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17 July 1979
SUPERSEDING
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MILITARY SPECIFICATION

COILS, FIXED AND VARIABLE, RADIOFREQUENCY

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 radiofrequency coils, fixed and variable, for use as simple inductive elements in radiofrequency circuits. Procurement of coils of a specific design will require additional data in the form of complementary Service documents, giving detailed electrical and mechanical requirements, tolerances, and applicable additions and exceptions to the general requirements and tests specified herein (see 3.1 and 3.3.1).

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).

1.2.1.1 Style. The style is identified by the two-letter symbol "LT" followed by a one or two digit number. The letters identify radiofrequency coils; the number identifies the grade and class in accordance with table I, 1.2.1.1.1, and 1.2.1.1.2.

TABLE I. Grade and class.

Number	Grade	Class
1	1	C
2	2	C
3	3	C
4	1	B
5	2	B
6	3	B
7	1	D
8	2	D
9	3	D
10	1	A
11	2	A
12	3	A

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Electronics Research and Development Command, ATTN: DRDEL-ED, Adelphi, MD 20783, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

1.2.1.1.1 Grade. The grades, including their environmental characteristics, are as follows:

Grade 1 - Resistant to the immersion and moisture-resistance tests (see 4.8.17 and 4.8.18).
Grade 2 - Resistant to the moisture-resistance test (see 4.8.18).
Grade 3 - For use in sealed assemblies.

1.2.1.1.2 Class. The classes of coils denoting the maximum operating temperatures (temperature rise (see 4.8.11 and 4.8.11.1) plus maximum ambient temperature) are as follows:

Class 0	85°C
Class A	105°C
Class B	125°C
Class C	*125°C

1.2.1.2 Family. The family is identified by a single letter indicating its function as follows:

K	Coil, radiofrequency, fixed.
V	Coil, radiofrequency, variable.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

J-W-1177	-	Wire, Magnet, Electrical
QQ-S-571	-	Solder, Tin Alloy: Tin-Lead Alloy; and Lead Alloy.
QQ-S-781	-	Strapping, Steel, and Seals.
PPP-B-566	-	Boxes, Folding, Paperboard.
PPP-B-585	-	Boxes, Wood, Wirebound.
PPP-B-601	-	Boxes, Wood, Cleated-Plywood.
PPP-B-621	-	Boxes, Wood, Nailed and Lock-Corner.
PPP-B-636	-	Boxes, Shipping, Fiberboard.
PPP-B-676	-	Boxes, Setup.
PPP-T-60	-	Tape: Packaging, Waterproof.
PPP-T-76	-	Tape, Packaging (for carton Sealing).

MILITARY

MIL-P-116	-	Preservation-Packaging, Methods of
MIL-F-14256	-	Flux, Soldering, Liquid (Rosin-Base).
MIL-C-45662	-	Calibration System Requirements.

(See Supplement 1 for applicable specification sheets or MS sheet form standards).

STANDARDS

FEDERAL

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

MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129	-	Marking for Shipment and Storage.
MIL-STD-202	-	Test Methods, for Electronic and Electrical Component Parts.
MIL-STD-810	-	Environmental Test Methods.
MIL-STD-1276	-	Leads, Weldable, for Electronic Component Parts.
MIL-STD-1285	-	Marking of Electrical and Electronic Parts

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

3. REQUIREMENTS

3.1 Detail requirements for individual types of coils. The individual part requirements shall be as specified herein and in accordance with the applicable specification sheet. (The military standards now associated with this specification are in effect until conversion to specification sheets). Where there is no specification sheet (or military standard) the individual part requirement shall be as specified in the complementary document (see 6.2.2). In the event of any conflict between requirements of this specification and the specification sheet (or military standard) or complimentary document, the latter shall govern (see 6.2).

3.2 Qualification. Coils furnished under this specification and covered by specification sheets (or military standards listed in supplement 1 shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.5 and 6.3).

3.3 First article. When specified (see 6.2.2), the coils furnished under this specification and not covered by specification sheets (or military standards) shall be products which have been tested and passed first article inspection specified in 4.6, after award of contract and prior to production.

3.3.1 Information to be furnished with the first article sample. The applicable information outlined in 6.2.2 shall be furnished with the first article sample, together with any other pertinent information as required by the Government.

3.4 Material. The material for each part shall be as specified herein, however, when a definite material is not specified, a material shall be used which will enable the coils 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. Reclaimed materials shall be used to the maximum extent possible.

3.4.1 Substitution of material. If the contractor desires to substitute another material for a specified material or fabricated part, he shall submit a statement to the Government describing the proposed substitution, together with evidence to substantiate his claims that such substitute is suitable. At the discretion of the Government, test samples may be required to prove the suitability of the proposed substitute. Before such substitutions are made, approval for each substitution shall be obtained in writing from the Government.

3.4.2 Flammable materials. So far as practicable, materials used in the construction of coils shall be nonflammable and nonexplosive.

3.4.3 Corrosive materials. Corrosive materials used in any of the manufacturing processes shall be removed or neutralized so that no corrosion will result from their use. So far as practicable, materials used in the construction of coils shall be noncorrosive.

3.4.4 Threaded parts. Threaded parts shall be of corrosion-resistant material or shall be protected against corrosion.

3.4.5 Screws, nuts, and washers. All mounting and terminal screws, nuts, and washers shall be of corrosion-resistant material or shall be protected against corrosion.

3.4.6 Wire.

3.4.6.1 Magnet wire. Magnet wire shall conform to FED-STD-J-W-1177. When types and sizes of magnet wire not covered by FED-STD-J-W-1177 are essential in a winding design, other wire may be used with the approval of the Government.

3.4.7 Solder and soldering flux. Solder shall be in accordance with QQ-S-571, the flux core solder shall be type R or RMA. Flux shall be in accordance with MIL-F-14256, type R or RMA.

3.5 Design and construction. Coils shall be of the design, construction, and physical dimensions specified (see 3.1 and 6.2.2).

3.5.1 Threaded parts. Unless otherwise specified (see 3.1 and 6.2.2), all threaded parts shall be in accordance with FED-STD-H28.

3.5.1.1 Engagement of threaded parts. Unless otherwise specified (see 3.1 and 6.2.2), all threaded parts shall engage by at least three full threads.

3.5.2 Terminals. Terminals shall be of the shape and physical dimensions specified (see 3.1 and 6.2.2).

3.5.2.1 Solderable/weldable lead terminals. Unless otherwise specified, the manufacturer shall verify by certification that all leads conform to type C of MIL-STD-1276.

3.5.2.2 Winding ends. The termination of the winding ends shall not depend on solder alone to attain mechanical strength.

3.5.3 Weight. Coils shall not exceed the weight specified (see 3.1 and 6.2.2).

3.6 Thermal shock. When coils are tested as specified in 4.8.2, all windings shall be electrically continuous (see 3.10 and 4.8.6); there shall be no dielectric breakdown nor impairment of protective coatings; and the insulation resistance shall be as specified in 3.9.

3.7 Dielectric withstanding voltage. When coils are tested as specified in 4.8.3, there shall be no arcing, flashover, breakdown, nor other damage, the leakage current shall not exceed 100 microamperes (μA).

3.8 Barometric pressure (when applicable). When coils are tested as specified in 4.8.4, there shall be no arcing, breakdown, flashover, nor other damage.

3.9 Insulation resistance. When measured as specified in 4.8.5, the insulation resistance shall be not less than 1,000 megohms (MΩ).

3.10 Winding continuity (when applicable). When coils are tested as specified in 4.8.6, all windings shall be electrically continuous.

3.11 Operating torque (applicable only to variable coils). When coils are tested as specified in 4.8.7, the torque required to rotate the tuning core shall be within the limits specified (see 3.1 and 6.2.2).

3.12 Electrical characteristics. The electrical characteristics shall be as specified (see 3.1 and 4.8.8).

3.12.1 Inductance. When coils are tested as specified in 4.8.8.1, the inductance shall be as specified (see 3.1 and 6.2.2).

3.12.2 Q of coils. When coils are tested as specified in 4.8.8.2, the Q shall be as specified (see 3.1 and 6.2.2).

3.12.3 Self-resonant frequency. When coils are tested as specified in 4.8.8.3, the self-resonant frequency shall be not less than the minimum value specified (see 3.1 and 6.2.2).

3.12.4 Percent coupling (when specified). When coils are tested as specified in 4.8.8.4 or 4.8.8.4.1, the percent coupling shall be specified (see 3.1 and 6.2.2).

3.12.5 Incremental current inductance change (when specified). When coils are tested as specified in 4.8.8.5 inductance value shall represent a change of 5 percent or less of the inductance measured with zero direct current (dc) (see 3.1 and 6.2.2).

3.12.6 Effective parallel resistance (when specified). When coils are tested as specified, in 4.8.8.6, the effective parallel resistance shall be as specified (see 3.1).

3.12.7 DC resistance. When coils are tested as specified in 4.8.8.7, the dc resistance shall be as specified (see 3.1 and 6.2.2).

3.13 Temperature rise (applicable to cylindrical insulated coils and when specified). When coils are tested as specified in 4.8.9 or 4.8.9.1, the temperature rise of any winding above the specified maximum ambient temperature (see 3.1 and 6.2.2) shall not exceed the value specified (see 3.1 and 6.2.2) and there shall be no evidence of physical damage.

3.14 Overload. When coils are tested as specified in 4.8.10, there shall be no evidence of cracked cases, nor loosening of the terminals.

3.15 Resistance to soldering heat. When coils are tested as specified in 4.8.11, there shall be no evidence of mechanical damage nor loosening of the terminals.

3.16 Terminal strength. When coils are tested as specified in 4.8.12, there shall be no winding discontinuity, no loosening or rupturing of the terminals, nor other mechanical damage.

3.17 Life. When coils are tested as specified in 4.8.13, there shall be no evidence of mechanical damage. The changes in electrical characteristics between the initial measurements and 250 $^{+48}_{-0}$ hours shall not exceed the initial limits specified for phenolic and iron core coils and the electrical characteristics from the 250 $^{+48}_{-0}$ hours up to and including 2,000 hours shall not exceed the degradation limits specified (see 3.1). The change in electrical characteristics for ferrite-core coils between the initial measurements up to and including 2,000 hours shall not exceed the degradation limits specified (see 3.1 and 6.8).

3.18 Low-temperature storage. When coils are tested as specified in 4.8.14, there shall be no impairment of protective coating, no loosening of the windings or terminals, nor any other evidence of mechanical damage.

3.19 Vibration. When coils are tested as specified in 4.8.15.1 or 4.8.15.2, there shall be no winding discontinuity (see 3.10), nor evidence of physical or mechanical damage.

3.20 Shock (specified pulse). When coils are tested as specified in 4.8.16, there shall be no winding discontinuity (see 3.10), nor evidence of physical or mechanical damage.

3.21 Immersion (grade 1 only). When coils are tested as specified in 4.8.17,there shall be no winding discontinuity, no evidence of corrosion, nor other visible damage. There shall be no dielectric breakdown, and the insulation resistance shall be not less than 1,000 MΩ.

3.22 Moisture resistance (grades 1 and 2 only). When coils are tested as specified in 4.8.18, the dielectric withstanding voltage shall meet the requirements specified in 3.7, the insulation resistance shall be as specified in 3.9 for grade 1 units, and not less than 100 MΩ for grade 2 units, the electrical characteristics shall be as specified in 3.12, and there shall be no evidence of corrosion affecting the mechanical or electrical operation.

3.23 Fungus. All external materials shall be nonnutrient to fungus growth or shall be suitably treated to retard fungus growth. The manufacturer shall verify by certification that all external materials are fungus resistant or shall test the coils as specified in 4.8.19. There shall be no evidence of fungus growth on the external surfaces.

3.24 Solderability. When coils are tested as specified in 4.8.20 they shall meet the applicable criteria for termination in method 208 of MIL-STD-202 and electrical connections shall be mechanically secure before soldering and electrically continuous after soldering.

3.25 Resistance to solvents. When coils are tested as specified in 4.8.21 there shall be no evidence of mechanical damage and the marking shall remain legible.

3.26 Flammability. When coils are tested as specified in 4.8.22, there shall be no evidence of violent burning which results in an explosive-type fire, and the coating material used on the coils shall be self-extinguishing. A coil shall not be considered to have failed in the event that it is consumed by the applied flame. A coil shall be considered to have failed only if an explosion or dripping of flaming material occurs, an explosive-type flame is produced, or if visible burning continues beyond the allowable duration of 3 minutes after removal of the applied flame.

3.27 Marking (not applicable to cylindrical coils). Coils shall be permanently and legibly marked with the military part number, manufacturer's source code, date code, and lot symbol as shown in the following example. The marking shall remain legible after all tests.

EXAMPLE:

M15305/1-001 or MS75008-21	-	Military part number
12345	-	Manufacturer's source code
6733A	-	Date code and lot symbol

3.27.1 Manufacturer's source code and date code. The manufacturer's source code and date code shall be marked in accordance with MIL-STD-1285.

3.27.2 Lot symbol. The lot shall be identified by a single letter assigned alphabetically, except that letters "I", "J", and "O" shall not be used.

3.27.3 For cylindrical coils. Cylindrical coils shall be marked with five colored bands. A silver band MIL identifier of double the width of the other bands, located near one end of the coil, identifies military radiofrequency coils; four other bands of equal width, three indicating the inductance in microhenries and the fourth band indicating the tolerance in percent. Color coding shall be in accordance with the color code of table II. When either the first or second band of the three bands is gold, this band shall represent the decimal point for inductance values less than 10, and the other two bands shall represent significant figures. For inductance values of 10 or more, the first two bands shall represent significant figures, and the third band shall represent the multiplier. For small units, dots may be used instead of bands, when specified (see 3.1 and 6.2.2). The diameter of the MIL-identifier dot shall be larger than the other dots. The colors used shall be in accordance with MIL-STD-1285. Typical color coding for units with inductance values less than 10 and for 10 or greater is shown on figure 1. The marking shall be legible upon completion of each examination or test.

TABLE II. Color code.

Color	Significant figure	Multiplier 1/	Inductance tolerance (percent)
Black	0	1	---
Brown	1	10	±1%
Red	2	100	±2%
Orange	3	1,000	±3%
Yellow	4	---	---
Green	5	---	---
Blue	6	---	---
Violet	7	---	---
Gray	8	---	---
White	9	---	---
None 2/	---	---	±20
Silver	---	---	±10
Gold	Decimal point	---	±5

1/ The multiplier is the factor by which the two significant figures are multiplied to yield the nominal inductance value.
2/ Indicates body color.

3.28 Workmanship. Coils shall be processed in such a manner as to be uniform in quality and shall be free from cracks, rough edges, loose mountings, broken leads, and other defects that will affect life, serviceability, or appearance.

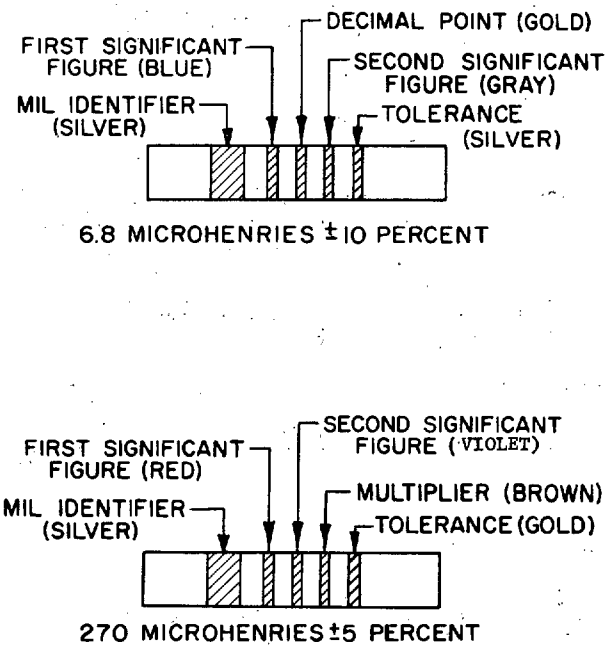


FIGURE 1. Typical color coding.

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 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the inspection facility. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-C-45662.

4.2 Classification of inspections. The inspections specified herein are classified as follows:

a. Materials inspection (see 4.3).
b. Qualification inspection (see 4.5).
c. First article inspection (see 4.6).
d. Quality conformance inspection (see 4.7).

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials listed in table III, used in fabricating the coils, are in accordance with the applicable referenced specifications or requirements prior to such fabrication.

TABLE III. Materials inspection.

Material	Requirement paragraph	Applicable standard
Solderable/weldable lead terminals- - - - -	3.5.2.1	MIL-STD-1276
External materials- - - - - - - - - - - - -	3.23	---

4.4 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.

4.4.1 Test voltage. The test voltage shall contain no more than 5-percent harmonic distortion.

4.4.2 Test frequency. When a test frequency is specified without a tolerance, the frequency used shall be within ±0.1 percent of the specified value.

4.4.3 Demagnetization. When necessary to overcome remanence effects, demagnetization is permitted.

4.5 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.

4.5.1 Sample size. The number of sample coils to be subjected to qualification inspection shall be as specified in the appendix to this specification, and table IV.

4.5.2 Inspection routine. Sample units shall be subjected to the qualification inspection specified in table IV, in the order shown. All sample units shall be subjected to the inspection of group I, except those units of groups V and VI. The sample units shall then be divided as specified in table IV for groups II to IV inclusive, and the sample units subjected to the inspection for their particular group. Additional units shall be required for groups V and VI tests.

4.5.2.1 Comparison standards. When the use of comparison standards is specified (see 3.1 and 6.2.2), three sample units nearest to the design-center values of the electrical characteristics (see 4.8.8) will be selected from those sample units which have been subjected to the inspection of group I of table IV, and clearly and permanently marked with these values. Two of the sample units selected will be retained by the Government as standards. The remaining sample unit will be returned to the contractor for use as a comparison standard (see 6.5) for correlation of measurements in the electrical-characteristics quality conformance inspection specified (see 3.1 and 6.2.2).

4.5.3 Failures. One or more failures shall be cause for refusal to grant qualification approval.

4.5.4 Retention of qualification. To retain qualification, the contractor shall forward, at 6-month intervals, to the qualifying activity, a summary of the results of groups A and B tests, indicating as a minimum the number of lots which passed and the number which failed, and a summary of the results of group C tests, including the number and type of any part failures. The summary shall include those tests performed during that 6-month period. If the summary of the test results indicates nonconformance with specification requirements, action shall be taken to remove the failing product from the qualified products list. Failure to submit the summary shall result in loss of qualification for that product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 6-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification. In the event that no production occurred during the reporting period, a report indicating no production shall be submitted. However, an item out of production for a period of 36 months must be requalified or it will be removed from the qualified products list.

TABLE IV. Qualification inspection.

Examination or test	Requirement paragraph	Method paragraph	Number of sample units to be inspected 4/
Group I			
Thermal shock	3.6	4.8.2	All sample units except Groups V & VI
Dielectric withstanding voltage	3.7	4.8.3	
Barometric pressure	3.8	4.8.4	
Insulation resistance	3.9	4.8.5	
Operating torque (when applicable)	3.11	4.8.7	
Electrical characteristics (initial)	3.12	4.8.8	
Inductance	3.12.1	4.8.8.1	
Q	3.12.2	4.8.8.2	
Self-resonant frequency	3.12.3	4.8.8.3	
DC resistance	3.12.7	4.8.8.7	
Other electrical characteristics (see 3.1) (initial):			
Percent coupling (when specified)	3.12.4	4.8.8.4	
Incremental current inductance change (when specified)	3.12.5	4.8.8.5	
Effective parallel resistance (when specified)	3.12.6	4.8.8.6	
Visual and mechanical examination (external)	3.1,3.4 to 3.5.3 incl, 3.27 and 3.28	4.8.1.1	
Group II			
Temperature rise	3.13	4.8.9	6
Overload 2/	3.14	4.8.10	
Resistance to soldering heat	3.15	4.8.11	
Terminal strength	3.16	4.8.12	
Electrical characteristics (final)	3.8	4.8.4	
Inductance	3.8.1	4.8.4.1	
Q	3.8.2	4.8.4.2	
Group III			
Life	3.17	4.8.13	6
Group IV			
Low temperature storage (-65°C)	3.18	4.8.14	6
Vibration	3.19	4.8.15	
Shock (specified pulse)	3.20	4.8.16	
Immersion	3.21	4.8.17	
Moisutre resistance	3.22	4.8.18	
Electrical characteristic (final)	3.8	4.8.4	
Visual and mechanical examination (external)	3.1,3.4 to 3.5.3 incl, 3.27 and 3.28	4.8.1.1	
Visual and mechanical examination (internal) (only 2 samples need be dissected)	3.1,3.4 to 3.4.6.1	4.8.1.2	
Group V			
Fungus 3/	3.23	4.8.19	2
Group VI			
Solderability 1/ (both leads)	3.24	4.8.20	6
Resistance to solvents 1/	3.25	4.8.21	3
Flammability (use 3 units from solderability)	3.26	4.8.22	(3)

1/ The units shall be clean units that have not been subjected to any other test.
2/ After the overload test is performed, a period of 24 hours shall elapse prior to taking electrical characteristics (final) measurements.
3/ The fungus requirement is either by certification or performance.
4/ Combined submission will be in accordance with the appendix (see 20.1.2).

4.6 First article inspection. First article inspection shall be performed by the contractor, after award of contract and prior to production, at a location acceptable to the Government (see 6.2.2). First article inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. First article approval is valid only on the contract or purchase order under which it is granted, unless extended by the Government to other contracts or purchase orders.

4.6.1 Sample size. Unless otherwise specified (see 6.2.2), the number of coils to be subjected to first article inspection shall be as specified in 4.5.1.

4.6.2 Inspection routine. Unless otherwise specified (see 6.2.2), the test routine shall be as specified in 4.5.2 and table IV.

4.6.3 Failures. One or more failures shall be cause for refusal to grant approval for inspection of coils not covered by military standards.

4.7 Quality conformance inspection.

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

4.7.1.1 Inspection lot. An inspection lot shall consist of all the coils of the same style and made of the same core material and of the same specification sheet (or Military Standard sheet) produced under essentially the same conditions, and offered for inspection at one time. The manufacturer may combine coils of different inductance values and inductance tolerances. The inductance value shall be equally representative of the production lot for that period.

4.7.1.2 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table V, in the order shown.

4.7.1.2.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality levels (AQL) shall be as specified in table V. Major and minor defects shall be as defined in MIL-STD-105.

4.7.1.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be kept separate from new lots, and shall be clearly identified as reinspected lots.

TABLE V. Group A inspection.

Examination or test	Requirement paragraph	Method paragraph	AQL (percent defective) Major	AQL (percent defective) Minor
Thermal shock 1/	3.6	4.8.2	1.0	---
Operating torque (when applicable)	3.11	4.8.7		
Electrical characteristics (initial)	3.12	4.8.8		
Visual and mechanical examination (external)	3.1, 3.4 to 3.5.3 incl, 3.27 and 3.28	4.8.1.1	1.0	4.0

1/ Measurements after thermal shock, not applicable.

4.7.1.3 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table VI, in the order shown, and shall be made on sample units which have been subjected to and have passed group A inspection.

4.7.1.3.1 Sampling plan. The sampling plan shall be in accordance with MIL-STD-105 for special inspection level S-4. The AQL shall be 2.5 percent defective.

4.7.1.3.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.7.1.3.3 Disposition of sample units. Sample units which have passed all the group B inspection may be delivered on the contract or purchase order, if the lot is accepted and the sample units are still within specified electrical tolerances and meet the requirements for visual and mechanical inspection. The leads of these sample units shall also be clean, smooth and free from any foreign particles.

TABLE VI. Group B inspection.

Test	Requirement paragraph	Method paragraph
Dielectric withstanding voltage	3.7	4.8.3
Barometric pressure	3.8	4.8.4
Insulation resistance	3.9	4.8.5
Electrical characteristics (initial)		
Inductance	3.12.1	4.8.8.1
Q	3.12.2	4.8.8.2

4.7.1.4 Periodic inspection. Periodic inspections shall consist of group C inspection. Except as specified in 4.7.1.4.5, delivery of products which have passed groups A and B inspection shall not be delayed pending the results of group C inspection.

4.7.1.4.1 Group C inspection. Group C inspection shall consist of the examinations and tests specified in table VII, in the order shown. Group C inspection shall be made on sample units selected from inspection lots which have passed the groups A and B inspection.

4.7.1.4.2 Sampling plan. Sample units of the same style, core material and of the same specification sheet (or Military Standard sheet) shall be selected as specified for each subgroup in accordance with table VII. The Government shall review all selections made from the preceding 24-month period for the purpose of group C inspection to assure that the type designations of a given style and core material are representative of the coils manufactured during this inspection period.

4.7.1.4.3 Failures. Sample units shall not exceed the allowable failures specified in table VII.

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

4.7.1.4.5 Noncompliance. If a sample fails to pass group C inspection, the contractor shall take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with 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 corrective 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 reinstituted; however, final acceptance shall be withheld until group C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.7.2 Inspection of packaging. Except for commercial packaging, the sampling and inspection of the preservation-packaging and interior package marking shall be in accordance with the groups A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129. The inspection of commercial packaging shall be as specified in the contract or purchase order (see 6.2).

TABLE VII. Group C inspection.

Examination or test	Requirement paragraph	Method paragraph	Number of sample units to be inspected	Number of defectives permitted
Subgroup I (Quarterly)				
Electrical characteristics (initial)	3.12	4.8.8	6	1
Inductance	3.12.1	4.8.8.1		
Q	3.12.2	4.8.8.2		
Temperature rise	3.13	4.8.9		
Overload	3.14	4.8.10		
Resistance to soldering heat	3.15	4.8.11		
Terminal strength	3.16	4.8.12		
Electrical characteristics (final)	3.12	4.8.8		
Inductance	3.12.1	4.8.8.1		
Q	3.12.2	4.8.8.2		
Subgroup II (Quarterly)				1
Electrical characteristics (initial)	3.12	4.8.8	6 of the highest inductance value	
Low temperature storage	3.18	4.8.14		
Vibration	3.19	4.8.15		
Shock (specified pulse)	3.20	4.8.16		
Immersion	3.21	4.8.17		
Moisture resistance	3.22	4.8.18	12	1
Electrical characteristics (final)	3.12	4.8.8	6 of the lowest inductance value	
Visual and mechanical examination (internal) 1/	3.1, 3.4 to 3.4.6.1 incl, and 3.27	4.8.1.2		
Subgroup III (Semi-annual)			6 of the highest inductance value	
Thermal shock 2/	3.6	4.8.2	12	1
Electrical characteristics (initial)	3.12	4.8.8	6 of the lowest inductance value	
Life	3.17	4.8.13		
Electrical characteristics (final)	3.12	4.8.8		
Subgroup IV (Semi-annual) 3/				
Solderability (both leads)	3.24	4.8.20	6	0
Resistance to solvents	3.25	4.8.21	3	
Flammability	3.26	4.8.22	(3)	

1/ Only two sample units need to be dissected.
2/ Defectives due to thermal shock must be replaced prior to start of life test.
3/ Nine sample units of any inductance value shall be subjected to subgroup IV inspection; 6 units shall be used for solderability, 3 units for resistance to solvents and 3 of the 6 units subjected to solderability shall be used for flammability test.

4.8 Methods of examination and test.

4.8.1 Visual and mechanical examination.

4.8.1.1 External. Coils shall be examined to verify that the weight, materials, external design and construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.4 to 3.5.3 inclusive, 3.27, and 3.28).

4.8.1.2 Internal. Coils shall be dissected and examined to verify that the materials, internal design, construction, and workmanship are in accordance with the applicable requirements (see 3.1, 3.4 to 3.4.6.1 inclusive, and 3.27).

4.8.2 Thermal shock (see 3.6). Coils shall be tested in accordance with method 107 of MIL-STD-202. The following details and exceptions shall apply:

a. Test condition - A-1 for Qualification and for group C inspection under "in-use conditions" (see 6.9); A for group A inspection not under "in-use condition". Step 3 shall be at the maximum operating temperature for the class.
b. Measurements after cycling - Winding continuity shall be determined, dielectric withstanding voltage, and the insulation resistance as specified in 4.8.6, 4.8.3, and 4.8.5, respectively.

4.8.3 Dielectric withstanding voltage (see 3.7). Coils shall be tested in accordance with method 301 of MIL-STD-202. The following details shall apply:

a. Special preparation or conditions - Cylindrical insulated coils shall be clamped in the trough of a 90 degree metallic V-block using a metallic strap with a 0.075-inch thick layer of conductive moisture-resistant resilient material, having a resistivity of less than 1,000 Ω per centimeter, shall be bonded to the surface of the strap next to the coils. The body of the coil shall not extend beyond the extremities of the block or resilient material. The surface of the V-block shall be free from contamination. The coil leads shall be so positioned that the distance between the leads and any point of the V-block shall be not less than the radius of the coil and minus the radius of the lead wire. The metallic V-block shall be of noncorrosive material. Other types of coils shall be tested by any other suitable means.
b. Magnitude of test voltage - The ac test voltage shall be a minimum of 1,000 V with a leakage current not to exceed 100 μA unless otherwise specified (see 3.1 and 6.2.2). The time duration shall be a minimum of 60 seconds.
c. Points of application of test voltage - Unless otherwise specified (see 3.1 and 6.2.2), the test voltage shall be applied between the leads of the coil connected together and the V-block with block and metal strap at ground potential.
d. Examination after test - Coils shall be examined for evidence of damage resulting from arcing, flashover, breakdown of insulation, or other damage.

4.8.4 Barometric pressure (when applicable) (see 3.8). Coils designed for operation above 10,000 feet shall be tested in accordance with method 105 of MIL-STD-202. The following details and exceptions shall apply:

a. Special preparation or conditions - Cylindrical insulated coils shall be clamped in the trough of a 90 degree metallic V-block using a metallic strap with a 0.075-inch thick layer of conductive moisture-resistant resilient material, having a resistivity of less than 1,000Ω per cm, shall be bonded to the surface of the strap next to the coils. The body of the coil shall not extend beyond the extremities of the block or resilient material. The surface of the V-block shall be free from contamination. The coil leads shall be so positioned that the distance between the leads and any point of the V-block shall be not less than the radius of the coil and minus the radius of the lead wire.
b. Test condition - As specified (see 3.1 and 6.2.2).
c. Test during subjection to reduced pressure - Coils shall be subjected to 60 Hz, ac test voltage at a minimum of 200 volts root mean square (Vrms) at 70,000 feet unless otherwise specified (see 3.1 and 6.2.2) for a minimum of 60 seconds
d. Points of application of test voltage - Unless otherwise specified (see 3.1 and 6.2.2), the test voltage shall be applied between the leads of the coil connected together and the V-block with block and metal strap at ground potential.
e. Examination after test - Coils shall be examined for evidence of damage resulting from arcing, flashover, breakdown of insulation, or other damage.

4.8.5 Insulation resistance (see 3.9). Coils shall be tested in accordance with method 302 of MIL-STD-202. The following details and exceptions shall apply:

a. Test condition letter - B, except that for coils with a dielectric withstanding test voltage less than 500 V (see 3.1), test condition letter A shall be used.
b. Points of measurements - Unless otherwise specified (see 3.1 and 6.2.2), measurements shall be made between insulation points. For cylindrical coils, the measurements shall be made between the coil winding and the metal strap in the coil-connecting assembly specified on figure 2, or between the coil leads connected together and the V-block (see 4.8.4d).

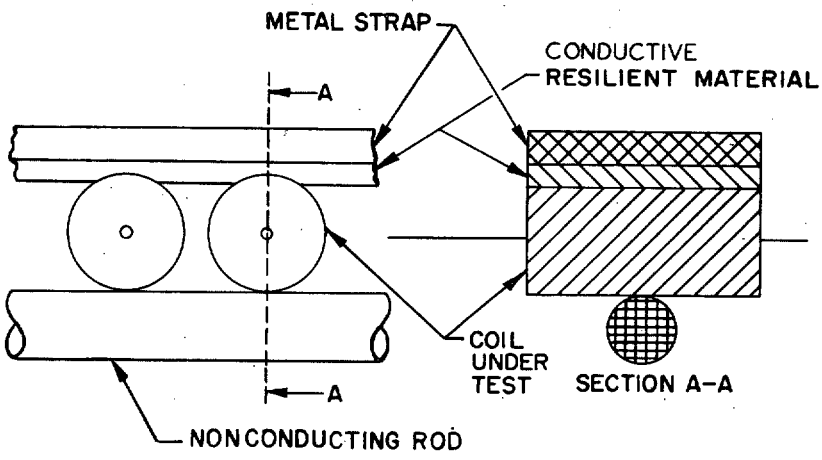
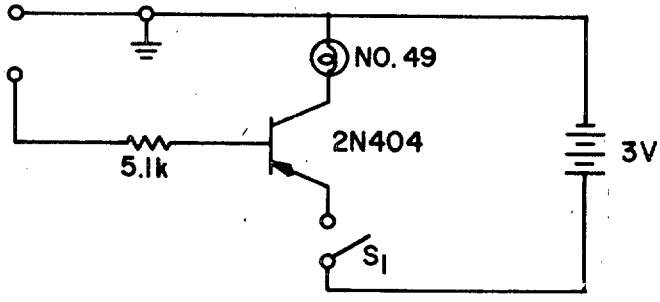


FIGURE 2. Coil-contacting assembly for mounting during polarization.

4.8.6 Winding continuity (see 3.10). All windings of coils shall be tested for electrical continuity by any suitable means that will not introduce currents in excess of the rated value, or the incremental current value (when specified (see 3.1)), whichever is less.

The following test circuit is recommended for ferrite core coils to limit the test current to less than .6 mA.



4.8.7 Operating torque (see 3.11) (applicable only to variable coils). Coils shall be exposed to a temperature of 25° $^{+10°}_{-5°}$ C. The coil under test shall be rigidly clamped by the body. The tuning core shall be rotated for eight cycles (16 excursions) from maximum core extension to minimum position for one complete cycle while not exceeding the maximum or minimum torque specified (see 3.1). Each cycle shall take a minimum of 40 seconds to perform.

4.8.8 Electrical characteristics (see 3.1 and 3.12). The coils shall be mounted by their normal mounting means on their applicable test fixture. The electrical characteristics to be determined shall include inductance, Q, self-resonant frequency, and dc resistance. Additional electrical characteristics shall be measured when specified (see 3.1).

4.8.8.1 Inductance. Unless otherwise specified (see 3.1 and 6.2.2), effective inductance of coils shall be measured at the frequency specified. For cylindrical coils, the test procedures of 4.8.8.1.1 and 4.8.8.1.2 shall be used. For quality conformance inspection, the measurement of effective inductance shall be referred to a comparison standard for correlation, when specified. (See 3.1, 4.5.2.1, 6.2.2, and 6.5.) When true inductance is specified (see 3.1 and 6.2.2), the following test procedure, or equivalent, shall be used. A calibrated capacitor shall be used to tune the winding to resonance at several frequencies. The points shall describe a straight line of added capacitance, one point of which shall be $\frac{1}{f_o^2}$, as abscissa, versus the reciprocal of the frequency squared, as ordinate, to be plotted, and true inductance to be calculated by the following formula:

True inductance = KM

Where: $K = \frac{1}{4\pi^2} = 0.0253$

M = Slope of line representing added capacitance.

f_o = Self-resonant frequency of the coil at the abscissa of zero capacity.

4.8.8.1.1 Effective inductance for cylindrical coils (inductance 0.10 to 10.0 microhenries inclusive). The tests shall be performed using instruments such as Hewlett Packard (HP) models 260A, HP4342A, HP250RX meter or equivalent. Suitable means shall be used to calibrate the frequency dial of the Q meter within ±0.1 percent for the applicable test frequency. Frequencies to be used for testing the various ranges of inductance shall be as follows:

Inductance range, microhenry (μH)	Test frequency megahertz (MHz)
0.10 to 1.0 incl - - - - - - - -	25.0
Above 1.0 to 10.0 incl - - - - -	7.9

Allowance shall be made for the internal inductance of the Q meter and the test fixture as determined in 4.8.8.1.1.1.

4.8.8.1.1.1 Effective inductance. Effective inductance shall be determined as follows when using test fixtures TF-A or TF-B, as applicable on figure 3 or 4. The appropriate test fixture shall be inserted in the Q-meter coil terminals with the side showing the test-fixture letter facing the capacitance terminals. The appropriate shorting bar conforming to figure 5 or 6 shall be inserted in the clips of the test fixture in such a manner that the terminals rest firmly against the stops, and so that the bar is centered between the test-fixture terminals. The Q-meter capacitance dial shall be set at 400 picofarads (pF) and the vernier capacitance dial at zero. The Q meter shall then be resonated using the frequency dial until a peak reading is obtained. This frequency shall be monitered in order to obtain an accuracy of 0.1 percent. This resonant frequency value in MHz shall be recorded. The main capacitance dial shall be calibrated periodically in accordance with a routine calibration program for test equipment. The sum of the residual inductance of the Q meter and the inductance of the program for test equipment. The sum of the residual inductance of the Q meter and the inductance of the test fixture shall be calculated from:

$$L_{cf} = \frac{1}{4\pi^2 f^2 C} - L_{bar}$$

Where: L_{cf} = inductance in μH of the test fixture and residual inductance of the Q meter.

f = frequency in MHz.

C = capacitance in microfarads (μF).

L_{bar} = calculated inductance in μH of the shorting bar as determined from the following formula:

$$L_{bar} = 0.002\ell \left[2.303 \log_{10} \frac{4\ell}{d} - 1 + \frac{d}{2\ell} \right]$$

Where: ℓ = length of wire (cm).

d = diameter of cross section (cm).

The shorting bar shall then be removed from the test fixture and the Q meter frequency shall be set to the frequencies specified in 4.8.8.1.1. The coil under test shall then be inserted in the test fixture in such a manner that the leads are straight and rest firmly against the stops, and so that the unit is centered between the test-fixture terminals. The L-C dial of the Q meter shall then be tuned until the resonance meter indicates a peak reading. The inductance (L_d) shall be read directly on the L-C dial, using the inductance scale and the effective inductance (see 3.1), of the coil calculated from the formula:

$$L = L_d - L_{cf}$$

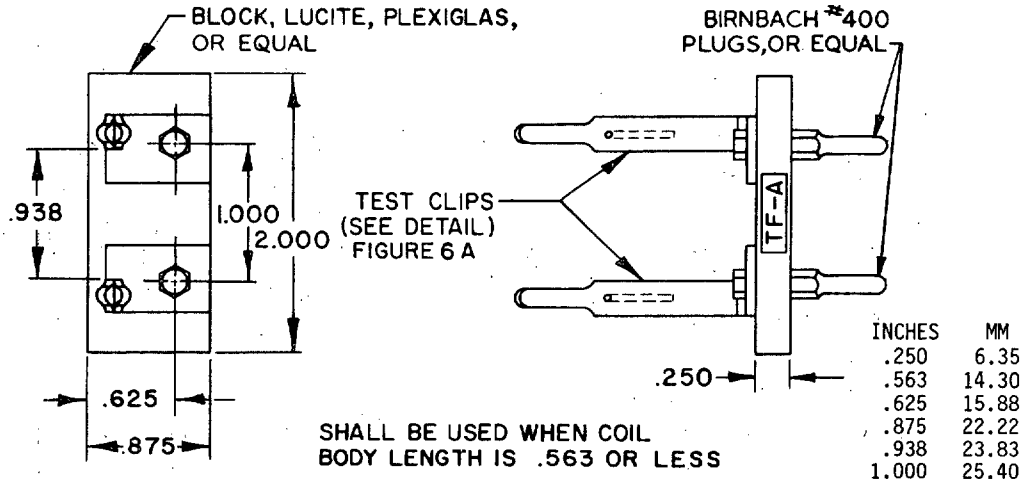
Where: L = effective inductance in µH of coils.

L_c = inductance dial reading in µH.

L_{cf} = correction factor for inductance of test fixture and residual inductance of the Q meter in µH.

4.8.8.1.2 Effective inductance for cylindrical coils (inductance greater than 10 µH). Test as specified in 4.8.8.1.1, except that no allowance is made for residual inductance of Q meter and inductance of test fixture. Frequencies to be used for testing various ranges of inductance shall be as follows:

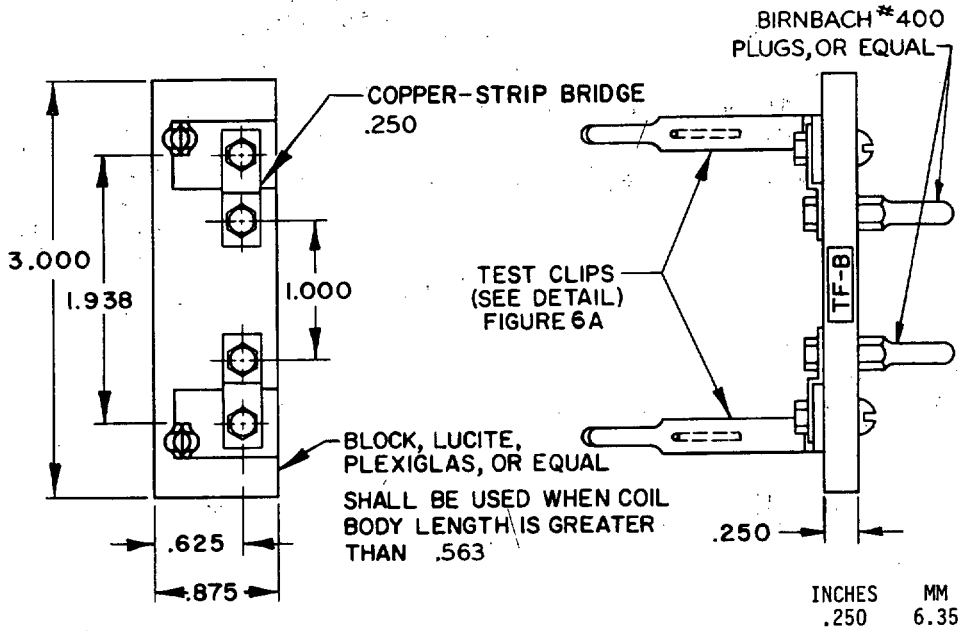
Inductance range, µH	Test frequency, MHz
Above 10.0 to 100.0, inclusive	2.5
Above 100.0 to 1,000.0, inclusive	0.790
Above 1,000.0 to 10,000.0, inclusive	0.250
Above 10,000.0 to 100,000.0, inclusive	0.079



INCHES	MM
.250	6.35
.563	14.30
.625	15.88
.875	22.22
.938	23.83
1.000	25.40
2.000	50.80

NOTES:
1. Dimensions are in inches.
2. Letters in blocks to be marked on fixture.
3. Unless otherwise specified, tolerance is ±.005 (.13 mm).
4. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.

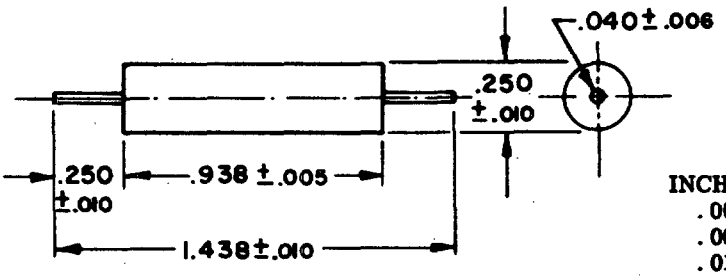
FIGURE 3. Test fixture TF-A (for axial leads).



INCHES	MM
.250	6.35
.563	14.30
.625	15.88
.875	22.22
1.000	25.40
1.938	49.23
3.000	76.20

NOTES:
1. Dimensions are in inches.
2. Letters in blocks to be marked on fixture.
3. Unless otherwise specified, tolerance is ±.005 (.13 mm).
4. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.

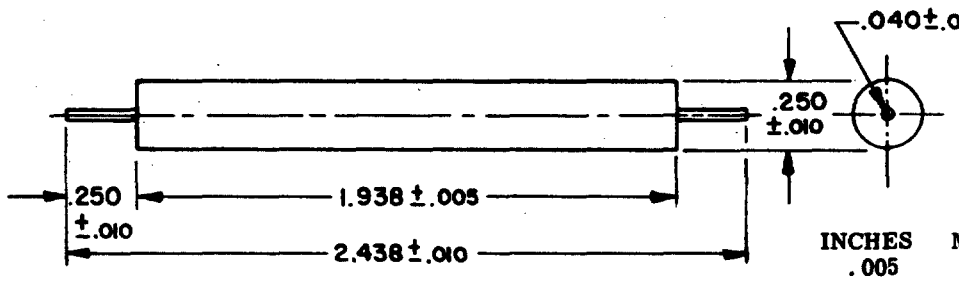
FIGURE 4. Test fixture TF-B (for axial leads).



INCHES	MM
.005	.13
.006	.15
.010	.25
.040	1.02
.250	6.35
.938	23.83
1.438	36.53

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.

FIGURE 5. Shorting bar for test fixture TF-A (for axial leads).



INCHES	MM
.005	.13
.006	.15
.010	.25
.040	1.02
.250	6.35
1.938	49.23
2.438	61.93

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.

FIGURE 6. Shorting bar for test fixture TF-B (for axial leads).

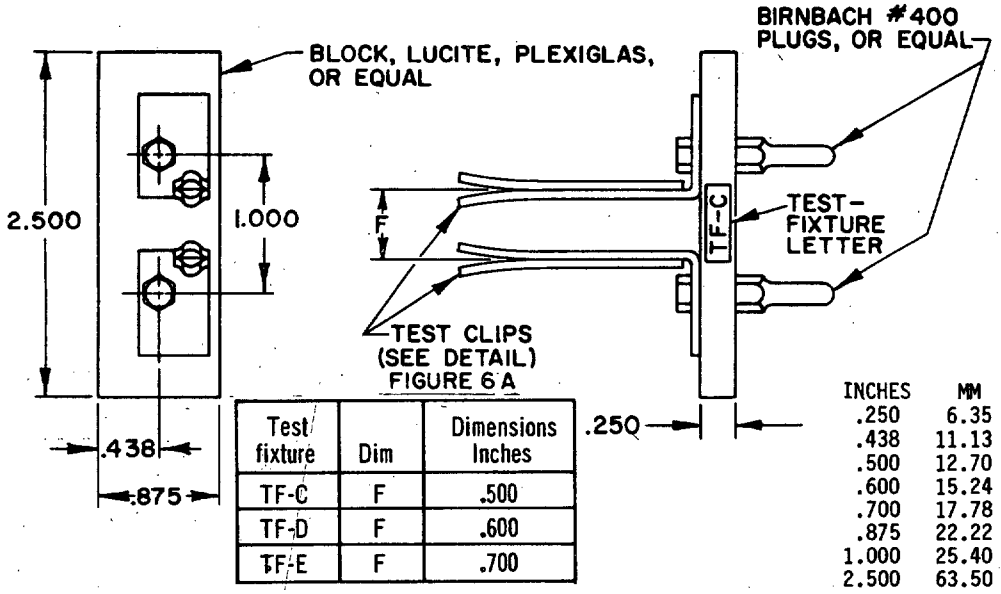
4.8.8.1.3 Effective inductance for radial lead coils (inductance 0.10 to 10.0 µH, inclusive). The test shall be performed as specified in 4.8.8.1.1.1, except that test fixtures TF-C, TF-D, or TF-E, on figure 7, shall be used. The shorting bar for use with these test fixtures shall be made of AWG size No. 18 solid copper wire approximately 1.25 inches long, and shall be bent as required.

4.8.8.1.3.1 Effective inductance for radial lead coils (inductance greater than 10 µH). The test shall be performed as specified in 4.8.8.1.2.

4.8.8.2 Q of coils. The test shall be performed using a Q meter such as Hewlett Packard model 260A, or equivalent, and Hewlett Packard Q-standard, type 513A, or equivalent. Suitable means shall be used to calibrate the frequency dial of the Q meter and the Q-standard within ±0.1 percent of the applicable test frequency. Frequencies to be used for testing the various ranges of inductance shall be as specified in 4.8.8.1.1 and 4.8.8.1.2. The appropriate test fixture, as applicable, as shown on figure 3, 4, or 7, shall be assembled to the coil terminals of the Q meter, with the side showing the test fixture letter facing the capacitance terminals. The unit under test shall then be inserted into the test clip in such a manner that the leads are straight and rest firmly against the stops, and so that the unit is centered between the terminals. The Q shall then be read on the Q voltmeter.

4.8.8.3 Self-resonant frequency. Unshielded coils shall be placed in the field of a variable-frequency oscillator, such as McGraw-Edison megacycle meter, model 159LF or equivalent. The oscillator shall include a device for indicating the relative amount of power absorbed from the field (e.g., a grid-dip meter). The unit under test shall be placed on the appropriate test fixture shown on figure 8 or 9. Units shall be suspended or supported a minimum of 1.50 inches from any surface other than the test-fixture supports or oscillator coil. The frequency of the oscillator shall be varied through the frequency range near the self-resonant frequency specified (see 3.1 and 6.1). At any frequency in the frequency range where an abrupt increase in power absorption is indicated, the coupling between the oscillator coil and the unit under test shall be decreased, by increasing the separation between the coils, until a moderate dip in grid current results when tuning to this resonance. This frequency shall be considered the self-resonant frequency of the unit, and shall be accurately determined by suitable means to within ±0.2 percent. A check shall be made for spurious indications due to a resonance not associated with the unit under test, by removing the unit form the field (at frequencies below 2.5 MHz, any suitable method may be used). Coils which cannot be resonated in this manner shall be tested as specified in 4.8.8.3.1. Shielded coils shall be tested in a similar manner, however, when electrostatic shielded coils are tested, the shield of the coil shall be grounded. The following method may be used as an alternate method of measurement of shielded coils (see 3.12.3).

4.8.8.3.1 Alternate test method. When coils under test cannot be resonated by the method specified in 4.8.8.3, the test shall be performed using a Hewlett Packard model 260A or HP4342A, Q meter or a 250RX bridge or equivalent (when using the 250RX bridge see the equipment manual for appropriate procedure). The coils shall be mounted in the appropriate test fixture, as applicable, as shown on figure 3, 4, or 7, with the test-fixture letter facing the inductance terminals. The tuning capacitor of the Q meter shall then be set to approximately 400 pF, and the Q circuit shall be resonated by adjusting the oscillator frequency of the Q meter. The unit under test shall then be replaced with a shielded comparsion coil having an inductance about 1/25 that of the unit under test, or a coil that will resonate in the Q circuit at a frequency about 10 times the initial resonant frequency. The Q meter shall then be set to a frequency approximately 10 times the initial resonant frequency, and the Q circuit shall then be resonated at this new frequency. (This factor of 10 is based on the distributed capacitance of the unit under test being in the region of 4 pF, which is common for small coils. Higher distributed capacitances will lower the resonant frequency of the unit under test, and a factor smaller than 10 will prevail.) The unit under test shall then be connected across the capacitance terminals of the Q meter, taking care to avoid coupling between the unit under test and the comparsion coil. The Q circuit shall then be re-resonated by means of the Q-tuning capacitor or the vernier-tuning capacitor, observing whether the capacitance has to be increased or decreased from its previous value, in order to restore resonance. If the capacitance has to be increased, the oscillator frequency shall be increased by 10 to 20 percent. If the capacitance has to be decreased, the oscillator frequency shall be decreased by the same amount. The unit under test shall then be disconnected from the Q meter, and the Q circuit shall be resonated to the new frequency by means of the Q-tuning capacitor. The previous procedure shall then be repeated, while at the same time changing the oscillator frequency by smaller increments as it approaches the resonant frequency of the unit under test, until the frequency reaches a value at which the Q-circuit capacitance is unchanged when the unit under test is connected or disconnected. The self-resonant frequency of the unit under test will then be the frequency of the oscillator and shall be accurately determined to within ±0.2 percent (see 3.12.3).

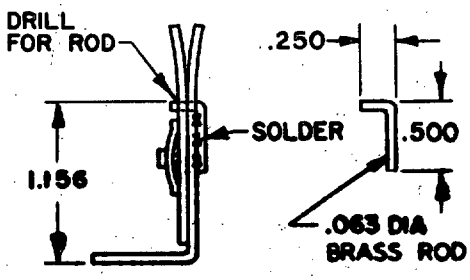


Test fixture	Dim	Dimensions Inches
TF-C	F	.500
TF-D	F	.600
TF-E	F	.700

INCHES	MM
.250	6.35
.438	11.13
.500	12.70
.600	15.24
.700	17.78
.875	22.22
1.000	25.40
2.500	63.50

NOTES:
1. Dimensions are in inches.
2. Unless otherwise specified, tolerance is ±.005 (.13 mm).
3. Letters in blocks to be marked on fixture.
4. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.

FIGURE 7. Test fixtures TF-C, TF-D and TF-E (for radial leads).

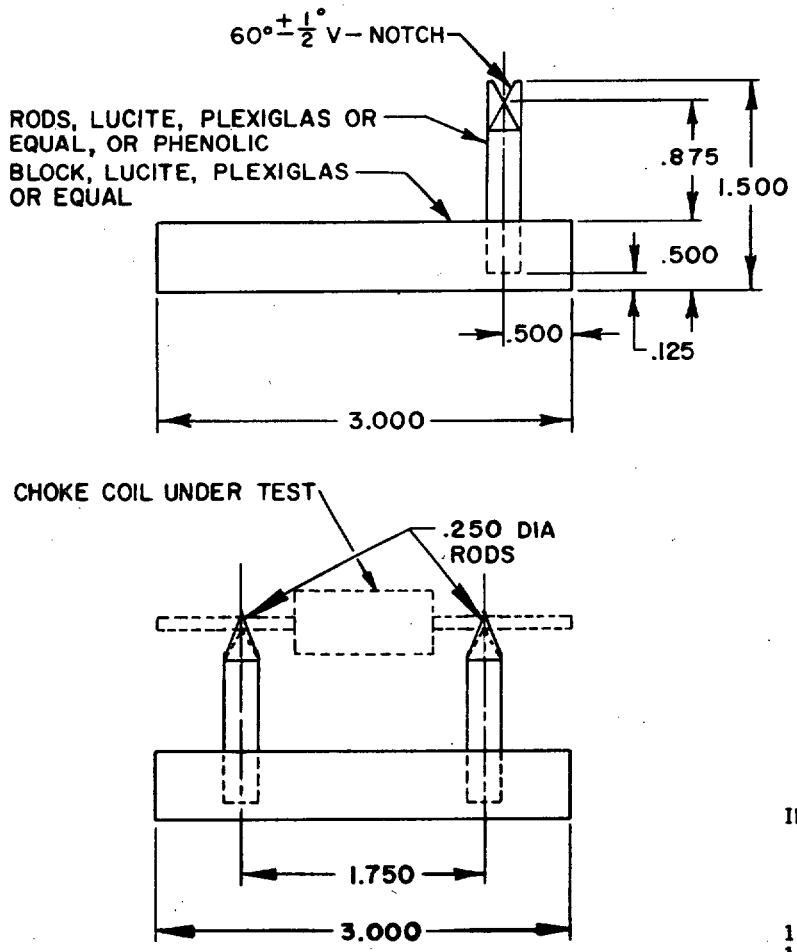


INCHES	MM
.063	1.60
.250	6.35
.500	12.70
1.156	29.36

RAPID TEST CLIP R OR L OR EQUAL

NOTES:
1. Dimensions are in inches.
2. Unless otherwise specified, tolerance is ±.005 (.13 mm).
3. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.

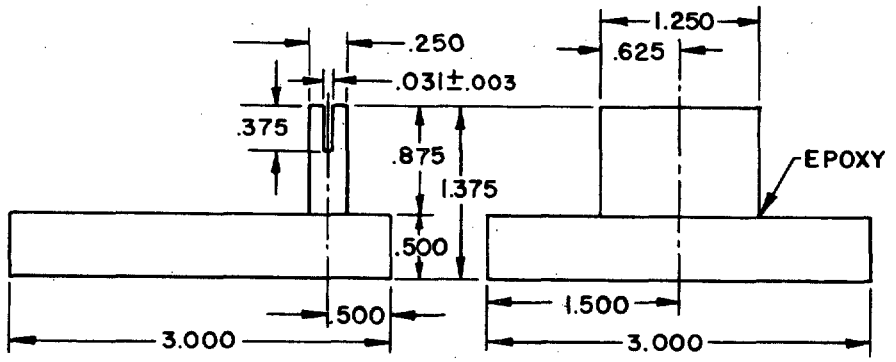
FIGURE 7A. Detail.



INCHES	MM
.125	3.18
.250	6.35
.500	12.70
.875	22.22
1.500	38.10
1.750	44.45
3.000	76.20

NOTES:
1. Dimensions are in inches.
2. Unless otherwise specified, tolerance is ±.005 (.13 mm).
3. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.

FIGURE 8. Test fixture for self-resonant-frequency test (for axial leads).



INCHES	MM
.003	.08
.031	.79
.250	6.35
.375	9.52
.500	12.70
.625	15.88
.875	22.22
1.250	31.75
1.500	38.10
3.000	76.20

NOTES:
1. Dimensions are in inches.
2. Unless otherwise specified, tolerance is ±.005 (.13 mm).
3. Material: Lucite or equivalent.
4. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.

FIGURE 9. Test fixture for self-resonant frequency test (for radial leads).

4.8.8.4 Percent coupling (when specified). The percent coupling of radio frequency coils, is determined by the table below. Two coils with the same dash number shall be placed side by side and in contact with each other. The inductance values are taken of the two coils, first series aiding (L_{T1}) and then series bucking (L_{T2}) at the frequency specified. The ac test voltage shall be the lowest voltage across the coil which will permit the bridge to operate satisfactorily. The percent coupling is then calculated using the following formula:

$$\text{Percent coupling} = \frac{M}{\sqrt{L_1 L_2}} \times 100$$

Where: $M = \frac{L_{T1} - L_{T2}}{4}$ = coefficient of mutual inductance in μH

L_{T1} = Total inductance series aiding (μH)

L_{T2} = Total inductance series bucking (μH)

The inductance values L_1 and L_2 in μH are the measured values of the two coils under measurement at the specified frequency in table VIII.

TABLE VIII. Test equipment for percent coupling.

Inductance	Test frequency	Instrument
µH	kHz	
≤1.0	100.0	HP 63H bridge or equal
>1.0 to 100 incl	10.0	General Radio 1632-A Inductance bridge or equal
>100	1.0	General Radio 1632-A Inductance bridge or equal

Percent coupling test is applicable in qualification inspection, Group I, electrical characteristics (initial) and group C inspection, subgroup II under electrical characteristics (initial).

4.8.8.4.1 Percent coupling (alternate method). The percent coupling between two radio frequency coils is to be determined by measuring the voltage induced in a coil when a voltage is applied to an adjacent coil. In order to maintain reasonable impedance levels, the measurement is to be performed at 100 kHz for nominal inductances of 10 µH or less, at 10 kHz for nominal inductances less than or equal to 100 µH but greater than 10 µH, and at 1 kHz for inductances greater than 100 µH. The measurement circuit is shown on figure 10.

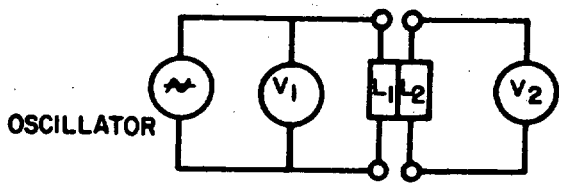


FIGURE 10. Test circuit for percent coupling (alternate method).

Equipment for 1 kHz and 10 kHz consists of H.P. Model 200 audio oscillator and Model 400 vacuum tube voltmeter; for 100 kHz Model 606 signal generator and Model 400 vacuum tube voltmeter, or equivalent.

The coils to be tested shall be taped or otherwise secured such that the bodies of the coils are kept parallel and in contact with each other to insure maximum coupling. The voltage levels shall be as low as possible to permit reliable readings of V_2. The inductance L should be measured at the same voltage level so that any saturation effects are taken into account.

The percent coupling is to be calculated using the equation

$$\text{percent coupling} = \sqrt{\frac{L_1}{L_2}}\,\frac{V_2}{V_1} \times 100$$

Where: L_1 = effective inductance of primary coil (measured at test frequency)
L_2 = effective inductance of secondary coil
V_1 = voltage measured across primary
V_2 = voltage measured across secondary

NOTE: This test may also be performed using the Q Meter for the oscillator at the standard test frequency allowing simultaneous reading of L_1. Reversing the coils allows reading of L_2 and also a second measurement of coupling for verification or averaging.

The percent coupling is to be calculated using the equation

When V_1 = .02 Q

$$\text{Percent coupling} = \frac{50\ V_2}{Q}\sqrt{\frac{L_1}{L_2}} \times 100$$

L_1 = effective inductance of primary coil (measured at test frequency)

L_2 = effective inductance of secondary coil

V_2 = voltage measured across secondary

Q = as measured

4.8.8.5 Incremental current inductance change (when specified). Incremental current inductance change is the dc required to cause a change of no more than five percent from the inductance measured with zero dc and the inductance measured with the specified value of incremental current (see 3.1 and 6.2.2). This test is performed using a General Radio Type 1633-A incremental inductance bridge, or equivalent, at 10 kHz for inductance values between 10 and 100 µH, and 1 kHz for inductance values greater than 100 µH, and the General Radio Type 1632-A inductance bridge, or equivalent at 10 kHz for inductance values less than 10 µH. The ac test voltage to be used across the coil for bridge operation shall be determined by the following formula:

$$E = f\sqrt{L}$$

Where:

E = voltage (rms) in (mV)
f = frequency in (kHz)
L = nominal value of inductance in (µH).

This voltage is to be measured with a vacuum tube voltmeter connected directly across the coil. This voltmeter is disconnected prior to making the inductance measurement. The inductance of the coil under test shall be determined and recorded with zero dc in the coil. The specified value of incremental current shall be applied through the coil and this inductance measurement recorded. The change in inductance between the two values shall be less than five percent.

4.8.8.6 Effective parallel resistance (when specified). The test may be performed using a model HP260A or HP4342A Q-meter, or HP250RX meter or equivalent test method. The oscillator controls shall be set at the specified measurement frequency followed by the insertion of a suitable work coil attached to the Q-meter coil terminals and the capacitor adjusted for resonance. The capacitance dial reading (C_1) and Q dial (Q_1) shall be recorded, also the "multiply Q by" meter dial, when it is other than XI which is preferable. Connect the coil under test to the capacitance terminals and restore resonance by adjusting the capacitor. Record the dial reading (Q_2). The effective parallel resistance of the inductor is calculated by the following formula:

$$R_p = \frac{159\ Q_1\ Q_2}{FC_1\ (Q_1 - Q_2)}$$

Where:

Q_1 = Q of the Q circuit alone

Q_2 = Q of the Q circuit with the test coil connected to the Q circuit

R_p = effective resistance in kilohms (kΩ)

F = frequency in MHz

C_1 = capacitance in pF

4.8.8.6.1 Effective parallel resistance (alternate method). The test may be performed by direct measurement using an H.P. Model 250A RX meter for Rp values of 50 kΩ or less.

4.8.8.7 DC resistance. DC resistance of coils shall be measured in accordance with method 303 of MIL-STD-202.

4.8.9 Temperature rise (see 3.13). The temperature rise of cylindrical insulated coils shall be determined as specified in 4.8.9.1. The temperature rise of the winding of other coils (when specfied (see 3.1 and 6.2.2)) shall be determined by any suitable method (preferably by the resistance-change method). This test shall be performed at the specified ambient temperature and with rated dc applied (see 3.1 and 6.2.2). When the resistance of the winding, measured at 5-minute intervals, remains constant, the temperature of the winding shall be considered stabilized. If the method used for determining the resistance of the winding requires the removal of power, the measurement shall be made within 10 seconds after the removal of power.

4.8.9.1 For cylindrical insulated coils. The coil under test shall be connected to a test fixture conforming to figure 11 with each wire lead wrapped one turn around the test-fixture terminal and shall be soldered to the terminal for uniform low contact resistance. The test fixture, with the attached coil, shall then be placed in a test chamber which allows forced-air circulation to be shut off during testing. The test chamber shall be free of test-area drafts and direct thermal radiation. A termperature-indicating device with an accuracy of ± 0.5°C shall be located in the area surrounding the coil under test, but not where it will be influenced by the temperature rise of the coil. The test chamber temperature shall then be stabilized at the specified ambient temperature (see 3.1 and 6.2.2). The dc resistance (r) shall be measured with one-tenth rated dc applied at the specified ambient temperature (t). When the resistance of the coil is stabilized, the resistance value shall be recorded. The ammeter-voltmeter method may be used for determining this resistance provided that the accuracy of these meters is 0.5 percent or better and the resistance of the voltmeter is at least 1,000Ω per volt. The rated dc (see 3.1 and 6.2.2) shall then be applied to the coil under test, using a stable current source such as a storage battery. Forced-air circulation shall be shut off when rated current is applied. When the resistance of the coil under test is stabilized with rated current applied, the resistance (r) and the test chamber temperature (T) shall be recorded. The temperature rise (ΔT) shall be calculated by the following formula:

$$\Delta T = \frac{R - r}{r} \quad (t + 234.5) - (T - t)$$

Where: ΔT = Temperature rise in °C above the specified ambient temperature of the coil under test.

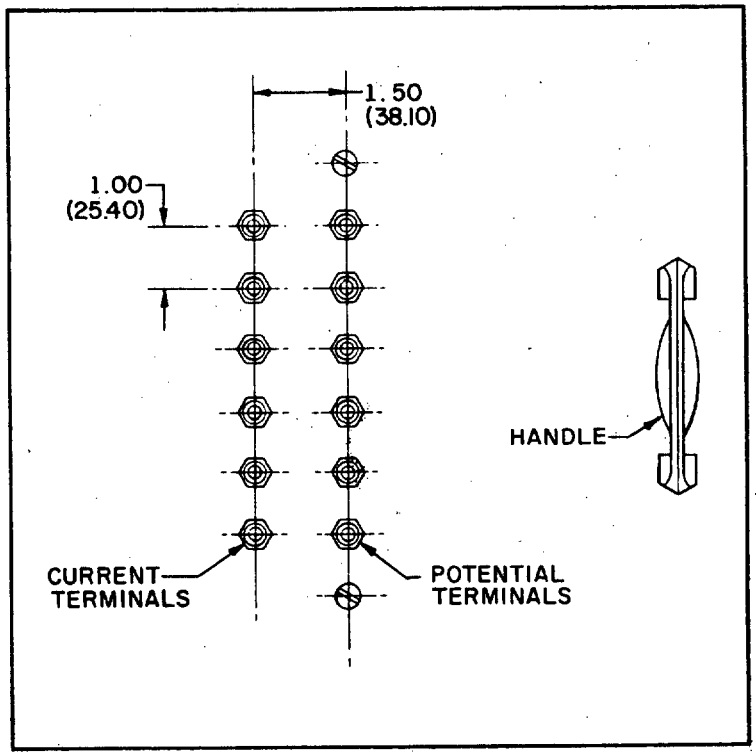
R = Resistance of coil in ohms with rated dc applied at temperature $(T + \Delta T)$.

r = Resistance of coil in ohms at temperature (t), the specified ambient temperature.

t = Stabilized specified ambient temperature in °C of the coil under test without dc applied.

T = Ambient temperature in °C (at time forced-air circulation is shut off) with rated dc applied. T shall not differ from t by more than 5°C.

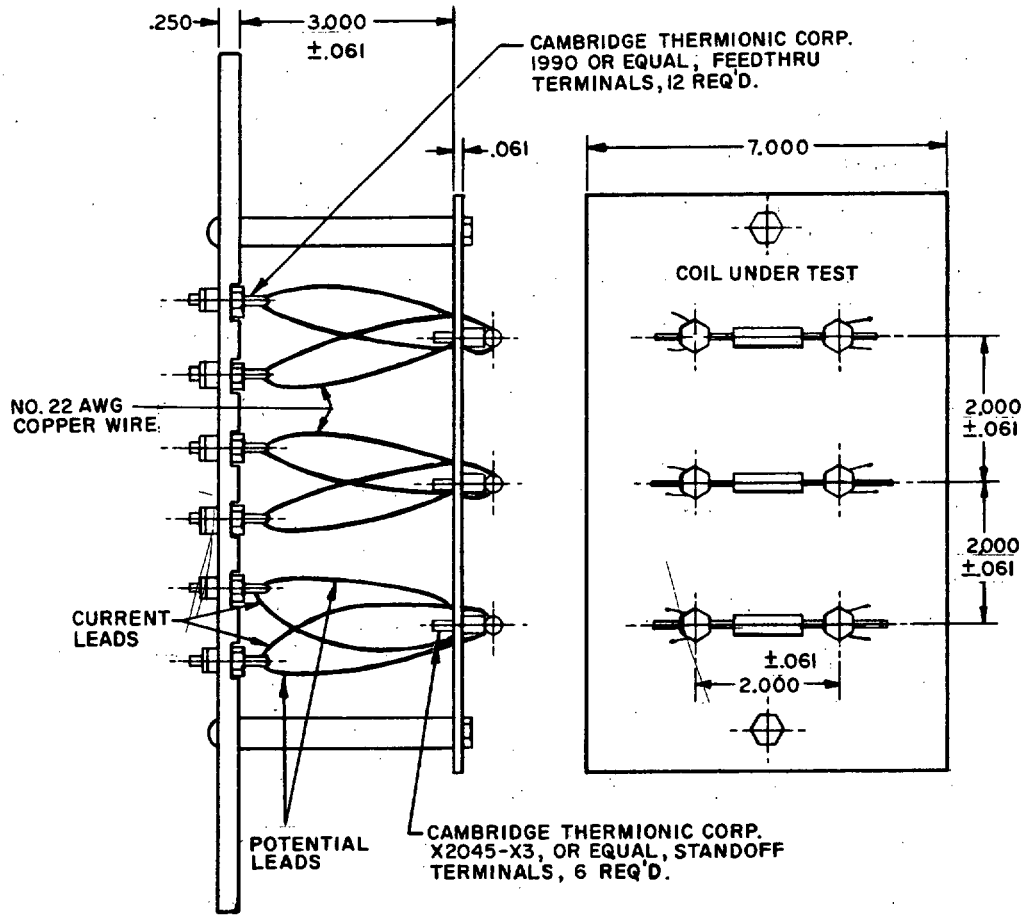
4.8.10 Overload (see 3.14). DC equivalent to 1-1/2 times the specified rated current (see 3.1 and 6.2.2) shall be applied to the windings for 5 minutes. After the test, coils shall be examined for evidence of cracked cases, distorted or softened insulation, or loosened windings or terminals.



FRONT VIEW

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.
3. Metric equivalents are in parentheses.

FIGURE 11. Test fixture for temperature-rise test on insulated coils.



INCHES	MM
.061	1.55
.250	6.35
2.000	50.80
3.000	76.20
7.000	177.80

NOTES:
1. Dimensions are in inches.
2. Unless otherwise specified, tolerance is ±.005 (.13 mm).
3. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.

FIGURE 11. Test fixture for temperature-rise test on insulated coils - Continued.

4.8.11 Resistance to soldering heat (see 3.15). Terminals to be used for soldered connections shall be tested in accordance with method 210 of MIL-STD-202. The following details shall apply:

a. Depth of immersion in molten solder - 0.25 inch from the nearest insulating material, or to 1/2 the exposed length of the terminal, whichever point is closer to the insulating material.
b. Test-condition letter - A. After the test and as soon as the soldered terminals have returned to room ambient temperature, the coils shall be examined for evidence of mechanical damage and loosening of the terminals.

4.8.12 Terminal strength (see 3.16). Coils shall be tested as specified in 4.8.12.1 to 4.8.12.3.1, as applicable.

4.8.12.1 Pull.

4.8.12.1.1 All terminals. Each terminal shall be tested in accordance with method 211 of MIL-STD-202. The following details shall apply:

a. Test-condition letter - A.
b. Applied force - Unless otherwise specified (see 3.1 and 6.2.2), the applied force shall be 5 pounds.

4.8.12.2 Twist.

4.8.12.2.1 Solid wire lead terminals (axial and radial lead terminals, not printed circuit terminals). Each terminal shall be tested in accordance with test condition D, method 211, of MIL-STD-202.

4.8.12.3 Torque.

4.8.12.3.1 All other terminals (excluding solid wire, axial, radial, and printed circuit terminals). All other terminals shall be subjected to a torque of 0.25 pound-inch applied in alternating directions, in a manner tending to produce rotation of the terminal.

4.8.13 Life test (see 3.17). Coils shall be tested in accordance with method 108 of MIL-STD-202. The following details and exceptions shall apply:

a. Method of mounting -
   1. Wire-lead terminal coils - Supported by wire leads mounted by lightweight push-post terminals on each side of the body. The effective length of each terminal shall be 0.50 inch minimum. The panel racks or breadboarding device shall be equipped with current sensing terminals. Coils shall be so arranged that the temperature on any one coil shall not appreciably influence the temperature of any other coil.
   2. All other terminals - Supported as specified (see 3.1 and 6.2.2). Coils shall be so arranged that the temperature of any one coil shall not appreciably influence the temperature on any other coil.
b. Ambient test temperature and tolerances unless otherwise specified -
   1. Phenolic core coils: 90 ±2°C.
   2. Iron core coils: 90 ±2°C.
   3. Ferrite core coils: 90 ±2°C.
   4. Other core coils: As specified (see 3.1 and 6.2.2).
c. Operating conditions - 100 percent rated cyclic loaded conditions (see 3.1), 1-1/2 hours on and 1/2-hour off, for the applicable number of hours specified and at the ambient test temperatures. "On time" shall be three-fourths of the total lapsed time.
d. Initial measurements - Measurements of inductance, Q, dc resistance, and self-resonant frequency shall be performed at room temperature prior to subjecting the coils to the specified test temperature. These initial measurements shall be used as reference in determining degradation limits after exposure of the test temperature after each of the specified test intervals.

e. Measurements during test - Measurements of inductance, Q, dc resistance, and self-resonant frequency shall be made after each of the following test intervals: 250 $^{+48}_{-0}$, 500 $^{+48}_{-0}$, 1,000 $^{+48}_{-0}$, and 2,000 $^{+72}_{-0}$ hours. The coils shall be stabilized at room temperature for a minimum of 1/2-hour after removal from the test chamber prior to taking measurements. Coils shall remain at room temperature for no greater period of time than necessary to perform the required measurements before return to test chamber.
f. Degradation limits - Unless otherwise specified, coils shall not exceed the degradation limits specified (see 3.1 and 6.8) for the 250-hour test interval and for succeeding test intervals up to and including the 2,000-hour test interval.
g. Examination after test - Coils shall be examined for evidence of mechanical damage.

4.8.14 Low temperature storage (see 3.18).

4.8.14.1 Mounting. Coils shall be mounted by their normal mounting means (see 3.1), in such a manner that there is at least 1 inch (25.4 mm) of free airspace around each coil, and in such a position with respect to the airstream that the mounting offers substantially no obstruction to the flow of air across and around the coil.

4.8.14.2 Procedure. Coils shall be placed in a cold chamber at -63° $^{+0°}_{-2°}$ C. Ninety-six hours after the coils have reached this temperature, the temperature of the chamber shall be gradually increased to room temperature within a period of not more than 8 hours. Coils shall be examined for evidence of cracks or other mechanical damage.

4.8.15 Vibration (see 3.19 and 6.2.2). Coils shall be tested in accordance with 4.8.15.1 or 4.8.15.2 Unless otherwise specified, high frequency vibration per 4.8.15.1 is applicable.

4.8.15.1 Vibration, high frequency. Coils shall be tested in accordance with method 204 of MIL-STD-202. The following details shall apply:

a. Method of mounting - The coils shall be securely fastened by their normal mounting means (see 3.1 and 6.2.2). Units which are normally supported by their wire leads shall be mounted and soldered to rigidly-supported terminals, so spaced that the length of each lead is 1.25 inch from the coil body.
b. Test-condition letter - D (0.06-inch) double amplitude (maximum total excursion) or 20G, whichever is less, with 10 through 2,000 Hz frequency.
c. Measurement during vibration - Each coil shall be monitored to determine electrical discontinuity by a method which shall at least be sensitive enough to monitor or register, automatically, any electrical discontinuity of 0.1 millisecond or greater duration.
d. Examination after vibration - Coils shall be examined for evidence of physical or mechanical damage, and winding continuity shall be tested as specified in 4.8.6.

4.8.15.2 Vibration, low frequency (when specified (see 3.1 and 6.2.2)). Coils shall be tested in accordance with method 201 of MIL-STD-202. The following details shall apply:

a. Method of mounting - As specified in 4.8.15.1a.
b. Measurement during vibration - As specified in 4.8.15.1c.
c. Examination after vibration - As specified in 4.8.15.1d.

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

a. Method of mounting - Coils 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 to be most detrimental. Cylindrical insulated coils shall be soldered to rigidly-supported terminals, so spaced that the length of each is 0.25 inch from the coil body.
b. Test-condition letter - I.
c. Examination after test - Coils shall be tested for winding continuity as specified in 4.8.6, and examined for evidence of physical or mechanical damage.

4.8.17 Immersion (grade 1 only) (see 3.21). Coils shall be tested in accordance with method 104 of MIL-STD-202. The following details shall apply:

a. Test-condition letter - B.
b. Measurements after final cycle - Units shall be examined for evidence of flow of impregnating material from the case, corrosion, or other visible damage, and winding continuity shall be tested as specified in 4.8.6. For quality conformance inspection, the units shall be subjected to the dielectric withstanding voltage test specified in 4.8.3 at 90 percent of the test voltage specified (see 3.1 and 6.2.2) and to the insulation-resistance test specified in 4.8.5.

4.8.18 Moisture resistance (grades 1 and 2 only) (see 3.22). Coils shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting - On racks. Cylindrical insulated coils shall be 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 coil lead is approximately 0.25 inch when measured from the edge of the supporting terminal to the coil body. For polarization the coils shall be covered with a flat, corrosion-resistant metal strap whose width is equal to the length of the coils and of sufficient thickness to be rigid. A 0.075-inch thick layer of conductive, moisture-resistant, resilient material, having a resistivity of less than 1,000 Ωcm, shall be bonded to the surface of the strap next to the coils. Sufficient contact pressure shall be maintained by applying a compressive force between the strap and a cylindrical, corrosion-resistant, nonconducting rod held beneath the coils, as shown on figure 2. The mounting strap may be used to cover one or more coils at a time. All mounting straps shall be removed to perform steps 7a and 7b, and shall be replaced prior to returning the coils to the humidity chamber.
b. Polarization - Unless otherwise specified (see 3.1 and 6.2.2), during steps 1 to 6 inclusive, a polarizing voltage of 100 V dc shall be applied. The voltage shall be positive with respect to the mounting hardware or case. For coils having no mounting hardware, the polarizing voltage shall be applied as specified (see 3.1 and 6.2.2).
c. Final measurements - Following the 1-1/2 to 3-1/2-hour conditioning period, unless otherwise specified (see 3.1 and 6.2.2), the units shall be removed to room ambient conditions. Within 30 minutes after removal, the dielectric withstanding voltage test specified in 4.8.3 shall be performed at 90 percent of the test voltage specified (see 3.1 and 6.2.2), and the insulation resistance test shall be performed in accordance with 4.8.5 and the units shall be examined for evidence of corrosion. Within 24 hours after these measurements, the specified electrical characteristics (see 3.1 and 6.2.2), shall be measured as specified in 4.8.8 and the units shall be examined for evidence of corrosion.

4.8.19 Fungus (see 3.23). Unless certification is provided, coils shall be tested in accordance with method 508 of MIL-STD-810.

4.8.20 Solderability (see 3.24). Coils shall be tested in accordance with method 208 of MIL-STD-202. (both leads on each unit shall be tested.)

4.8.21 Resistance to solvents (see 3.25). Coils shall be tested in accordance with method 215 of MIL-STD-202. The following details shall apply:

a. Portion of specimen to be brushed - Marked portion of coil.
b. Number of specimens to be tested - See table IV and table VII.
c. Permissible extent of damage to the specimen - See 3.25.

4.8.22 Flammability (see 3.26). Coils shall be tested in accordance with method 111 of MIL-STD-202. The following details and exception shall apply:

a. Point of impingement of applied flame - The flame shall be applied to the body and one end of each coil.
b. Allowable time for burning of visible flame on specimen - 3 minutes maximum.
c. Examinations during and after test - Coils shall be examined for evidence of violent burning which results in an explosive-type fire, dripping of flaming material, and visible burning which continues beyond the allowable duration after removal of the applied flame.

5. PACKAGING

5.1 Preservation-packaging. Preservation-packaging shall be level A or C, or as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Coils shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Coils shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative application. Preservatives shall not be used.

5.1.1.4 Unit packaging. Unless otherwise specified (see 6.2), each coil shall be individually unit packaged in accordance with MIL-P-116, submethod IA-8 insuring compliance with the applicable requirements of that specification. Wire leads shall be maintained in the configuration prescribed in the applicable specification sheet, Military Standard sheet or drawing.

5.1.1.5 Intermediate packaging. Coils, packaged as specified in 5.1.1.4, shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate containers shall be uniform in size, shape and quantities, shall be of minimum tare and cube and shall contain multiples of five unit packages, not to exceed 100 unit packages. No intermediate packaging is required when the total quantity shipped to a single destination is less than 100 unit packages.

5.1.2 Level C. Coils shall be clean, dry and packaged in a manner that will afford adequate protection against corrosion, deterioration and physical damage during shipment from supply source to the first receiving activity. This level may conform to the contractor's commercial practice when such meets the requirements of this level.

5.2 Packing. Packing shall be level A, B, or C, or as specified (see 6.2).

5.2.1 Level A. The packaged coils shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. In lieu of the closure and waterproofing requirement in the appendix of PPP-B-636, closure and waterproofing shall be accomplished by sealing all seams, corners and manufacturer's joint with tape, 2 inches minimum width, conforming to PPP-T-60, class 1 or PPP-T-76. Banding (reinforcement requirements) shall be applied in accordance with the appendix to PPP-B-636 using nonmetallic or tape banding only.

5.2.2 Level B. The packaged coils shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the appendix thereto.

5.2.3 Level C. The packaged coils shall be packed in shipping containers in a manner that will afford adequate protection against damage during direct shipment from the supply source to the first receiving activity. These packs shall conform to the applicable carrier rules and regulations and may be the contractor's commercial practice when such meets the requirements of this level.

5.3 Marking. In addition to any special marking required by the contract or purchase order (see 6.2), each unit package, intermediate and exterior container shall be marked in accordance with MIL-STD-129.

5.4 General.

5.4.1 Exterior containers. Exterior containers (see 5.2.1, 5.2.2, and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

5.4.2 Army procurements.

5.4.2.1 Level A (maximum military protection) unit and intermediate packaging. MIL-P-116 submethod IC-1 shall be used in lieu of submethod IA-8. All intermediate containers shall either be overwrapped with waterproof barrier materials or shall conform to PPP-B-566 or PPP-B-676, variety 2 (see 5.1.1.4, 5.1.1.5, and 6.2).

5.4.2.2 Level A (maximum military protection) and Level B (minimum military protection) packing. For level A packing the fiberboard containers shall not be banded but shall be placed in a close fitting box conforming to PPP-B-601, overseas type; PPP-B-621, class 2, style 4 or PPP-B-585, class 3, style 2 or 3. Closure and strapping shall be in accordance with applicable container specification except that metal strapping shall conform to QQ-S-781, type I, finish A. When the gross weight exceeds 200 pounds or the container length and width is 48 x 24 inches or more and the weight exceeds 100 pounds, 3 x 4 inch skids (laid flat) shall be applied in accordance with the requirements of the container specification. If not described in the container specification, the skids shall be applied in a manner which will adequately support the item and facilitate the use of material handling equipment. For level B packing, fiberboard boxes shall be weather resistant as specified in level A and the containers shall be banded (see 5.2.1 and 5.2.2).

5.4.2.3 Commercial unit packaging and packing. Commercial unit packaging and packing shall conform to the requirements of 5.1.2 and 5.2.3 as applicable (6.2).

5.4.2.4 Commercial marking. All unit, intermediate and exterior containers shall, as a minimum, be marked with the following: Noun (nomenclature), Federal Stock Number (or part number when the NSN is not given), Governemnt contract or purchase order number, quantity, contractor's name and any additional marking which may be required by the contract or the contractor's policy or procedures. Exterior containers shall also be marked with the appropriate address. All markings shall be applied by any means providing legibility.

6. NOTES

6.1 Intended use. The coils covered by this specification are suitable for conventional application. Manufacturers using these parts in printed circuits involing dip-soldering should check the assembly after processing to verify that there is no degradation of the coils.

6.2 Ordering data.

6.2.1 For coils listed in supplement 1. Procurement documents should specify the following:

a. Title, number, and date of this specification.
b. Title, number, and date of applicable specification sheet (or military standard), the military part number, and the complete type designation (see 1.2.1 and 3.1).
c. Levels of preservation-packaging and packing, and applicable marking (see section 5).
d. Method of preservation, if other than submethod IA-8 (see 5.1.1.4 and 5.4.2.1).
e. Special marking, if required.
f. Inspection of commercial packaging (see 4.7.2).

6.2.2 For coils not listed in supplement 1. Procurement documents should specify the following:

a. Title, number, and date of this specification.
b. Grade and class, as indicated by equipment requirements (see 1.2.1.1.1 and 1.2.1.1.2).
   1. Maximum operating temperature (for class C units).
c. Family (see 1.2.1.2).
d. Dimensions, weight, and design and construction including tolerances (see 3.5).
e. Core material.
f. Type of mounting and dimensions including tolerances.
g. Screw threads, if other than in accordance with FED-STD-H28 (see 3.5.1).
   1. Engagement if other than a minimum of 3 full threads (see 3.5.1.1).
h. Whether first article inspection is required (see 3.3), and if so:
   1. The laboratory at which first article inspection is to be performed (see 4.6).
   2. Samples, submission of data, and test routine, if other than that specified (see 3.3.1 and 4.6).
   3. Method of selection of comparison standard, if required (see 6.5).
i. Applicable electrical characteristics, values, tolerances, and operating frequencies (see 4.8.8).
   1. Test frequencies at which they are to be measured.
   2. Whether true inductance is required (see 4.8.8.1).
   3. Whether measurements are to be referred to comparison standards and applicable electrical characteristics to be marked thereon (see 6.5).
   4. Effective inductance (see 4.8.8.1).
   5. End points at which measurements of percent coupling are to be measured (see 4.8.8.4.1).
   6. Self-resonant frequency required (see 4.8.8.3).

j. Marking information (see 3.27).
k. Voltage and current ratings of winding.
l. Dielectric-withstanding test voltage (see 4.8.3).
   1. Points of application of test voltage, if other than that specified (see 4.8.3c).
   2. Whether the unit has special dielectric features requiring a dielectric-withstanding test voltage other than that specified (see 4.8.3b).
m. Altitude rating and applicable test-condition letter for the barometric pressure test, when required. (Applicable only to units rated above 10,000 feet.) (See 4.8.4).
n. Whether insulation resistance measurements are applicable, and if so:
   1. Whether applicable initially, after thermal shock, immersion, and moisture-resistance tests. Insulation resistance is normally applicable, except for single-winding coils without shields or separate mounting means (see 4.8.5).
   2. Test-condition letter and points of measurements (see 4.8.5b).
o. Whether temperature-rise test (see 4.8.9 and 4.8.9.1) is applicable, for units other than cylindrical insulated coils, and if so:
   1. Maximum ambient temperature.
   2. Maximum allowable temperature rise.
   3. Characteristics of current to be applied.
p. Overload test rated current (see 4.8.10).
q. Magnitude of terminal pull, and whether terminal twist test is applicable (see 4.8.12.1 and 4.8.12.2).
r. Whether low-frequency vibration test is applicable (see 4.8.15).
s. Whether shock test is applicable (see 4.8.16).
t. Whether polarization is applicable during moisture-resistance cycling and polarity at specified points of application (see 4.8.18b).
u. The particular complementary document.
v. Inspection of commercial packaging (see 4.7.2).
w. Levels of preservation-packaging and packing required (see 5.1, 5.2, and 5.4.2.3).
x. Method of preservation, if other than submethod IA-8 (see 5.1.1.4 and 5.4.2.1).
y. Special marking, if required (see 5.3).

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 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 the Electronics Research and Development Command, however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-EQ), Dayton Ohio 45444.

6.4 First article inspection. Information pertaining to first article inspection of products covered by this specification should be obtained from the procuring activity for the specific contracts involved (see 3.3).

6.5 Comparison standards. Comparison standards will be established during qualification and first article inspection. The values of electrical characteristics (see 4.8.8) which are to be referred to comparison standards will be marked on or permanently attached to each coil. One unit will be returned to the contractor for use in measuring those characteristics which are to be referred to the comparison standard, and two units will be retained by the Government (see 3.1, 4.5.2.1, and 6.2.2).

6.6 Supersession data. The intermediate and radio-frequency transformers formerly covered by MIL-C-15305C are now covered by MIL-T-55631.

6.7 Dielectric withstanding voltage. The following method can be used in determining the dielectric withstanding voltages required for special coil designs.

Working voltage 1/	RMS test voltage, 60 Hz
<30	100
30 to 174 incl	500
175 to 700 incl	2.8 x working voltage
>700	1.4 x working voltage + 1,000 V

1/ The working voltage is defined as the maximum instantaneous voltage stress that may appear, under normal-rated operation, across the insulation being considered.

6.8 Degradation limits.

6.8.1 Phenolic and iron cores. The degradation limits for phenolic and iron core coils shall not exceed the following limits:

Inductance	±5 percent
Q	±10 percent
Self-resonant frequency	±8 percent
Direct-current resistance	±3 percent + 0.001Ω

6.8.2 Ferrite cores. The degradation limits for Ferrite core coils shall not exceed the following limits:

Inductance	±10 percent
Q	±20 percent
Self-resonant frequency	±15 percent
Direct-current resistance	±5 percent +0.001Ω

The above life test degradation limits shall be used unless otherwise specified.

6.9 In-use condition. When the coils are mounted by their normal mounting means and soldered to their connection.

6.10 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

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

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

User activities:
Army - ME
Navy - AS, CG, MC, SH
Air Force - 19

Preparing activity:
Army - ER

Agent:
DLA - ES

(Project 5950-0550)

APPENDIX

PROCEDURE FOR QUALIFICATION INSPECTION

10. SCOPE

10.1 Scope. This appendix details the procedure for submission of samples, with related data, for qualification inspection of coils covered by this specification. The procedure for extending qualification of the required sample to other coils covered by this specification is also outlined herein.

20. SUBMISSION

20.1 Sample.

20.1.1 Single-type submission. A sample consisting of 27 sample units of each core material, style and individual inductance value for which qualification is sought shall be submitted. Two additional sample units shall be submitted for the fungus test if certification is not provided.

20.1.2 Combined-type submission. A sample consisting of 18 sample units of the lowest inductance value and 18 sample units of the highest inductance value for each style covered by a single specification sheet (or Military Standard) for which qualification is sought shall be submitted. Nine additional samples of any inductance value shall be submitted for group VI tests. Two additional sample units of any inductance value shall be submitted for the fungus test if certification is not provided.

20.2 Description of items. The manufacturer shall submit a detailed description of the coils being submitted for inspection, including the material used for the coil form, encapsulation of molding, type of winding, wire size, insulation, etc.

20.3 Identification for coils. Coils for which a coordinated MS Military Standard exists shall be identified by the type designation of the coil described in the specification. Coils for which MS Military Standards do not exist shall be identified by a type designation and by a descriptive document maintained by the responsible agency.

30. EXTENT OF QUALIFICATION

30.1 Single-type. Qualification shall be restricted to the single-type designation submitted.

30.2 Combined-type submission. Qualification shall be restricted to all of the inductance values within a style covered on a single specification sheet (or military standard) between the values passing qualification inspection.