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MILITARY SPECIFICATION

COIL, RADIO FREQUENCY, FIXED, MOLDED, ESTABLISHED RELIABILITY GENERAL SPECIFICATION FOR

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

1. SCOPE

1 1 Scope This specification covers the general requirements for established reliability fixed, radio frequency, molded coils which are resistant to immersion and moisture. Radio frequency coils meeting the requirements specified herein have failure rate levels ranging from 1.0 percent per 1,000 hours to 0.001 percent per 1,000 hours which are established at a 60 percent confidence level (see 1 2 1.4). The failure rate level identified by the applicable symbol specified in table III is referred to operation at full load cyclic condition at the specified ambient temperature (see 3.1). A part per million (PPM) quality system is used for documenting and reporting the average outgoing quality of coils supplied to this specification. Statistical process control (SPC) techniques are required in the manufacturing process to minimize variation in production of coils supplied to the requirements of this specification.

1.2 Classification.

1.2 1 Part or Identifying Number (PIN) The PIN consists of the letter M, the basic number of the specification sheet, and alphanumeric designators (see 3.1) as shown in the following example:

M39010/01	A	1R0	J	M
Specification sheet number	Class (see 1.2.1.1)	Inductance (see 1.2.1.2)	Inductance tolerance (see 1.2.1.3)	Failure rate level (see 1.2.1.4)

1 2 1.1 Class. The classes of coils denoting the maximum operating temperatures (see 3.1) are identified by a single letter in accordance with table I.

TABLE I. Maximum operating temperature.

Class	Temperature
	°C
A	105
B	125
F	150

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Research Laboratory, ATTN: AMSRL-EP-RD, Fort Monmouth, NJ 07703-5601 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5950

1 2 1 2 Inductance The nominal inductance value expressed in microhenries (μH) is identified by three symbols in accordance with the following

Nominal inductance values less than 10 μH are identified with two numbers representing the significant figures and the letter (R) designating decimal point location

Example 0 12 μH=R12, 1.2 μH=1R2

Nominal inductance values of 10 μH and greater are identified by a 3-digit number The first two digits represent significant figures, and the last digit specifies the number of zeroes to follow.

Example 12 μH=120; 120 μH=121

1.2 1 3 Inductance tolerance The inductance tolerance is identified by a single letter in accordance with table II

TABLE II Inductance tolerance.

Symbol	Tolerance
	percent
J	± 5
K	± 10
L	± 20

1.2 1 4 Failure-rate-level designation. The specified failure rate level per 1,000 hours is initially established at the 60 percent consumer's confidence level and maintained at a 10 percent producer's risk is identified by a single letter in accordance with table III and as described in MIL-STD-690

TABLE III. Failure rate level (established at a 60 percent confidence level)

Symbol	Failure rate level (percent/1,000 hours)
M	1 0
P	0 1
R	0 01
S	0.001

2 APPLICABLE DOCUMENTS

2 1 Government documents

2.1 1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

J-W-1177 - Wire, Magnet, Electrical.
QQ-S-571 - Solder, Tin Alloy. Tin-lead Alloy; and Lead Alloy.

MILITARY

MIL-P-116 - Preservation, Methods of
MIL-F-14256 - Flux, Soldering, Liquid (Rosin Base).
MIL-I-46058 - Insulating Compound, Electrical (For Coating Printed Circuit Assemblies)

(See supplement 1 for list of associated specifications)

STANDARDS

MILITARY

MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts
MIL-STD-454 - Standard General Requirements for Electronic Equipment.
MIL-STD-690 - Failure Rate Sampling Plans and Procedures.
MIL-STD-790 - Product Assurance Program for Electronic and Fiber Optic Parts Specifications
MIL-STD-810 - Environmental Test Methods & Engineering Guildlines.
MIL-STD-1276 - Leads for Electronic Component Parts.
MIL-STD-1285 - Marking of Electrical and Electronic Parts.
MIL-STD-2073-1 - DoD Material Procedures for Development and Application of Packaging Requirements.
MIL-STD-45662 - Calibration Systems Requirements

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094).

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

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

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

(Applications for copies should be addresses to the EIA, 2001 Pennsylvania Ave. N.W., Washington, D.C. 20006.)

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

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual items requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between the requirements of this specification and the specification sheets, the latter shall govern (see 6.2).

3 2 Qualification Coils furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list (QPL) at the time of award of contract (see 4 4 and 6 3) In addition, the manufacturer shall obtain certification from the qualifying activity that the product assurance program requirements of 4.1 have been met and are being maintained for ER coils Authorized distributors which are approved to MIL-STD-790 distributor requirements by the QPL manufacturers are listed in the QPL

3 3 Quality

3 3 1 Product assurance program The product assurance program for coils furnished under this specification shall be established and maintained in accordance with the procedures and requirements specified in MIL-STD-790 and MIL-STD-690 with details and exceptions specified in 4 1 2, 4.4.4, 4 5, and 4.6.2 1 1

3.3.2 Statistical process control (SPC) The contractor shall implement and use statistical process control techniques in the manufacturing process for parts covered by this specification The SPC program shall be developed and maintained in accordance with EIA-557. The SPC program shall be documented and maintained as part of the overall product assurance program as specified in MIL-STD-790 The implementation date for statistical process control for manufacturers qualified to this specification shall be 12 months from the date of this specification For manufacturers initially qualifying to this specification the implementation date for SPC shall be 6 months from the date of initial qualification. The application of SPC techniques should include but are not limited to the following:

a. Coil winding

b Molding dimensions (final)

c Final electricals

d. Final inspection.

e Production monitoring

3.3.3 Quality levels. The quality of lots, that have been subject to and have passed the subgroup 1, 100 percent screening inspections, of the group A inspection, shall be established and maintained in accordance with 4.6.1.2.3 and EIA-554, method B. Individual PPM defect levels (i.e., PPM-2 and -3) and an overall PPM defect level (i e , PPM-5) shall be established, based on the tests prescribed in the subgroup 2 test of the group A inspections The defect level for PPM-2 shall be less than 100 PPM For purposes of meeting 100 PPM requirement for PPM-2, data from all specification sheets may be combined. Data shall not be excluded from the appropriate PPM calculation unless specifically authorized by the qualifying activity. Guidance for exclusion of data is specified in EIA-554. The implementation date for PPM verification for manufacturers qualified to this specification shall be 12 months from the date of this specification For manufacturers initially qualifying to this specification the implementation date for PPM verification shall be 6 months from the date of initial qualification.

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 constructed as a guaranty of the acceptance of the finished product.

3.4.1 Substitution of material. If the supplier 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 Wire

3 4.4 1 Magnet wire. Magnet wire shall conform to J-W-1177 When types and sizes of magnet wire not covered in J-W-1177 are essential in a winding design, other wire may be used with the approval of the qualifying activity

3 4.5 Solder and soldering flux Solder shall be in accordance with QQ-S-571 and shall have a liquidus melting point greater than +270°C and a plastic stage not to exceed +10°C. The plastic stage is the duration between solid and liquid Flux shall be in accordance with MIL-F-14256, type R or RMA.

3.5 Design, construction, and physical dimensions. Coils shall be of the design, construction, and physical dimensions specified (see 3 1)

3.5.1 Terminals. Terminals shall be of the shape and physical dimensions specified (see 3 1 and 6 1).

3.5 1 1 Solderable/weldable lead terminals Unless otherwise specified, the manufacturer shall verify by certification that all leads conform to type LW(---)C-52 in accordance with MIL-STD-1276 The maximum thickness of 200 microinches is not applicable. Tin plating is prohibited on leads as a final finish (see 6.6) Use of tin-lead (Sn-Pb) finishes are acceptable provided the minimum lead content is 3 percent.

3.5.1.2 Winding ends The ends and end turns shall be secured in such a manner as to anchor them securely in place. The length of leads from windings shall be as short as practicable. The termination of element to terminal shall not depend on solder or welding alone to attain mechanical strength.

3.5.2 Solder dip (retinning). The manufacturer (or his authorized category B or C distributor) may solder dip/retin the leads of coils supplied to this specification, provided the solder dip process has been approved by the qualifying activity.

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

a. When the original lead finish qualified was hot solder dip lead finish 52 in accordance with MIL-STD-1276 (NOTE: The 200 microinch maximum thickness is not applicable). The manufacturer shall use the same solder dip process for retinning as was used in the original manufacture of the coil.

b When the lead originally qualified was not solder dip lead finish 52 of MIL-STD-1276 as prescribed in (a), approval for the process to be used for solder dip shall be based on the following procedure·

(1) Thirty samples of any inductance value for each style and lead finish shall be subjected to the manufacturer's solder dip process The coils shall then be subjected to all group A electricals No defects are allowed.

(2) Ten of the 30 samples shall then be subjected to the solderability test, with no defects allowed

(3) The remaining 20 samples shall be subjected to the resistance to soldering heat test, followed by the moisture resistance test, with no defects allowed

3.5.2.2 Solder dip/retinning options. The manufacturer may solder dip/retin as follows:

a. After group A tests. Following the solder dip/retinning process, the electrical measurements required in group A, subgroup 1 tests shall be repeated on the lot The group A, subgroup 1, lot rejection criteria shall be used. Following these tests, the manufacturer shall submit the lot to the group A solderability test as specified in 4.7.12.

b As a corrective action if the lot fails the group A solderability test

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

3 6 Thermal shock When coils are tested as specified in 4.7 2, there shall be no dielectric breakdown nor impairment of protective coatings, and the insulation resistance shall be as specified in 3 10

3 7 Electrical characteristics The electrical characteristics shall be as specified (see 3 1 and 4 7 3)

3 7 1 Inductance When coils are tested as specified in 4 7.3 1, the inductance shall be as specified (see 3 1 and 6 1)

3 7 2 Q of coils When coils are tested as specified in 4 7 3.2, the Q shall be as specified (see 3 1)

3 7 3 Self-resonant frequency. When coils are tested as specified in 4 7.3 3, the self-resonant frequency shall be not less than the minimum value specified (see 3.1)

3 7 4 Percent coupling (when specified). When coils are tested as specified in 4.7 3 4 or 4 7.3 4.1, the percent coupling shall be as specified (see 3 1)

3 7 5 Incremental current inductance change (when specified) When coils are tested as specified in 4 7.3 5, inductance value shall represent a change of 5 percent or less of the inductance measured with zero dc current (see 3.1).

3.7 6 DC resistance When coils are tested as specified in 4.7.3 6, the dc resistance shall be as specified (see 3.1).

3 8 Dielectric withstanding voltage. When coils are tested as specified in 4.7 4, there shall be no arcing, flashover, breakdown, nor other damage, and the leakage current shall not exceed 100 microamperes.

3 9 Barometric pressure (when applicable). When coils are tested as specified in 4.7.5, there shall be no arcing, breakdown, flashover, nor other damage, and the leakage current shall not exceed 100 microamperes.

3 10 Insulation resistance When measured as specified in 4 7.6, the insulation resistance shall be not less than 1,000 megohms.

3.11 Winding continuity (when applicable) When coils are tested as specified in 4 7.7, all windings shall be electrically continuous.

3 12 Temperature rise. When coils are tested as specified in 4.7.8 or 4 7 8 1, the temperature rise of any winding above the specified maximum ambient temperature (see 3 1), shall not exceed the value specified (see 3 1), and there shall be no evidence of physical damage

3 13 Overload When coils are tested as specified in 4.7 9, there shall be no evidence of cracked cases, no loosening of the terminals or other mechanical damage

3.14 Resistance to soldering heat. When coils are tested as specified in 4.7.10, there shall be no evidence of mechanical damage, loosening of terminals or solder reflow as evidenced by solder flowing from the body.

3 15 Terminal strength When coils are tested as specified in 4.7 11, there shall be no winding discontinuity, no loosening or rupturing of the terminals, nor other mechanical damage.

3.16 Solderability. When coils are tested as specified in 4.7 12, the one-inch portion of the dipped surface of the leads closest to the body shall be at least 95 percent covered with a new, smooth, solder coating. The remaining 5 percent may contain only small pinholes or rough spots, these shall not be concentrated in one area Bare base metal where the solder dip failed to cover the original coating is an indication of poor solderability, and shall be cause for failure. In case of dispute, the percent of coverage with pinholes or rough spots shall be determined by actual measurement of these areas, as compared to the total area Electrical connections shall be mechanically secure before soldering, and electrically continuous after soldering.

3.17 Resistance to solvents (nonlaser marked units only). When coils are tested as specified in 4.7.13, there shall be no evidence of mechanical damage and the marking shall remain legible

3 18 Flammability When coils are tested as specified in 4 7 14, 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 (see 6 4) 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 19 Low-temperature storage. When coils are tested as specified in 4 7.15, there shall be no impairment of protective coating, no loosening of the windings or terminals, nor any other evidence of mechanical damage

3 20 Vibration When coils are tested as specified in 4 7 16 there shall be no winding discontinuity (see 3 11), nor evidence of physical or mechanical damage.

3 21 Shock (specified pulse). When coils are tested as specified in 4 7 17, there shall be no winding discontinuity (see 3.11), nor evidence of physical or mechanical damage.

3.22 Moisture resistance. When coils are tested as specified in 4.7 18, the dielectric withstanding voltage shall meet the requirements specified in 3 8, the insulation resistance shall be as specified in 3 10, the electrical characteristics shall be as specified in 3 7, and there shall be no evidence of corrosion affecting the mechanical or electrical operation.

3.23 Life.

3.23 1 Qualification inspection. When coils are tested in accordance with 4.7 19, there shall be no evidence of mechanical damage. Initial measurements shall be in accordance with the "Electrical characteristics (initial)" requirements of the individual component specification sheet. Succeeding measurements up to and including the 2,000 hours shall be in accordance with the "Electrical characteristics (final)" requirements of the individual components specification sheet (see 3.1).

3.23.2 Failure rate (FR) level determination (extended FR test). When coils are tested in accordance with 4 7 19, there shall be no evidence of mechanical damage. Initial measurements shall be in accordance with the "Electrical characteristics (initial)" requirements of the individual component specification sheet Succeeding measurements up to and including the 10,000 hours shall be in accordance with the "Electrical characteristics (final)" requirements of the individual components specification sheet (see 3 1).

3.24 Fungus Materials used in the construction of coils shall be fungus inert in accordance with requirement 4 of MIL-STD-454 (see 4.7.20).

3.25 Marking. Coils shall be marked as specified herein. Paper labels shall not be used. Other markings which in any way interfere with, obscure, or confuse those specified herein, are prohibited. Each coil shall be legibly marked that will with stand the environmental conditions specified herein At the option of the manufacturer, coils may be laser marked. The marking shall remain legible after all tests.

3 25.1 Marking legibility (laser marking only). When tested as specified in 4.7.1.3 the marking shall remain legible.

3.25.2 Full marking Marking shall be in accordance with method I of MIL-STD-1285. Unless otherwise specified (see 3.1), coils shall be marked with the PIN, manufacturer's CAGE (Commercial and Government Entity) code, JAN marking, date code, and lot symbol as shown in the following example: (see 6.2).

Example:	M39010/ D1A1R0KM	PIN
	JAN 7233A	JAN marking, date code, and lot symbol
	12345	Manufacturer's CAGE code

At the option of the manufacturer, three lines may be used for the PIN In this event the divisions shall be as specified in the following example

Example	M39010	
	/01A	PIN
	1ROKM	
	J7233A	JAN marking, date code, and lot symbol
	12345	Manufacturer's CAGE code

3 25.3 JAN and J marking The United States Government has adopted, and is exercising legitimate control over the certification marks "JAN" and "J", respectively, to indicate that items so marked or identified are manufactured to, and meet all the requirements of military specifications. Accordingly, items acquired to, and meeting all of the criteria specified herein and in applicable specifications shall bear the certification mark "JAN" except that items too small to bear the certification mark "JAN" shall bear the letter "J" The "JAN" or "J" shall be placed immediately before the PIN except that if such location would place a hardship on the manufacturer in connection with such marking, the "JAN" or "J" may be located on the first line above or below the PIN. Items furnished under contracts or orders which either permit or require deviation from the conditions or requirements specified herein or in applicable specifications shall not bear "JAN" or "J". In the event an item fails to meet the requirements of this specification and the applicable specification sheets or associated detail specifications, the manufacturer shall remove the "JAN" or the "J" from the sample tested and also from all items represented by the sample. The "JAN"' or "J" certification mark shall not be used on products acquired to contractor drawings or specifications. The United States Government has obtained Certificate of Registration Number 504,860 for the certification mark "JAN".

3.25.4 Supplying to higher failure rate levels. A manufacturer may supply to all higher failure rate levels than that to which he is qualified. Items of an exponential failure rate level as shown in table IV and marked to lower failure rate levels with procuring agency approval, are substitutable for higher failure rate levels, and shall not be remarked unless specified in the contract or purchase order (see 6.2), the lot date codes on the parts are unchanged, and the workmanship criteria is met

TABLE IV. Failure rate level substitution.

Parts qualified to failure rate level	Are substitutable for failure rate level
S	M, P and R
R	M and P
P	M

3 25.5 Supplying to lower inductance tolerance levels. Parts qualified to lower inductance tolerance levels with procuring activity approval are suitable for higher tolerance levels as long as the label reflects the correct inductance (see table V). Parts that are physically marked shall not be remarked unless specified in the contract or purchase order (see 6.2).

TABLE V. Inductance tolerance substitution.

Parts qualified to inductance tolerance	Are substitutable for inductance tolerance
J(5)	K(10), L(20)
K(10)	L(20)

3.26 Workmanship. Coils shall be processed in such a manner as to be uniform in quality and free of defects that will affect life, serviceability, or appearance.

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 (examinations and tests) as specified herein Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4 1 1 Responsibility for compliance All items shall meet all requirements of sections 3 and 5 The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material

4 1.2 Product assurance program A product assurance program shall be established and maintained in accordance with MIL-STD-790. Evidence of such compliance shall be verified by the qualifying activity of this specification as a prerequisite for qualification and continued qualification.

4 1.3 Statistical process control (SPC). An SPC program shall be established and maintained in accordance with EIA-557. Evidence of such compliance shall be verified by the qualifying activity as a prerequisite for qualification and retention of qualification.

4 1.4 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-STD-45662.

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

a. Qualification inspection (see 4.4).

b Verification of qualification (see 4.5).

c. Quality conformance inspection (see 4.6)

4 3 Inspection conditions Unless otherwise specified, all inspections shall be performed in accordance with the test conditions as specified in the "General Requirements" of MIL-STD-202 The exception to those conditions is the Relative Humidity which should be in the range of 15 percent to 75 percent.

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

4.3 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 3.3 Demagnetization. When necessary to overcome remanence effects, demagnetization is permitted.

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

4.4.1 Sample size. The number of sample units comprising a sample of coils to be submitted for qualification inspection shall be as specified in the appendix to this specification, and table VI.

4.4.2 Test routine Sample units shall be subjected to the qualification inspection specified in table VI in the order shown. All sample units except group III, shall be subjected to the inspection of group I. The sample units shall then be divided as specified in table VI and subjected to the inspection for their particular group.

4 4 3 Failures Failures in excess of those allowed in table VI shall be cause for refusal to grant qualification approval

4 4 4 Failure rate level and quality level verification

4 4 4 1 Failure rate (FR) qualification Failure rate qualification shall be in accordance with the general and detailed requirements of MIL-STD-690 with the following details

a Procedure I - Qualification at the initial FR level. Level M (1 percent/1,000 hours) of FRSP-60 shall apply Sample units shall be subjected to the qualification inspection specified in group VI, table VI The entire life test sample shall be continued on test to 10,000 hours as specified in 4.7.19 upon completion of the 2,000 hour qualification.

b Procedure II - Extension of qualification to lower FR levels. To extend qualification to the R (0 01 percent) and S (0.001 percent) FR levels, data from two or more classes of all core materials may be combined.

c Procedure III - Maintenance of FR level qualification Maintenance period B of FRSP-10 shall apply. Regardless of the number of production lots produced during this period, the specified number of unit hours shall be accumulated to maintain qualification (see 4.6 2 1 1) For FR levels R and S data from all classes and core materials may be combined.

4 4 4 2 Quality level verification The contractor is responsible for establishing a quality system to verify the PPM defect level of lots that are subjected to subgroup 2 tests of the group A inspections The PPM defect level shall be maintained for each specification sheet. The PPM defect level shall be based on a 6-month moving average The contractor shall verify and report individual PPM categories (i.e., PPM-2 and PPM-3) and an overall PPM defect level (i e , PPM-5). In the event that the contractor meets or exceeds 100 PPM for PPM-2 the qualifying activity shall take action specified in 4.4.4.3

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

4.5 Verification of qualification. Every six months the manufacturer shall compile a summary of the results of quality conformance inspections and, where applicable, extended FR test data, in the form of a verification of qualification report, and forward it to the qualifying activity as the basis of continued qualification approval In addition to the periodic submission of FR test data, the manufacturer shall immediately notify the qualifying activity whenever the FR data indicates that the manufacturer has failed to maintain his qualified FR level. Continuation shall be based on evidence that, over the six month period, the following has been met

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

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

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

d Requirements for group B inspection are met.

e The records of all FR tests combined substantiate that the M (1.0 percent) or P (0.1 percent) FR levels have been maintained or that the manufacturer continues to meet the R (0.01 percent), or S (0.001 percent) FR level for which qualified, although the total component hours of testing does not, as yet, meet the requirements of 4.4.4.1c.

f The contractor shall provide documentation to the qualifying activity pertaining to PPM calculations including numbers of parts in accordance with style tested, individual PPM defect categories (i.e., PPM-2 and -3) and the overall PPM defect rate (PPM-5). This information shall be submitted on a specification sheet basis.

If group B requirements were not met and the manufacturer has taken corrective action satisfactory to the Government, the forwarding of the verification of qualification report may be delayed until within 30 days after completion of retesting of the periodic quality conformance tests In this case, the qualifying activity shall be notified on this condition within the time that the original verification of qualification report was due All reports shall be certified by a responsible company official and the Government inspector The qualifying activity shall be contacted for the report format

4.5 1 Records Test records shall be in accordance with the format in MIL-STD-690

4.6 Quality conformance inspection

4 6 1 Inspection of product for delivery Inspection of product for delivery shall consist of group A inspection

4.6.1 1 Inspection and production lot.

4 6 1 1 1 Inspection lot An inspection lot shall consist of all the coils of the same class and core material 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 product lot for that period. The total number of pieces in any given lot submitted for quality conformance inspection shall not exceed the number of pieces accumulated from one month's production.

4.6 1.1.2 Production lot. A production lot shall consist of all coils of a single PIN. Manufacture of all parts in the lot shall have been started, processed, assembled, and tested as a group Lot identity shall be maintained throughout the manufacturing cycle

4.6 1.2 Group A inspection Group A inspection shall consist of the inspections specified in table VII, in the order shown.

4.6.1.2.1 Subgroup 1 tests. Subgroup 1 tests shall be performed on a production lot basis on 100 percent of the product supplied under this specification. Coils failing the tests of subgroup 1 shall be removed from the lot If during the 100 percent inspection, screening requires more than 5 percent of the coils be discarded, the entire lot shall be rejected.

TABLE VI. Qualification inspection

Inspection	Requirement paragraph	Method paragraph	Number of 1/ sample units to be inspected	Number of defectives allowed
Group IA (screening test) 2/				
Thermal shock	3 6	4 7 2	All units (except group III)	N/A
Electrical characteristics (initial)	3 7	4 7 3		
Inductance	3 7 1	4 7.3 1		
Q of coils	3 7.2	4 7.3.2		
Self-resonant frequency	3.7.3	4 7 3.3		
DC resistance	3.7.6	4.7 3 6		
Group IB				
Other electrical characteristics (see 3.1)				
Percent coupling (when specified)	3 7.4	4 7.3.4 or 4 7 3 4 1	All units (except group III)	0
Incremental current inductance change	3 7.5	4.7 3.5		
Visual and mechanical inspection (external)	3.1, 3 4 to 3.5 1 inclusive 3.5 3, 3.25 and 3.26	4 7.1		
Group II				
Dielectric withstanding voltage	3.8	4 7 4	20	1
Barometric pressure (when applicable)	3.9	4.7.5		
Insulation resistance	3 10	4 7.6		
Temperature rise	3 12	4.7.8		
Overload 3/	3.13	4 7.9		
Resistance to soldering heat	3 14	4 7 10		
Terminal strength	3 15	4.7 11		
Electrical characteristics (final)-	3 7	4 7.3		
Inductance	3.7.1	4 7.3.1		
Q of coils	3 7.2	4 7.3 2		
Group III				
Solderability 4/	3 16	4 7 12	6	0
Resistance to solvents 4/ (nonlaser marked units only)	3.17	4 7 13	4	
Flammability (use 3 units from solderability)	3.18	4.7.14	(3)	

See footnotes at end of table

TABLE VI Qualification inspection - Continued

Inspection	Requirement paragraph	Method paragraph	Number of 1/ sample units to be inspected	Number of defectives allowed
Group IV				
Low temperature storage	3 19	4.7 15	20	1
Vibration	3 20	4 7 16		
Shock (specified pulse)	3.21	4 7 17		
Moisture resistance	3.22	4 7 18		
Electrical characteristics (final)	3.7	4.7 3		
Group V				
Visual and mechanical inspection (internal) (Only 3 samples need be dissected)	3 1, 3 4 to 3 4.4 1 inclusive and 3.26	4 7 1		
Group VI				
Life	3.23	4 7.19	102	1
Group VII				
Fungus 5/	3.24	4.7 20	10	0

1/ Combined submission will be in accordance with the appendix (see 30 1.2).
2/ Thermal shock, Inductance and Q, need not be performed if the manufacturer presents certified data proving that tests have been previously performed as part of Group A inspections.
3/ After the overload test is performed, a period of 24 hours shall elapse prior to taking electrical characteristics (final) measurements.
4/ The units shall be clean units that have not been subjected to any other test.
5/ The fungus requirement is either by certification or performance.

TABLE VII Group A inspection

Inspection	Requirement paragraph	Method paragraph	Sampling plan
Subgroup 1			
Thermal shock	3 6	4 7 2	100% inspection
Electrical characteristics 1/			
Inductance	3 7.1	4 7 3 1	100% inspection
Q of coils	3 7 2	4 7 3 2	100% inspection
Subgroup 2 (PPM)			
Inductance (PPM-2)	3.7 1	4 7 3 1	see table VIII
Q of coils (PPM-2)	3 7 2	4 7 3 2	
Self-resonant frequency (PPM-2)	3 7 3	4 7 3 3	
DC resistance (PPM-2)	3 7 6	4 7.3 6	
Dimensions (PPM-3)	3.5	4 7 1 1	
Subgroup 3			
Visual (external)			see table VIII
Marking	3.25	4.7.1 1	
Workmanship	3.26	4 7.1 1	
Subgroup 4			
Solderability	3 16	4 7 12	13 samples 0 failures see 4.6 1.2 5

1/ Coils shall meet the specified initial inductance and Q values.

TABLE VIII Group A sampling plan.

Lot size	Subgroup 2 Sample size	Subgroup 3 Sample size
2 to 13	100 percent	100 percent
14 to 124	100 percent	13
125 to 150	125	13
151 to 280	125	20
281 to 500	125	29
501 to 1,200	125	34
1,201 to 3,200	125	42
3,201 to 10,000	192	50
10,001 to 35,000	294	60
35,001 to 150,000	294	74
150,001 to 500,000	345	90
500,001 and over	435	102

4 6 1 2.2 Manufacturer's production inspection. If the manufacturer performs tests similar to those specified in subgroup 1, table VII, as the final step of his production process, group A, subgroup 1 inspection may be waived and the data resulting from the manufacturer's production tests may be used instead. Authority to waive the subgroup 1 inspection shall be granted by the qualifying activity only The following criteria must be complied with.

a Tests conducted by the manufacturer during production shall be clearly identical to or more stringent than that specified for subgroup 1

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

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

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

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

4.6.1.2.3 Subgroup 2 test (PPM categories).

4 6 1.2.3.1 Sampling plans Subgroup 2 tests shall be performed on an inspection lot basis Samples subjected to subgroup 2 shall be selected in accordance with table VIII based on the size of the inspection lot. In the event of 1 or more failures the lot shall be rejected. Equipment and operators used to perform the subgroup 2 tests shall not be the same as those used in the subgroup 1, 100 percent tests.

4.6 1.2 3.2 Rejected lots. The rejected lot shall be separated from new lots and those lots that have passed inspection The rejected lot shall be 100 percent inspected for those quality characteristics found defective in the sample and any defectives found removed from the lot. A new sample of parts shall then be randomly selected in accordance with table VIII If 1 or more defects are found in this second sample the lot shall be rejected and shall not be supplied to this specification.

4.6 1 2.3.3 PPM calculations PPM calculations shall be based on the results of the first sample check as prescribed in 4.6.1.2.3 1. (NOTE: PPM calculations shall not use data on the second sample submission).

4 6.1.2.4 Subgroup 3 A sample of parts shall be randomly selected in accordance with table VIII. If one or more defects are found, the lot shall be rescreened and defects removed. After screening and removal of defects, a new sample of parts shall be randomly selected in accordance with table VIII, if one or more defects are found in the second sample, the lot shall be rejected and shall not be supplied to this specification.

4.6 1.2.5 Subgroup 4

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

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

a. If only a portion of the inspection lot is suspected as being defective a "sublot" breakdown can be established to assist in verifying that condition. This sublotting can be based on size, value, date lot code, or other factors that could have made the processing of the other sublots different from the parts sampled and which failed the first sample.

Each sublot must contain a complete sample size and be accepted or rejected on zero accept criteria In any case the sublot category that failed in the original submission will not be allowed to be shipped until after that sublot is reworked and has passed the subsequent resubmission If the sublots that did not fail in the original submission pass after individual sampling they may be shipped as good lots Sublot groupings that fail the solderability test may be tested at the production lot level 4 6 1 2 5.2b or reworked and retested as described in procedure 4 6 1 2 5 2c

b Each production lot that was used to form the original inspection lot may be individually submitted to the solderability test as required in 4 6 1 2 5 a Production lots that pass the solderability test are available for shipment Production lots failing the solderability test may be reworked and retested as described in the procedure of paragraph 4 6 1 2.5.2c

c The manufacturer submits the failed lot(s) to a 100 percent hot solder dip using an approved dip process in accordance with 3.5 2 2 A new inspection lot or lots are formed and thirteen additional samples shall then be selected from each of these lots and subjected to the solderability test with zero defects allowed If the lot(s) fails this solderability test the lot(s) may be reworked a second time and retested If the lot(s) fails this second rework the lot(s) shall be considered rejected and shall not be furnished against the requirements of this specification Following the hot solder dip and successful completion of the resubmitted sample testing the electrical measurements required in group a subgroup 1 tests shall be repeated on 100 percent of the lot(s) The percent defective allowable (PDA) for the electrical measurements shall be as for the subgroup 1 tests

4.6 1.2.5 3 Disposition of samples The solderability test is considered a destructive test and samples submitted to the solderability test shall not be supplied on the contract or purchase order

4.6.2 Periodic inspection Periodic inspection shall consist of group B inspection Except as specified in 4.6 2 1 3, delivery of products which have passed group A inspection shall not be delayed pending the results of group B inspection.

4.6 2.1 Group B inspection Group B inspection shall consist of the tests specified in table IX, in the order shown, and shall be performed on sample units of each class and core material and selected from lots that have passed group A inspection

4 6.2 1 1 Sampling plan

4 6 2.1 1 1 Monthly (subgroup 1) Test samples shall be selected from each class and core material produced during a one-month period These samples shall be accumulated and placed on the life test as specified in 4 7 19, once a month, for the full 10,000-hour-life test period The test sample size shall be determined by the manufacturer so that the unit hours generated meet the maintenance of qualification requirements specified for the qualified failure rate level (see 4.4 4) In any event a minimum of 5 samples shall be selected from each class and core material As far as is practicable the inductance values tested during maintenance period shall be representative of the class and core material produced during this period. The accumulated data shall be used for maintenance and extension of failure rate qualification.

4.6.2.1 1 2 Quarterly (subgroup 2) Every 3 months, 4 sample units of any inductance value shall be subjected to subgroup 2 inspection.

4 6 2.1 1.3 Quarterly (subgroup 3) Every 3 months, 12 sample units of any inductance value shall be inspected

4.6.2 1.1.4 Yearly (subgroup 4). Every year, 12 sample units of any inductance value shall be inspected.

4.6 2 1.2 Disposition of sample units. Sample units which have been subjected to group B inspection shall not be delivered on the contract or order

TABLE IX Group B inspection.

Inspection	Requirement paragraph	Method paragraph	Number of sample units to be inspected	Number of defectives allowed
Subgroup 1 (Monthly)				
Life (extended)	3.23	4.7 19	(see 4 6 2 1 1 1)	
Subgroup 2 (Quarterly)				
Resistance to solvents 1/ or Marking legibility 2/ (as applicable)	3.17 3.25 1	4.7 13 4.7.1.3	4	0
Subgroup 3 (Quarterly)				
Electrical characteristics (initial)	3.7	4.7.3		
Inductance	3.7 1	4.7.3 1		
Q of coils	3.7.2	4.7.3.2		
Percent coupling (when specified)	3 7 4	4 7.3.4		
Incremental current inductance change (when specified)	3 7.5	4.7.3.5		
Dielectric withstanding voltage	3.8	4 7.4		
Barometric pressure	3 9	4.7.5		
Insulation resistance	3 10	4 7.6		
Temperature rise	3.12	4.7.8	12	1
Overload 3/	3.13	4.7.9		
Resistance to soldering heat	3 14	4.7.10		
Terminal strength	3.15	4.7 11		
Electrical characteristics (final)				
Inductance	3.7.1	4.7.3.1		
Q of coils	3.7.2	4.7.3.2		
Subgroup 4 (Yearly)				
Electrical characteristics (initial)	3 7	4 7 3		
Low temperature storage	3 19	4.7 15		
Vibration	3.20	4.7.16		
Shock (specified pulse)	3.21	4.7.17	12	1
Moisture resistance	3.22	4.7 18		
Electrical characteristics (final)	3.7	4.7.3		

1/ Nonlaser marked units.
2/ Laser marked units only
3/ After overload test is performed, a period of 24 hours shall elapse prior to taking electrical characteristics (final) measurements for ferrite core coils only.

4 6 2 1 3 Noncompliance If a sample fails to pass group B inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are manufactured under essentially the same materials and processes, and which are considered subject to the same failure Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken After the corrective action has been taken group B inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed, at the option of the qualifying activity). Group A inspection may be reinstituted, however, final acceptance and shipment shall be withheld until the group B inspection has shown that the corrective action was successful In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4 7 Methods of inspection

4 7 1 Visual and mechanical inspection.

4 7 1 1 External Coils shall be inspected 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 5.1 inclusive, 3 5 3, 3 25, and 3.26).

4 7 1.2 Internal Coils shall be inspected to verify that the materials, internal design, construction, and workmanship are in accordance with the applicable requirements (see 3.1, 3 4 to 3 4.4 1 inclusive, and 3.26).

4 7 1.3 Marking legibility (laser marking only, see 3.25 1). Coils shall be coated with .005 (0 13 mm) minimum of silicone resin insulating compound, type SR of MIL-I-46058 After curing, coated coils shall be examined for legibility under normal production room lighting by an inspector with normal or corrected 20/20 vision

4.7.2 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 (25 cycles). Step 3 shall be at the maximum temperature of the class.

b. After the test, coils shall be inspected for evidence of cracked cases, distorted or softened insulation, or loosened windings or terminals.

4 7.3 Electrical characteristics (see 3.1 and 3 7) 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.

4.7.3.1 Inductance Unless otherwise specified (see 3 1), effective inductance of coils shall be measured at the frequency specified. For cylindrical coils, the test procedures of 4 7.3.1.1 and 4.7.3.1.2 shall be used. (Note: Hewlett Packard model HP4342A is the preferred equipment as reference standard)

When true inductance is specified (see 3.1), 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 $\frac{1}{fo^2}$ 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

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

4 7.3 1.1 Effective inductance for cylindrical coils (inductance 0 10 to 10 0 microhenries, inclusive) The tests shall be performed using a meter such as Hewlett Packard model 260A, HP4342A, HP250RX, or equivalent at appropriate test frequencies as listed in the instructions for the test equipment 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.

Range, µH	Reference test frequency (MHz) for 260A 1/
0 10 to 1 0 inclusive	25.0
Above 1.0 to 10.0 inclusive	7.9

Inductance range, µh	Test frequency (MHz) for HP4342 1/
0 10 to 1.0 inclusive	25 1730 ±0.1 percent
Above 1 0 to 10.0 inclusive	7 96180 ±0.1 percent

1/ Where improved test repeatability is required (qualification, Group B maintenance and/or supplier/customer correlation) results shall be obtained while maintaining test frequency using an external Frequency Counter within the following limits:

Inductance range, µh	Test frequency (MHz) for 260A	
	minimum	maximum
0.10 to 1.0 inclusive	24.9997	25.0003
Above 1.0 to 10.0 inclusive	7 89997	7 90003

Inductance range, µh	Test frequency (MHz) for HP4342A	
	minimum	maximum
0.10 to 1.0 inclusive	25.1727	25.1733
Above 1 0 to 10.0 inclusive	7 96177	7.96183

Allowance shall be made for the internal inductance of the meter and the test fixture as determined in 4.7.3.1.1.1.

4 7 3 1.1.1 Effective inductance. Effective inductance shall be determined as follows when using test fixture TF-A, as applicable, on figure 1. 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 2 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 The frequency shall be monitored in order to obtain an accuracy of 0.1 percent. This resonant frequency value in megahertz (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 test fixture shall be calculated from:

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

Where:

L_{cf} = inductance in microhenries of the test fixture and residual inductance of the Q meter.
f = frequency in megahertz.
C = capacitance in microfarads.
L_b = calculated inductance in microhenries of the shorting bar as determined from the following formula:

$$L_b = 0.002l \cdot \left(2\ 303 \log_{10}\frac{4l}{d} - 1 + \frac{d}{2l}\right)$$

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 4.7.3.1.1. 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 turned 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 microhenries of coils.
- L_d = inductance dial reading in microhenries.
- L_{cf} = correction factor for inductance of test fixture and residual inductance of the Q meter in microhenries.

4.7.3.1.2 Effective inductance for cylindrical coils (inductance greater than 10 microhenries). Test as specified in 4.7.3.1.1, 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: (Note: Hewlett Packard model HP4342A is the preferred equipment as reference standard)

Inductance range, µH	Reference test frequency (MHz) for 260A
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

Where improved test repeatability is required (qualification, Group B maintenance and/or supplier/customer correlation) results shall be obtained while maintaining test frequency within the following limits:

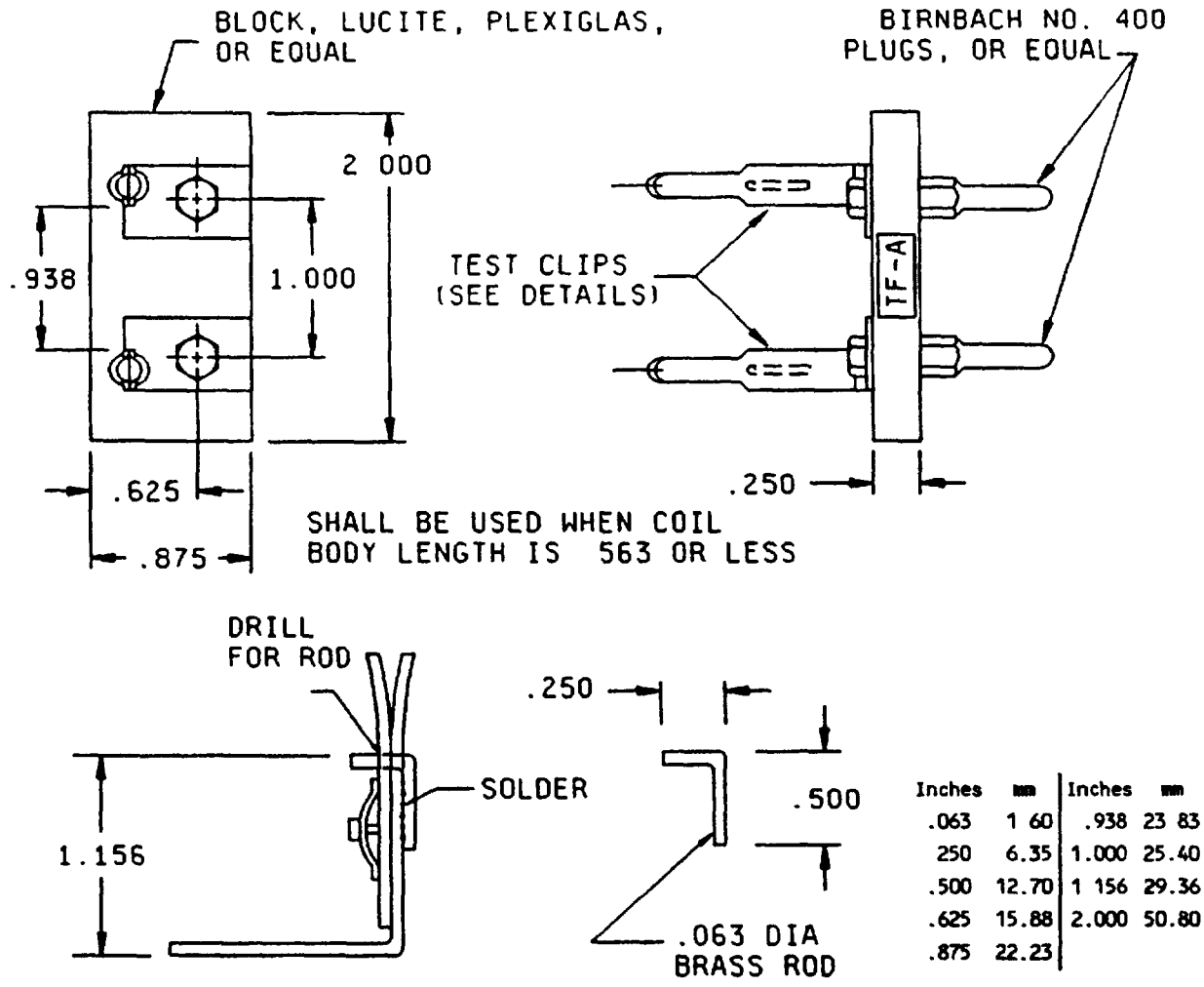
Inductance range, µh	Test frequency (MHz) for 260A	
	minimum	maximum
Above 10.0 to 100.0 inclusive	2.49997	2.50003
Above 100.0 to 1,000.0 inclusive	.789997	.790003
Above 1,000.0 to 10,000.0 inclusive	.249997	.250003
Above 10,000.0 to 100,000.0 inclusive	.0789997	.0790003

Inductance range, µh	Test frequency (MHz) for HP4342
Above 10.0 to 100.0 inclusive	2.51730 ±0.1 percent
Above 100.0 to 1,000.0 inclusive	.79618 ±0.1 percent
Above 1,000.0 to 10,000.0 inclusive	.251730 ±0.1 percent
Above 10,000.0 to 100,000.0 inclusive	.079618 ±0.1 percent

Where improved test repeatability is required (qualification, Group B maintenance and/or supplier/customer correlation) results shall be obtained while maintaining test frequency within the following limits:

Inductance range, µh	Test frequency (MHz) for HP4342A	
	minimum	maximum
Above 10.0 to 100.0 inclusive	2.51727	2.51733
Above 100.0 to 1,000.0 inclusive	.796177	.796183
Above 1,000.0 to 10,000.0 inclusive	.251727	.251733
Above 10,000.0 to 100,000.0 inclusive	.0796177	.0796183

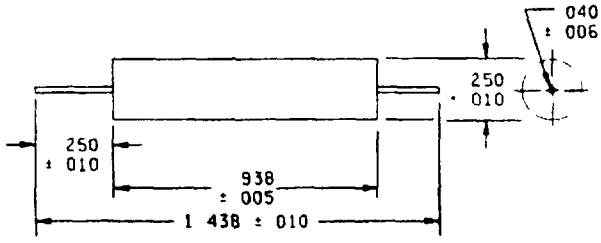
4.7.3.2 Q of coils. The test shall be performed using a Q meter such as Hewlett Packard model 260A, HP4342A, or equivalent. Suitable means shall be used to calibrate the frequency dial of the Q meter and the Q-standard within ±0.1 percent of the applicable test frequency. Frequencies to be used for testing the various ranges of inductance shall be as specified in 4.7.3.1.1 and 4.7.3.1.2. The appropriate test fixture, as applicable, as shown on figure 1 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.



Inches	mm	Inches	mm
.063	1 60	.938	23 83
250	6.35	1.000	25.40
.500	12.70	1 156	29.36
.625	15.88	2.000	50.80
.875	22.23		

NOTES
1. Dimensions are in inches.
2. Unless otherwise specified, tolerance is ±.005 (0.13 mm).
3. Letters in blocks to be marked on fixture.
4. Metric equivalents are given for general information only
5. The entire test clip will be made of brass.

FIGURE 1 Test fixture TF-A (for axial leads) or equivalent



COPPER OR BRASS

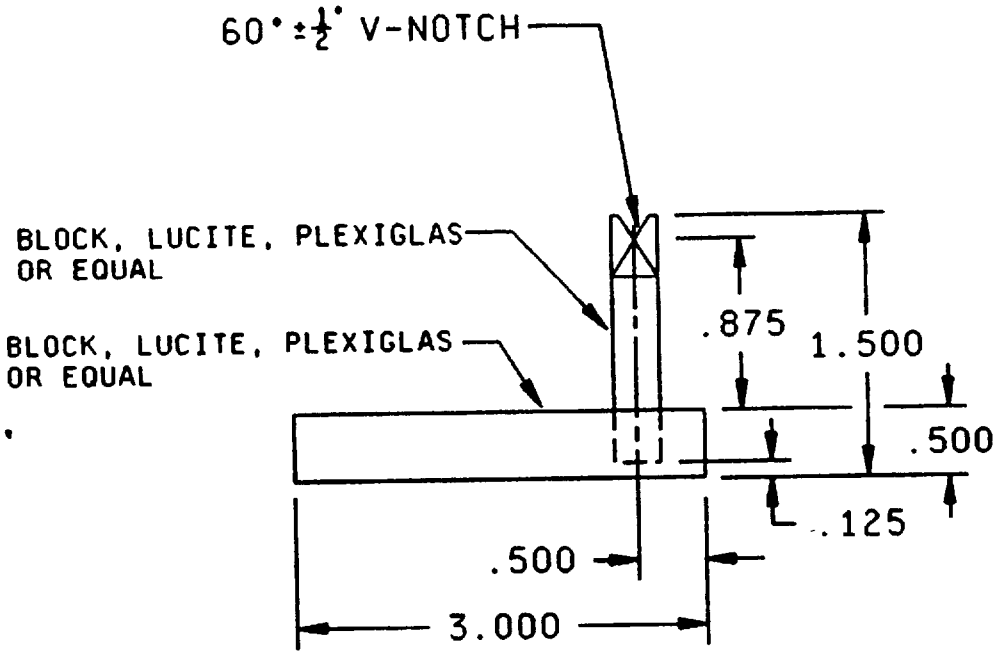
Inches	mm
.005	0.13
.006	0.15
.010	0.25
.040	1.02
.250	6.35
.938	23.83
1.438	36.53

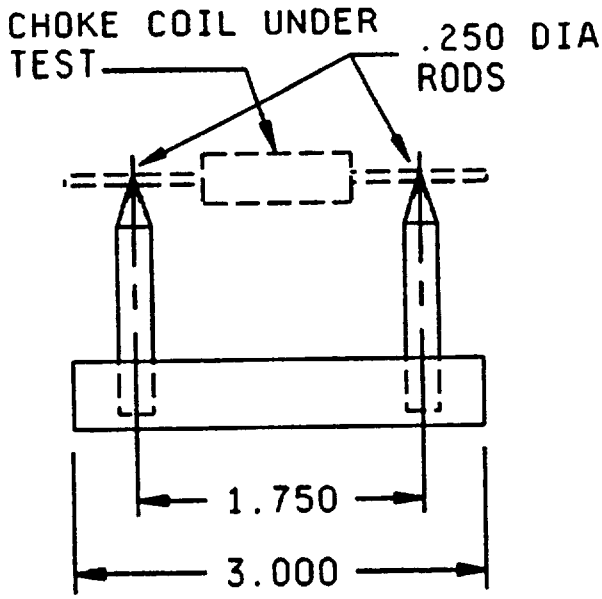
NOTES
1. Dimensions are in inches
2. Metric equivalents are given for general information only

FIGURE 2. Shorting bar for test fixture TF-A (for axial leads).

4.7.3.3 Self-resonant frequency. Unshielded coils shall be placed in the field of a variable-frequency oscillator, such as Measurements Corporation megacycle meter, model 59, 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 3. Units shall be suspended or supported a minimum of 1-1/2 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 from 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 4.7.3.3.1. 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 3.7.3).

4.7.3.3.1 Alternate test method. When coils under test cannot be resonated by the method specified in 4.7.3.3, the test shall be performed using the instruments specified in 4.7.3.2, or equivalent. The coils shall be mounted in the appropriate test fixture, as applicable, as shown on figure 1 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 comparison coil having an inductance about .04 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 comparison 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 3.7.3).





Inches	mm
125	3.18
.250	6.35
.500	12.70
.875	22.23
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 (0.13 mm)
3. Metric equivalents are given for general information only.

FIGURE 3. Test fixture for self-resonant-frequency test (for axial leads) or equivalent.

4 7 3.4 Percent coupling (when specified) The percent coupling of radio frequency coils, is determined by table X 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 microhenries (μH)

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

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

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

TABLE X 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

4 7.3 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 4.

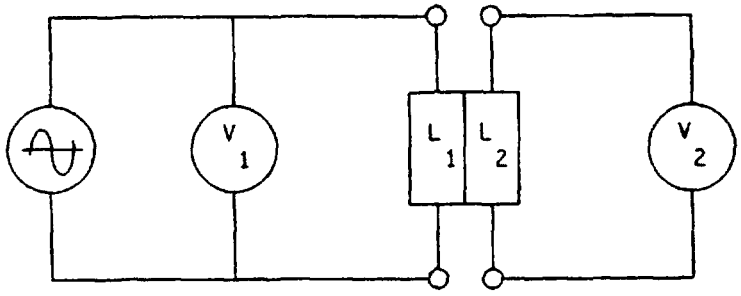


FIGURE 4. Test circuit for percent coupling (alternate method).

Equipment for 1 kHz and 10 kHz consists of Hewlett Packard 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 $V_1 = .02\ Q$

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

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 7 3.5 Incremental current inductance change (when specified) Incremental current inductance change is the dc current required to cause a change of no more than 5 percent from the inductance measured with zero dc current and the inductance measured with the specified value of incremental current (see 3 1) This test is performed using a General Radio Type 1633-A incremental inductance bridge, or equivalent, at 10 kilohertz (kHz) for inductance values between 10 and 100 microhenries, and 1 kHz for inductance values greater than 100 microhenries, and the General Radio Type 1632-A inductance bridge, or equivalent at 10 kHz for inductance values less than 10 microhenries 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 millivolts
f = frequency in kilohertz
L = nominal value of inductance in microhenries

This voltage is to be measured with a suitable 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 current 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 5 percent.

4.7.3 6 DC resistance. Direct current (dc) resistance of coils shall be measured in accordance with method 303 of MIL-STD-202.

4 7 4 Dielectric withstanding voltage (see 3.8) 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 ohms 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.

b Magnitude of test voltage The ac test voltage shall be a minimum of 1,000 volts with a leakage current not to exceed 100 microamperes unless otherwise specified (see 3.1). The time duration shall not exceed 60 seconds

c. Points of application of test voltage. Unless otherwise specified (see 3.1), 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 Inspection after test Coils shall be inspected for evidence of damage resulting from arcing, flashover, breakdown of insulation, or other damage.

4 7 5 Barometric pressure (when applicable) (see 3 9) 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 1,000 ohms 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

b. Test condition as specified (see 3 1).

c. Test during subjection to reduced pressure Coils shall be subjected to 60 Hz, ac test voltage at a minimum of 200 volts rms at 70,000 feet unless otherwise specified (see 3 1), for a minimum of 60 seconds

d. Points of application of test voltage Unless otherwise specified (see 3 1), 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. Inspection after test. Coils shall be inspected for evidence of damage resulting from arcing, flashover, breakdown of insulation, or other damage.

4 7.6 Insulation resistance (see 3.10) 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 volts (see 3.1), test condition letter A shall be used

b. Points of measurement. Unless otherwise specified (see 3 1), measurements shall be made between insulated 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 5 or between the coil leads connected together and the V-block (see 4.7.5d).

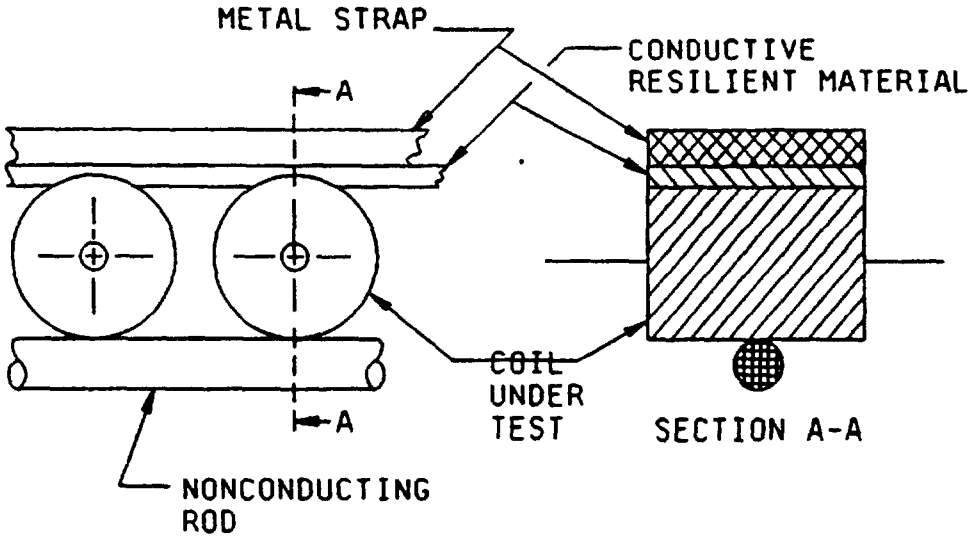
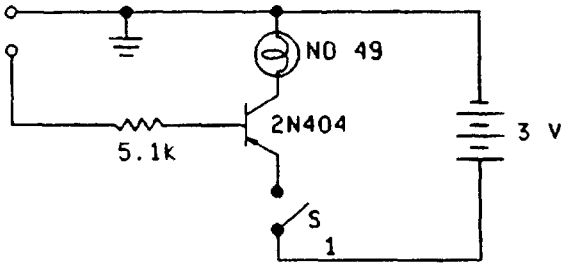


FIGURE 5. Coil contacting assembly for mounting during polarization

4 7.7 Winding continuity (see 3 11) 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



4.7.8 Temperature rise (see 3 12). The temperature rise of cylindrical coils shall be determined as specified in 4.7.8.1. The temperature rise of the winding of other coils (when specified see 3 1) 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 current applied (see 3.1). When the resistance of the winding, measured at 5 minute intervals, remains constant, the temperature of the winding requires the removal of power. The measurement shall be made within 10 seconds after the removal of power

4.7 8 1 For cylindrical coils. The coil under test shall be connected to a test fixture conforming to figure 6 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 temperature-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). The dc resistance (r) shall be measured with one-tenth rated direct current 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 1,000 ohms per volt The rated direct current (see 3.1), 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

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

Where.

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

R = resistance of coil in ohms with rated direct current applied at temperature (T + ΔT).

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 current applied

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

4 7 9 Overload (see 3 13) DC current equivalent to 1-1/2 times the specified rated current (see 3 1), shall be applied to the windings for 5 minutes After the test, coils shall be inspected for evidence of cracked cases, charred windings, distorted or softened insulation, or loosened windings or terminals

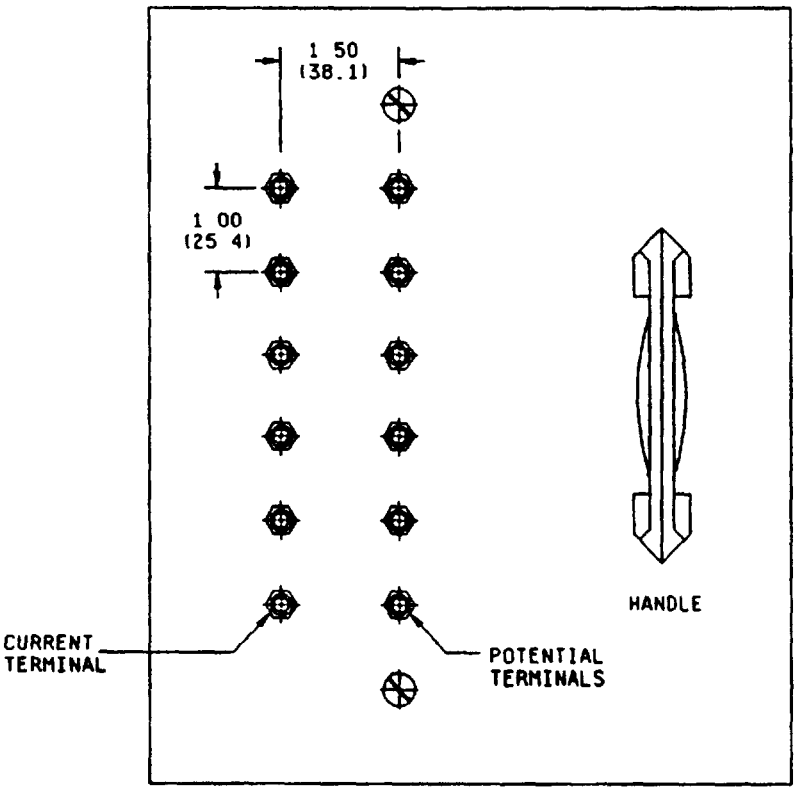
4 7 10 Resistance to soldering heat (see 3.14) Terminals to be used for soldered connections shall be tested in accordance with method 210 of MIL-STD-202 The following details shall apply

a Depth of immersion in molten solder. One-fourth inch from the nearest insulating material, or to one-half the exposed length of the terminal, whichever point is closer to the insulating material

b Test condition letter - C

c. After the test and as soon as the solder terminals have returned to room ambient temperature, the following tests shall be made in the order shown

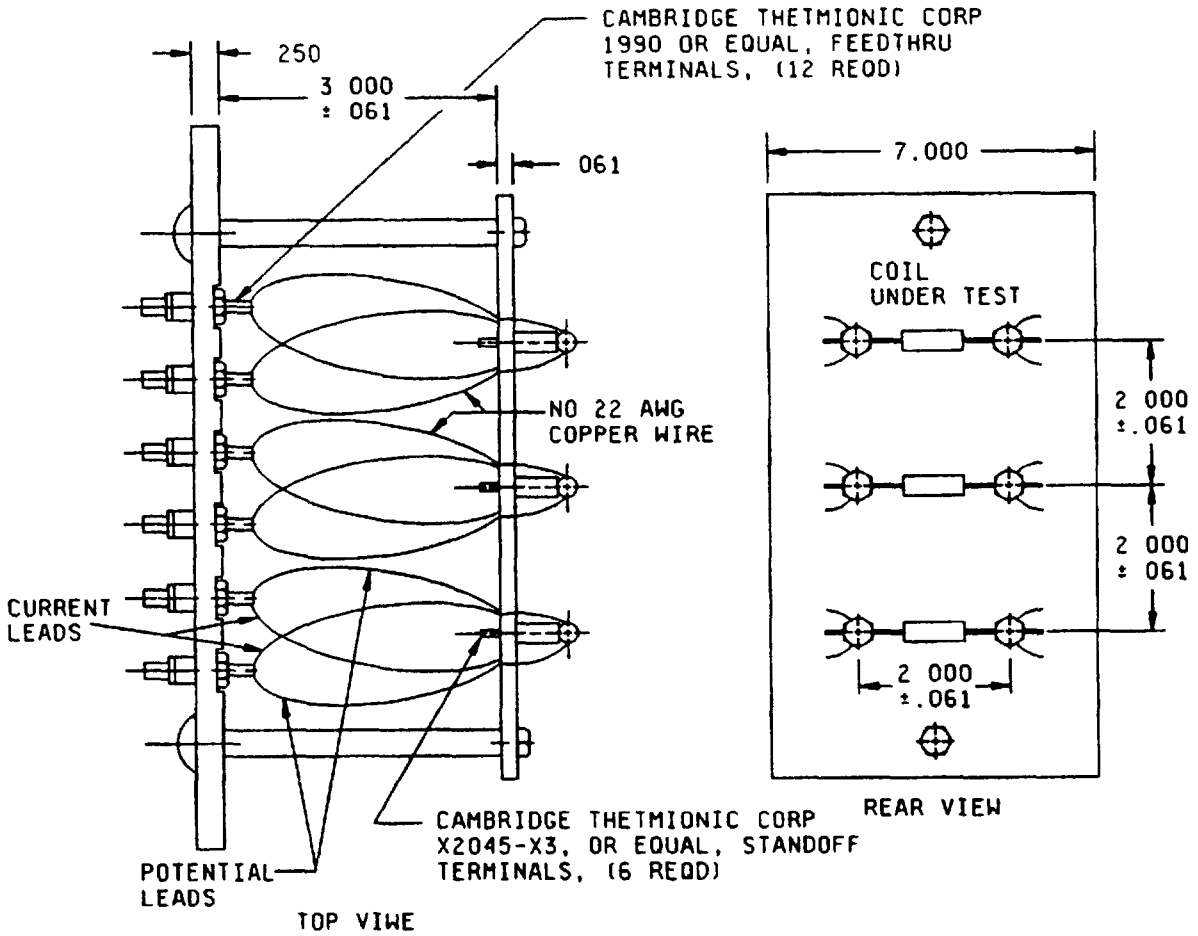
(1) Visual There shall be no evidence of solder reflow of internal connections as evidenced by solder flowing from the body of the device.



FRONT VIEW

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

FIGURE 6. Test fixture for temperature-rise test on insulated coils or equivalent



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 (0.13 mm).
3 Metric equivalents are given for general information only

FIGURE 6. Test fixture for temperature-rise test on insulated coils or equivalent - Continued.

4 7 11 Terminal strength (see 3 15) Coils shall be tested as specified in 4 7.11 1 to 4 7 11 2 1, as applicable

4 7 11 1 Pull

4 7 11 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 A.

b. Applied force. Unless otherwise specified (see 3 1), the applied force shall be 5 pounds.

4 7.11.2 Twist

4 7 11.2.1 Solid wire lead terminals Each terminal shall be tested in accordance with method 211, test condition D, MIL-STD-202.

4.7.12 Solderability (see 3 16) Coils shall be tested in accordance with method 208 of MIL-STD-202. (Both leads on each unit shall be tested.)

4 7.13 Resistance to solvents (see 3.17) 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 tables VI and IX).

c. Permissible extent of damage to the specimen (see 3.13).

4.7.14 Flammability (see 3.18). 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. Inspection during and after test. Coils shall be inspected 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.

4.7 15 Low temperature storage (see 3.19).

4.7.15.1 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 7.15.2 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 inspected for evidence of cracks or other mechanical damage.

4 7 16 Vibration (see 3.20). Coils shall be tested in accordance with 4 7.16.1.

4 7 16 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. Coils shall be rigidly mounted on appropriate jig fixtures with their leads supported at a distance of .25 inch, minimum, from the coil body The coil shall be mounted with the body clamped or cemented to a flat surface Where used, the cement material shall not extend above the coil body centerline in a vertical plane or beyond the coil body ends in a horizontal plane In no case shall the coil body be completely encapsulated These fixtures shall be constructed in a manner to insure that points of the coil-mounting supports will have the same motion as the vibration test table. The fixtures shall also be of a construction that will preclude any resonance in the fixture when subjected to vibration within the test frequency range, and the fixture shall be monitored for these features on the vibration table Test leads used during this test shall be no larger than AWG 22 stranded wire, so that the influence of the test lead on the coil will be held to a minimum The test lead length shall be no greater than necessary In all cases, the 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 most detrimental. A shielded cable which may be necessary because of the field surrounding the vibration table, shall be clamped to the coil-mounting jig.

b. Test condition 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. Inspection after vibration Coils shall be inspected for evidence of physical or mechanical damage, and winding continuity shall be tested as specified in 4.7.7.

4.7.17 Shock (specified pulse) (see 3.21). 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 rigidly mounted on appropriate jig fixtures with their leads supported at a distance of .25 inch, minimum, from the coil body. The coil shall be mounted with the body clamped or cemented to a flat surface. Where used, the cement material shall not extend above the coil body centerline in a vertical plane or beyond the coil body ends in a horizontal plane. In no case shall the coil body be completely encapsulated These fixtures shall be constructed in a manner to insure that points of the coil-mounting supports will have the same motion as the shock test table. Test leads used during this test shall be no larger than AWG 22 stranded wire, so that the influence of the test lead on the coil will be held to a minimum. The test lead length shall be no greater than necessary. In all cases, the 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 most detrimental.

b Test condition letter I.

c. Inspection after test Coils shall be tested for winding continuity as specified in 4.7.7 and inspected for evidence of physical or mechanical damage.

4 7 18 Moisture resistance (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 25 inch when measured from the edge of the supporting terminal to the coil body For polarization (see 3.1 and 6 1), the coils shall be covered with a flat, corrosion-resistant metal strap and the width of the strap is equal to the length of the coils and 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 ohms-centimeter, 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 5. The mounting strap may be used to cover one or more coils at a time. When units are removed from the humidity chamber, all mounting straps shall be removed to perform step 7a, and shall be replaced prior to returning the coils to the humidity chamber. Step 7b shall not be applicable.

b. Polarization. Unless otherwise specified (see 3 1), during steps 1 to 6 inclusive, a polarizing voltage of 100 volts dc shall be applied. The voltage shall be positive with respect to the mounting strap. For other type coils and units having no mounting hardware, the polarizing voltage shall be applied as specified (see 3.1).

c. Final measurements. Following the 1-1/2 to 3-1/2-hour conditioning period, unless otherwise specified (see 3.1 and 6.1), the units shall be removed to room ambient conditions. Within 30 minutes after removal, the dielectric withstanding voltage test specified in 4 7.4 shall be performed at 90 percent of the test voltage specified (see 3.1) and the insulation resistance test shall be performed in accordance with 4.7.6. Within 8 hours after these measurements, the specified electrical characteristics (see 3.1), shall be measured as specified in 4 7.3. After the test, units shall be inspected for evidence of corrosion.

4.7 19 Life (see 3.23). 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 shall be supported by wire leads mounted by lightweight push-post terminals on each side of the body or equivalent The effective length of each terminal shall be .125 inch minimum. The panel racks or breadboarding device shall be equipped with current sensing terminals. Coils shall be so arranged that the temperature of any one coil shall not appreciably influence the temperature of any other coil

(2) All other terminals shall be supported as specified (see 3.1). Coils shall be so arranged that the temperature of any one coil shall not appreciably influence the temperature of 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).

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 Qualification inspection Measurement 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 Initial measurements shall be in accordance with the "Electrical characteristics (initial)" requirements of the individual component specification sheet Extended life testing: Measurements of inductance and Q shall be performed at room temperature prior to subjecting the coils to the specified test temperature Initial measurements shall be in accordance with the "electrical characteristics (initial)" requirements of the individual components specification sheet "

e Test conditions· 2,000 hours elapsed time for qualification inspection with all samples continued to 10,000 hours 10,000 hours for group B failure rate level inspection.

f. Measurements during test

(1) Qualification inspection Measurements of inductance, Q, dc resistance and self-resonant frequency shall be made after 250 +72, -24 hours, 500 +72, -24, 1,000 +72, -24, 2,000 +96, -24 hours have elapsed 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

(2) Extended life test Coils shall be tested for a period of 10,000 +96-0 hours. Inductance and Q shall be measured at the following intervals: 250 +72, -24 hours, 500 +72, -24, 1,000 +72, -24, and 2,000 +96, -24 hours and every 2,000 +96, -24 hours thereafter. Final measurements after exposure shall include dc resistance and self-resonant frequency (see 3 1)

g. Inspection after test Coils shall be inspected for evidence of mechanical damage.

4 7 20 Fungus (see 3 24). Unless certification is provided, coils shall be tested in accordance with method 508 of MIL-STD-810.

5. PACKAGING

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

5.1.1 Level A.

5 1.1 1 Cleaning. Coils shall be clean or be cleaned in accordance with MIL-P-116, process C-1

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

5 1.1 3 Preservative application Preservatives shall not be used.

5.1.1.4 Unit packs. Each coil shall be individually unit packed in accordance with MIL-P-116, submethod IA-8, insuring compliance with the applicable requirements of that specification.

5.1.1 5 Intermediate packs. Coils, packaged as specified in 5.1 1 4, shall be placed in intermediate containers conforming to MIL-STD-2073-1 requirements

5.1.2 Level C. Level C preservation shall be in accordance with MIL-STD-2073-1 requirements for that level.

5.2 Packing. Packing shall be in accordance with MIL-STD-2073-1 requirements for the specified level (see 6.2)

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

5 4 Packaging inspection Quality conformance and first article inspections shall be in accordance with MIL-P-116 (see 6.2)

6 NOTES

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

6 1 Intended Use These radio frequency coils are designed for use in radio frequency circuits where the need for resistance to immersion and moisture, reliability, long life, and continuity of operation are necessary

6.2 Ordering data Acquisition documents must specify the following

a Title, number, and date of the specification

b. Title, number, and date of the applicable specification sheet, and the complete PIN.

c. Levels of preservation and packing required (see 5 1 and 5.2).

d. If special or other identification marking is required (see 5.3)

e. Lead length: Specify 1 00 + 625, -0 000 inch for tape and reel packaging If not specified, 1.5 ±.125 inch lead length will be supplied.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No. 39010 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the US Army Research Laboratory, ATTN: AMSRL-EP-RD, Fort Monmouth, NJ 07703-5601, however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-E), 1507 Wilmington Pike, Dayton, Ohio 45444-5270

6.4 Flammability (self-extinguishing material). Material may be considered self-extinguishing if the following conditions are met

a. The duration of visible flame does not exceed 3 minutes after removal of the applied flame.

b There is no explosion, nor any violent burning which results in an explosive type flame.

c There is no dripping of flaming material from the transformer under test

6 5 Final electrical characteristics The degradation limits specified for the final electrical characteristics, should remain the same for tighter inductance tolerances.

6.6 Tin plated finishes. Tin plating is prohibited (see 3.5.1.1) since it may result in tin whisker growth. Tin whisker growth could adversely affect the operation of electronic equipment systems. For additional information on this matter, refer to ASTM B545 (Standard Specification for Electrodeposited Coating of Tin).

6.7 Subject term (key word) listing

Parts per million (PPM)
Statistical process control (SPC)

6 8 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

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 This appendix is a mandatory part of the specification The information contained herein is intended for compliance.

20 APPLICABLE DOCUMENTS This section is not applicable to this appendix

30 SUBMISSION

30.1 Sample

30 1 1 Single-type submission. A sample consisting of 152 sample units of each core material, class and individual inductance value for which qualification is sought shall be submitted. Ten additional sample units shall be submitted for the fungus test if certification is not provided.

30.1 2 Combined-type submission A sample consisting of 152 sample units for each class covered by a single specification sheet for which qualification is sought shall be submitted. All sample units except group III units shall be submitted to the tests of groups IA and IB. Twenty sample units, ten of the lowest inductance value and ten of the highest inductance value, shall be submitted to the tests of group II. Ten sample units of any inductance value shall be submitted to the tests of group III as specified in table VI. Twenty sample units, ten of the lowest inductance value and ten of the highest inductance value shall be submitted to the tests of group VI. One hundred and two sample units, 51 of the lowest inductance value and 51 of the highest inductance value shall be submitted to the test of group VI. Ten additional sample units of any inductance value shall be submitted for the fungus test if certification is not provided.

30.2 Qualification to tighter inductance tolerances. Twenty sample units shall be tested, (ten of the lowest inductance value and ten of the highest inductance value of the specified inductance tolerance), for each class covered by a single specification sheet. They shall be submitted to the tests of group IA and visual and mechanical inspection of group IB of table VI

40. EXTENT OF QUALIFICATION

40 1 Single-type. Qualification shall be restricted to the single PIN submitted.

40.2 Combined-type submission. Qualification shall be restricted to all of the inductance values covered on a single specification sheet between the values passing qualification inspection.

CONCLUDING MATERIAL

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

Review activities:
Army - AR, ME, MI
Navy - AS, CG, MC, OS,
Air Force - 17, 19, 99
DLA - ES

Preparing activity
Army - ER

Agent
DLA - ES

(Project 5950-0802)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

The preparing activity must complete blocks 1, 2, 3, and 8 In block 1, both the document number and revision letter should be given

2 The submitter of this form must complete blocks 4, 5, 6, and 7.

3 The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-C-39010D	2. DOCUMENT DATE (YYMMDD) 4 January 1994

3. DOCUMENT TITLE
Coil, Radio Frequency Fixed, Molded, Established Reliability, General Specification For

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)	b ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME US Army Research Laboratory ATTN. AMSRL-EP-RD	b. TELEPHONE (Include Area Code) (1) Commercial (908) 544-3441/3148 (2) AUTOVON
c. ADDRESS (Include Zip Code) Fort Monmouth, NJ 07703-5601	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340