

INCH-POUND
MIL-DTL-7790A
w/Amendment 3
25 August 2016
SUPERSEDING
MIL-DTL-7790A
w/Amendment 2
11 September 2011

DETAIL SPECIFICATION

RESISTOR, THERMOCOUPLE LEAD SPOOL

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

Inactive for new design as of 24 September, 1993

1. SCOPE

1.1 Scope. This specification covers one type of thermocouple lead spool resistors. The part or identifying number (PIN) for this item is AN5534-2.

2. APPLICABLE DOCUMENTS

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

2.2 Government documents.

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

FEDERAL STANDARDS

[FED-STD-H28](#) - Screw Thread Standards for Federal Services.

DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-202](#) - Test Method Standard Electronics and Electrical Components Parts.

[MIL-STD-202-103](#) - Test Method Standard Method 103, Humidity (Steady State)

[MIL-STD-202-107](#) - Test Method Standard Method 107, Thermal Shock

[MIL-STD-202-204](#) - Test Method Standard Method 204, Vibration Frequency

Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990, or emailed to resistor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

AMSC N/A



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DEPARTMENT OF DEFENSE STANDARDS - Continued

MIL-STD-810	-	Environmental Engineering Considerations and Laboratory Tests.
MIL-STD-1276	-	Leads for Electronic Components Parts.

(Copies of these documents are available online at <http://quicksearch.dla.mil>).

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DEPARTMENT OF DEFENSE DRAWINGS

AN5538-1	-	Terminal - Thermocouple Lead
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(Copies of these documents are available online at <http://quicksearch.dla.mil>).

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

INTERNATIONAL ORGANIZATION for STANDARDS (ISO)

ISO 10012	-	Measurement Management Systems - Requirements for Measurement Processes and Measuring Equipment.
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(Applications for copies are available online at <http://www.ansi.org/>).

NATIONAL AEROSPACE STANDARD (NAS)

NASM-21332	-	Fastener Snapslide
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(Applications for copies are available online at <http://www.aia-aerospace.org/>).

NATIONAL CONFERENCE of STANDARDS LABORATORIES (NCSL)

NCSL Z540-3	-	Laboratories, Calibration, and Measuring and Test Equipment.
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(Applications for copies are available online at <http://www.ncsli.org>).

(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.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

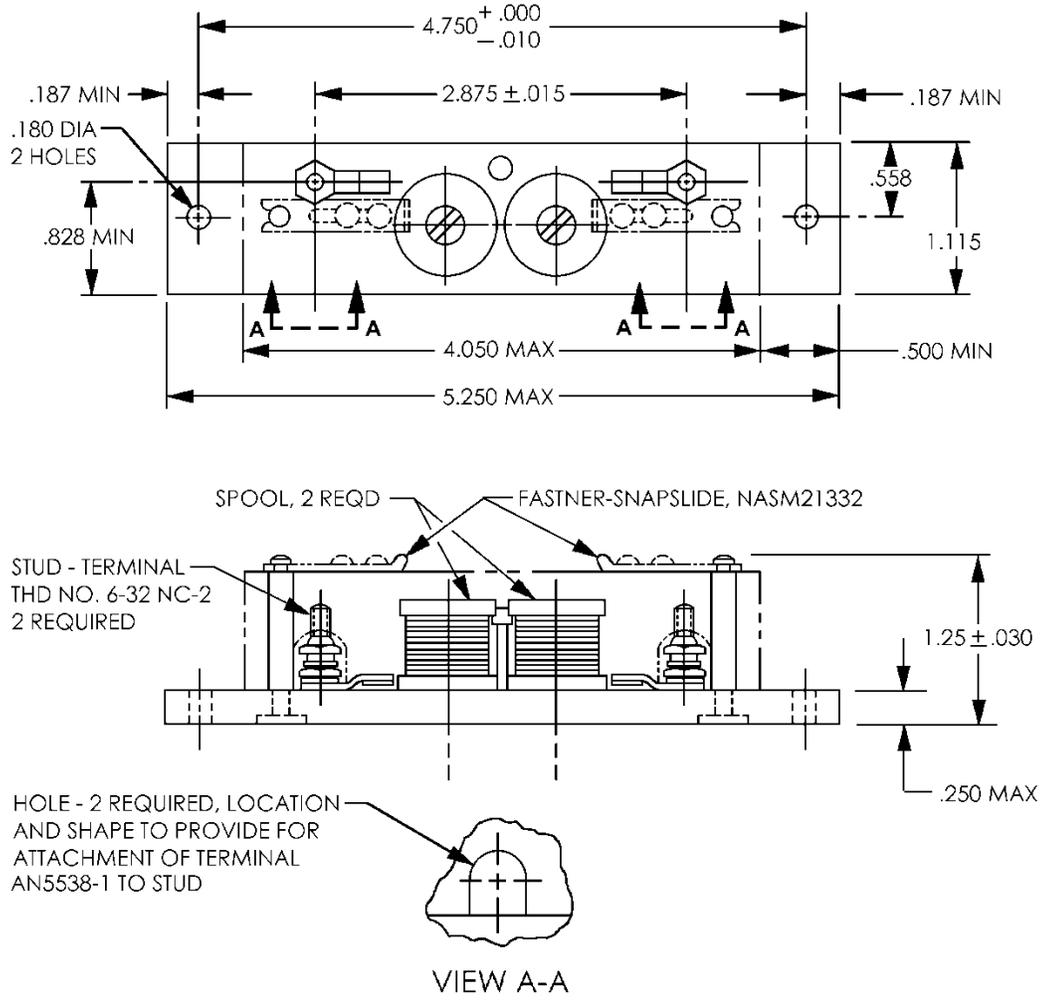
3. REQUIREMENTS.

3.1 Qualification. Resistors furnished under this specification shall be products which are qualified for listing on the applicable qualified product list (QPL) before contract award (see [4.4](#) and [6.3](#)).

3.2 Materials. Materials shall be used which will enable the resistors to meet the 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.

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3.3 Interface and physical dimensions. The resistor shall meet the interface and physical dimensions specified in figure 1.



<u>Inch</u>	<u>mm</u>								
.010	0.25	.180	4.57	.500	12.70	1.115	28.32	4.050	102.87
.015	0.38	.187	4.75	.558	14.17	1.250	31.75	4.750	120.65
.030	0.76	.250	6.35	.828	21.03	2.875	73.03	5.250	133.35

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information.

FIGURE 1 - Resistor, Thermocouple Lead Spool.

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3.3.1 Base and cover. The base shall be of a nonconducting material. The cover shall be made of anodized aluminum alloy with insulating bushings provided for the two lead ports. The base and cover shall conform to the dimensions shown in [figure 1](#). The cover shall be attached by snap slide fasteners of the design shown in [figure 1](#) and shall not become loose under conditions of vibration.

3.3.2 Terminal posts. The terminal posts shall be as shown in [figure 1](#). They shall be so attached to the base that they will not turn in their mounting. The following shall be furnished as part of the terminal post and shall be attached in the order given: Solder terminal, lockwasher, hex nut, plain washer, lock washer, and hex nut. The hardware shall be of commercial design and plated. The washers, nuts, terminals and terminal posts shall be made of brass.

3.3.3 Spools. The spools shall be of a material and of sufficient size to hold the required wire. They shall be securely attached to the base. The mounting screws or bolts used to anchor the spools to the mounting base shall be made of non-ferrous materials.

3.3.3.1 Wire. The wire used shall be No. 24 Enamel insulation and shall be neatly wound on the spool. The free ends of each spool of wire shall be secured so that the wire will not unravel.

3.3.4 Peg. A peg of nonconducting material shall be furnished as shown in [figure 1](#) to secure the loose end of the wire prior to soldering at installation and prevent the spool from unwinding.

3.3.5 Screw threads. Screw thread shall be in accordance with [FED-STD-H28](#).

3.4 Finish. All metal parts, including hardware, shall be finished to resist corrosion.

3.5 Total resistance. The total resistance of each spools shall be 8 ohms +10 percent, -0 percent. The value of each spool shall be noted for use in the high temperature tests.

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

3.6 Thermal shock. When resistors are tested as specified in [4.7.3](#), resistor shall show no evidence of mechanical damage and electrical continuity shall not be affected. The change in total resistance of each resistor shall not exceed the values specified (see [3.1](#)).

3.7 Humidity (steady-state). When resistors are tested as specified in [4.7.4](#), the change in total resistance shall not exceed 10 percent between the initial total resistance measurement and each succeeding total resistance measurements.

3.8 Vibration, high frequency. When resistance are tested as specified in [4.7.5](#), there shall be no open circuits or intermittent contacts. The resistance shall not change in excess of 5 percent between terminals 1 and 2 and 2 percent between terminals 1 and 3. There shall be no evidence of mechanical damage.

3.9 Fungus. All external materials shall be nonnutrient to fungus growth or shall be treated to retard fungus growth. The manufacturers shall certify that all external materials are fungus resistant or shall perform the test specified in [4.7.6](#). There shall be no evidence of fungus growth on the external surface as a result of the test.

3.10 Pure tin. The use of pure tin, as an underplate or final finish is prohibited both internally and externally. Tin content of resistor components and solder shall not exceed 97 percent, by mass. Tin shall be alloyed with a minimum of 3 percent lead, by mass (see [6.6](#)).

3.11 Marking. Resistors shall be permanently marked with the PIN and manufacturer's name and or trademark. The location of the manufacturer's code symbol shall be at the discretion of the manufacturer. Marking shall remain legible at the end of all tests. There shall be no space between symbols that comprise the PIN.

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

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

4. VERIFICATION

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

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

4.2 Test equipment and inspection facilities. The manufacturer shall establish and maintain a calibration system in accordance with NCSL Z540-3, ISO 10012, or equivalent system as approved by the qualifying activity.

4.3 Inspection conditions and precautions.

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

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

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample size. Three sample units shall be subjected for qualification inspection.

4.4.2 Inspection routine. Three sample units shall be subjected to the qualification inspection specified in table I, in the order shown.

Table I. Qualification inspection.

Inspection	Requirements paragraph	Method paragraph	Number of samples	Number of defectives
Visual and mechanical examination	3.3 to 3.4, 3.11 and 3.13 inclusive;	4.7.1	3	0
Total resistance	3.5	4.7.2		
Thermal shock	3.6	4.7.3		
Humidity	3.7	4.7.4		
Vibration	3.8	4.7.5		
Fungus	3.9	4.7.6		

4.4.3 Defective. Failure of a resistor in one or more tests of a group shall be charged as a single failure. Failures in excess of those allowed shall be cause for refusal to grant qualification.

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4.5 Retention of qualification. Every 12 months, the manufacturer shall verify the retention of qualification to the qualifying activity. In addition, the manufacturer shall immediately notify the qualifying activity whenever the group A inspection results indicate failures of the qualified product to meet the requirements of this specification. Verification shall be based on meeting the following requirements:

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

4.6 Conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of packaging shall consist of group A inspections.

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

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

Table II. Group A inspection.

Inspection	Requirements paragraph	Method paragraph	Sampling plan
Visual and mechanical examination	3.3 to 3.4, 3.11 and 3.13 inclusive	4.7.1	4.6.1.2.1
Total resistance	3.5	4.7.2	

^{1/} Marking defects shall be charged only for illegible, incomplete, or incorrect marking. Incorrect resistance, and resistance marking shall be determined by and shall be charged to the total resistance test (4.7.2).

4.6.1.2.1 Sampling plan. A sample of parts from each inspection lot shall be randomly selected in accordance with table III. If one or more defects are found, the lot shall be screened and defectives removed. After screening and removal of defectives a new sample of parts shall be randomly selected in accordance with table III. If one or more defects are in the this second sample, the lot shall be rejected and shall not be supplied to this specification.

TABLE III. Group A sampling plan.

Lot size	Sample size
1 to 12	100 percent
13 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
500,001 and over	102

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4.6.1.3 Small quantity production. If no more than 75 units of the same style or group of styles, defined for lot formation (see 4.6.1.1), 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 subject to corrective action.

4.6.1.4 Disposition of sample units. Sample units which have been subjected to group A inspection may be delivered on the contract.

4.7 Methods of examination and test.

4.7.1 Visual and mechanical examination. Resistors shall be examined to verify that the materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3 to 3.4, 3.11 and 3.13, inclusive).

4.7.2 Total resistance. The resistance of each spool shall be measured. It shall be 8 ohms +10 percent, -0 percent. The value of the resistance of each spool shall be noted for use in the thermal shock and humidity paragraphs 4.7.3 and 4.7.4 (see 3.5).

4.7.3 Thermal shock. Resistors shall be tested in accordance with MIL-STD-202-107. The following details shall apply (see 3.6):

- a. Mounting: Resistors shall be mounted by their mounting in such a manner that there is at least 1 inch of free air space around each resistor, and with the mounting in such a position with respect to the air stream that it offers the least obstruction to the flow of the air across and around the resistors.
- b. Measurements before cycling: Not applicable.
- c. Test conditions: As specified in table IV.
- d. Measurements after cycling: Total resistance shall be measured as specified in 4.7.2 and resistors shall be examined of evidence of mechanical damage.

TABLE IV. Thermal shock.

Steps	Temperature (°C)	Time (in minutes, minimum)
1	-55 + 0 -3	60
2	25 +10 -5	15
3	120 + 3 -0	60
4	25 +10 -5	15

NOTE: At the option of the manufacturer the reverse sequence may be as follows:

- 1. Room Temperature
- 2. +120°C ±3°C
- 3. Room temperature
- 4. -55°C ±3°C

4.7.4 Humidity (steady state). Resistors shall be tested in accordance with MIL-STD-202-103 (see 3.7). The following details shall apply:

- a. Mounting: On an aluminum panel.
- b. Measurement after conditioning: Total resistance (see 4.7.2) shall be measured.
- c. Test condition: B.
- d. Measurement during test: Total resistance (see 4.7.2) shall be measured at the end of the 96 hour period.
- e. Measurement after the test: Total resistance (see 4.7.2) shall be measured after the resistors have been removed from the humidity chamber and placed in a dry atmosphere at $40^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for one hour and fifteen minutes.

4.7.5 Vibration, high frequency. Resistors shall be tested in accordance with MIL-STD-202-204 (see 3.8). The following details and exceptions shall apply:

- a. Mounting: Resistors shall be mounted by their normal mounting means to an appropriate nonresonant mounting fixture. The mounting fixture shall be constructed in a manner as to insure that the points of the resistor mounting supports shall have the same motion as the vibration test table. Test leads used during this test shall be as small as a wire size as practicable (e.g., AWG 22 stranded) so the influence of the test lead on the resistor will be held to a minimum. The test lead length shall be no longer than necessary. A shielded cable which may be necessary because of the field surrounding the vibration test table, shall be clamped to the mounting fixture. In all cases, resistors shall be mounted in relation to the test equipment in such a manner that the stress applied is in the direction which would be considered most detrimental.
- b. Measurements after mounting: Resistors shall be measured as specified in 4.7.2.
- c. Test condition: C, part 2.
- d. Motion: In each of two mutually perpendicular directions, one perpendicular and the other parallel to the longitudinal axis of the resistor.
- e. Measurements during test: Each resistor shall be monitored to determine momentary discontinuity of the element, and between the contact arm and element, by a method which shall at least be sensitive enough to monitor or register automatically any momentary discontinuity having a duration of 0.1 millisecond (ms) or less, as well as those of greater duration. A measurement of transient resistance change shall also be made.
- f. Examinations after shock: Resistors shall be measured as specified in 4.7.2. Resistors shall be examined for evidence of mechanical and electrical damage.

4.7.6 Fungus. Resistors shall be tested in accordance with method 508 of MIL-STD-810. Resistors shall be examined for evidence of mechanical damage (see 3.9).

5. PACKAGING.

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

6. NOTES

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

6.1 Intended use. The resistors covered by this specification are military unique due to the fact that these devices must be able to operate satisfactorily in military systems under the following demanding conditions: 15 g's of high frequency vibration, and 10 g's of acceleration. In addition, these military requirements are verified under a qualification system. Commercial components are not designed to withstand these military environmental conditions.

6.2 Acquisition documents. Acquisition documents should specify the following:

- a. Title, number, and date of the applicable association specification, and complete PIN (see 1.1).
- b. Unless otherwise specified (see 2.1), the versions of the individual documents referenced will be those in effect on the date of release of the solicitation.
- c. Packaging requirements (see 5.1)

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Product List QPL-7790 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 QPL and, information pertaining to qualification of products may be obtained from the DLA Land and Maritime, ATTN: VQP, Post Office Box 3990, Columbus, OH 43218-3990. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil>.

6.4 Subject term (key word) listing.

Terminal Post
Base and cover
Peg

6.5 PIN. This specification requires a PIN that describes technology and appropriate references to associated documents (see 1.1).

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

6.7 Amendment notations. The margins of this specification are marked with vertical lines to indicate where modifications from this amendment were made. This was done as a convenience only and the government assumes no liability whatsoever for any inaccuracies in those notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

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Custodians:
Army - CR
Navy - AS
Air Force - 85
DLA - CC

Preparing activity:
DLA - CC

Review activities:
Air Force - 99

(Project 5905-2016-058)

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