1/} Within same style

^{2/} For lots 3 and 6, number of allowable defectives shown in the last column of [table VII](#) will apply individually to the submission that is made in each resistance taper. For all other lots, the number of allowable defectives will be shown in [table VII](#).

TABLE A-II. Samples for qualification inspection of additional locking bushing types.

Quantity in the same style	Test group: Specimen number		
	I	II	III
12	1 to 12	1 to 6	7 to 12

APPENDIX A

A.4 EXTENT OF QUALIFICATIONS

A.4.1 Single type submission. Qualification as shown in the type submitted.

A.4.2 Combined type submission. Qualification within a style and characteristic will be shown in table A-III. Qualification of resistors with standard (N) type bushings will qualify resistors with sealed (S) type bushings. Conversely, qualification of resistors with sealed (S) type bushing will qualify resistors with standard (N) type bushing. Qualification of resistors with locking (L) type bushing will qualify resistors with sealed (T) type bushings. Conversely, qualification resistors with sealed (T) type bushings shall qualify resistors with locking (L) type bushings.

TABLE A-III. Extent of qualification.

Lot	Qualification coverage
1	All resistance values between the highest value and all lower values for which qualification is sought; taper A, without switches.
2	All resistance values between the highest value and all lower values for which qualification is sought; taper C, without switches.
3	All resistance values between the highest value and all lower values for which qualification is sought; all tapers, without switches.
4	All resistance values between the highest value and all lower values for which qualification is sought, taper A, with or without switches.
5 <u>1/</u>	All resistance values between the highest value and all lower values for which qualification is sought, taper C, with or without switches.
6 <u>1/</u>	All resistance values between the highest value and all lower values for which qualification is sought, all tapers, with or without switches.

1/ In the event of switch failure only, qualification will be granted as stated, except for switches.

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

Preparing activity:
DLA - CC

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

(Project 5905-2008-045)

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