



# AEROSPACE RECOMMENDED PRACTICE

Society of Automotive Engineers, Inc.  
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

## ARP 1172

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Revised

### FILTERS, CONVENTIONAL, ELECTROMAGNETIC INTERFERENCE REDUCTION GENERAL SPECIFICATION FOR

#### 1. SCOPE

This specification covers the general requirements for conventional AC and/or DC current carrying filter networks for the reduction of electromagnetic interference. A conventional filter is defined herein as a component containing definitive, lumped, R-L-C components and not employing distributed parameters as a required characteristic.

#### 2. APPLICABLE DOCUMENTS

The following specifications and standards, of the issue in effect on the date of award of contract, shall form a part of this document to the extent specified herein. In the event of conflict between this document and the following specifications or standards, including specifications and standards referenced therein, this document shall govern to the extent of such conflict.

##### 2.1 Federal Specifications:

FF-S-85 Screw, Cap, Slotted - and Hexagon Head  
 FF-S-92 Screws, Machine, Slotted or Cross-Recessed  
 PPP-T-60 Tape: Pressure Sensitive Adhesive, Waterproof, for Packaging  
 PPP-B-566 Boxes, Folding, Paperboard  
 PPP-B-636 Box, Fiberboard  
 PPP-B-676 Boxes, Set-up, Paperboard

##### 2.2 Military Specifications:

MIL-P-116 Preservation, Methods Of  
 MIL-E-2036 Enclosures for Electric and Electronic Equipment  
 (Naval Shipboard Use)  
 MIL-F-15733 Filters, Radio Interference, General Specification for  
 MIL-T-21200 Test Equipment for use with Electronic and Fire Control  
 Systems, General Specification for

##### 2.3 Military Standards:

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes  
 MIL-STD-129 Marking for Shipment and Storage  
 MIL-STD-130 Identification Marking of U.S. Military Property  
 MIL-STD-202 Test Methods for Electronic and Electrical Component Parts  
 MIL-STD-220 Method of Insertion-Loss Measurement  
 MIL-STD-889 Dissimilar Metals

##### 2.4 Other Publications:

National Bureau of Standards

Handbook H28 Screw-Thread Standards for Federal Services

American Society for Testing Materials

D92-57 Method of Test for Flash and Fire Points by Cleveland Open Cup

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report, in formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

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

### 3. DESIGN REQUIREMENTS

#### 3.1 General:

3.1.1 Specification Sheets: The individual part requirements shall be as specified herein and in accordance with the applicable procurement specification. In the event of conflict between this document and the control specification sheet, the latter shall govern.

3.1.2 Qualification: Filters furnished under this specification shall be a product which has been designed to meet the qualification tests specified in 3.2 through 3.4 herein.

3.1.3 Design and Construction: Filters shall be of the design, construction, and physical dimensions specified by the control specification. (See Section 6)

3.1.4 Workmanship: Filters shall be processed in such a manner as to be uniform in quality and shall be free from cold soldering, corrosion, pits, dents, cracks, rough edges, misalignments, and other defects that will affect life, serviceability, or appearance.

3.1.5 Marking: Unless otherwise noted by the control specification, filters shall be marked with the part number, voltage, current, input and/or output terminals (if the filter is not electrically symmetric), and the maximum operating (power) frequency. If sufficient space is available, the manufacturers name, trademark, or code symbol numbers may be added. Government procured filters shall be marked in accordance with MIL-STD-130. In all cases, the part number shall include a letter suffix which designates the electrical configuration as shown in Table I.

TABLE I. ELECTRICAL CONFIGURATION

Part No. Suffix	Circuit Configuration
A	C <sub>input</sub> El network*
B	L <sub>input</sub> El network*
C	Pi network
D	Tee network
E	Ladder network
F	Series network

\* = input is defined as interference source terminal and need not necessarily be the power source terminal.

3.1.6 Design Constraints: Filters designed for use with portable equipment, U-L approved appliances, and MIL-T-21200 test equipment, shall limit power current flow to the chassis to a maximum level of 0.005 amperes unless otherwise specified by the control specification. The maximum safe values of capacitance permitted between the power line and frame or chassis shall not exceed the value calculated with the following applicable formula:

A. For single-phase equipment

$$C = \frac{1}{2 \eta F_e}$$

B. For three-phase equipment

$$C = \frac{1}{\sqrt{2} \eta F e}$$

Where: C = capacitance in farads  
 I = 0.005 amperes RMS  
 F = powerline frequency in Hz  
 e = powerline voltage (line-to-line), RMS

### 3.2 Mechanical:

- 3.2.1 Material: When a definite material is not specified, a material shall be used which will enable the filter to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.
- 3.2.2 Impregnating and Potting Compounds: Compounds used in the impregnating and potting of filters shall be chemically inactive with respect to the filter unit and the case. The compound, either in the state of original application or as a result of having aged, shall have no adverse effect on the performance of the filter.
- 3.2.3 Case: Filters shall be enclosed in metallic cases which shall protect the filter elements from moisture and mechanical damage under all test conditions specified herein. All external bonding or grounding surfaces shall be free from all insulating protective finishes unless otherwise noted in the control specification. Nonmetallic cases may be employed if stipulated by the control specification.
- 3.2.4 Finish: All exposed metallic surfaces shall be suitably protected against corrosion by plating, lead-alloy coating, or other means as noted in the control specification. The finish shall provide good electrical contact when used on a terminal or as a conductor, shall have uniform texture and appearance, shall be adherent, and shall be free from blisters, pinholes and other defects that may affect the protective value of the coating. Dissimilar metals, as defined by MS33586, shall not be used in intimate contact with one another either in the filter manufacture or installation.
- 3.2.5 Threaded Parts: Unless otherwise specified, all threaded parts shall be in accordance with Handbook H-28. Where practical, all threads shall be in conformity with the coarse-thread series. The fine-thread series shall be used only for applications that might show a definite advantage through their use. Where a special diameter-pitch combination is required, the thread shall be of American National Form and of any pitch between 16 and 36 which is used in the fine-thread series. Screws shall conform to FF-S-85 or FF-S-92 as applicable.
- 3.2.6 Creepage and Clearance Distance: Filters procured for naval shipboard installation shall conform to the clearance and creepage distance requirements specified by MIL-F-15733. Enclosures shall be as classified by MIL-E-2036.
- 3.2.7 Terminal Strength: When filters are tested in accordance with 4.6.1.2, no part of the terminals shall loosen or rupture and no other damage shall result. Bends shall not be considered as damage unless an incipient break occurs.
- 3.2.8 Flashpoint of Impregnant or Potting Compound: When measured in accordance with 4.6.1.3, the flashpoint of the impregnant or potting compound shall not be lower than specified in Table II unless otherwise noted in the control specification.

TABLE II. FLASHPOINT of IMPREGNANT or POTTING COMPOUND

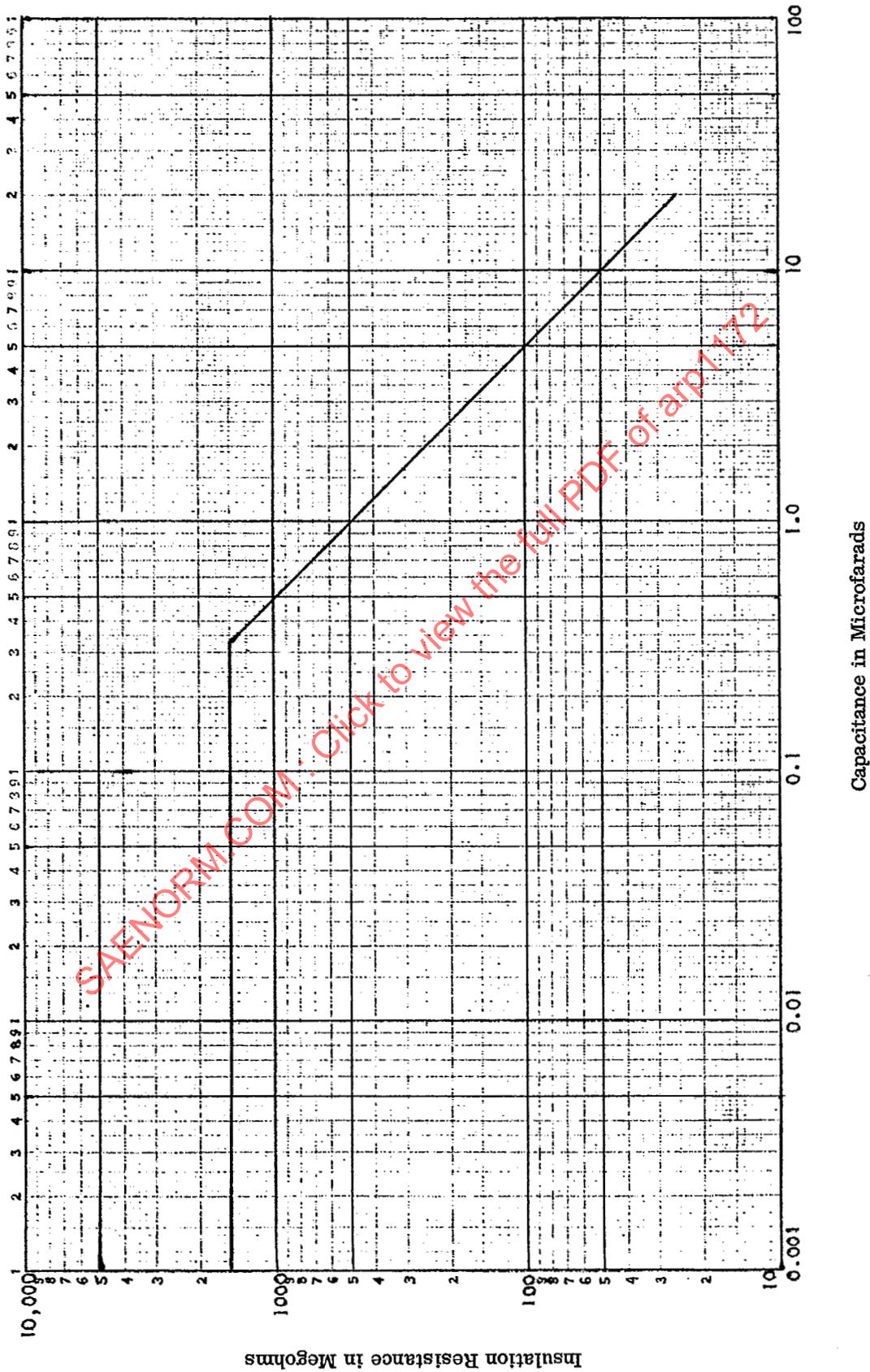
Operating Temperature	Minimum Allowable Flashpoint
-65 to +85 C	145 C
-65 to +125 C	165 C
-65 to +200 C	240 C

- 3.2.9 Weight: Filters shall be of minimum weight commensurate with the required design requirements and shall not exceed the maximum weight specified by the control specification.
- 3.2.10 Resistance to Soldering Heat (soldered terminals only): When filters are tested in accordance with 4.6.1.4, there shall be no damage to the filters or to the terminal insulators which will cause hermetically sealed filters to leak. Chipping of terminal insulators alone shall not be cause for failure unless the chipping extends to the outer periphery.
- 3.3 Electrical:
- 3.3.1 Capacitance: When filters are tested in accordance with 4.6.2.1, the line-to-ground and/or line-to-line capacitance (if required by 6. E) shall be as specified in the control specification.
- 3.3.2 Inductance: When measured in accordance with 4.6.2.2, the terminal-to-terminal inductance (if required by 6. F) shall be as specified in the control specification.
- 3.3.3 Temperature Rise: When filters are tested in accordance with 4.6.2.3, the temperature rise shall be as specified in the control specification.
- 3.3.4 Dielectric Withstanding Voltage: When filters are tested in accordance with 4.6.2.4, there shall be no breakdown, flashover, or impairment of any characteristic qualities sufficient to cause failure of the filter.
- 3.3.5 Insulation Resistance: When measured in accordance with 4.6.2.5, the insulation resistance of any filter section shall be not less than the applicable value shown on Figure 1. The value of insulation resistance varies with temperature, and it is necessary to apply a correction factor to measurements made at a temperature other than 25 C. Correction factors for measurements made between 20 C and 30 C are contained in Table III. The required value of insulation resistance shall be multiplied by the correction factor to determine the new value required at the test temperature.

TABLE III. INSULATION RESISTANCE CORRECTION FACTORS

Degrees Centigrade	Correction Factor
20	1.42
21	1.33
22	1.24
23	1.16
24	1.08
25	1.00
26	0.94
27	0.87
28	0.82
29	0.76
30	0.71

- 3.3.6 Voltage Drop: When filters are tested in accordance with 4.6.2.6, the voltage drop shall be as specified in the control specification.
- 3.3.7 Insertion-Loss: When filters are tested in accordance with 4.6.2.7, the insertion-loss shall be as specified by the control specification.



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Figure 1. Graphical Presentation of Insulation Resistance at 25°C

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- 3.3.8 Overload: When filters are tested in accordance with 4.6.2.8, the insulation resistance and voltage drop shall be as specified in 3.3.5 and 3.3.6 respectively. There shall be no physical damage to the filters.
- 3.4 Environmental:
- 3.4.1 Barometric Pressure: When filters are tested in accordance with 4.6.3.1, there shall be no breakdown, flashover, or impairment of any characteristic qualities sufficient to cause failure of the filters.
- 3.4.2 Salt Spray: When filters are tested in accordance with 4.6.3.2, there shall be no harmful or extensive corrosion, and at least 90% of any exposed metallic surface of the filter shall be protected by the finish. The marking shall remain legible. In addition, there shall not be more than 10% corrosion of the terminal hardware or mounting surface.
- 3.4.3 Temperature and Immersion Cycling: When tested as specified in 4.6.3.3, filters shall meet the requirements of 3.4.9 herein.
- 3.4.4 Shock - Medium Impact: When filters are tested in accordance with 4.6.3.4, there shall be no evidence of intermittent, open or short circuiting, and no mechanical damage to the filter. The insertion-loss shall be as specified in the control specification. Instrumentation used for monitoring intermittent open or short circuited conditions shall be capable of detecting those parameters which are in excess of 100 nanoseconds.
- 3.4.5 Vibration: When filters are tested in accordance with 4.6.3.5, there shall be no intermittent open or short circuiting during vibration. After the test there shall be no evidence of physical damage to the filters. Instrumentation used for monitoring intermittent open or short circuited conditions shall be capable of detecting those parameters which are in excess of 100 nanoseconds.
- 3.4.6 Moisture Resistance: When tested as specified in 4.6.3.6, filters shall meet the requirements of 3.4.9 herein.
- 3.4.7 Seal: When filters are tested in accordance with 4.6.3.7, there shall be no evidence of leakage.
- 3.4.8 Life: When tested as specified in 4.6.3.8, filters shall meet the requirements of 3.4.9 herein.
- 3.4.9 Post Test Requirements: Upon completion of the final cycle or test period, filters shall comply with the following requirements:
- Dielectric Withstanding Voltage - As specified in 3.3.4
  - Insulation Resistance - Not less than 30% of value in 3.3.5
  - Insertion-Loss - As specified in 3.3.7
  - Visual Examination - There shall be no visible mechanical damage.
    - Corroded areas shall not exceed limits in 3.4.2,
    - and marking shall remain legible.
- 3.4.10 Alternate Environmental Requirements: In the event that the environmental requirements stipulated by 3.4.1 through 3.4.8 herein are deemed inadequate, they may be deleted and/or superceded by so noting in the control specification. Test methods may not be deviated from.

## 4. QUALITY ASSURANCE PROVISIONS

- 4.1 Inspection Responsibility: Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise noted, the supplier may utilize his own facilities or any commercial laboratory acceptable to the procuring activity. The procuring activity reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

- 4.2 Test Equipment and Facilities: Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The supplier shall establish calibration of inspection equipment to the satisfaction of the procuring activity.
- 4.3 Classification of Inspection: The examination and testing of filters shall be classified as follows:
- A. Qualification Inspection
  - B. Quality Conformance Inspection

Unless otherwise specified herein, all quality conformance inspection shall be in accordance with 2.2, General Requirements, of MIL-STD-202.

4.4 Qualification Inspection:

- 4.4.1 Samples: A total of 13 identical units shall be deemed to comprise a sample of filters subjected to qualification inspection.
- 4.4.2 Test Routine: Specimens will be subjected to the qualification inspection tests specified in Table IV, in the order shown. All specimens will be subjected to the inspection of group 1. They will then be divided into three groups of four units each, and subjected to the inspection for their particular group. The additional unit is to permit substitution for the allowable defective in group 1.
- 4.4.3 Defective Units: Defectives in excess of those allowed by Table IV will be cause for refusal to grant qualification.
- 4.4.4 Qualification by Similarity: Certain aspects of the qualification test program may be deleted through the process of qualification by similarity to filters previously qualified. Such qualification by similarity shall be limited to filters with the following identical parameters:

Finish  
Terminal Type  
Potting Compound

Those portions of the qualification test program which may be deleted are shown below:

Flashpoint	Temperature and Immersion Cycling
Seal	Shock
Barometric Pressure	Vibration
Terminal Strength	Moisture Resistance
Resistance to Soldering Heat	Life
Salt Spray	

Visual and mechanical inspection, capacitance, inductance, temperature rise, dielectric withstanding voltage, insulation resistance, voltage drop, insertion-loss, and overload tests shall be performed for each distinct filter type regardless of any previous qualification tests and/or data.

The above provisions for qualification by similarity may be deleted at the direction of the procuring activity.

4.5 Quality Conformance Inspection:

- 4.5.1 Inspection Lot: An inspection lot shall consist of identical filters produced under essentially the same conditions, and offered for inspection at one time.

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4.5.1.1 If an inspection lot is rejected, the supplier may replace it with a new lot, rework it to correct the defects, or screen out the defective units and submit it again for inspection. Resubmitted lots shall be kept separate from new lots and shall be clearly identified as resubmitted lots. They shall be inspected using tightened inspection procedures.

4.5.2 Group A Inspection: Group A inspection shall consist of the examinations and tests specified in Table V, and shall be made on the same set of sample units in the order shown.

Statistical sampling shall be in accordance with MIL-STD-105. The acceptable quality levels (AQL) shall be as specified in Table V. Major and minor defects shall be identified according to the definitions in MIL-STD-105.

4.5.3 Group B Inspection: Group B inspection shall consist of the tests specified in Table VI in the order shown, and shall be performed on lots that have passed Group A inspection.

The sampling plan shall be in accordance with MIL-STD-105 for special inspection levels. Unless otherwise specified, normal inspection shall be used at the start of the contract. The AQL shall be 4.0 (percent defective) and the inspection level S-4.

Sample units which have been subjected to group B inspection shall not be delivered on the contract or order.

4.5.4 Group C Inspection: Group C inspection shall consist of the tests specified in Table VII, in the order shown for each subgroup. The number of sample units to be inspected for each subgroup shall be as specified by the table. Separate samples shall be used for each subgroup, and shall be performed on sample units that have passed groups A and B inspection.

Once each calendar month sample units shall be subjected to group C inspection; however, this inspection shall be invoked only by direction of the procuring activity.

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

4.5.5 Noncompliance: If a sample fails to pass group C inspection, the supplier shall take corrective action on the materials or processes, or both, as warranted, on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc, and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the procuring activity, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the procuring activity). Groups A and B inspection may be reinstated; final acceptance shall be withheld until the group C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the procuring activity.

4.5.6 Retention of Qualification: In order to retain qualification, the manufacturer shall forward to the procuring activity a summary of the results of groups A and B tests indicating as a minimum the number of lots which passed and the number which failed, and a summary of the results of group C tests, including the number and type of any part failures. The summary shall include those tests performed during that past 6 month interval. If the summary of the test results indicates nonconformance with specification requirements, action may be taken to remove the failing product from the QPL. Failure to submit the summary may result in loss of qualification for that product. In addition to the periodic submission of data, the supplier shall immediately notify the procuring activity that inspection data indicates failure of the qualified product to meet the requirements of the specification.

TABLE IV. QUALIFICATION INSPECTION

Examination or Test	Requirement Para.	Method Para.	Samples Tested	Defectives Allowed ***
Flashpoint of impregnant or potting compound	3.2.8	4.6.1.3	-----	0
Group I				
Visual & mechanical examination: material, design, construction, marking, & workmanship*	3.1.3 thru 3.1.5	4.6.1.1	} 13	} 1
Seal.....	3.4.7	4.6.3.7		
Capacitance.....	3.3.1	4.6.2.1		
Inductance.....	3.3.2	4.6.2.2		
Temperature rise.....	3.3.3	4.6.2.3		
Dielectric withstanding... voltage	3.3.4	4.6.2.4		
Barometric pressure.....	3.4.1	4.6.3.1		
Insulation resistance.....	3.3.5	4.6.2.5		
Voltage drop.....	3.3.6	4.6.2.6		
Insertion-loss.....	3.3.7	4.6.2.7		
Overload.....	3.3.8	4.6.2.8		
Terminal strength.....	3.2.7	4.6.1.2		
Group II				
Resistance to solder heat.	3.2.10	4.6.1.4	} 4	} 1
Salt spray.....	3.4.2	4.6.3.2		
Temperature & Immersion... cycling	3.4.3	4.6.3.3		
Group III				
Shock - medium impact.....	3.4.4	4.6.3.4	} 4	} 2
Vibration.....	3.4.5	4.6.3.5		
Moisture resistance.....	3.4.6	4.6.3.6		
Group IV				
Life.....	3.4.8	4.6.3.8	4	1

Notes: \* = marking to be considered a defect only if it becomes illegible as a result of the inspection.

\*\* = three specimens only to be subjected to this test.

\*\*\* = a sample unit having one or more defects will be charged as a single defective.

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TABLE V. GROUP A INSPECTION

Examination or Test	Requirement Para.	Method Para.	AQL (%defective)	
			Major	Minor
Visual & mechanical exam.*	----	4.6.1.1	1.0	4.0
Material	3.2.1-3.2.2	-----		
Body dimensions	3.1.3	-----		
Design & construction	3.2.3-3.2.6	-----		
Marking	3.1.5	-----		
Workmanship	3.1.4	-----		
Seal	3.4.7	4.6.3.7	1.0	---
Capacitance	3.3.1	4.6.2.1		
Inductance	3.3.2	4.6.2.2		
Dielectric withstanding volts	3.3.4	4.6.2.4		
Barometric pressure	3.4.1	4.6.3.1		
Insulation resistance	3.3.5	4.6.2.5		
Voltage drop	3.3.6	4.6.2.6		
Insertion-loss**	3.3.7	4.6.2.7		

\* = may be performed before or after units are sealed.

\*\* = to be performed on three units only

TABLE VI. GROUP B INSPECTION

Test	Requirement Para.	Method Para.
Temperature rise	3.3.3	4.6.2.3
Overload	3.3.8	4.6.2.8
Terminal strength	3.2.7	4.6.1.2
Resistance to soldering heat	3.2.10	4.6.1.4
Temperature & Immersion cycle	3.4.3	4.6.3.3

TABLE VII. GROUP C INSPECTION

Test	Requirement Para.	Method Para.	Samples Tested	Defectives Allowed	
<u>Subgroup 1</u>					
Insertion-loss	3.3.7	4.6.2.7	4	1	
Salt spray	3.4.2	4.6.3.2			
<u>Subgroup 2</u>					
Shock-medium impact	3.4.4	4.6.3.4	4		
Vibration	3.4.5	4.6.3.5			
Moisture resistance	3.4.6	4.6.3.6			
<u>Subgroup 3</u>					
Life	3.4.8	4.6.3.8	4	1	

4.5.7 Qualification by Similarity: Qualification by similarity shall be permissible under the limitations and conditions imposed by 4.4.4 herein. These provisions for qualification by similarity may be deleted at the direction of the procuring activity.

4.6 Methods of Examination and Test:

4.6.1 Mechanical:

4.6.1.1 Visual and Mechanical Examination: Filters shall be examined to verify that the materials, design, construction, physical dimensions, weight, creepage and clearance distances, marking and workmanship, are in accordance with the applicable requirements.

4.6.1.2 Terminal Strength: Filters shall be tested in accordance with method 211 of MIL-STD-202. Unless otherwise noted in the control specification, terminal test conditions shall be as specified below:

Solder-lug terminals - MS-202 test conditions A and B  
 Wire-lead terminals - MS-202 test conditions C and D  
 Screw-thread terminals - MS-202 test condition E (applied torque  
 shall be in accordance with Table VIII herein.)

TABLE VIII. TORQUE

Thread Size	Torque (lb-in.)
4-40	3.0
6-32	9.0
8-32	14
10-32	18
1/4-20	30
5/16-24	50
3/8-24	100
7/16-20	150
1/2-20	250
1/2-28	200
12-28	23
1/4-28	40

4.6.1.3 Flashpoint of Impregnant or Potting Compound: The flashpoint of the impregnant or potting compound shall be measured as specified in Publication D92-57. Paragraphs therein concerning firepoint and precision do not apply to this test.

4.6.1.4 Resistance to Soldering Heat: Filters shall be tested in accordance with method 210, test condition B, of MIL-STD-202. Depth of immersion in the molten solder shall be to a point of 1/16 (+ 1/32) in. from the insulation. Cooling time prior to final examinations shall be 15 minutes. Capacitance to ground and coil continuity measurements shall be made one hour after immersion.

4.6.2 Electrical:

4.6.2.1 Capacitance: Capacitance (line-to-ground or line-to-line) shall be measured in accordance with method 305 of MIL-STD-202. A test frequency of 1000 cps  $\pm$  100 cps, shall be used where the nominal capacitance is one-microfarad or less, and a test frequency of 60 cps,  $\pm$  6 cps, used where the nominal capacitance is greater than one-microfarad. The limit of accuracy for this measurement shall be within  $\pm$  2 percent.

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4.6.2.2 Inductance: Terminal-to-terminal inductance shall be measured in accordance with the following requirements: A test frequency of 1000 cps,  $\pm 100$  cps, shall be employed. The oscillator output shall be 100 millivolts minimum. Suitable measurement techniques shall be used to minimize errors due to the connections between the measuring apparatus and the test specimen. The test lead inductance shall be subtracted from the measured inductance in determining filter inductance value. The limit of accuracy for this measurement shall be within  $\pm 5$  percent.

4.6.2.3 Temperature Rise: Filter case temperature rise shall be measured in accordance with methods A or B outlined below. Method B shall be limited to those filters where size, weight, configuration, or terminal arrangement is not suitable for the method A measurement technique.

Method A: Filters shall be suspended by their terminals and energized with rated current at nominal rated frequency. Lead wires shall be of copper, 6 in. long, and of the size specified in Table IX. After thermal stability has been reached, and while the filter is still energized, the maximum hotspot on the filter case shall be determined by the use of thermocouples. Temperature rise shall not exceed the measured unenergized value by more than specified by the control specification.

Method B: Filters shall be mounted by means of a dielectric material having a minimum volume resistivity of  $10^{10}$ . This mount shall not cover greater than 10% of the filter mounting surface and shall be of the minimum dimensions illustrated in Figure 2. Remaining details of Method A above shall apply.

4.6.2.4 Dielectric Withstanding Voltage: Filters shall be tested in accordance with method 301 of MIL-STD-202. The following details and exceptions shall apply:

- A: Magnitude and nature of test voltage - DC test voltage of the potential specified in Table X shall be used.
- B: Duration of application of test voltage - For qualification inspection the voltage shall be applied for a period of one minute after the filter has reached thermal stability at the maximum operating temperature produced by passage of rated current at the nominal rated frequency... For quality conformance inspection the voltage shall be applied for one second.
- C: Points of application of test voltage - The test voltage shall be applied between the case (ground) and all live (not grounded) terminals of the same circuit connected together.
- D: Limiting value of surge current - A current limiting resistor shall be connected in series with the filter to limit the surge current to the maximum rated current, or one ampere, whichever is less.

TABLE X. DIELECTRIC WITHSTANDING VOLTAGES

Rated Filter Voltage	DC Test Voltage	
	For Qualification Inspection	For Quality Conformance Inspection
Up to 100vdc	200v	250v
Over 100 vdc	2 x rated	2.5 x rated
AC	2.8 x rated rms	4.2 x rated rms

TABLE IX. LEAD WIRE SIZES

Rated filter Current (amperes)	Wire Size (AWG)
up to 3	24
3-5	22
5-11	20
11-16	18
16-22	16
22-32	14
32-41	12
41-55	10
55-73	8
73-101	6
101-135	4
135-181	2
181-211	1

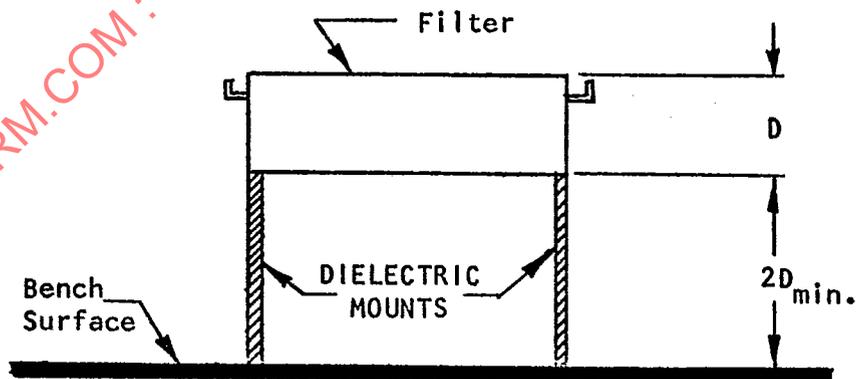


Figure 2. Method B Mounting Configuration

4.6.2.5 Insulation Resistance (terminal-to-ground): Filters shall be tested in accordance with method 302 of MIL-STD 202. The following details shall apply:

- A. Test condition letter A.
- B. Measurements shall be carefully made to prevent damage to the filter seal. When filters fail this test due to ambient relative humidity in excess of 50%, they may be retested at any relative humidity from 20 to 50 percent.
- C. Points of measurement shall be between case (ground) and all live (not grounded) terminals of the same circuit connected together.

4.6.2.6 Voltage Drop: Voltage drop, AC and/or DC as applicable, shall be measured in accordance with the following requirements:

AC Filters - Voltage drop is the difference between the input voltage to the filter and the output voltage of the filter when the filter is carrying rated current and rated voltage, with a resistive load, at nominal rated frequency. The method of voltage measurement is shown in Figure 3. Measurements shall be made by using expanded scale meters which will enable voltage differences of less than 1 volt to be read.

DC Filters - The voltage drop shall be determined in accordance with Figure 4. Measurements shall be made by using a dc reading meter.

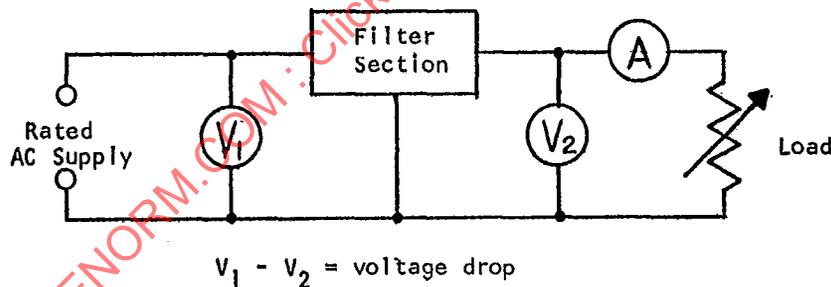


Figure 3. Measurement of AC Voltage Drop

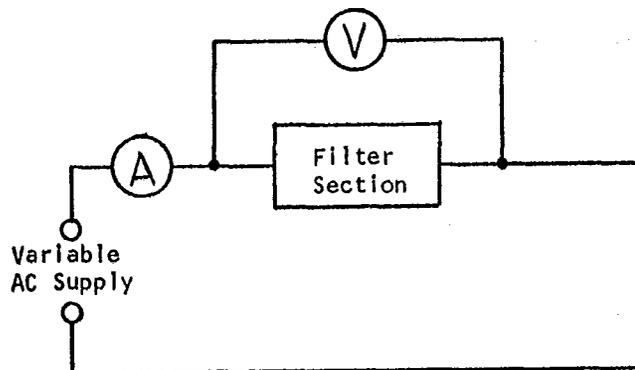


Figure 4. Measurement of DC Voltage Drop

- 4.6.2.7 Insertion-Loss: Filters shall be tested under rated load in accordance with MIL-STD-220, except that adapters may be modified to fit the particular style of the filter. Measurements shall be taken at a sufficient number of frequencies to plot a curve of insertion-loss versus frequency, accurate to within  $\pm 3$  decibels (dB) over the specified frequency range.
- 4.6.2.8 Overload: Filters shall be suspended by their conductors in free air at an ambient temperature of 20 C minimum. A current equal to 140% of rated current at nominal rated frequency shall then be applied for 15 minutes. After the filter has returned to room temperature, the insulation resistance and voltage drop shall be measured as specified in 4.6.2.5 and 4.6.2.6 respectively. Filters will be visually examined for evidence of physical damage.

In the event that suspension by their conductors is impractical due to size, weight, configuration, or terminal arrangement, the mounting procedure of 4.6.2.3 (B) may be employed.

4.6.3 Environmental:

- 4.6.3.1 Barometric Pressure (reduced): Filters shall be tested in accordance with method 105 of MIL-STD-202. The following details shall apply:

- A. Filters shall be securely fastened by normal mounting means.
- B. Test condition letter B shall be used.
- C. Testing for dielectric withstanding voltage shall be accomplished while subjected to reduced pressure, except that the test voltage shall be 125% of the rated voltage.
- D. Filters shall be examined for evidence of flashover, breakdown, or impairment which would cause failure. This test shall be accomplished after subjection to reduced pressure.

- 4.6.3.2 Salt Spray: Filters shall be tested in accordance with method 101 of MIL-STD-202. The following details and exception shall apply:

- A. Unless otherwise noted by the control specification, test condition B shall be used.
- B. After test the filters shall be visually examined for corrosion and obliteration of marking.

- 4.6.3.3 Temperature and Immersion Cycling: Filters shall be tested in accordance with the following procedures:

- A. Temperature cycling - Filters shall be tested in accordance with method 102, test condition D, of MIL-STD-202. No measurements shall be made after temperature cycling.
- B. Immersion cycling - Following temperature cycling, filters shall be tested in accordance with method 104, test condition A, of MIL-STD-202. After the final cycle dielectric withstanding voltage with 90% of the voltage specified in 4.6.2.4, shall be applied for  $5 \pm 1$  second, insulation resistance and insertion loss (check test) tests performed as specified in 4.6.2.5 and 4.6.2.7. Filters shall be visually examined for corrosion and obliteration of marking.