NOTE: The document identifier and heading has been changed on this page to reflect that this is a performance specification. There are no other changes to this document. The document identifier on subsequent pages has not been changed, but will be changed the next time this document is revised.

INCH-POUND

MIL-PRF-122A
19 February 1990
SUPERSEDING
MIL-R-122
8 June 1983

PERFORMANCE SPECIFICATION

RESISTORS, FIXED, PRECISION, ESTABLISHED RELIABILITY, GENERAL SPECIFICATION FOR

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

1. SCOPE

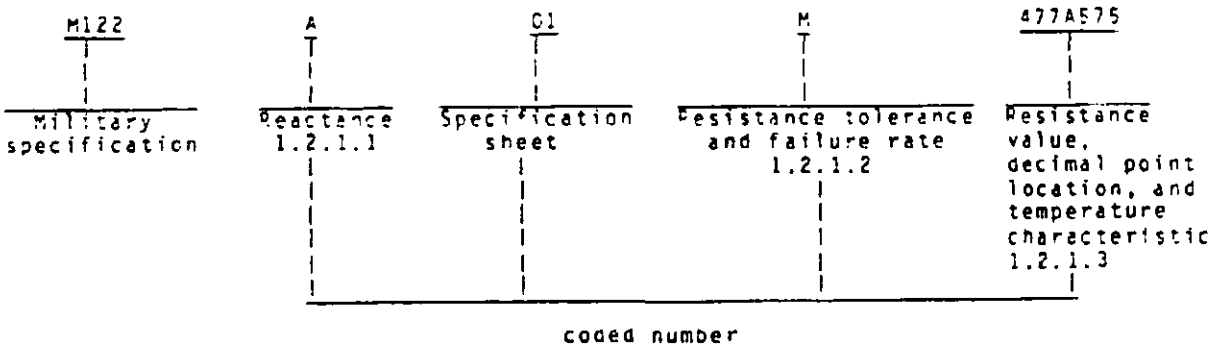
1.1 Scope. This specification covers the general requirements for hermetically sealed, high precision, low reactance, fixed, resistors that possess a high degree of stability with respect to time under severe environmental conditions, with an established reliability. Resistors covered by this specification have life failure rates ranging from 1 percent to 0.001 percent per 1,000 hours (see 1.2.1.2). These failure rates are established at 60 percent confidence on the basis of life tests. The failure rate (FR), identified by the appropriate symbol, is referred to operation at full rated voltage and rated temperature, with a permissible change of ±0.5 percent in resistance as the criteria for failure (see 6.1). A part per million (ppm) quality system is used for documenting and reporting the average outgoing quality of resistors supplied to this specification. Statistical process control (SPC) techniques are required in the manufacturing process to minimize variation in production of resistors supplied to the requirements of this specification.

1.2 Classification.

1.2.1 Military part number. The resistors specified herein should be identified by a part number which should consist of the basic military specification sheet and a coded number. The number will be coded to provide information concerning the reactance characteristic, resistance tolerance and failure rate, resistance value, decimal point location, and temperature characteristic. The military part number should be in the following form with the coded number derived as indicated.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Electronics Supply Center, ATTN: DESC-ELDM, 1507 Wilmington Pike, Dayton, OH 45444-5765, 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



1.2.1.1 Reactance. The reactance is identified by a single letter in accordance with table I.

TABLE I. Reactance.

Frequency					
≤ 10 kHz		≤ 1 MHz		≤ 100 MHz	
Code	Limits 1/	Code	Limits 1/	Code	Limits 1/
A	≤ 1	F	≤ 1	L	≤ 1
B	≤ 3	G	≤ 3	M	≤ 3
C	≤ 10	H	≤ 10	N	≤ 10
D	≤ 30	J	≤ 30	P	≤ 30
E	Uncontrolled	K	Uncontrolled	S	Uncontrolled

1/ Maximum percentage change in the initial impedance at zero Hz (nominal resistance) due to all reactive components, for all frequencies up to and including the frequency specified.

1.2.1.2 Resistance tolerance and life failure rate. The resistance tolerance is identified by a single letter in accordance with table II. The same letter symbol also identifies the life failure rate level for which the resistor is qualified (see 4.5 and 6.3).

TABLE II. Resistance tolerance and failure rate.

Tolerance percent (±)	Failure rate percent (1,000 hours)	Symbol
.005	1.0	A
.005	0.1	B
.005	0.01	C
.005	0.001	D
.01	1.0	E
.01	0.1	F
.01	0.01	G
.01	0.001	H
.05	1.0	I
.05	0.1	J
.05	0.01	K
.05	0.001	L
0.1	1.0	M
0.1	0.1	N
0.1	0.01	O
0.1	0.001	P
0.5	1.0	Q
0.5	0.1	R
0.5	0.01	S
0.5	0.001	T
1.0	1.0	U
1.0	0.1	V
1.0	0.01	W
1.0	0.001	X

1.2.1.3 Resistance value, temperature characteristic, and decimal point. The nominal resistance expressed in ohms is identified by seven characters consisting of six digits and one letter symbol. The digits represent significant figures and the letter symbol represents the temperature characteristic, decimal point location and multiplier in accordance with table III. All digits preceding and following the symbol letter represent significant figures. Minimum and maximum resistance values should be as specified (see 3.1). The standard values for every decade will follow the sequence specified in table VI for tolerances 1.0 and 0.5. The resistance values for tolerances 0.1, 0.05, 0.01, and 0.005 may be any value within the specified limits (see 3.1).

TABLE III. Resistance temperature characteristic, decimal point, and multiplier.

RTC code 1/	Decimal point and multiplier 2/	Symbol
Y	R	A
Y	K	B
A	R	C
A	K	D
B	R	E
B	K	F
C	R	G
C	K	H
D	R	J
D	K	K
E	R	L
E	K	M
F	R	N
F	K	P
G	R	Q
G	K	R

1/ See tables IV and V for RTC codes.
2/ The decimal point and multiplier letter symbol representing the R (X1) multiplier in table III is used to represent values less than 1,000 ohms. The letter symbol representing the K (X 1000) multiplier is used for all values greater than 1,000 ohms.

TABLE IV. Characteristic.

Resistance temperature characteristic (referenced to 25°C) (ppm/°C)												
	Temperature °C											
	-55		-15		+65		+125		+150		+175	
RTC code	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Y	-0	5	-1.5	3.5	-4	1.0	-5	0	-5.5	-.5	-7	-1
A	-2.5	2.5	-2.5	2.5	-2.5	2.5	-2.5	2.5	-3.5	3.5	-4.5	4.5
B	-5	5.0	-5	5.0	-5	5.0	-5	5	-6	6.0	-7	7.0
C	-10	10	-10	10	-10	10	-10	10	-12	12.0	-15	15
D	-2.5	2.5	-1.5	1.5	-1.5	1.5	-2.5	2.5	-3.5	3.5	-4.5	4.5
E	-5	5.0	-2.5	2.5	-2.5	2.5	-5	5.0	-6	6.0	-7	7.0
F	-10	10	-5	5.0	-5	5.0	-10	10	-12	12.0	-15	15.0
G	0.7	3.7	-.7	2.3	-2.8	0.2	-3.3	-.3	-4.1	-1.1	-4.5	-1.5

TABLE V. Resistance temperature characteristic modifiers for low resistance values.

Resistance value (ohms)	Modifier ppm/°C
5 or greater, but less than 10	±5
1 or greater, but less than 5	±10
Less than 1	±50

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

Resistance tolerance											
(0.5) D	(1.0) F	(0.5) D	(1.0) F	(0.5) D	(1.0) F	(0.5) D	(1.0) F	(0.5) D	(1.0) F	(0.5) D	(1.0) F
10.0	10.0	14.7	14.7	21.5	21.5	31.6	31.6	46.4	46.4	68.1	68.1
10.1		14.9		21.8		32.0		47.0		69.0	
10.2	10.2	15.0	15.0	22.1	22.1	32.4	32.4	47.5	47.5	69.8	69.8
10.4		15.2		22.3		32.8		48.1		70.6	
10.5	10.5	15.4	15.4	22.6	22.6	33.2	33.2	48.7	48.7	71.5	71.5
10.6		15.6		22.9		33.6		49.3		72.3	
10.7	10.7	15.8	15.8	23.2	23.2	34.0	34.0	49.9	49.9	73.2	73.2
10.9		16.0		23.4		34.4		50.5		74.1	
11.0	11.0	16.2	16.2	23.7	23.7	34.8	34.8	51.1	51.1	75.0	75.0
11.1		16.4		24.0		35.2		51.7		75.9	
11.3	11.3	16.5	16.5	24.3	24.3	35.7	35.7	52.3	52.3	76.8	76.8
11.4		16.7		24.6		36.1		53.0		77.7	
11.5	11.5	16.9	16.9	24.9	24.9	36.5	36.5	53.6	53.6	78.7	78.7
11.7		17.2		24.2		37.0		54.2		79.6	
11.8	11.8	17.4	17.4	25.5	25.5	37.4	37.4	54.9	54.9	80.6	80.6
12.0		17.6		25.8		37.9		55.6		82.5	
12.1	12.1	17.8	17.8	26.1	26.1	38.3	38.3	56.2	56.2	82.5	82.5
12.3		18.0		26.4		38.8		56.9		83.5	
12.4	12.4	18.2	18.2	26.7	26.7	39.2	39.2	57.6	57.6	84.5	84.5
12.6		18.4		27.1		39.7		58.3		85.6	
12.7	12.7	18.7	18.7	27.4	27.4	40.2	40.2	59.0	59.0	86.6	86.6
12.9		18.9		27.7		40.7		59.7		87.6	
13.0	13.0	19.1	19.1	28.0	28.0	41.2	41.2	60.4	60.4	88.7	88.7
13.2		19.3		28.4		41.7		61.2		89.8	
13.3	13.3	19.6	19.6	28.7	28.7	42.2	42.2	61.9	61.9	90.9	90.9
13.5		19.8		29.1		42.7		62.6		92.0	
13.7	13.7	20.0	20.0	29.4	29.4	43.2	43.2	63.4	63.4	93.1	93.1
13.8		20.3		29.8		43.7		64.2		94.2	
14.0	14.0	20.5	20.5	30.1	30.1	44.2	44.2	64.9	64.9	95.3	95.3
14.2		20.8		30.5		44.8		65.7		96.5	
14.3	14.3	21.0	21.0	30.9	30.9	45.3	45.3	66.5	66.5	97.6	97.6
14.5		21.3		31.2		45.9		67.3		98.8	

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).

SPECIFICATION

MILITARY

MIL-R-122/1	-	Resistors, Fixed, Film, Precision, Established Reliability, Style RFP01.
MIL-R-122/3	-	Resistors, Fixed, Film, Precision, Established Reliability, Style RFP02.
MIL-R-122/10	-	Resistors, Fixed, Film, Precision, Established Reliability, Style RFP10.
MIL-F-14256	-	Flux, Soldering, Liquid (Rosin Base).
MIL-P-28809	-	Printed Wiring Assemblies.
MIL-R-39022	-	Resistors Packaging of.

STANDARDS

MILITARY

MIL-STD-202	-	Test Methods for Electronic and Electrical Component Parts.
MIL-STD-690	-	Failure Rate Sampling Plans and Procedures.
MIL-STD-790	-	Reliability Assurance Program for Electronic Parts Specifications.
MIL-STD-810	-	Environmental Test Methods and Engineering Guidelines.
MIL-STD-1285	-	Marking of Electrical and Electronic Parts.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

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

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA-554	-	Assessment of Outgoing Nonconforming Levels in Parts Per Million (PPM).
EIA-557	-	Statistical Process Control Systems.

(Applications for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, Washington, DC 20006.)

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

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), 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 detail specifications. The individual item requirements shall be as specified herein and in accordance with the applicable associated detail specification. In the event of any conflict between the requirements of this specification and the associated detail specification, the latter shall govern (see 6.2).

3.2 Qualification. The resistors furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.4 and 6.3). In addition, the manufacturer shall obtain certification from the qualifying activity that the reliability assurance requirements of 4.1.1 have been met and are being maintained.

3.3 Reliability and quality.

3.3.1 Reliability. The reliability of resistors furnished under this specification shall be established and maintained in accordance with the requirements and procedures specified in MIL-STD-790 and MIL-STD-690 with details and exceptions specified in 4.1.2, 4.5, and 4.6.2.1.1.1.

3.3.2 Quality.

3.3.2.1 Statistical process control. The contractor shall implement and use statistical process control techniques in the manufacturing process for parts covered by this specification. The SPC program shall be developed and maintained in accordance with all the requirements of EIA-557. The SPC program shall be documented and maintained as part of the overall reliability assurance program as specified in MIL-STD-790. The implementation of statistical process control shall be 12 months from the date of this specification. Processes for application of SPC techniques should include but are not limited to:

a. Film disposition.

b. Cap and lead attachment.

c. Laser trimming.

d. Encapsulation.

e. Weld strength.

3.3.2.2 Quality levels. The quality of lots that have been subjected to and passed subgroup 1, 100 percent screening inspection of the group A inspection shall be established and maintained in accordance with 4.6.1.2.2 and EIA-554. Individual ppm defect level (i.e., ppm-2, ppm-3, and ppm-4) and an overall ppm defect level (i.e., ppm-5) shall be established based on the tests prescribed in the subgroup 2 tests of the group A inspections. The defect level for ppm-2 shall be less than 100 ppm. The implementation of ppm verification shall be 12 months from the date of this specification.

3.3.2.2.1 Noncompliance. The contractor shall notify the qualifying activity when the 100 ppm level is reached or exceeded for ppm-2. The contractor shall provide sufficient information to the qualifying activity documenting the causes of the problem and what corrective action is being taken. Failure to correct this problem shall be the basis for removal of the affected product from the QPL.

3.4 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.

3.5 Design and construction. The resistors shall be of the design, construction, and physical dimensions specified. Each resistor shall consist of a resistance element protected by a suitable enclosure (see 3.1).

3.5.1 Aqueous-extract conductivity (applicable to ceramic forms). The manufacturer shall verify by certification that the aqueous-extract conductivity, when determined as specified in 4.8, does not exceed the values shown below for the incoming materials for the parts indicated:

Part	Maximum conductivity (siemens (mhos per cm))
Core	1.0×10^{-6}
Shell (with metallized ends)	2.0×10^{-6}

3.5.1.1 Metallizing of shell ends (applicable to cores). When used, metallizing shall be uniform around the periphery of the ends of the shell, well bonded to the base material, and provide a good seal with the mated part.

3.5.2 Resistive elements. The resistive elements shall be comprised of a suitable form supporting a suitable resistive material adjusted to the final resistance value.

3.5.2.1 Film (when applicable). Films shall be uniformly deposited. The film shall be free of blisters, thin spots, areas inadequately bonded to the core, discolored spots, or other blemishes likely to cause flaking or nonuniform ribbon when spiraled (helixed). Where used, spiraling shall occupy no less than 70 percent of resistor element actual length. The resistor element length shall be defined as the nominal distance between terminal bands less .046875 inch (1.19000 mm).

3.5.3 Termination. The termination of the resistive element shall be by an electrically sound method.

3.5.4 Terminal leads. The terminal leads shall be made of solid conductor of the length and diameter specified (see 3.1). The conductor shall be solderable and nonmagnetic.

3.5.5 Flux. The manufacturer shall verify by certification that only noncorrosive fluxes shall be used. Noncorrosive fluxes shall comply with the requirements for resistivity of water extract and effect on vacuum-deposited copper specified in MIL-F-14256. Resistors shall comply with the cleanliness requirement of MIL-P-28809.

3.5.6 End caps (when applicable). When end caps are used in construction of the resistor, the misalignment of the cap with respect to the core shall not exceed 3°C.

3.6 Power rating. Resistors shall have a power rating based on continuous full-load operation at an ambient temperature of 125°C. This power rating is dependent of the ability of resistors to meet life (see 3.24). For temperatures in excess of 125°C, the load shall be derated (see figure 1).

3.7 Voltage rating. Resistors shall have a rated direct current (dc) continuous working voltage or an approximately sine wave root mean square (rms) continuous working voltage at commerical-line frequency and waveform corresponding to the power rating, as determined from the following formula:

Where: $E = \sqrt{PR}$

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

The rated dc or rms continuous working voltage shall be not greater than the applicable maximum value (see 3.1).

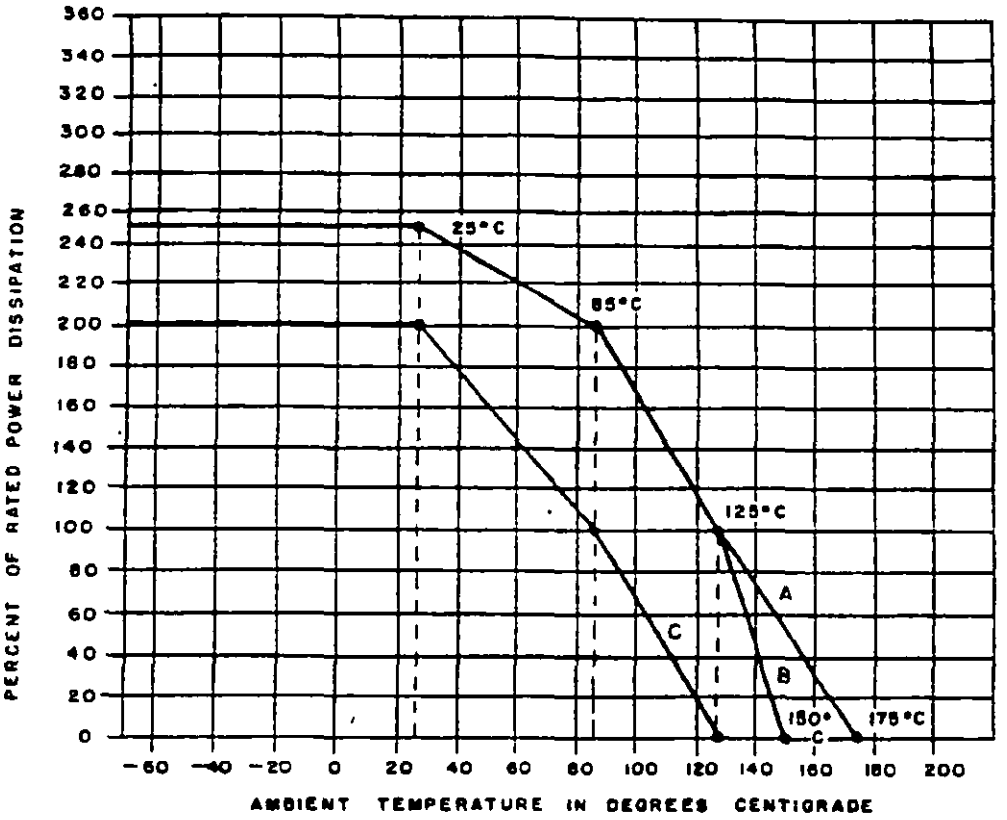
3.8 Power conditioning. When resistors are tested as specified in 4.7.2, there shall be no evidence of mechanical damage; the change in resistance shall not exceed ±(.02 percent +.001 ohm) for rating curves A and B and ±(.05 percent +.001 ohm) for curve C for power conditioning, thermal shock, and overload test combined (see 3.8 and 3.9).

3.9 Thermal shock. When resistors are tested as specified in 4.7.3, there shall be no evidence of mechanical damage; the change in resistance shall not exceed ±(.02 percent +.001 ohm) for rating curves A and B and ±(.05 percent +.001 ohm) for rating curve C for power conditioning, thermal shock, and overload tests combined (see 3.8, 3.9, and 3.10).

3.10 Overload. When resistors are tested as specified in 4.7.4, there shall be no evidence of arching, burning, or charring; the change in resistance shall not exceed ±(.02 percent +.001) for rating curves A and B and ±(.05 percent +.001 ohm) for rating curve C for power conditioning, thermal shock, and overload tests combined (see 3.8, 3.9, and 3.10).

3.11 DC resistance. When resistors are tested as specified in 4.7.5, the dc resistance shall be within the specified tolerance of the nominal resistance (see 1.2.1.3) for all products deliverable on the contract.

3.12 Hermetic seal (when applicable). For the purposes of this specification, a hermetically sealed resistor is one in which the resistive element is contained within a sealed enclosure of ceramic, glass, or metal, or combinations thereof; where sealing is accomplished by material fusion, welding, brazing, or soldering. When tested as specified in 4.7.6, the resistors supplied shall be capable of passing the seal tests, meeting a fine leak rate requirement of not more than 1×10^{-7} atm cc/s, and a gross seal test showing no evidence of a continuous stream of bubbles emanating from the specimen.



NOTE: These curves indicate the percentage of nominal wattage to be applied at temperatures higher and lower than 125°C for the same ΔR change that would occur at 125°C during life testing (see 3.24). However, at no time shall the applied voltage exceed the maximum for each style (see 3.1).

FIGURE 1. Derating curves for various ambient temperatures.

3.13 Solderability. When resistors are tested as specified in 4.7.7, they shall meet the criteria for wire-lead terminal evaluation in the test method.

3.14 Resistance to solvents. When resistors are tested as specified in 4.7.8, there shall be no evidence of mechanical damage and the markings shall remain legible.

3.15 Resistance temperature characteristic. When resistors are tested as specified in 4.7.9, the resistance temperature characteristic, at each of the temperatures specified in table XIII, referred to 25°C ±5°C shall not exceed the value specified in table III for the applicable characteristic.

3.16 Low temperature storage and operation. When resistors are tested as specified in 4.7.10, there shall be no evidence of mechanical damage. The change in resistance shall not exceed ±(0.01 percent +.001 ohm).

3.17 Terminal strength. When resistors are tested as specified in 4.7.11, 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 ±(.01 percent +.001).

3.18 Dielectric withstanding voltage. When resistors are tested as specified in 4.7.12, there shall be no evidence of flashover, mechanical damage, arching, or insulation breakdown. The change in resistance shall not exceed ±(.01 percent +.001 ohm).

3.19 Insulation resistance. When resistors are tested as specified in 4.7.13, the insulation resistance shall be not less than 10,000 megohms.

3.20 Resistance to soldering heat. When resistors are tested as specified in 4.7.14, there shall be no evidence of mechanical damage. The change in resistance shall not exceed ±(.01 percent +.001 ohm).

3.21 Moisture resistance. When resistors are tested as specified in 4.7.15, there shall be no evidence of mechanical damage. The change in resistance for nonhermetically sealed resistors shall not exceed ±(.05 percent +.001 ohm). For hermetically sealed resistors, the change in resistance shall not exceed ±(.01 percent +.001 ohm). In addition, the change in resistance due to dielectric withstanding voltage shall not exceed ±(.02 percent +.001 ohm), and the insulation resistance shall be 100 megohms minimum.

3.22 Shock (specified pulse). When resistors are tested as specified in 4.7.16, there shall be no evidence of mechanical or electrical damage. The change in resistance shall not exceed ±(.01 percent +.001 ohm). There shall be no electrical discontinuity during the test.

3.23 Vibration, high frequency. When resistors are tested as specified in 4.7.17, there shall be no evidence of mechanical damage. The change in resistance shall not exceed ±(.01 percent +.001 ohm). There shall be no electrical discontinuity during the test.

3.24 Life.

3.24.1 Qualification. When resistors are tested as specified in 4.7.18, there shall be no evidence of mechanical damage. The change in resistance between the initial measurement and any of the succeeding measurements, up to and including 2,000 hours, shall not exceed ±(.05 percent +.001 ohm) and ±(.2 percent +.001 ohm) after 10,000 hours.

3.24.2 Failure rate level determination. When resistors are tested as specified in 4.7.16, there shall be no evidence of mechanical damage to the resistance element, or enclosure. The change in resistance between the initial measurement and any of the succeeding measurements shall not exceed ±(.2 percent +.001 ohm). This single failure criteria shall be applicable to all measurements during the life test for purposes of determining failure rate level qualification and is applicable as a parallel requirement with 3.24.1 to the measurements made during the life test specified for qualification inspection.

3.24.3 85°C power rating. For qualification testing only, resistors shall be subjected to the specified voltage and dissipate the assigned 85°C wattage rating for a 2,000 hour duration. The change in resistance shall not exceed ±(.05 percent +.001 ohm). The data acquired is not applicable to the establishment, maintenance, or extension of failure rate level.

3.24.4 25°C power rating. For qualification testing only, resistors shall be subjected to the specified voltage and dissipate the assigned 25°C wattage rating for 2,000 hours. The change in resistance shall not exceed ±(.05 percent +.001 ohm). The data acquired is not applicable to the establishment, maintenance, or extension of failure rate level (see 3.1).

3.25 Storage life. When resistors are tested as specified in 4.7.19, the change in resistance shall not exceed ±(.0025 percent +.001 ohm) for hermetically sealed resistors and ±(.005 percent +.001 ohm) for nonhermetically sealed resistors.

3.26 High temperature exposure. When resistors are tested as specified in 4.7.20, there shall be no evidence of mechanical damage. The change in resistance shall not exceed ±(.05 percent +.001 ohm) for nonhermetically sealed resistors and (±0.02 percent +.001 ohm) for hermetically sealed resistors. Following this test, the dielectric withstanding voltage shall be as specified in 3.16, and the insulation resistance shall be 1,000 megohms minimum.

3.27 Maximum allowable reactance (when applicable). When resistors are tested as specified in 4.7.21, the maximum reactance shall be as specified in table I.

3.28 Current noise. When resistors are tested as specified in 4.7.22, the current noise index shall not exceed -32 dB maximum, unless otherwise specified.

3.29 Voltage coefficient (resistors of 1,000 ohms and over). When resistors are tested as specified in 4.7.23, the voltage coefficient shall not exceed 0.0001 percent per volt.

3.30 Thermal EMF. When resistors are tested as specified in 4.7.25, the thermal EMF (Seebeck Effect) shall not exceed 1.0 microvolt per °C, unless otherwise specified (see 3.1).

3.31 Fungus. The manufacturer shall certify that all materials are fungus resistant or shall perform the test specified in 4.7.24. When resistors are tested as specified in 4.7.24, examination shall disclose no evidence of fungus growth on the external surface of the resistor.

3.32 Marking.

3.32.1 Full marking. The resistors shall be marked with the part number, "JAN" marking, date code, source code, and manufacturers production lot code (see 6.2). Date and source code shall be in accordance with MIL-STD-1285. The following is an example of the complete marking:

12345	-	Source code.
3242J	-	Date code and JAN marking.
M122AXX	-	Military specification, reactance and sheet number.
M4775A75	-	Resistance tolerance and failure rate, resistance value and temperature characteristic.

The date code shall be the date of the final assembly operation for the production lot as defined in 6.6. The common manufacturing record shall include the same date code as that placed on the parts covered by record.

3.32.2 Minimum marking. When the physical size of the resistor style precludes the marking of all above information, the minimum marking required shall be as specified in the detail specification (see 3.1). Marking shall remain legible at the end of all tests. In those cases where full marking requirements are not on the resistor body, the full marking shall be marked on the unit package.

3.32.3 JAN and J marking. The United States Government has adopted, and is exercising legitimate control over the certification marks "JAN" and "J", respectively, to indicate that items so marked or identified are manufactured to, and meet all the requirements of military specifications. Accordingly, items acquired to, and meeting all of the criteria specified herein and in applicable specifications shall bear the certification mark "JAN" except that items too small to bear the certification mark "JAN" shall bear the letter "J". The "JAN" or "J" shall be placed immediately before the part number except that if such location would place a hardship on the manufacturer in connection with such marking, the "JAN" or "J" may be located on the first line above or below the part number. Items furnished under contracts or orders which either permit or require deviations from the conditions or requirements specified herein or in applicable specifications shall not bear "JAN" or "J". In the event an item fails to meet the requirements of this specification and the applicable specification sheets or associated detail specifications, the manufacturer shall remove the "JAN" or the "J" from the sample tested and also from all items represented by the sample. The "JAN" or "J" certification mark shall not be used on products acquired to contractor drawings or specifications. The United States Government has obtained Certificate of Registration Number 504,860 for the certification mark "JAN".

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

3.34 Supplying to lower resistance temperature characteristics and lower resistance tolerances. Parts qualified and marked to lower resistance temperature characteristics and lower tolerance levels are substitutable for parts marked to higher resistance temperature characteristics and higher tolerance levels, with procuring agency approval, parts shall not be remarked unless specified in the contract or purchase order.

3.35 Supplying to higher failure rate levels. A manufacturer may supply to all higher failure rate levels than that to which he is qualified. Parts qualified and marked to lower failure rate levels are substitutable for higher failure rate levels with procuring agency approval, and shall not be remarked unless specified in the contract (see 6.2).

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 Reliability assurance program. A reliability assurance program shall be established and maintained in accordance with MIL-STD-790. Evidence of such compliance shall be verified by the qualifying activity of this specification as a prerequisite for qualification and continued qualification.

4.1.3 Statistical process control. A SPC program shall be established and maintained in accordance with EIA-557. Evidence of such compliance shall be verified by the qualifying activity as a prerequisite for qualification and retention of qualification.

4.2 Classification of inspection. Inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.4).

b. Verification of qualification (see 4.5).

c. Quality conformance inspection (see 4.6).

4.3 Inspections conditions and precautions.

4.3.1 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" OF MIL-STD-202.

4.3.2 Precautions. Adequate precautions shall be taken during inspection to prevent condensation of moisture on resistors. Precautions shall also be taken to prevent damage by heat when soldering resistor leads to terminals.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3).

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. The sample shall be taken at random from a production run and produced with equipment and procedures normally used in production. Each resistor style shall be qualified separately.

4.4.2 Test routine. Sample units shall be subjected to the qualification inspection specified in table VII, in the order shown. All sample units, with the exception of 17 samples for group IA inspection, shall be subjected to the inspection of group I. The 560 sample units shall then be divided as specified in table VII for groups II through VIII, inclusive, and subjected to the inspection for their particular group. Two additional unenclosed sample units shall be subjected to the visual and mechanical inspection of group I only. Sample sizes and extent of qualification for characteristics shall be as specified in the appendix to this specification. For purposes of verifying the 85°C and 25°C power rating (see 3.1), a separate sample of 102 units shall be subjected to group I, group VA, and group VB of table VII for each power rating. These tests are an initial qualification requirement only.

TABLE VII. Qualification inspection.

Inspection	Requirement paragraph	Test method paragraph	Number of sample units for inspection	Failures permitted 1/
Group I 2/				
Visual and mechanical inspection 3/	3.1, 3.3, 3.4, 3.31 and 3.32	4.7.1	All sample units	N/A
Power conditioning	3.8	4.7.2		
Thermal shock	3.9	4.7.3		
Overload 4/	3.10	4.7.4		
DC resistance 4/	3.11	4.7.5		
Hermetic seal (when applicable) 4/	3.12	4.7.6		
Group IA				
Solderability	3.13	4.7.7	12 sample units	0
Resistance to solvents	3.14	4.7.8		
Group II				
Resistance temperature characteristic	3.15	4.7.9	(10 high value, 10 critical value or nearest, 10 low value) 30	1 5/
Low temperature storage and operation	3.16	4.7.10		
Terminal strength	3.17	4.7.11		
Hermetic seal (when applicable)	3.12	4.7.6		
Group III				
Dielectric witnstanding voltage	3.18	4.7.12	(10 high value, 10 critical value or nearest, 10 low value) 30	
Insulation resistance	3.19	4.7.13		
Resistance to soldering heat	3.20	4.7.14		
Moisture resistance	3.21	4.7.15		

See footnotes at end of table.

TABLE VII. Qualification inspection - Continued.

Inspection	Requirement paragraph	Test method paragraph	Number of sample units for inspection	Failures permitted 1/
Group IV				
Shock (specified pulse)	3.22	4.7.16	30 (10 high, 10 critical value or nearest, 10 low value)	1
Vibration, high frequency	3.23	4.7.17		
Hermetic seal (when applicable)	3.12	4.7.6		
Group V				
Life	3.24	4.7.18	102 (34 high value, 34 critical value, or nearest, 34 low value)	1
Group VA				
85°C power rating	3.24.3	4.7.18	102 (34 high value, 34 critical value or nearest, 34 low value)	1
Group VB				
25°C power rating	3.24.4	4.7.18	102 (34 high value, 34 critical value or nearest, 34 low value)	1
Group VI				
Storage life	3.25	4.7.19	30 (10 high value, 10 critical value or nearest, 10 low value)	1
Group VII				
High temperature exposure	3.26	4.7.20	102 6/ (34 high value, 34 critical value or nearest, 34 low value)	1
Group VIII				
Maximum allowable reactance	3.27	4.7.21	10 highest value	0
Current noise	3.28	4.7.22		
Voltage coefficient (resistors of 1,000 ohms and over)	3.29	4.7.23		
Fungus	3.31	4.7.24		
Thermal EMF	3.30	4.7.25	10 lowest value	0

See footnotes on next page.

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

2/ Samples may be exempt from group I inspection if subjected to and pass group A inspection.

3/ Marking shall be considered defective if the marking is illegible or incorrect. The two additional unenclosed sample units shall be subjected to the visual and mechanical inspection of group I only. Marking shall remain legible at the end of all test.

4/ Nondestructive tests.

5/ For hermetically sealed resistors, zero failures are permitted in moisture resistance.

6/ Ten sample units shall be subjected to dielectric withstanding voltage and insulation resistance.

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

4.4.4 FR qualification. FR qualification shall be in accordance with the general and detail requirements of MIL-STD-690 and the following details:

a. Procedure I: Qualification at the initial FR level. Level M (1.0 percent) of FRSP-60 shall apply. Sample units shall be subjected to the qualification inspection specified in group V, table VII (see 4.4.2). Entire life test sample shall continue on test to 10,000 hours as specified in 4.7.18, upon completion of the 2,000 hour qualification.

b. Procedure II: Extension of qualification to lower FR levels. To extend qualification to the R level (0.01 percent) and S (0.001 percent) FR levels, data from two or more styles of similar construction may be combined.

c. Procedure III: Maintenance of FR level qualification. Maintenance period A of FRSP-10 shall apply. Regardless of the number of production lots produced during this period, the specified number of unit hours shall be accumulated to maintain qualification (see 4.6.2.1). For FR levels R and S, data from all lead types may be combined.

4.4.5 Quality level verification. The contractor is responsible for establishing a quality system to verify the ppm level of lots that are subjected to subgroup 2 tests of group A inspections. The ppm defect level shall be based on a 6-month moving average. The contractor shall verify and report individual ppm categories (i.e., ppm-2, ppm-3, and ppm-4) and an overall ppm defect level (i.e., ppm-5). In the event that the contractor meets or exceeds 100 ppm for ppm-2, the qualifying activity shall take the actions specified in EIA-554, method B.

4.5 Verification of qualification. Every six months the manufacturer shall compile a summary of the results of quality conformance inspections and extended FR data, in the form of a verification of qualification report, and forward it to the qualifying activity within 30 days after the end of the reporting period as the basis of continued qualification approval. In addition, the manufacturer shall immediately notify the qualifying activity whenever the FR data indicates that the manufacturer has failed to maintain the qualified FR level, or the group C inspection data indicates failure of the qualified product to meet the requirements of this specification. Continuation shall be based on evidence that over the 6-month period the following has been met:

a. Verification by the qualifying activity that the manufacturer meets the requirements of MIL-STD-790.

b. The manufacturer has not modified the design of the item.

c. The specification requirements for the item have not been amended so far as to affect the character of the item.

d. Lot rejection for group A inspection does not exceed 5 percent or one lot, whichever is greater. (Subgroup 2, group A, not included in reject rate.)

e. Lot rejection for group B inspection does not exceed 5 percent or one lot, whichever is greater. (Subgroup 2, group B, not included in reject rate).

f. The requirements for group C inspection are met.

g. The records of FR tests combined substantiate that the "M" (1.0 percent), or "P" (0.1 percent) FR level has been maintained, or that the manufacturer continues to meet the "R" (0.01 percent), and "S" (0.001 percent FR level for which qualified, although the total component hours of testing does not, as yet, meet the requirements of 4.4.4c.

h. The contractor shall provide documentation to the qualifying activity pertaining to ppm calculations including numbers of part types tested, individual ppm defect categories (i.e., ppm-2, ppm-3, ppm-4) and the overall ppm defect rate (ppm-5). This information shall be submitted on a detail specification basis.

When group C requirements were not met and the manufacturer has taken corrective action satisfactory to the Government, group C retesting shall be instituted. A summary of the retesting shall be forwarded to the qualifying activity within 30 days after completion of the retest. All reports are to be certified by a responsible company official and Government inspector.

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspection. Except as specified in 4.6.2.1.3, delivery of products which have passed the groups A and B inspection shall not be delayed pending the results of the group C inspection.

4.6.1.1 Inspection lot. An inspection lot shall consist of all the resistors of the same style, characteristic, and protective enclosure or coating manufactured under essentially the same process and conditions during a manufacturing period of 1 month, maximum. For purposes of lot formation, all terminal type may be included in the same lot; however, all lead types which are combined shall have the same method of terminal attachment. All leads in the lot shall be represented in a similar proportion by samples selected for inspection.

4.6.1.2 Group A inspection. Group A inspection shall consist of the inspections specified in table VIII, and shall be made on the same set of sample units, in the order shown.

4.6.1.2.1 Subgroup I tests. Subgroup I tests shall be performed on 100 percent of the product supplied under this specification. Resistors that are out resistance tolerance or which experience a change in resistance greater than that permitted for the tests of this subgroup shall be removed from the lot. Lots having more than 5 percent total rejects, or one resistor, whichever is greater due to exceeding the specified resistance change limit, shall not be furnished on the contract.

4.6.1.2.2 Manufacturer's production inspection. If the manufacturer performs tests equal to or more stringent than those specified in subgroup I, table VIII as the final step of this production process, group A, subgroup I inspection may be waived and the data resulting from the manufacturers production tests may be used instead. Authority to waive the subgroup I inspection shall be granted by the qualifying activity only. The following criteria must be complied with:

a. Tests conducted by the manufacturer during production shall be clearly identical to or more stringent than that specified for subgroup I. Test conditions shall be equal to or more stringent than those specified for subgroup I.

b. Manufacturer subjects 100 percent of the product supplied under this specification to the production tests.

c. The parameters measured and the failure criteria shall be the same or more stringent than those specified herein.

d. The lot rejection criteria is the same or more stringent than that specified herein.

e. The manufacturer shall make available all information concerning the test procedures and instrumentation used in the production tests. This data shall be provided as part of the evaluation required for MIL-STD-790. The manufacturer shall also make available to the Government all records of all detail test data resulting from production tests.

TABLE VIII. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph	Number of samples
Subgroup I			
Power conditioning	3.8	4.7.2	100 percent inspection
Thermal shock	3.9	4.7.3	
Overload 1/	3.10	4.7.4	
Hermetic seal (when applicable) 2/	3.12	4.7.6	
DC resistance 3/	3.11	4.7.5	
Subgroup II			
DC resistance (ppm-2)	3.11	4.7.5	See table IX
Mechanical (ppm-3)	3.4	4.7.1	
Hermetic seal (when applicable) (ppm-4)	3.12	4.7.6	
Subgroup III			
Visual and mechanical inspection 4/	3.1, 3.3, 3.4, 3.31 and 3.32	4.7.1	13 samples 0 failures

1/ At the manufacturer's option, the determination of resistance change may be by any method which is within the accuracy requirements of this specification. The determination of resistance change shall be made upon completion of the overload test; the allowable change in resistance for the combined tests shall be specified (see 3.8).

2/ Applicable to hermetically sealed styles only.

3/ Resistors shall meet the specified initial resistance tolerance after being subjected to the preceding tests. The resistance measurement made upon completion of the overload test may be used if a measurement has been made which can, without conversion, be directly related to nominal resistance value and tolerance.

4/ At the manufacturer's option, marking inspection may be performed after group B inspection; however, if this is done, no defects shall be permitted. Marking shall remain legible at end of all tests.

4.6.1.2.3 Subgroup II (ppm categories). Subgroup II tests shall be performed on an inspection lot basis. Samples subjected to subgroup II shall be selected in accordance with table IX based on the size of the inspection lot. (Note: Larger samples may be inspected by the contractor in order to calculate ppm; however, rejection of the lot shall be based on one or more defects.) In the event of one or more failures, the lot shall be rejected. Equipment used to perform the subgroup II tests shall not be the same as those used in subgroup I, 100 percent tests.

4.6.1.2.3.1 Rejected lots. The rejected lot shall be segregated from new lots and those lots that have passed inspection. The rejected lot shall be 100 percent inspected for those quality characteristics found defective in the sample and any defects found removed from the lot. A new sample of parts shall then be randomly selected in accordance with table IX. If one or defects are found in this second sample, the lot shall be rejected and shall not be supplied to this specification.

4.6.1.2.3.2 PPM calculations. PPM calculations shall be based on the results of the first sample check as prescribed in 4.6.1.2.3. Calculations and data exclusion shall be in accordance with EIA-554, method B. (Note: PPM calculations shall not use data on the second sample submission).

4.6.1.2.4 Subgroup III tests. Subgroup III shall be performed on an inspection lot basis. Statistical sampling inspection shall be performed on an inspection lot basis. A sample of 13 parts shall then be randomly selected, if one or more defects are found, the lot shall be rescreened and defects removed. A new sample of 13 parts shall then be randomly selected. 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 IX. Sampling plan for ppm categories.

Lot size	Sample size
0 - 3,200	125
3,201 - 10,000	200
10,001 - 35,000	315
35,001 - 150,000	500
150,001 - 500,000	800
500,001 - up	1250

4.6.1.3 Group B inspection. Group B inspection shall consist of the inspections specified in table X, in the order shown, and shall be made on samples from lots which have been subjected to and passed the group A inspection.

4.6.1.3.1 Sampling plan.

4.6.1.3.1.1 Subgroup I. A sample of 13 parts shall then be randomly selected and if one or more defects are found, the lot shall be rescreened and defects removed. If one or defects are found, a new sample of 13 parts shall then be randomly selected. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

4.6.1.3.1.2 Subgroup II. A sample of 13 parts shall then be randomly selected and if one or more defects are found, the lot shall be rescreened and defects removed. If one or defects are found, a new sample of 13 parts shall then be randomly selected. If one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

TABLE X. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph	Number of samples
Subgroup I			
Resistance temperature characteristic	3.15	4.7.9	13
Dielectric withstanding voltage (atmospheric)	3.18	4.7.12	
Insulation resistance	3.19	4.7.13	
Subgroup II			
Visual and mechanical inspection (when applicable) 1/	3.1, 3.31, and 3.32	4.7.1	13

1/ Only applicable when marking inspection is not performed in group A inspection. No defects shall be permitted. Marking shall remain legible at end of all tests.

4.6.1.3.3 Disposition of sample units. Sample units which have been subjected to group B inspection may be delivered on the contract provided they are within resistance tolerance and meet requirements for visual and mechanical inspection.

4.6.2 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.6.2.1.3), delivery of products which have passed groups A and B shall not be delayed pending the results of the periodic inspections.

4.6.2.1 Group C inspection. Group C inspection shall consist of the inspections specified in table XI, in the order shown. Group C inspection shall be made on sample units selected from inspection lots which have passed the group A and B inspection.

4.6.2.1.1 Sampling plan.

4.6.2.1.1.1 Monthly (subgroup I). Samples shall be accumulated from each inspection lot and placed on extended life test of 4.7.18 once a month for the full 10,000 hour life test. A sufficient number of samples shall be selected from each lot by the manufacturer so that the maintenance of failure rate requirements are met within the specified maintenance period. In any event, a minimum of five samples shall be selected from each lot. As far as practicable, the manufacturer shall select the resistance values so that all resistance decades produced during the maintenance period are represented. The accumulated data shall be used for maintenance or extension of failure rate qualification.

4.6.2.1.1.2 Monthly (subgroup II). Each month, the tests specified in subgroup II shall be performed on 30 sample units of each style and characteristic on resistance values in the highest decade produced. The samples selected from highest decade shall be representative of the decade, and a month's production samples selected shall not be from low value end of decade.

4.6.2.1.1.3 Monthly (subgroup III). Each month, 12 sample units of each style and characteristic and in any resistance value, shall be subjected to the tests of subgroup III, in the order shown.

4.6.2.1.1.4 Quarterly. Every 3 months, 15 sample units of any resistive value below critical and 15 sample units of any resistance value above critical of each style and characteristic, shall be subjected to the quarterly tests in the order shown.

4.6.2.1.1.5 Semiannually (subgroup I). Every 6 months, 30 sample units of each style and characteristic, and any resistance value shall be subjected to semiannual tests specified in table XI in the order shown.

4.6.2.1.1.6 Semiannually (subgroup II). Thirty sample units divided equally between the lowest and highest resistance values produced during the 6-month period shall be subjected to the tests shown in table XI.

4.6.2.1.1.7 Annually (subgroup I). Twenty sample units divided among the lowest, critical, and highest resistance values produced during the 6-month period shall be subjected to the semiannual inspection of table XI in the order shown, except only 10 samples of the highest resistance values shall be subjected to voltage coefficient, and 10 samples of the lowest resistance shall be subjected to thermal EMF.

4.6.2.1.1.8 Annually (subgroup II). Thirty sample units divided equally among the lowest, critical, and highest resistance values produced during the annual period shall be subjected to each of the tests shown in table XI.

4.6.2.1.2 Disposition of samples. Sample units which have been subjected to group C inspection shall not be delivered on the contract.

TABLE XI. Group C inspection.

Inspection	Requirement paragraph	Test method paragraph	Number of sample units for inspection	Number of failures allowed
Montnly				
Subgroup I				
Life	3.24	4.7.18	5 units minimum per test	See 4.6.2.1.1.1
Subgroup II				
Dielectric withstanding voltage	3.18	4.7.12		
Insulation resistance	3.19	4.7.13	30	1 1/
Resistance to soldering heat	3.20	4.7.14		
Moisture resistance	3.21	4.7.15		
Subgroup III				
Solderability	3.13	4.7.7		
Resistance to solvents	3.14	4.7.8	12	0

See footnote at end of table.

TABLE XI. Group C inspection - Continued.

Inspection	Requirement paragraph	Test method paragraph	Number of sample units for inspection	Number of failures allowed
Quarterly				
Low temperature storage and operation	3.16	4.7.10		
Terminal strength	3.17	4.7.11	30	1
Hermetic seal (when applicable)	3.12	4.7.6		
Semiannually				
Subgroup I				
Shock (specified pulse)	3.22	4.7.16		
Vibration, high frequency	3.23	4.7.17	30	1
Hermetic seal (when applicable)	3.12	4.7.6		
Subgroup II				
High temperature exposure	3.26	4.7.20	30	1
Annually				
Subgroup I				
Thermal EMF	3.30	4.7.25		
Voltage coefficient (resistors of 1,000 ohms and over)	3.29	4.7.23	20	1
Current noise	3.28	4.7.22		
Maximum allowable reactance	3.27	4.7.21		
Storage life	3.25	4.7.19		
Subgroup II				
85°C power rating	3.24.3	4.7.18	30	1
25°C power rating	3.24.4	4.7.18	30	1

1/ For hermetically sealed resistors, zero failures.

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

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

4.7 Methods of inspection.

4.7.1 Visual and mechanical inspection. Resistors shall be examined to verify that the materials, design, construction, physical dimensions, marking and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.4, 3.5, 3.31, 3.32, and 3.33).

4.7.2 Power conditioning (see 3.8). Resistors shall be conditioned in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply:

a. Method of mounting: Resistors shall be supported by their terminal leads. Resistors shall be arranged so that the temperature of any one resistor shall not appreciably influence the temperature of any other resistor. If forced air circulation is employed, the air velocity shall not exceed 500 feet per minute.

b. Test temperature and tolerance: 25°C +10°C, -5°C.

c. Initial measurements: The initial dc resistance shall be measured at room temperature before mounting. This initial measurement shall be used for all subsequent measurements under the same conditions.

d. Operating conditions: Rated dc continuous working voltage or rated working voltage from an ac supply at commerical-line frequency, intermittently, 1.5 hours "on" and 0.5 hour "off" for a minimum of 96 hours. Where the resulting waveform is other than that of a commerical-line, voltages shall be set using a true rms voltmeter and the peak voltage shall not exceed 2.5 times the rated continuous working voltage. Each resistor shall dissipate a wattage equal to the wattage of the resistor.

e. Measurements after test: Resistors shall be stabilized at room temperature for a period of 4 +4, -0 hours before resistance measurements as in accordance with 4.7.5 are made.

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

4.7.3 Thermal shock (see 3.9). Resistors shall be tested in accordance with method 107 of MIL-STD-202. The following details and exceptions shall apply:

a. Special mounting:

(1) Qualification inspection: Resistors shall be mounted by means other than soldering.

(2) Quality conformance inspection: Resistors shall be mounted by means other than soldering or may be placed in trays. When trays are used, they must be designed to present a minimum of obstruction to the airstream. In no case shall the fixture prevent the specified ambient temperature from being achieved within 4 minutes after resistors are placed in chamber. One chamber may be used for this test.

b. Measurement before cycling. DC resistance shall be measured as specified in 4.7.5.

c. Test condition:

(1) Qualification inspection: Test condition C, except that the extreme high temperature shall be 175°C +3°C, -0°C for power rating curve A, 150°C +3°C, -0°C for power rating curve B, and 125°C +3°C, -0°C for power rating curve C.

(2) Quality conformance inspection: Test condition C, except that the extreme high temperature shall be 175°C +3°C, -0°C for power rating curve A, 150°C +3°C -0°C for power rating curve B, and 125°C +3°C -0°C for power rating curve C. These extreme temperatures shall be achieved within 6 minutes.

d. Measurement after cycling: DC resistance shall be measured as specified in 4.7.5 and following test of 4.7.4.

e. Examination after tests: Resistors shall be examined for evidence of mechanical damage.

4.7.4 Overload (see 3.10). Resistors shall be tested as follows:

4.7.4.1 Qualification inspection. Resistors shall be mounted horizontally in free space with no object, except the mounting base, closer than 3 inches to the resistor case. The mounting base shall not be closer than 2 inches below resistors. They shall be mounted in still air, with no circulation other than that caused by the heat of the resistors being operated.

4.7.4.2 Quality conformance inspection. Resistors may be mounted in any position and allotted any size space deemed necessary by the manufacturer. Forced air cooling may be used to maintain a test ambient temperature range of 20°C to 25°C. The average velocity of the forced air, if employed, shall not exceed 500 feet per minute.

4.7.4.3 Procedure. The load of 6.25 times the rated power for 5 seconds or 2 times the rated power for 10 minutes shall be applied as applicable. The maximum voltage applied shall be as specified (see 3.1).

4.7.5 DC resistance. (see 3.11). Resistors shall be tested in accordance with method 303 of MIL-STD-202. The following details and exception shall apply:

a. Measuring apparatus: The same measuring instrument shall be used for any one test but not necessarily for all tests.

b. Limit of error of measuring apparatus shall not exceed one-fourth of the resistor tolerance or the resistance change limit for which the measurement is being made. Manufacturers, at their option, may use the apparatus of less accuracy, provided limits are reduced to fully compensation for accuracy deviation.

c. Test voltage: Measurements of resistance shall be made by using the test voltages specified in table XII. The test voltage chosen, whether maximum or a lower voltage which would still provide the sensitivity required, shall be applied across the terminals of the resistor. This same voltage shall be used whenever a subsequent resistance measurement is made.

d. Resistance measurement point, see 3.1.

TABLE XII. DC resistance test voltages.

Resistance, nominal	Maximum test voltage	
	0.5 watt or greater	Less than 0.5 watt
Ohms	Volts	Volts
10 to 98.8 inclusive	1	1
100 to 980 inclusive	3	3
1,000 to 9,800 inclusive	10	3
10,000 to 98,800 inclusive	30	10
0.1 megohm or higher	100	30

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

4.7.6 Hermetic seal (when applicable)(see 3.12). Resistors shall be tested in accordance with method 112 of MIL-STD-202.

a. For qualification inspection and group C: Test condition C, procedure IIIa or procedure IIIb, and gross leak test condition A shall be used.

b. Group A inspection: The gross leak test condition A of method 112 of MIL-STD-202 shall be used.

4.7.7 Solderability (see 3.13). Resistors shall be tested in accordance with method 208 of MIL-STD-202. Both leads shall be tested.

4.7.8 Resistance to solvents (see 3.14). Resistors shall be tested in accordance with method 215 of MIL-STD-202. The following details shall apply:

a. Marked portion of the resistor body shall be brushed.

b. The number of sample units, see table VII and XI, as applicable.

c. Resistor shall be examined for mechanical and legibility of markings.

4.7.9 Resistance temperature characteristic (see 3.15). Resistors shall be tested in accordance with method 304 of MIL-STD-202. The following details and exceptions shall apply:

a. Referenced temperature: Room ambient temperature.

b. Test temperature: In accordance with table XIII.

c. Stability of temperature: Resistors shall be maintained for 30 to 45 minutes within .°C at each of the test temperatures in table XIII. This tolerance shall be maintained at the established test temperatures. Allow resistor to stabilize at the temperature in table XIII for a minimum of 5 minutes.

d. The resistance temperature coefficient will be based on the stabilized temperature.

TABLE XIII. Resistance temperature characteristic.

Sequence	Temperature
	Qualification and group inspection
	°C
1	Room temperature 1/
2	-15 ±3
3	-55 ±3
4	Room temperature 1/
5	+65 ±3
6	+125 ±3
7	Maximum temperature (see 3.1)

1/ Reference temperature for each of the succeeding temperatures.

4.7.10 Low temperature storage and operation (see 3.16).

4.7.10.1 Mounting. Resistors shall be mounted by their terminals so that there is at least 1 inch of free airspace around each resistor, and the mounting is in such a position with respect to the air that it offers substantially no obstruction to the flow of air across and around the resistors.

4.7.10.2 Procedure. Following a dc resistance measurement, the mounted resistors shall be placed in a cold chamber at room temperature. The temperature shall be gradually decreased to -65°C +0°C, -5°C within 1.5 hours. For group C inspection only, and at the option of the manufacturer, the resistors may be placed in the cold chamber when the chamber is already at the extreme low temperature. Resistors shall be maintained at this temperature for 24 ±4 hours. After the storage period at the decreased temperature, full rated continuous working voltage (see 3.7) shall be applied for 45 minutes. The resistors may be loaded individually or in parallel. Fifteen +5, -0 minutes after the removal of the voltage, the temperature in the chamber shall be gradually increased to room temperature within not more than 8 hours. The resistors shall be removed from the chamber and maintained at a temperature of 25°C ±5°C for approximately 24 hours. The dc resistance shall then be measured as specified in 4.7.5 and resistors shall be examined for evidence of mechanical damage.

4.7.11 Terminal strength (see 3.17). Resistors shall be tested in accordance with method 211 of MIL-STD-202 with the following exceptions:

a. Pull test:

(1) Test condition letter A.

(2) Measurement before test: DC resistance as specified in 4.7.5.

(3) Applied force: Two pounds in all styles.

b. Twist test:

(1) Test condition letter D.

(2) Measurement after test: DC resistance as specified in 4.7.5. Examine for evidence of breaking and loosening of terminals and chipping of coating.

4.7.12 Dielectric withstanding voltage (see 3.18).

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

a. Special preparations. Resistors with axial leads shall be clamped in the trough of a 90° metallic V-block of such size that the body of the resistor does not extend beyond the extremities of the block. The resistor leads shall be positioned so that the distance between the resistor lead and any point of the V-block is not less than the radius of the resistor, minus the radius of the lead wire. Resistors with radial leads shall be held between metal straps of such size that the body of the resistor does not extend beyond the extremities of the metal straps (see figure 2).

b. Initial measurement: DC resistance shall be measured as specified in 4.7.5.

c. Magnitude of test potential: Sine wave test potential of magnitude as specified (see 3.1).

d. Nature of potential: An ac supply at commerical-line frequency (not more than 100 Hz and waveform.

e. Rate of application of test voltage: One hundred volts per second.

f. Duration of application of test voltage: One minute.

g. Points of application of test voltage: Between the resistor terminals connected together and the V-block or metal straps, as applicable.

h. Measurement after test: DC resistance shall be measured as specified in 4.7.5.

i. Examination after test: Resistors shall be examined for evidence of flashover, mechanical damage, arching, and insulation breakdown.

4.7.12.2 *Barometric pressure (reduced)*. Resistors shall be tested in accordance with method 105 of MIL-STD-202. The following details and exception shall apply:

a. Method of mounting: As specified in 4.7.12.1a.

b. Initial measurement: DC resistance shall be measured as specified in 4.7.5.

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

d. Magnitude of test voltage: Sine wave test potential of magnitude as specified (see 3.1).

e. Nature of potential: As specified in 4.7.12.1d.

f. Rate of application of test voltage: One hundred volts per second.

g. Duration of test: One minute.

h. Points of application of test voltage: As specified in 4.7.12.1g.

i. Final measurement: DC resistance shall be measured as specified in 4.7.5.

j. Examination after test: As specified in 4.7.12.1i.

4.7.13 *Insulation resistance (see 3.19)*. Resistors shall be tested in accordance with method 302 of MIL-STD-202. The following details and exception shall apply:

a. Test condition B (500 volts).

b. Special preparations: As specified in 4.7.12.1a.

c. Points of application: Between the resistor terminals connected together and the V-block for axial resistors or straps for radial resistors.

4.7.14 *Resistance to soldering heat (see 3.20)*. Resistors shall be tested in accordance with method 210 of MIL-STD-202. The following details and exceptions shall apply:

a. Measurement before test: DC resistance shall be measured as specified in 4.7.5.

b. Special preparation of specimen: Sample units shall not have been soldered during any of the previous tests.

c. Depth of immersion in molted solder: To a point 1/8 inch from the resistor body.

d. Test condition A.

e. Measurement after test: After completion of terminal immersion and following a 45-minute cooling period, dc resistance shall be measured as specified in 4.7.5.

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

4.7.15 Moisture resistance (see 3.21). Resistors shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting: 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 V-shaped metal strap, where the width is equal to that of the resistor body (for axial leaded devices and metal straps for radial leaded devices, see figure 2). The strap shall be made of corrosion resistant metal and kept in contact with the resistor body (see figure 2) with a nonconducting, noncorrosive support whose width is less than that of the body and will not act as a moisture trap. The mounting straps may be individual for each resistor or continuous for all resistors.

b. Initial measurement: Immediately following the initial drying period, dc resistance shall be measured as specified in 4.7.5.

c. Polarization and loading voltage: The resistance value selected shall be divided equally as possible for polarization and load.

(1) Polarization voltage: During steps 1 to 6 inclusive, a 100 volt dc potential shall be applied only to those resistors that have a polarizing strap. This potential shall be applied with the positive lead connected to the resistor terminals tied together, and the negative lead connected to the polarizing straps.

(2) Loading voltage: During the first 2 hours of steps 1 and 4, a dc test potential equivalent to 100 percent rated wattage but not exceeding the maximum rated voltage shall be applied to those resistors that do not have a polarizing strap specified in 4.7.15a.

d. Subcycle: Subcycle step 7b shall not be applicable. Step 7a shall be performed during any five of the first nine cycles only. All polarization straps may be removed to perform step 7a and shall then be replaced prior to starting the next cycle.

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 1.5 to 3.5 hours. The same straps used for polarizing the resistors may also be used for the dielectric withstanding voltage and insulation resistance tests. Resistors shall be removed from the chamber; within 0.5 hour and without any additional handling, the dc resistance, dielectric withstanding voltage, and insulation resistance shall be measured as specified in 4.7.5, 4.7.12, and 4.7.13, respectively. The sample units shall not be subjected to forced air circulation during the tests.

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

4.7.16 Shock, specified pulse (see 3.22). Resistors shall be tested in accordance with method 213 of MIL-STD-202. The following details and exceptions shall apply (see figure 3):

a. Special mounting means: Resistors shall be rigidly mounted on appropriate jig fixtures with their leads supported at a distance of .250 inch (6.35 mm) from the resistor body. The resistor shall be mounted with the body clamped or cemented to a flat surface. Where used, the cement material shall not extend above the centerline in a vertical plane or beyond the resistor body ends in a horizontal plane. In no case shall the resistor body be completely encapsulated (see 3.1). These fixtures shall be constructed 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 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 necessary. In all cases, the resistors shall be mounted in relation to test equipment so that the stress applied is in the direction that would be considered most detrimental.

b. Measurement before shock: DC resistance shall be measured as specified in 4.7.5.

c. Number and direction of applied shock: The resistors shall be subjected to a total of 10 shocks in each of three mutually perpendicular planes, two perpendicular and the other parallel to the longitudinal axis of the resistor.

d. Test condition I (100 g's, 6 milliseconds (ms) sawtooth).

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

f. Measurement after shock: DC resistance shall be measured as specified in 4.7.5.

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

4.7.17 Vibration, high frequency (see 3.23). Resistors shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply (see figure 3):

a. Mounting of specimens: Resistors shall be mounted on appropriate jig fixtures as specified in 4.7.16a. These fixtures shall be constructed to insure that the points of the resistor mounting supports shall have the same motion as the vibrating 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 will be held to a minimum. The test lead length shall be no greater than is necessary. A shielded cable, which may be necessary because of the field surrounding the vibration table, shall be clamped to the resistor mounting jig.

b. Initial measurement: DC resistance shall be measured as specified in 4.7.5.

c. Test condition D.

d. Direction of motion: In each of three mutually perpendicular directions, two perpendicular and the other parallel to the longitudinal axis of the resistor. Duration shall be 2.5 hours in each plane with total test time of 7.5 hours.

e. Measurements during vibration: Each resistor shall be monitored to determined electrical discontinuity by a method that shall at least be sensitive enough to monitor or register, automatically, any electrical discontinuity of 0.1 ms or greater duration.

f. Measurement after vibration: DC resistance shall be measured as specified in 4.7.5.

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

4.7.18 Life (see 3.24). 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 on lightweight terminals (see figure 4). The effective length of each terminal shall be 1 inch (25.4 mm). Resistors shall be arranged so that the temperature of any other resistor shall not appreciably influence the temperature of any resistor. The voltage at the resistor terminal shall be at least 95 percent of the specified test voltage.

b. Test temperature:

(1) Qualification inspection: 125°C ±5°C.

(2) 85°C power rating: 85°C ±5°C.

(3) 25°C power rating: 25°C ±5°C.

(4) Failure rate level determination: 125°C ±5°C.

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

(1) Inside chamber: When measurements are made inside the chamber, the initial dc resistance shall be measured after mounting at the applicable test temperature, after temperature stabilization, and within 8 hours of exposure of the resistors to the test temperature. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same condition.

(2) Outside chamber: When measurements are made outside the chamber, the initial dc resistance shall be measured after mounting at the room temperature. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same condition.

d. Operating conditions: Rated dc continuous working voltage, or filtered or nonfiltered full wave rectified ac voltage shall be applied intermittently, 1.5 hours on and 0.5 hour off, for the applicable number of hours (see 4.7.18f), and at the applicable test temperature. "On time" shall be three quarters of the total elapsed time. During the "on" cycle, the voltage shall be regulated and controlled to maintain ±5 percent of the rated continuous working voltage.

e. Test condition: Two thousand hours elapsed time for qualification inspection with all samples continued to 10,000 hours; 2,000 hours for 85°C and 25°C power rating; 10,000 hours for failure rate level inspection group C.

f. Measurements during test:

(1) Qualification inspection: DC resistance shall be measured at the end of the 0.5 hour "off" periods after 250 +48, -0, 500 +48, -0, 1,000 +48, -0, and 2,000 +72, -0 hours have elapsed.

(2) Extended life testing: DC resistance shall be measured at the end of the 0.5 hour "off" periods after 250 +48, -0, 500 +48, -0, 1,000 +48, -0, 2,000 +72, -0 and every 2,000 +96, -0 hours thereafter until the required 10,000 hours have elapsed. Measurements shall be made as near as possible to the specified time but may be adjusted so that measurements need not be made during other than normal workdays.

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

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

4.7.19 Storage life (see 3.25) (resistance values from 100 ohms to 50 kilohms, inclusive).

4.7.19.1 Storage conditions.

a. Resistors under test shall be stored at room conditions of 15°C to 35°C temperature, and from 15 percent to 75 percent relative humidity.

b. Lapsed time:

(1) DC resistance shall be measured before and after resistors have been subjected to 2,000 hours of storage conditions for qualification.

(2) DC resistance shall be measured before and after resistors have been subjected to the 2,000 to 10,000 hours of storage conditions for group C inspection with readings at each 2,000 +96, -0 hours.

4.7.20 High temperature exposure (see 3.26).

a. Mounting: Resistors shall be mounted by their normal mounting means.

b. Initial measurements: DC resistance shall be measured as specified in 4.7.5 at room ambient conditions.

c. Procedure: Following initial resistance measurements, resistors shall be placed in a chamber maintained at 175°C +5°C, -0°C for power rating curve A, at 150°C +5°C, -0°C for power rating curve B, and at 125°C +3°C, -0°C for power rating curve C for 2,000 hours with no load applied.

d. Measurement during test: 250 +48, -0 hours.

e. Final measurements: After removal from test chamber, resistors shall be permitted to stabilize at room ambient temperature. Within 6 hours after removal, dielectric withstanding voltage, insulation resistance, and dc resistance shall be measured as specified in 4.7.12, 4.7.13, and 4.7.5, respectively. Resistors shall be examined for evidence of mechanical damage.

4.7.21 Maximum allowable reactance (see 3.27). The inherent reactance shall be measured as follows:

a. Measure with a test instrument having an accuracy measurement of ±5 percent.

b. Test frequency (see table I).

4.7.22 Current noise (see 3.28). Current noise shall be measured in accordance with method 308 of MIL-STD-202.

4.7.23 Voltage coefficient (1,000 ohms and over) (see 3.29). Resistors shall be tested in accordance with method 309 of MIL-STD-202. The continuous working voltage shall be as specified (see 3.1).

4.7.24 Fungus (see 3.31). Resistors shall be tested in accordance with method 508 of MIL-STD-810.

4.7.25 Thermal EMF (see 3.30).

4.7.25.1 Mounting. Resistors shall be mounted by inserting one lead wire to a depth of 0.50 inch (12.7 mm) from the body in the test apparatus of figure 5. The other lead shall be connected to one terminal of the test instrument by a solid copper wire. The test instrument shall be placed at least 18 inches from the apparatus to avoid undue heating.

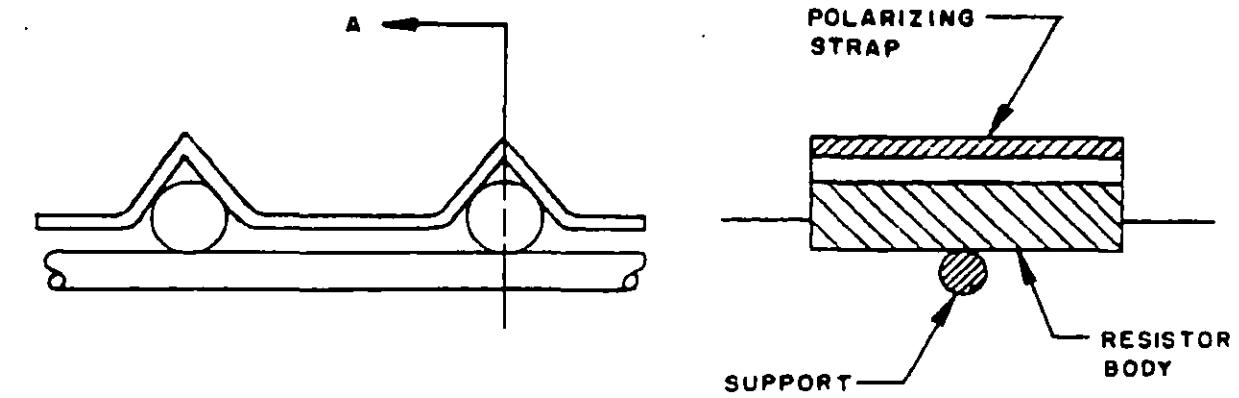
4.7.25.2 Test instrument. Keithley model 155 microvoltmeter or equivalent, having a sensitivity of at least 1 microvolt full scale and an input impedance of at least 1 megohm.

4.7.25.3 Procedure.

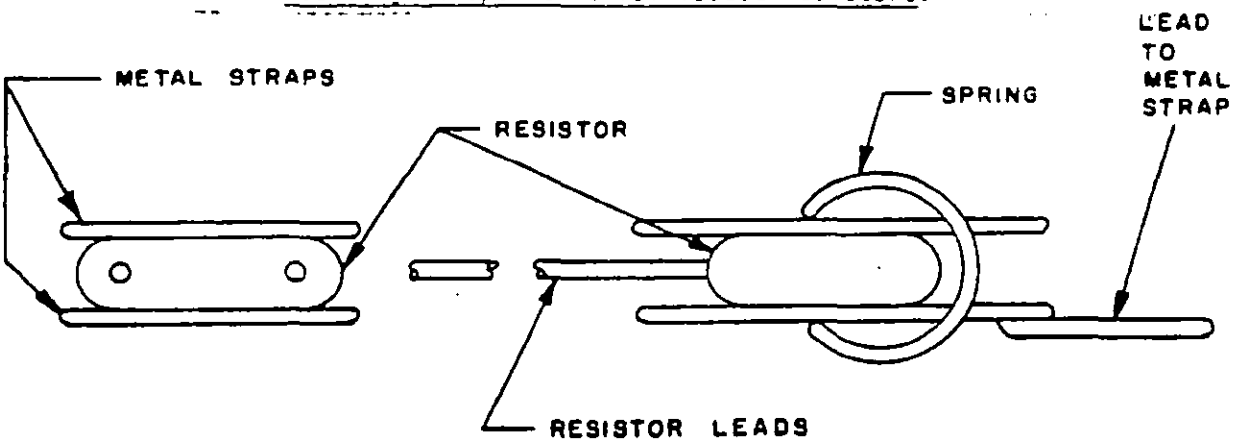
a. The resistor shall be mounted in the test block with the apparatus at ambient temperature (see figure 5 and 4.7.25.1).

b. The temperature of the block shall be raised to approximately 5°C above ambient. After the temperature has been stabilized for at least 5 minutes, the thermal output voltage and the temperature of the block shall be measured and recorded.

c. The temperature shall then be raised to approximately 10°C above ambient, and the thermal output voltage and the temperature shall be measured and recorded after the temperature of the block has stabilized for 5 minutes, minimum.

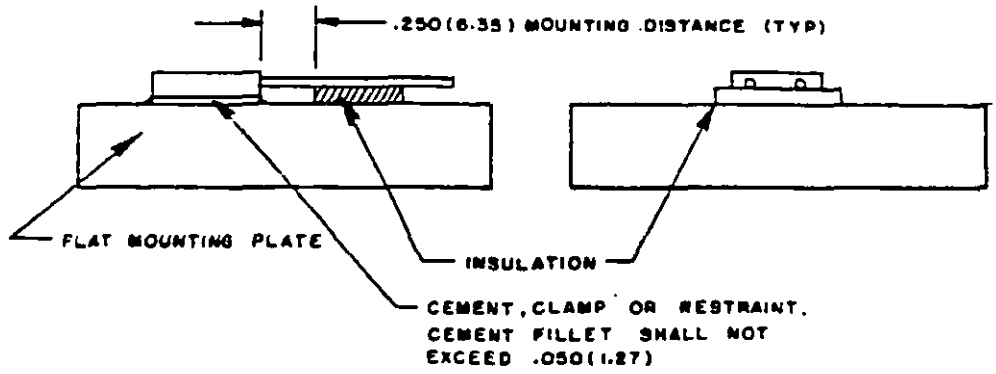


Mounting straps for axial leaded resistors.

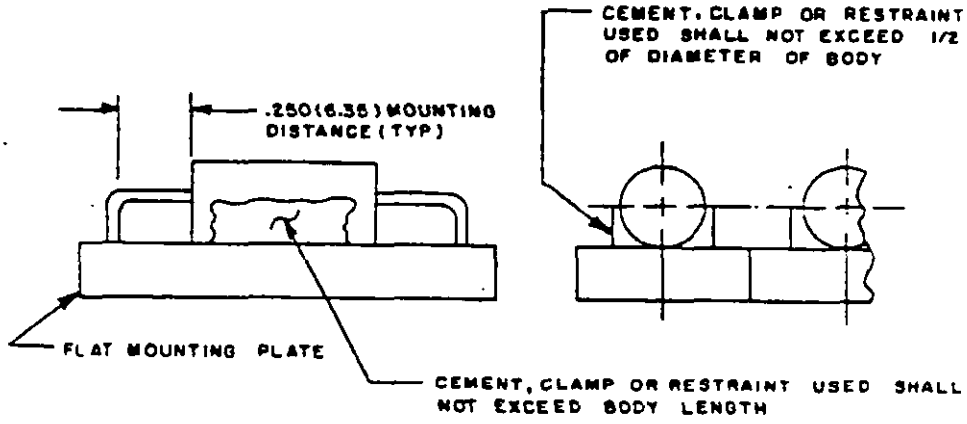


Metal strap assembly for radial leaded resistors.

FIGURE 2. Mounting straps for moisture resistance, dielectric withstanding voltage, and insulation resistance tests.



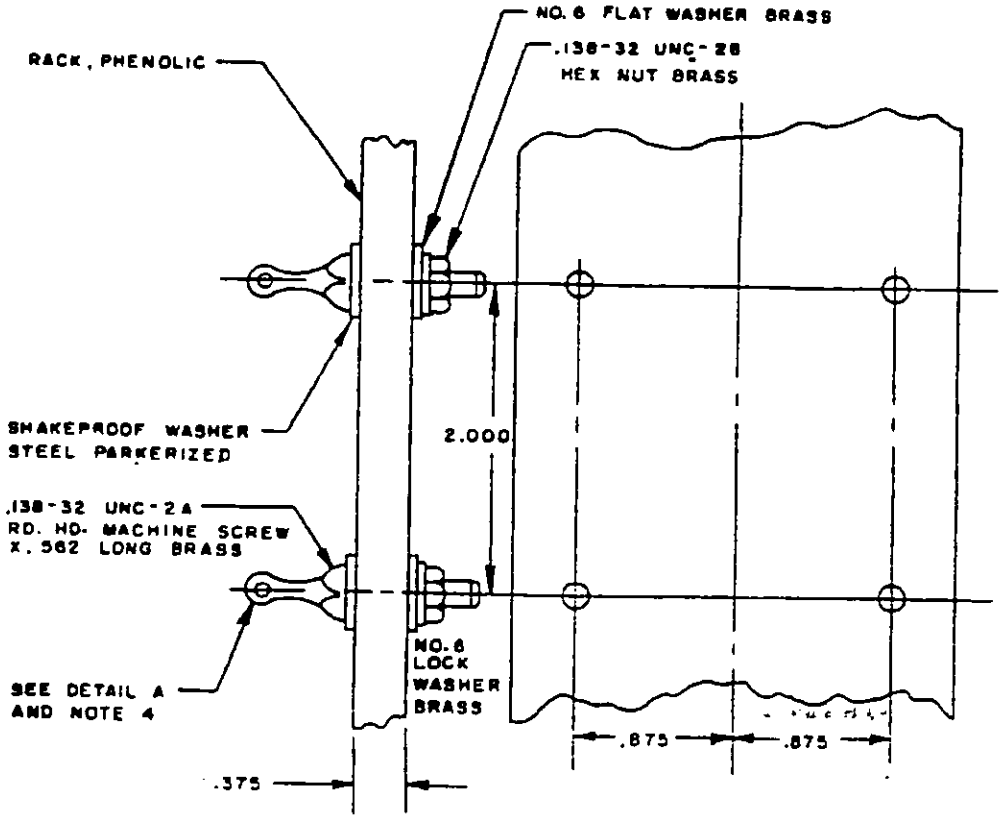
Mounting means for radial leaded resistors.

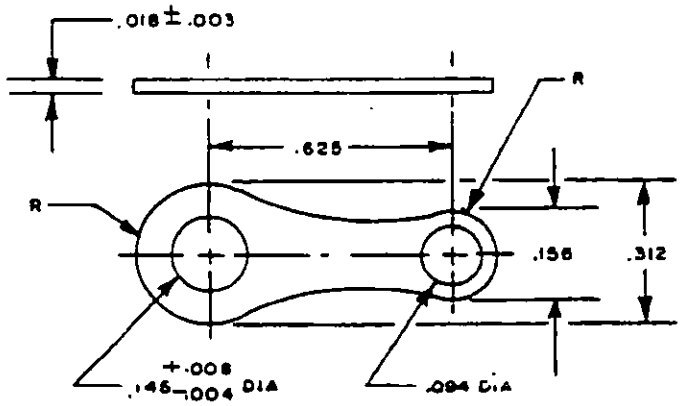


Mounting means for axial leaded resistors.

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are in parentheses.
3. Metric equivalents are given for general information only.
4. Following test, resistors shall be unmounted and examined for mechanical and electrical damage.

FIGURE 3. Mounting for shock and vibration, high frequency tests.





DETAIL A

FIGURE 4. Suggested mounting lug arrangement for life test.

Inches	mm
.003	0.08
.004	0.10
.008	0.20
.018	0.46
.094	2.39
.138	3.51
.145	3.68
.156	3.96
.312	7.92
.375	9.52
.562	14.27
.625	15.88
.875	22.22
2.000	50.80

NOTES:
1. Dimensions are in inches.
2. Unless otherwise specified, tolerance is ±.015 (0.38 mm).
3. Metric equivalents are given for general information only.
4. Solder lug, tinned brass in accordance with Catalog No. 2441; Cinch Manufacturing Corporation, Chicago, Ill., or equal.

FIGURE 4. Suggested mounting lug arrangement for life test - Continued.

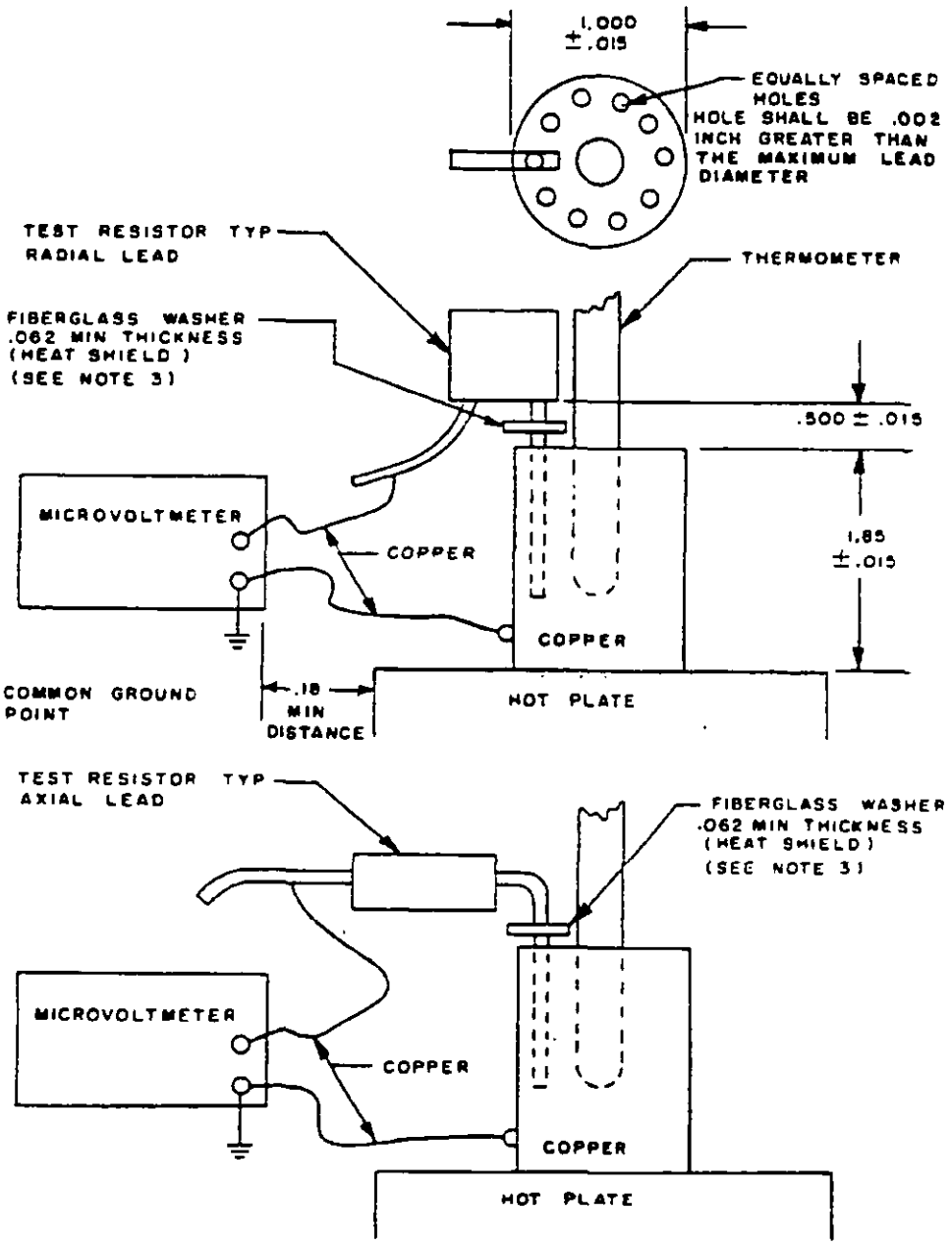


FIGURE 5. Thermal EMF test apparatus.

Inches	mm
.002	0.05
.015	0.38
.062	1.57
.180	4.60
.500	12.70
1.000	25.40
1.850	46.99

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Centrally located washer on lead inserted in test jig.

FIGURE 5. Thermal EMF test apparatus - Continued.

d. A third thermal output voltage shall be measured as in 4.7.25.3c except the temperature of the block shall be approximately 15 degrees above ambient.

e. Plot microvolt thermal output voltage against the recorded differential temperature above ambient of the three test points and draw a best fit straight line through these points.

f. The slope of the line determined in 4.7.25.3e is the thermal EMF in microvolts per °C.

4.8 Aqueous-extract-conductivity test procedure (see 3.5.1).

4.8.1 Outline of method. The sample is extracted with hot water. The conductivity of electrolytic surface contaminants is measured with a conductivity bridge or resistance indicator and compared with a distilled-water blank.

4.8.2 Apparatus.

4.8.2.1 Conductivity bridge. A conductivity bridge or resistance indicator shall be capable of measuring resistance up to 100,000 ohms. Within the range of 0.3 to 30,000 ohms inclusive, the accuracy of adjustment shall be 5 percent.

4.8.2.2 Condensers. Two bayonet water condensers or condensers of any type that will prevent evaporation in the extraction flasks.

4.8.2.3 Constant-temperature bath. A water bath maintained at 25°C ±0.5°C.

4.8.2.4 Beakers. Two acid alkali resistant glass, 125 milliliter (ml), tall-form beakers or any beakers of such dimensions that when the dip-type cell is immersed in 100 ml of liquid contained therein, the electrodes are fully covered.

4.8.2.5 Flasks. Two acid and alkali resistance glass, wide mouth flasks, so shaped that a maximum of 100 ml of water will completely cover the sample.

4.8.2.6 Thermometer. A thermometer having a range of -5°C to +50°C inclusive, graduated in 0.1°C intervals (for constant-temperature bath).

4.8.2.7 Conductivity cell. A dip type cell with platinum electrodes securely mounted and adequately protected so that their relative positions shall not be affected by handling or moderate jarring. The area of each electrode shall be not less than 2 square centimeters (cm^2). The cell shall be so constructed that the electrodes shall be completely immersed upon dipping the cell into the liquid medium and the cell constant shall be 0.1 reciprocal cm. The electrodes shall be platinized (in accordance with 4.8.2.7.1) if the measurements are made at low frequency (60 cycles). At a frequency of 1,000 cycles, this precaution is unnecessary.

4.8.2.7.1 Preparation and calibration of conductivity cell. If unplatinized, clean a new cell with warm chromic-acid solution, wash thoroughly with distilled water, and rinse with alcohol and ether. If the electrodes are already platinized, omit the chromic-acid wash. To platinize the electrodes, immerse the cell in a solution of 3.0 grams (g) of chloroplatinic acid and 0.010 g of lead acetate in 100 ml of distilled water. Electrolyze, using a current density of 30 mA per cm^2 for 8 minutes, reversing the current every 2 minutes. Wash the electrodes thoroughly with distilled water. To test for completeness of removal of electrolyte, immerse the cell in 50 ml of distilled water and measure the resistance initially and at the end of 10 minutes; if a decrease in resistance occurs, repeat the washing. Keep the cell immersed in distilled water when not

in use. To determine the cell constant, place a beaker containing 0.01 molar potassium solution in the constant-temperature bath maintained at 25°C ±0.5°C. After thermal equilibrium is established, measure the resistance of this solution. When the cell thermal equilibrium is established, measure the resistance of this solution. The cell constant K, may be calculated as follows:

$$K = C \times R \text{ per cm}$$

Where:

R = Resistivity in ohms.
C = Conductivity of the potassium-chlor solution (the value for C at 25°C is 1.41×10^{-3} siemens (mhos) per cm).

4.8.3 Reagents.

4.8.3.1 Distilled water. Prepare double-distilled water for use in preparing both the extract and the potassium solution. The second distillation is made over alkaline permanganate. The conductivity of water prepared in this manner shall be not more than 2.5 microsiemens (micromhos) per cm at 25°C ±0.5°C.

4.8.3.2 Potassium-chloride solution. Prepare a 0.01 molar solution with reagent-grade potassium chloride which has been dried for 2 hours at 100°C. After cooling, dissolve 0.7455 g of dried salt in distilled water and make up to 1 liter in volumetric flask at 20°C.

4.8.4 Procedure.

a. Place an unbroken sample or samples with a minimum surface area of 5 square inches in a suitable flask so that a maximum of 100 ml of boiling distilled water will completely cover the sample. Prepare a blank, using a like amount of distilled water in the equivalent flask, and with both sample and blank proceed as follows: Place condensers in position and heat the contents of the flasks to boiling. Continue boiling for 5 to 10 minutes. Care should be taken in this operation so that the sample remains unbroken.

b. Transfer the sample and the blank to the 125 ml, tall-form beakers and plug the beakers with rubber stoppers covered with either aluminum foil or tin foil. Place the beakers in a water bath at 25°C ±0.5°C.

c. As soon as thermal equilibrium is established, place the dip-type cell in the extract solution, making certain that the electrodes are completely immersed. Measure the resistance on the most sensitive scale of the bridge. Move the cell up and down in the solution several times and repeat the measurement, rinse the cell thoroughly in distilled water and gently shake off any water of the surface. Correct the conductivity of the extract solution for the blank. Test at least two specimens. If the conductivities on the duplicate specimens do not agree within 10 percent, repeat the determination.

4.8.5 Report. The conductivity shall be reported in microsiemens per cm for a sample having a minimum of 5 square inches surface area.

5. PACKAGING

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

6. NOTES

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

6.1 Intended use. The resistors covered by this specification are intended for use in application where high precision and stability are required.

6.2 Ordering data. Acquistion documents should 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. Optional: Requirement for notification of exceeding change of resistance in excess of that specified in 6.5.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified 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 contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the qualified products list is the Naval Electronic Systems Command; however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-E), 1507 Wilmington Pike, Dayton, OH 45444.

6.4 Selection and use information. Equipment designers should refer to MIL-STD-199, "Resistors, Selection and Use of" for a selection of standard resistors types and values for any new equipment design. All application and use information concerning these resistors are also provided in MIL-STD-199.

6.5 Life test measurement points and requirements. All known users of resistors from the affected lots should be notified, where such notification is requested under 6.2c, whenever the change in resistance exceeds the following values at the specified measurement point:

a. 0.05 percent ΔR at 250, 500, 1000, and 2,000 hours.

b. 0.20 percent ΔR at 4,000, 6,000, 8,000, and 10,000 hours.

c. 0.10 percent ΔR at 2,000 hours and 0.40 percent ΔR at 10,000 hours for power rating curve C.

6.6 Production lot. A production lot consists of parts manufactured from the same basic raw materials, processed under the same specification and procedures, and produced with the same equipments. Each production lot of parts should be a group identified by a common manufacturing record through all significant manufacturing operations, including the final assembly operation, such as casing, hermetic sealing, or lead attachment, rather than painting or marking, for example.

6.7 Electrostatic charge from packaging. Under several combinations of conditions, these resistors, packaged loosely in polyethylene bags, can be electrically damaged, by electrostatic charges, and drift from specified value. Users should consider this phenomena when ordering or shipping resistors. MIL-R-39032 specifies preventive packaging requirements.

6.8 Subject term (key word) listing.

Resistance
Ohm

APPENDIX

PROCEDURE FOR QUALIFICATION INSPECTION

10. SCOPE

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

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

30. SUBMISSION

30.1 Sample. A sample having any specification resistance tolerance in each style and characteristic for which qualification is sought shall be submitted and subjected to the inspection of table VII. Sample size submission and distribution shall be as specified in table XIV.

In addition, sample submission is required under the following conditions:

a. Qualification to closer tolerance than submitted above is desired:

30 additional samples of the closer tolerance to be qualified to group I of table VII.	10 high value, 10 critical or nearest critical, 10 low value

b. Hermetically sealed resistor style to be qualified by nonhermetically sealed resistor style submission:

30 additional samples of characteristic E to groups I, II, III, and IV.	10 high value, 10 critical or nearest critical, 10 low value.

APPENDIX

TABLE XIV. Sample size submission and distribution.

Qualification sample submission		
Group I		12 any value group IA
All samples (except group IA), then divide for groups II through VII inclusive:		
Group IA		186 highest value
12 any value		
Group II		
10 high value 30 10 critical or nearest critical 1/ 10 low value		176 critical or nearest critical
Group III		
10 high value 30 10 critical or nearest critical 1/ 10 low value		186 lowest value
Group IV		
10 high value 30 10 critical or nearest critical 1/ 10 low value		
Group V		
34 high value 102 34 critical or nearest critical 1/ 34 low value	560	
Group VA		
34 high value 102 34 critical or nearest critical 1/ 34 low value		
Group VB		
34 high value 102 34 critical or nearest critical 1/ 34 low value		
Group VI		
10 high value 30 10 critical or nearest critical 1/ 10 low value		
Group VII		
34 high value 102 34 critical or nearest critical 1/ 34 low value		
Group VIII		
20 10 high value 10 low value		

1/ If no critical value is specified, the samples shall be equally divided between the highest and lowest resistance values submitted (see table XV for critical resistance values applicable to 125°C wattage ratings. For 85°C and 25°C resistance values to be determined at wattage and voltage specified (see 3.1).

APPENDIX

TABLE XV. Critical resistance value.

Detail specification	Resistance (megohms)
MIL-R-122/1	0.300
MIL-R-122/3	0.300
MIL-R-122/10	0.267

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

30.3 Descriptions of items. The contractor shall submit a detailed description of the resistors being submitted for inspection, including materials used for the resistance element and the protective enclosure or coating and lead material. After qualification has been granted, no changes shall be made in materials, design, or construction without prior notification to the qualifying activity.

40. EXTENT OF QUALIFICATION

40.1 Extent of qualification. The resistance range included in the qualification of any one resistor style will be between two adjacent resistance values that pass the qualification inspection. Qualification will cover only the resistor types covered by the description of 30.3. Except as specified in 30.1b, separate submissions are required for each protective coating or enclosure used. Qualification of one characteristic is the basis for qualification of another characteristic, as indicated in table XVI. Also, qualification of the lower resistance tolerances shall qualify the higher resistance tolerances in accordance with table XVII. Qualification between failure rate levels shall be in accordance with table XVIII. Qualification of the higher power rating curve shall qualify the lower power rating curve in accordance with table XIX. Qualification between reactance limits shall be in accordance with table XX. As a requisite for extension of qualification, as described herein, between characteristics, tolerances, resistance values, failure rates, reactance limits, and power rating curves, the product involved must be manufactured using the same facilities, processes, and materials (excluding lead material) as the product originally submitted for qualification.

TABLE XVI. Extent of qualification.

Characteristic submitted	Characteristic qualified
G	G, Y, D, A, E, B, F, C
Y	Y, D, A, E, B, F, C
D	D, A, E, B, F, C
A	A, E, B, F, C
E	E, B, F, C
B	B, F, C
F	F, C
C	C

APPENDIX

TABLE XVII. Extent of qualification of resistance tolerances.

Resistance tolerance submitted	Resistance tolerance qualified
.005	.005, .01, .05, 0.1, 0.5, 1.0
.01	.01, .05, 0.1, 0.5, 1.0
.05	.05, 0.1, 0.5, 1.0
0.1	0.1, 0.5, 1.0
0.5	0.5, 1.0
1.0	1.0

TABLE XVIII. Extent of qualification of failure rate levels (percent/1000 hours).

Failure rate level	Will qualify failure rate level
.001	.001, .01, .1, 1.0
.01	.01, .1, 1.0
.1	.1, 1.0
1.0	1.0

TABLE XIX. Extent of qualification of power rating curves.

Power rating curve	Will qualify power rating curve
A	A, B, C
B	B, C
C	C

APPENDIX

TABLE XX. Extent of qualification of reactance limits.

Reactance limit code	Will qualify reactance limit code
L	A through S
M	A through K and M through S
N	A through K and N through S
P	A through K, P, and S
F	A through K, and S
G	A through E, G through K, and S
H	A through E, H through K, and S
J	A through E, J, K, and S
A	A through E, K and S
B	B through E, K and S
C	C through E, K and S
D	D, E, K, and S

40.2 Extention of qualification between associated detail specifications. Qualification between associated detail specifications will be in accordance with table XXI. Associated detail specifications not shown in the table qualify separately.

TABLE XXI. Extent of qualification detail specification.

Associated detail specification	Will qualify associated detail specification
MIL-R-122/1	MIL-R-122/1, MIL-R-122/3, MIL-R-122/10
MIL-R-122/3	MIL-R-122/3, MIL-R-122/10
MIL-R-122/10	MIL-R-122/10

1/ For hermetic style to be qualified by nonhermetic style, see 30.1b for additional sample submission.

CONCLUDING MATERIAL

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

Review activities:
Army - AR
Navy - AS, OS
Air Force - 11, 17, 99
DLA - ES

User activities:
Army - AT, AV, ME
Navy - CG, MC
Air force - 19

Preparing activity:
Navy - EC

Agent:
DLA - ES

(Project 5905-1162)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-R-122A	RESISTORS, FIXED, PRECISION, ESTABLISHED RELIABILITY, GENERAL SPECIFICATION FOR

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*:

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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DD FORM 1426

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