

MIL-R-29A

31 MAY 1960

SUPERSEDING

JAN-R-29

13 NOVEMBER 1944

MILITARY SPECIFICATION

RESISTORS, FIXED, METER MULTIPLIER, EXTERNAL (HIGH VOLTAGE, FERRULE TERMINAL TYPE)

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

1. SCOPE

1.1 Scope. This specification covers the requirements for high-voltage, external, meter-multiplier, fixed resistors of the ferrule-terminal type for use with direct-current (dc) instruments drawing 1 milliampere at full-scale deflection. These resistors have a resistance of 0.5 to 20 megohms, inclusive.

1.2 Classification.

1.2.1 Type designation. The type designation shall be in the following form, and as specified (see 3.1 and 6.2):



1.2.1.1 Style. The style is identified by a three-letter symbol. The first two letters, MF, identify high voltage, external, meter-multiplier, fixed resistors of the ferrule-terminal type. The third letter identifies the particular physical dimensions.

1.2.1.2 Resistance. The nominal resistance in ohms is designated by a three-digit number. The first two digits represent the first two significant figures of the resistance value, the third digit indicates the number of zeros to follow.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-585	— Boxes; Wood, Wire-bound.
PPP-B-591	— Boxes, Fiberboard, Wood-Cleated.
PPP-B-601	— Boxes, Wood, Cleated-Plywood.
PPP-B-621	— Boxes, Wood, Nailed and Lock-Corner.
PPP-B-636	— Boxes, Fiber.

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PPP-T-76 — Tape; Pressure-Sensitive Adhesive, Paper, Water Resistant.

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MIL-P-116 — Preservation, Methods of.

MIL-B-10377 — Box, Wood, Cleated, Veneer, Paper Overlaid.

MIL-R-10509 — Resistors, Fixed, Film (High Stability), General Specification for.

MIL-L-10547 — Liners, Case, Waterproof.

STANDARDS

MILITARY

MIL-STD-105 — Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129 — Marking for Shipment and Storage.

MIL-STD-130 — Identification Marking of U. S. Military Property.

MIL-STD-202 — Test Methods for Electronic and Electrical Component Parts.

(Copies of specifications and standards required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

OFFICIAL CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules

(Application for copies should be addressed to the Official Classification Committee, One Park Avenue, at 33d Street, New York 16, N. Y.)

3. REQUIREMENTS

3.1 Detail requirements for individual resistor types. Detail requirements or exceptions applicable to individual resistor types are specified on figure 2 (see 6.2).

3.2 Qualification. Resistors furnished under this specification shall be a product which has been tested, and has passed the qualification tests specified in 4.4, and has been listed on or approved for listing on the applicable qualified products list (see 6.3).

3.3 Definitions. For the purpose of this specification, the following definitions shall apply.

3.3.1 Still air. Still air is air with no circulation other than that created by the heat of the unit being operated.

3.3.2 Free space. A resistor shall be considered to be in free space when it is mounted horizontally with no object closer than 12 inches to the unit, except the mounting base which shall be no closer than 2 inches to the unit.

3.3.3 Hot spot. The hot spot is the point or elemental area of maximum temperature on the external surface of a resistor.

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 resistor to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.4.1 Fume-emitting material. Material that emits deleterious or toxic fumes at a temperature of 110°C. or lower shall not be used.

3.4.2 Ferrous material. Ferrous material shall not be used for current-carrying parts.

3.5 Design and construction. Resistors shall be so designed and constructed as to meet the requirements of this specification. Resistors shall consist of a resistance element or series of elements of the wirewound or film type. Completed resistors shall be cylindrical in shape with metal end ferrules and shall be of the configuration and physical dimensions specified (see 3.1).

3.5.1 Resistance elements.

3.5.1.1 Wirewound. Each resistance element shall be wound on a suitable form with resistance wire having not more than two joints, welds, or bonds, etc., per megohm of wire, not including those at the end of terminals or connections between elements. The design of the winding shall be such as to preclude shorting of turns or arcing between turns under the potential imposed between any adjacent turns.

3.5.1.1.1 Resistance wire. The resistance wire shall possess a substantially uniform cross section of conductor and insulation. The wire shall be as free as practicable from particles of impurity and grain growth or other factors contributing to spot weakness. The cross-sectional area of the wire shall be the maximum consistent with other requirements of this specification; however, in no case shall the nominal diameter of the conductor be less than 0.001 inch, and the absolute diameter be less than 0.0009 inch.

3.5.1.2 Film. Film-type resistance elements shall be resistors conforming to characteristic C of Specification MIL-R-10509.

3.5.2 Protective coating or inclosure. The

resistor assemblies shall be protected by a coating or inclosure of insulating and moisture-resistant material which shall completely cover the exterior of the resistance element, including connections between any two elements or between any element and a terminal ferrule. This material shall afford adequate protection against the effects of prolonged exposure to high humidities. The protective coating or enclosure shall be such as to minimize the establishment of leakage paths between terminals, resulting from collection of moisture film on the exterior surface of the resistor.

3.5.3.1 Engagement of threaded parts. When threaded parts are used, they shall engage by at least four full threads.

3.5.3.2 Locking of screw-thread assemblies. Screw-thread assemblies shall not loosen as a result of tests specified herein.

3.5.4 Terminals. The ends of the resistance element shall be connected to metal ferrule-type terminals, which shall serve for mechanical mounting and electrical connection by fitting into spring clips. The lead wires from the active resistance element to the ferrules shall be so arranged and connected that they will be protected from being cut by or placed in contact with the mounting clips at any angle of rotation of the unit.

3.5.5 Concentricity and parallelism of ferrules. The sides of the ferrules for any angle of rotation and for a distance of $\frac{3}{8}$ inch from the outer ends shall not depart from true parallelism by more than a total of 0.005 inch. The cross section of the ferrules shall not depart from a true circular form by more than a total of 5 percent of the mean outside diameter. The ferrules shall be so aligned with respect to each other and the resistor body that the maximum permissible departure from concentricity shall be as shown on figure 1.

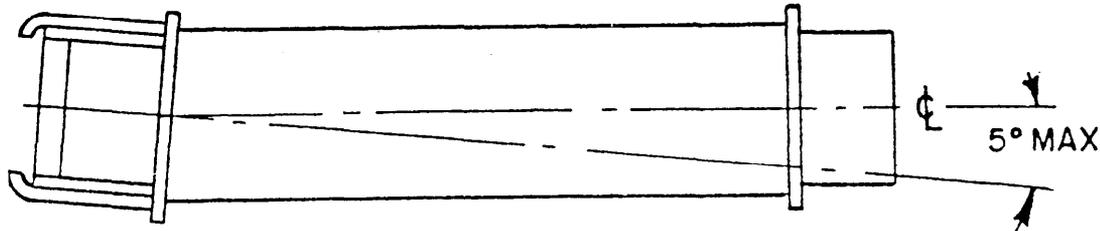


FIGURE 1. Maximum permissible departure from concentricity.

3.5.6 Ferrules. Ferrules shall be of one-piece construction and of a corrosion-resistant nonferrous material or shall be protected against corrosion by a coating. The ferrule-wall thickness of all styles, except C, shall be not less than 0.030 inch. If the ferrules of style C resistors are reinforced by some means to prevent deformation when pressed into mounting clips, the minimum ferrule-wall thickness shall be not less than 0.020 inch. If the ferrules are not reinforced, the minimum ferrule-wall thickness shall be 0.030 inch. All ferrule edges shall be free from burrs.

3.5.7 Resistor units. When a resistor unit is constructed by joining a number of individual resistance elements together, a means shall be provided for locking the segments securely together to preclude separation or disassembly in the field. There shall be no relative movement among the resistance elements within the housing of the completed resistor.

3.6 Dielectric withstanding voltage. When resistors are tested as specified in 4.6.2, there shall be no flashover or evidence of insulation breakdown.

3.7 Insulation resistance. When measured as specified in 4.6.3, the insulation resistance shall be not less than 1,000 times the nominal resistance value of the resistor being tested (see 3.1).

3.8 DC resistance. When tested as specified in 4.6.4, resistors shall have a dc resistance ± 0.5 percent of the nominal resistance specified (see 3.1).

3.9 Short-time overload. When tested as specified in 4.6.5, resistors shall not arc, burn, or char, or show evidence of other damage. The permanent change in resistance shall not exceed ± 0.5 percent.

3.10 Temperature rise. When resistors are tested as specified in 4.6.6, they shall operate continuously without having a hot-spot temperature in excess of 110°C . If impregnating compounds are used, there shall be no leakage or external displacement of any of the compounds, regardless of the mounting position, at any ambient temperature up to and including 85°C .

3.11 Resistance-temperature characteristic. When resistors are tested as specified in 4.6.7, the resistance change shall not exceed $+0.02$ or -0.005 percent ($+200$ or -50 parts per million) per degree centigrade.

3.12 Thermal shock. When resistors are tested as specified in 4.6.8, there shall be no evidence of chipping, crazing, cracking, or spalling of the exterior coating or enclosure. There shall be no evidence of other mechanical damage. The permanent change in resistance shall not exceed 0.5 percent.

3.13 Temperature cycling. When resistors are tested as specified in 4.6.9, there shall be no evidence of mechanical damage. The permanent change in resistance shall not exceed 0.2 percent.

3.14 Salt-water-immersion cycling. When resistors are tested as specified in 4.6.10, there shall be no evidence of mechanical

damage. The permanent change in resistance shall not exceed 1 percent.

3.15 **Vibration.** When resistors are tested as specified in 4.6.11, there shall be no evidence of mechanical damage. The change in resistance shall not exceed 0.5 percent. The dielectric withstanding voltage and insulation resistance shall be as specified in 3.6 and 3.7, respectively.

3.16 **Security of ferrules.** When resistors are tested as specified in 4.6.12, there shall be no shifting or loosening of either ferrule or visible relative movement of any of the components of the resistor.

3.17 **Mechanical strength.** When resistors are tested as specified in 4.6.13, there shall be no evidence of mechanical damage.

3.18 **Marking.** Resistors shall be marked in

accordance with Standard MIL-STD-130. The type designation and manufacturer's name or code symbol shall be marked on one ferrule (see 3.1), and the maximum rated voltage and current on the other ferrule (see 3.1). There shall be no space between the groups of letters and numbers which comprise the type designation. Marking shall remain legible at the end of all tests.

3.19 **Workmanship.** Resistors shall be processed in such a manner as to be uniform in quality and shall be free from corrosion, cracks, rough edges, and another defects that will affect life, serviceability, or appearance.

3.19.1 **Soldering.** When soldering is employed, only noncorrosive fluxes shall be used unless it can be shown that corrosive elements have been satisfactorily removed after soldering. Electrical connections shall be mechanically secure before and electrically continuous after soldering.

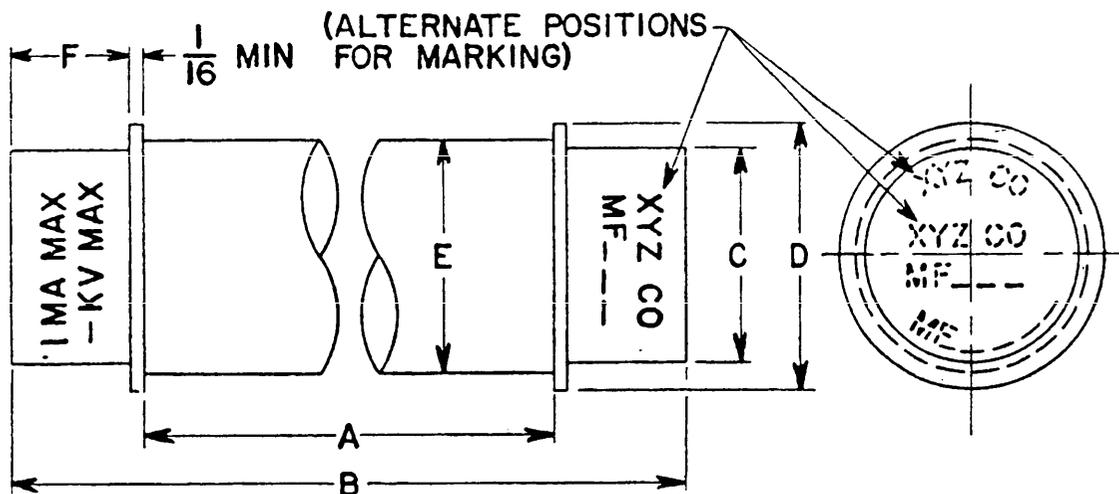


FIGURE 2. Resistor styles MFA, MFB, MFC, MFD, MFE, and MFF.

Style	Dimensions						
	A Max.	B ± 1/32	C ± 1/64 (dia)	D ± 1/64 (dia)	E (dia)		F
					Min.	Max.	
MFA	8 1/16	9 25/32	1 9/64	1 25/64	1 3/10	1 5/16	3 3/64 ± 1/64
MFB	4 3/16	5 9/32	1 9/64	1 25/64	1 3/10	1 5/16	3 3/64 ± 1/64
MFC	1 25/32	2 15/16	1 3/16	1.0	1 1/10	1 9/64	3 3/64 ± 1/64
MFD	13 1/2	16 1/2	1 5/32	...	1 3/16	1 1/10	1 1/2 + 0.010 - 0.000
MFE	20 1/2	23 1/2	1 5/32	...	1 3/16	1 5/16	1 1/2 + 0.010 - 0.000
MFF	27 1/2	30 1/2	1 5/32	...	1 3/16	1 5/16	1 1/2 + 0.010 - 0.000

1. All dimensions in inches.
2. These resistors should be supported by ferrule-terminals only.

FIGURE 1.—Continued

Type designation	Nominal resistance in megohms	Rated voltage in kilovolts
MFC504	0.5	0.5
MFC804	0.8	0.8
MFC105	1.0	1.0
MFB105	1.0	1.0
MFB155	1.5	1.5
MFB205	2.0	2.0
MFB255	2.5	2.5
MFB305	3.0	3.0
MFB355	3.5	3.5
MFA355	3.5	3.5
MFA405	4.0	4.0
MFA505	5.0	5.0
MFA605	6.0	6.0
MFD106	10.0	10.0
MFE156	15.0	15.0
MFF206	20.0	20.0

FIGURE 2—Continued.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.

4.1.1 *Supplier.* The supplier responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to

perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1.1 *Test equipment and inspection facilities.* Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The supplier shall establish calibration of inspection equipment to the satisfaction of the Government.

4.1.1.2 *Additional inspection.* Nothing specified herein shall preclude the supplier from taking such additional samples and making such additional inspection as he may deem necessary or desirable to assure conformance of the resistors to this specification.

4.1.2 *Government.* Acceptance of the resistors shall be based upon verification by the Government of the supplier's compliance with the requirements of this specification. The Government may, at its option, repeat any or all of the inspections specified herein (see 6.4).

4.2 *Classification of inspection.* The examination and testing of resistors shall be classified as follows:

- (a) Qualification inspection (see 4.4).

(b) Acceptance inspection (see 4.5).

1. Inspection of product for delivery (see 4.5.1).
2. Inspection of preparation for delivery (see 4.5.2).

4.3 Inspection conditions. Unless otherwise specified herein, all inspection shall be made at room ambient temperature, relative humidity, and pressure.

4.4 Qualification inspection.

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.

4.4.2 *Test routine.* Sample units will be subjected to the qualification inspection specified in table I, in the order shown.

TABLE I. Qualification inspection

Examination or test	Requirement paragraph	Method paragraph
Visual and mechanical examination	3.1, 3.4 to 3.5.7, incl. 3.18 to 3.19.1, incl.	4.6.1
Dielectric withstanding voltage	3.6	4.6.2
Insulation resistance	3.7	4.6.3
DC resistance	3.8	4.6.4
Short-time overload	3.9	4.6.5
Temperature rise	3.10	4.6.6
Resistance-temperature characteristic	3.11	4.6.7
Thermal shock	3.12	4.6.8
Temperature cycling	3.13	4.6.9
Salt-water-immersion cycling	3.14	4.6.10
Vibration	3.15	4.6.11
Security of ferrules	3.16	4.6.12
Mechanical strength	3.17	4.6.13

4.3.3 *Failures.* Failure of any sample unit in any test will be cause for refusal to grant qualification.

4.5 Acceptance inspection.

4.5.1 *Inspection of product for delivery.* Inspection of product for delivery shall consist of groups A, B, and C.

4.5.1.1 *Inspection lot.* An inspection lot, as far as practical, shall consist of all the resistors of the same style produced under essentially the same conditions, and offered

for inspection at one time.

4.5.1.2 *Group A inspection.* Group A inspection shall consist of the examinations and test specified in table II, and shall be made on the same set of sample units, in the order shown. Statistical sampling and inspection shall be in accordance with Standard MIL-STD-105 for ordinary inspection. The acceptable quality levels (AQL) shall be as specified in table II. Major and minor defects shall be as defined in Standard MIL-STD-105.

TABLE II. Group A inspection

Examination or test	Requirement paragraph	Method paragraph	Defect classification	AQL (percent defective)	
				Major	Minor
Visual and mechanical examination:	...	4.6.1	...		
Body and mounting dimensions ..	3.1 and 3.5	...	Major	1.0	4.0
Marking ¹	3.18	...	Major		
Concentricity and parallelism of ferrules	3.5.5	...	Major		
Workmanship	3.19 and 3.19.1	...	Major or minor		
DC resistance	3.8	4.6.4	Major	1.0	

¹ Marking defects shall be charged only for illegible, incorrect, or incomplete marking.

4.5.1.3 *Group B inspection.* Group B inspection shall consist of the tests specified in table III, in the order shown. They shall be performed on sample units that have

passed the group A inspection, unless the Government considers it more practical to select a separate sample from the lot for group B inspection.

TABLE III. Group B inspection

Test	Requirement paragraph	Method paragraph
Dielectric withstanding voltage	3.6	4.6.2
Insulation resistance	3.7	4.6.3
Short-time overload	3.9	4.6.5
Resistance-temperature characteristic	3.11	4.6.7

4.5.1.3.1 *Sampling plan.* The sampling plan shall be in accordance with Standard MIL-STD-105 for small-sample inspection. Unless otherwise specified herein, normal inspection shall be used at the start of the contract. For small-sample reduced inspection procedure, R-1 shall be used. The AQL shall be 4.0 (percent defective), and the inspection level shall be L8 for normal and tightened inspection, and L6 for reduced inspection.

4.5.1.3.2 *Disposition of sample units.* Sample units which have passed all the group B inspection and which are still within the initial resistance tolerance may be delivered on the contract or order, if the lot is accepted.

4.5.1.4 *Group C inspection.* Group C inspection shall consist of the tests specified in table IV, in the order shown. They shall be made on sample units selected from lots that have passed groups A and B inspection.

4.5.1.4.1 *Sampling plan.* Three sample

units of the highest resistance value in the largest style for which the supplier holds qualification and which were produced during the last 12 months shall be selected and inspected annually in accordance with table IV.

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

4.5.1.4.3 *Noncompliance.* If a sample fails to pass group C inspection, the supplier shall take corrective action on the materials or process, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, and essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the cor-

TABLE IV. Group C inspection¹

Test	Requirement paragraph	Method paragraph
DC resistance	3.8	4.6.4
Temperature rise	3.10	4.6.6.
Thermal shock	3.12	4.6.8
Temperature cycling	3.13	4.6.9
Salt-water-immersion cycling	3.14	4.6.10
Vibration	3.15	4.6.11
Security of ferrules	3.16	4.6.12
Mechanical strength	3.17	4.6.13

¹ No defective units will be allowed in any of the tests.

rective action has been taken, group C inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). Groups A and B inspection may be reinstated; however; final acceptance shall be withheld until the group C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the contracting officer.

4.5.2 Inspection of preparation for delivery. Sample items and packs shall be selected and inspected in accordance with Specification MIL-P-116 to verify conformance with requirements in section 5 of this specification.

4.6 Methods of examination and test.

4.6.1 Visual and mechanical examination. Resistors shall be examined to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.4 to 3.5.7, incl, 3.18 to 3.19.1, incl.).

4.6.2 Dielectric withstanding voltage (see 3.6). Resistors shall be tested in accordance with method 301 of Standard MIL-STD-202. The following details and exceptions shall apply:

- (a) Special preparations or conditions—a metal band $\frac{1}{2}$ inch wide ($\frac{1}{8}$ inch wide for style C) shall be centered and tightly clamped at the midpoint of the resistor body.
- (b) Magnitude of test voltage—twice the rated voltage plus 1,000 volts.
- (c) Nature of potential—ac.
- (d) Points of application of test voltage—between each ferrule and the metal clamping band.
- (e) Measurements after dielectric-withstanding-voltage test—resistors shall be examined for evidence of flashover or insulation breakdown.

4.6.3 Insulation resistance (see 3.7). Resistors shall be tested in accordance with method 302 of Standard MIL-STD-202. The following details shall apply:

- (a) Test-condition letter—B or C, whichever is practicable.
- (b) Special preparations or conditions—a metal band $\frac{1}{2}$ inch wide ($\frac{1}{8}$ inch wide for style C) shall be centered and tightly clamped at the midpoint of the resistor body.
- (c) Points of measurement—between each ferrule and the metal clamping band.

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4.6.4 DC resistance (see 3.8).

4.6.4.1 *Qualification inspection.* Resistors shall be tested in accordance with method 303 of Standard MIL-STD-202. The following details shall apply:

- (a) Limit of error of measuring apparatus—0.1 percent, maximum.
- (b) Test voltage—100 volts dc, maximum.

4.6.4.2 *Acceptance inspection.* A dc supply of twice the rated voltage specified (see 3.1) shall be applied to the resistors for a period of 1 second. Resistors shall then be subjected to the test specified in 4.6.4.1.

4.6.5 *Short-time overload.* Resistors shall be measured for dc resistance as specified in 4.6.4. A dc supply of twice the rated voltage specified (see 3.1) shall then be applied to the resistors for a period of 30 minutes in free space and still air at an ambient temperature of 25°C. Thirty minutes after removal of potential, resistors shall again be measured for dc resistance as specified in 4.6.4. At the end of this test, resistors shall be examined for evidence of arcing, burning, or charring, or other damage (see 3.9).

4.6.6 *Temperature rise.* A dc supply of the rated voltage specified (see 3.1) shall be applied to the resistors while maintained in an oven in free space and still air at a temperature of 85°C. The hot-spot temperature shall be determined after a period of 2 hours, using the thermocouple method with a thermocouple having wires no larger in diameter than 0.010 inch (No. 30 AWG). Resistors shall be horizontally mounted during this test with the thermocouple junction resting on the hot spot and the thermocouple wires hanging down on opposite sides of the resistor. Weights of at least 2 ounces on each lead shall provide the pressure of the thermocouple junction against the surface of units under test (see 3.10).

4.6.7 *Resistance-temperature characteristic (see 3.11).* Resistors shall be tested in accordance with method 304 of Standard MIL-STD-202. The following details shall apply:

- (a) Reference temperature—room ambient temperature.
- (b) Lowest and highest test temperatures— -55°C, +110°C.

4.6.8 *Thermal shock.* Resistors shall be measured for dc resistance as specified in 4.6.4 and then placed in an oven which has been heated to a temperature of 85°C. A dc supply of the rated voltage specified (see 3.1) shall be applied to the resistors for a period of 1 hour. Within 5 seconds after removal of potential, resistors shall be removed from the oven and plunged into tapwater at a temperature of 0°C. After 5 minutes, resistors shall be removed from the bath and the surface moisture removed. One hour after removal from the bath, the dc resistance shall again be measured as specified in 4.6.4 and compared with the initial resistance value. The resistors shall then be examined for evidence of chipping, crazing, cracking, or spalling of the exterior coating or enclosure, and for other mechanical damage (see 3.12).

4.6.9 *Temperature cycling (see 3.13).* Resistors shall be tested in accordance with method 102 of Standard MIL-STD-202. The following details and exceptions shall apply:

- (a) Initial measurements—prior to the first cycle, the dc resistance shall be measured as specified in 4.6.4.
- (b) Test-condition letter—D.
- (c) Final measurements—within 3 hours after completion of the fifth cycle and as soon as the resistors stabilize at room temperature, the dc resistance shall again be measured as specified in (a) above, and then examined for mechanical damage.

4.6.10 Salt-water-immersion cycling (see 3.14). Resistance shall be subjected to a total of five daily cycles as specified in 4.6.10.1. Each daily cycle shall be followed by a conditioning period wherein the resistors are maintained, without load, at a temperature of $25^{\circ} \pm 5^{\circ}\text{C}$. for a period of not less than 12 hours nor more than 24 hours. Testing may be discontinued at any time resistors change in resistance more than that allowed by the applicable requirements.

4.6.10.1 Daily cycle.

Step 1. Resistors shall be placed in a dry oven maintained at a temperature of $85^{\circ} \pm 2^{\circ}\text{C}$. A dc supply of the rated voltage specified (see 3.1) shall be applied to the resistors for a period of 1 hour. Immediately after removal of this potential, the dc resistance shall be measured while the resistors are in the oven.

Step 2. Within 5 seconds after removal from the oven, resistors shall be immersed for a period of 1 hour in a saturated solution of sodium chloride maintained at a temperature of $85^{\circ} \pm 2^{\circ}\text{C}$. Within 5 seconds after removal from this bath, resistors shall be immersed for a period of 1 hour in another saturated solution of sodium chloride maintained at a temperature of $0^{\circ} \pm 4^{\circ}\text{C}$. Resistors shall then be thoroughly and quickly washed in tapwater and all surfaces wiped or air blasted clean and dry.

Step 3. Resistors shall be placed in a dry oven maintained at a temperature of $85^{\circ} \pm 2^{\circ}\text{C}$. A dc supply of the rated voltage specified (see 3.1) shall be applied to the resistors for a

period of 1 hour. Resistors shall then be subjected again to steps 2 and 1, in that order.

4.6.11 Vibration (see 3.15). Resistors shall be tested in accordance with method 201 of Standard MIL-STD-202. The following details and exception shall apply:

- (a) Measurements prior to vibration—dc resistance measurement (see 4.6.4).
- (b) Method of mounting—resistors shall be mounted by securely clamping the ferrules to the vibration platform.
- (c) Tests and measurements after vibration—dc resistance measurements (see 4.6.4), dielectric-withstanding-voltage test (see 4.6.2), and insulation-resistance test (see 4.6.3). Resistors shall then be examined for evidence of mechanical damage.

4.6.12 Security of ferrules. One ferrule of the resistor shall be clamped in a fixed position and a torque of 5 inch-pounds applied to the other ferrule. The torque shall be applied in both clockwise and counterclockwise directions (see 3.16).

4.6.13 Mechanical strength. Resistors shall be supported $\frac{1}{8}$ inch from the outer end of each ferrule and shall be subjected to a transverse load of 25 pounds applied at the center of the unit through a fulcrum having a radius of not less than 0.25 inch (see 3.17).

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging (see 6.2).

5.1.1 Level A. Unless otherwise specified (see 6.2), resistors shall be individually protected and unit-packaged in accordance with method IC-3 of Specification MIL-P-116, without the use of contact preservatives.

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5.1.2 *Level C.* Resistors shall be afforded preservation and packaging in accordance with the supplier's normal commercial practice.

5.2 Packing (see 6.2).

5.2.1 *Level A.* Resistors packaged as specified (see 6.2) shall be packed in overseas-type wirebound wood, wood-cleated fiberboard, wood-cleated plywood, nailed wood, fiber (class 2 or 3), or wood-cleated paper-overlaid boxes conforming to Specification PPP-B-585, PPP-B-591, PPP-B-601, PPP-B-621, PPP-B-636, and MIL-B-10377, respectively, at the option of the supplier. Shipping containers shall have case liners conforming to Specification MIL-L-10547; the case liners shall be closed and sealed in accordance with the appendix thereto. Case liners for boxes conforming to Specification PPP-B-636 will not be required provided the center and edge seams and manufacturers' joints are sealed with tape, at least 1½ inches wide, conforming to Specification PPP-T-76. Box closures and strapping shall be as specified in the applicable box specification or appendix thereto. Fiber boxes conforming to Specification PPP-B-636 may be banded with tape conforming to type IV of Specification PPP-T-97 and appendix thereto in lieu of steel straps. The gross weight of wood boxes shall not exceed 200 pounds; fiberboard boxes shall not exceed the weight limitations of the applicable box specification.

5.2.2 *Level B.* Resistors packaged as specified (see 6.2) shall be packed in domestic-type wirebound wood, wood-cleated fiberboard, wood-cleated plywood, nailed wood, fiber (class 1 or 2, as specified (see 6.2)), or wood-cleated paper-overlaid boxes conforming to Specifications PPP-B-585, PPP-B-591, PPP-B-601, PPP-B-621, PPP-B-636, and MIL-B-10377, respectively, at the option of the supplier. Box closures shall be as specified in the applicable box specification or appendix thereto. The gross weight of wood boxes shall not exceed 200 pounds; fi-

berboard boxes shall not exceed the weight limitations of the applicable box specification.

5.2.3 *Level C.* Resistors packaged as specified (see 6.2) shall be packed in containers of the type, size, and kind commonly used for the purpose, in a manner that will insure acceptance by common carrier and safe delivery at destination. Shipping containers shall comply with the uniform freight classification rules, or regulations of other carriers as applicable to the mode of transportation.

5.2.4 *General.* So far as possible and practical, exterior containers shall be uniform in shape and size, shall be of minimum cube and tare consistent with the protection required, and shall contain identical quantities of identical items.

5.3 *Marking.* In addition to any special marking required by the contract or order, unit packages, intermediate packages, and exterior shipping containers shall be marked in accordance with Standard MIL-STD-129 (see 6.2).

6. NOTES

6.1 *Intended use.* Resistors covered by this specification are intended for use as external resistors for 2½ and 3½ inch voltmeters covered by Specifications MIL-M-6 "Meters, Electrical Indicating, Panel Type 2½ Inch and 3½ Inch General Specifications for" and MIL-M-10304 "Meters, Electrical Indicating, Panel Type, Ruggedized", or in other high-voltage application for which they may be found suitable. Resistors of the power type, intended to operate at hot-spot temperature in excess of 110°C., are not covered by this specification. It is not considered good engineering practice to support these resistors except by their ferrules.

6.2 *Ordering data.* Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Complete type designation (see 1.2.1 and 3.1).
- (c) Levels of preservation and packaging and packing, and applicable marking (see sec. 5).
- (d) Class of fiber (see 5.2.2).

6.2.1 *Indirect shipments.* The packaging, packing, and marking specified in section 5 apply only to direct purchases by or direct shipments to the Government and are not intended to apply to contracts or orders between the manufacturer and prime contractor.

6.3 **Qualification.** With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is Signal Corps; however, information pertaining to qualification

of products may be obtained from the Armed Services Electro-Standards Agency (ASE-SA), Fort Monmouth, N.J.

6.4 **Government verification inspection.** Verification inspection by the Government will be limited to the amount deemed necessary to determine compliance with the contract or order, and will be limited in severity to the definitive quality assurance provisions established in this specification and the contract or order. The amount of verification inspection by the Government will be adjusted to make maximum utilization of the supplier's quality control system and the quality history of the product (see 4.1.2).

Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodians:

Army—Signal Corps
Navy—Bureau of Ships
Air Force

Preparing activity:

Army—Signal Corps

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.

20. SUBMISSION

20.1 Sample. A sample consisting of three sample units of the highest resistance value for which qualification is sought shall be submitted.

20.2 Test data. Each submission shall be accompanied by test data covering the non-destructive tests specified in table I which have been performed on the submitted sample units. The performance of the destruc-

tive tests by the supplier on a duplicate set of sample units is encouraged, although not required. All test data shall be submitted in duplicate.

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

30. EXTENT OF QUALIFICATION

30.1 Qualification of a resistance value in the style submitted will also qualify all lesser resistance values in the same style, as well as lesser resistance values in other styles, as specified in table V. The resistor styles to which qualification is extended shall be of the same general construction and materials as the sample unit submitted.

TABLE V. *Submission and extent of qualification*

Style of resistor submitted for inspection	Resistor styles and resistance values qualified
MFF	MFF, MFE, MFD, MFA, MFB, and MFC up to the highest resistance value submitted
MFE	MFE, MFD, MFA, MFB, and MFC up to the highest resistance value submitted
MFD	MFD, MFA, MFB, and MFC up to the highest resistance value submitted
MFA	MFA, MFB, and MFC up to the highest resistance value submitted
MFB	MFB and MFC up to the highest resistance value submitted
MFC	MFC up to the highest resistance value submitted

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).

SPECIFICATION

ORGANIZATION (of submitter)

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A

DIRECT GOVERNMENT CONTRACT

SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

YES

NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)

DATE

FOLD

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PLATE NO. 15419 (BACK)