

INCH-POUND

MIL-R-93D  
AMENDMENT 5  
31 March 1996  
SUPERSEDING  
AMENDMENT 4  
23 July 1982

MILITARY SPECIFICATION  
RESISTORS, FIXED, WIRE-WOUND (ACCURATE),  
GENERAL SPECIFICATION FOR

This amendment forms a part of MIL-R-93D, dated 28 December 1965, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 1

Under title, add the following: "INACTIVE FOR NEW DESIGN AFTER 22 NOVEMBER 1968."

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2.1, SPECIFICATIONS, FEDERAL: Delete "PPP-B-566", "PPP-B-636", "PPP-B-676", "PPP-T-60", "PPP-T-76", and their corresponding titles.

\*2.1, SPECIFICATIONS, MILITARY: Delete and substitute:.

"2.1, SPECIFICATION, MILITARY, MIL-R-39005, Resistors, Fixed, Wire-Wound (Power Type)."

\* 2.1, STANDARDS, MILITARY: Delete "MIL-STD-105", "MIL-STD-129", and their corresponding titles.

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\* After 3.4.4, add the following:

"3.4.5 Solder dip (refinishing) leads. The manufacturer may solder dip/retin the leads of product supplied to this specification provided the solder dip process has been approved by the qualifying activity. The manufacturer shall maintain a solder purity in accordance with table VI-1, during the tinning process.

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"TABLE VI-1. Contamination limits.

Contamination	Tinning percent by weight <sup>1/</sup>
Copper	.75
Gold	.50
Cadmium	.01
Zinc	.008
Aluminum	.008
Antimony	.50
Iron	.02
Arsenic	.03
Bismuth	.25
Silver	.75
Nickel	.025

<sup>1/</sup> This is a fixed percentage by weight  
of the solder.

"3.4.5.1 Qualifying activity approval. Approval of the solder dip process will be based on one of the following options:

- a. When the original lead finish qualified was hot solder dip lead finish 52 of MIL-STD-1276. (NOTE: The 200 microinch maximum thickness is not applicable.) The manufacturer shall use the same solder dip process for reflowing as is used in the original manufacture of the product.
- b. When the lead originally qualified was not hot solder dip lead finish 52 of MIL-STD-1276 as prescribed in 3.4.5.1a., approval for the process to be used for solder dip shall be based on the following test procedure:

(NOTE: If hermetic seal testing is required in group A, these tests would also be performed. No defects are allowed.)

- (1) Thirty samples of any resistance value for each style and lead finish are subjected to the manufacturer's solder dip process. Following the solder dip process, the resistors are subjected to the dc resistance test (and other group A electricals). No defects are allowed.
- (2) Ten of the 30 samples are then subjected to the solderability test. No defects are allowed.
- (3) The remaining 20 samples are subjected to the resistance to solder heat test followed by the moisture resistance test (or hermetic seal test if the device is hermetically sealed). No defects are allowed.

"3.4.5.2 Solder dip/reflowing options. The manufacturer may solder dip/reflow as follows:

- a. After the 100 percent group A screening tests. Following the solder dip/reflowing process, the electrical measurements required in group A, subgroup 1, 100 percent screening tests shall be repeated on 100 percent of the lot. (NOTE: The manufacturer may solder dip/reflow prior to the 100

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percent electrical measurements of the group A, subgroup 1 tests.) The percentage defective allowable (PDA) for the electrical measurements shall be as for the subgroup 1 tests.

- b. As a corrective action if the lot fails the group A solderability test, the lot may be retinned no more than two times. The lot after retinning shall be 100 percent screened for group A electrical requirements (dc resistance) any parts failing (see 4.6.5) these screens shall not be supplied to this specification. If electrical failures are detected after the second retinning operation exceeding 1 percent of the lot, the lot shall not be supplied to this specification.
- c. After the group A inspection has been completed. Following the solder dip/retinning process, the electrical measurements required in group A, subgroup 1, 100 percent screening test shall be repeated on 100 percent of the lot. Following these tests, the manufacturer shall submit the lot to the group A solderability test as specified in 4.6.5."

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- \* 3.14, delete in its entirety.

PAGE 9

3.20, title, delete and "substitute the following:

"3.20 Shock (specified pulse)."

PAGE 11

- \* 4.5.1 and 4.5.1.1, delete and substitute the following:

"4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspection.

"4.5.1.1 Inspection lot. An inspection lot, as far as practicable, shall consist of all resistors of the same style produced in a period not to exceed 30 days, produced under essentially the same conditions, and offered for inspection at one time."

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- \* TABLE VII, group III: Delete "Salt-water-immersion cycling" and associated information.

TABLE VII, group VI: Delete "Shock, medium impact" and substitute "Shock (specified pulse)".

PAGE 13

- \* 4.5.1.3.1, TABLE VIII, 4.5.1.4, TABLE IX, 4.5.1.4.1, and 4.5.1.4.2, delete in their entirety and substitute the following:

"4.5.1.3.1 Subgroup 1

"4.5.1.3.1.1 Sampling plan. A sample of parts from each inspection lot shall be randomly selected in accordance with table VIII-1. If one or more defects are found, the lot shall be screened and defectives removed. After screening and removal of defectives, a new sample of parts shall be randomly selected in

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accordance with table VIII-1. If one or more defects are found in this second sample, the lot shall be rejected and shall not be supplied to this specification. Resistance values in the samples shall be representative, and where possible, in proportion to the resistors in the inspection lot.

"4.5.1.3.2 Subgroup 2.

"4.5.1.3.2.1 Sampling plan. Thirteen samples shall be selected randomly from each inspection lot and subjected to the subgroup 2 solderability test. The manufacturer may use electrical rejects from subgroup 1 screening tests for all or part of the samples to be used for solderability testing. If there are one or more defects, the lot shall be considered to have failed.

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

- a. Each production lot that was used to form the failed inspection lot shall be individually submitted to the solderability test as required in 4.6.5. Production lots that pass the solderability test can be reworked only is submitted to the solder dip procedure in 4.5.1.3.2.2b.
- b. The manufacturer submits the failed lot to a 100-percent solder dip using an approved solder dip process in accordance with 3.4.5. Following the solder dip the electrical measurements required in group A, subgroup 1 tests shall be repeated on 100-percent of the lot. The percent defective allowable (PDA) for the electrical measurements shall be as for the subgroup 1 tests. Thirteen additional samples shall be then selected and subjected to the solderability test with zero defects allowed. If the lot fails this solderability test, the lot shall be considered rejected and shall not be furnished against the requirements of this specification.

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

"TABLE VIII. Group A inspection.

Examination	Requirement paragraph	Method paragraph	Number of samples
<u>Subgroup 1</u> DC resistance	3.5	4.6.1	
Visual and mechanical examination: Body and mounting dimensions	3.1 and 3.4	4.6.2	See 4.5.1.3.1
Lug terminals	3.1 and 3.4.1.1		
Marking	3.23		
Workmanship	3.24		
<u>Subgroup 2</u> Solderability	3.8	4.6.5	See 4.5.1.3.2

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"TABLE VIII-1. Groups A and B sampling plan.

Lot size	Group A inspection
2 to 13	100 percent
14 to 150	13
151 to 280	20
281 to 500	29
501 to 1,200	34
1,201 to 3,200	42
3,201 to 10,000	50
10,001 to 35,000	60
35,001 to 150,000	74
150,001 to 500,000	90
500,000 and over	102

"4.5.1.4 Group B inspection. Group B inspection shall consist of the tests specified in table IX, in the order shown. The inspection shall be performed on sample units which have been subjected to and passed group A inspection.

"TABLE IX. Group B inspection.

Test	Requirement paragraph	Method paragraph	Number of samples
Short-time overload	3.6	4.6.3	See 4.5.1.4.1
Temperature cycling	3.7	4.6.4	

"4.5.1.4.1 Sampling plan. Thirteen sample units per lot shall be subjected to group B inspection with no failures permitted

"4.5.1.4.2 Small quantity production. If no more than 75 resistors of the same style or group of styles defined for lot formation (see 4.5.1.1) are produced during a continuous 3-month period, the entire 3 month production may be submitted as one lot. In case of failure, the entire lot shall be rejected and all units involved shall be subjected to corrective action.

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

PAGES 13, 14, 15, AND 16

\* 4.5.1.5, 4.5.1.5.1, 4.5.1.5.1.1, TABLE X, 4.5.1.5.1.2, 4.5.1.5.1.3, 4.5.1.5.2, TABLE XI, and 4.5.1.5.3, delete in their entirety.

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\* 4.5.2, delete and substitute the following:

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\*\*\*4.5.2 Inspection of preparation for delivery. Sample package or packs and the inspection of the preservation, packing and marking for shipment and storage shall be in accordance with the requirements section 5."

\* 4.5.3, delete and substitute:

"4.5.3 Retention of qualification. Every 6 months, the manufacturer shall compile a summary of the results of quality conformance inspections in the form of a retention of qualification report, and forward it to the qualifying activity within 30 days from the end of the reporting period as the basis of continued qualification approval. In addition, the manufacturer shall immediately notify the qualified activity whenever the group B inspection data indicates failure of the qualified product to meet the requirements of the specification. Continuation shall be based on the evidence that over the 6-month period, the following has been met:

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

When group B requirements are not met and the manufacturer has taken corrective action satisfactory to the government, group B 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 the government inspector."

"4.5.4 Alternate inspection. For the purpose of retention of qualification and quality conformance inspection (see 4.5 and 4.5.3), test data on identical items covered by MIL-R-39005 may be used."

\* 4.6.1(a), delete and substitute the following:

- "(a) Measuring apparatus: Different types of measuring test equipment (multimeters, bridges, or equivalent) are permitted to be used on the initial and final readings of this test, provided the equipment is the same style, model, or if it can be shown that the performance of the equipment is equivalent or better."

PAGE 19

4.6.8(b), second sentence: Delete.

PAGE 20

4.6.9, after first sentence, add the following: "(This time limit is not applicable to barometric pressure portion of 4.6.9.1.)"

PAGE 21

\*4.6.11, 4.6.11.1, 4.6.11.2, 4.6.11.3, and 4.6.11.4, delete in their entirety.

4.6.12, delete and substitute the following:

\*4.6.12 Life (see 3.15). Resistors shall be tested in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply:

(a) Method of mounting:

- (1) Lug-terminal resistors: Supported by wire leads, each approximately 1 inch in length.
- (2) Wire-lead-terminal resistors. Supported by their terminals: Axial-lead resistors at a point 1 inch from the resistor body; printed-circuit resistors at a point 3/4 inch from the resistor body: Resistors shall be so arranged that the temperature of any one resistor shall not appreciably influence the temperature of any other resistor. There shall be no undue draft over the resistor.

(b) Test temperature and tolerance:  $125^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

(c) Initial measurements: Measurements may be made inside or outside the chamber.

- (1) Inside chamber: When measurements are made inside the chamber, the dc resistance shall be measured at a temperature of  $125^{\circ}\text{C} \pm 5^{\circ}\text{C}$  after temperature stabilization and within 8 hours of exposure of the resistors to this temperature. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same conditions.
- (2) Outside chamber: When measurements are to be made outside the chamber, the measurement shall be made after units have been stabilized at room temperature for at least 8 hours. This initial measurement shall be used as the reference temperature for all subsequent measurements under the same conditions.

(d) Operating conditions: Rated or maximum dc continuous working voltage shall be applied intermittently, 1-1/2 hours on and 1/2 hours off for 2,000 hours, at the test temperature. Each resistor shall dissipate rated wattage but shall not exceed maximum voltage. Adequate precaution shall be taken to maintain constant voltage on the resistor.

(e) Test condition letter: Not applicable, test duration is 2,000 hours.

(f) Measurement during test: Measurements may be made inside or outside the chamber. While the resistor are still in the oven, the dc resistance shall be measured as specified in 4.6.1, at the end of the 1/2-hour off periods, after 250 +72, -24; 500 +72, -24; 1,000 +72, -24; 2,000 +96 -24 hours have elapsed. Measurement 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 weekdays.

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

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

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- 4.6.17, lines 1 and 2, delete and substitute the following:

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

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4.6.17(d), delete "Test condition - C" and substitute "Test condition - I".

PAGE 27

4.6.19, line 2, delete "procedure II".

- SECTION 5, delete in its entirety and substitute the following:

"5. PACKAGING

"5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department of Defense Agency or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity."

PAGE 30

6.9.1, line 2, delete " $\pm 0.025$ " and substitute " $\pm 0.25$ ".

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

CONCLUDING MATERIAL

Custodians:

Army - ER  
Navy - EC  
Air Force - 85

Review activities:

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

Preparing activity:  
Army - ER

Agent:  
DLA - ES

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